FREEWAVE

PROBLEMS, **SOLVED.**
SMART OPERATIONS, **ENABLED.**

How the right ***edge computing platform*** *can transform industrial environments*

Connected devices are giving industrial enterprises the ability to gain more insight than ever into the state of their remote operations, and how they can optimize performance in real time. But how do you acquire all of this new data without dragging down the network?

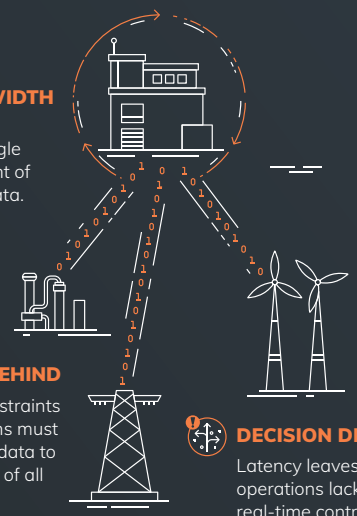
FreeWave solves the problems that traditional centralized computing creates from high bandwidth demands and latency challenges. Our **IQ** edge computing platform provides a smarter solution.

By distributing data capture and processing to the edge, you can optimize bandwidth and mitigate lags in decision making caused by latency—deriving more value from more data, more quickly, and without overburdening the network or replacing existing infrastructure.

THE CURRENT WAY

Centralized Computing

Data from remote locations must traverse the entire network to reach the closet or the cloud for analysis.



HIGH BANDWIDTH DEMANDS
Networks struggle under the weight of moving more data.

DATA LEFT BEHIND
Bandwidth constraints mean operations must prioritize what data to pull – a fraction of all available.

DECISION DELAYS
Latency leaves operations lacking real-time control.

HIGH LATENCY
Network congestion causes lags in data acquisition and analysis.

VS

THE IIoT WAY

Edge Computing

Processing is distributed to the edge of the network, where data is being generated in real time.

LOW BANDWIDTH
Local analysis at the edge frees up significant network resources.

LOW LATENCY
Bandwidth optimization ensures rapid response times.

ALL DATA ACCESSIBLE
Existing bandwidth can now be used to call more data for deeper analysis.

REAL-TIME ACTIONS
Operations can now react immediately to in-the-moment data and automate responses.

What makes our platform smarter?

FreeWave has taken our rugged OT products, designed for low-power operation across wide temperature ranges, and **infused them with IQ Application Environment,** an open source development platform to deploy and run applications in any Linux-compatible language.

This IQ is delivered through our Zum family of products, including the:

ZumIQ™ Edge Computer

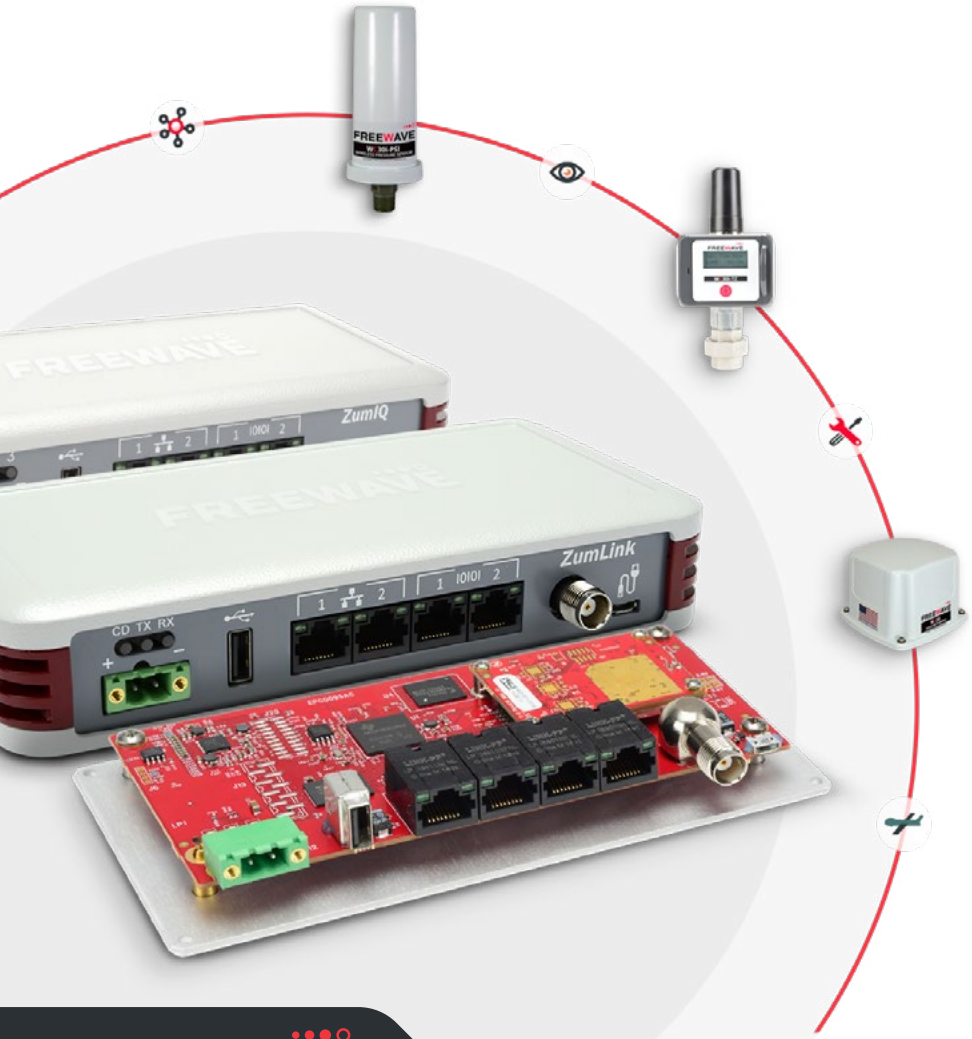
- Includes ARM Cortex CPU
- 1 GB of RAM and 1 GB of storage
- Low-power, hardened solution
- Flexible to deploy in wired or wireless networks

ZumLink™ IQ Edge Intelligent Radio

- ZumIQ with connectivity built-in
- Single solution to deploy and connect edge applications
- Enables wireless communications in the unlicensed 900 MHz spectrum

When combined with FreeWave's edge sensing solutions, you can create a complete edge ecosystem to drive transformative gains.

FreeWave's wireless modular endpoints, managed by an integrated gateway, are easy to configure and enable data transmission not feasible with conduit.



The Solution to Growing Network Pain Points

- **Extends the life** of networks by 3 to 5 years for significant cost-savings
- Enables IIoT solutions **without replacing** existing radios, controllers, or devices
- Optimizes existing bandwidth—**up to 80% reduction**
- Delivers an **open source Linux operating system**
- Reduces latency by **processing on the edge**
- Delivers a **low-power, ruggedized industrial** solution
- Comes **C1D2-certified** at the enclosed or board-level
- Provides for **serial and Ethernet interfaces**
- **Connects agnostically** across frequencies and platforms: *ZigBee, Wi-Fi, LoRa, Bluetooth, Cellular*
- **Converts protocols** like Modbus, MQTT, and DNP3

Get Cloud-Enabled

FreeWave's platform also provides a **turn-key solution to seamlessly extend Amazon Web Services (AWS) computing to the network edge,** allowing industrial devices to act locally on the data they generate while enabling you to leverage the cloud for management, analytics, and durable storage.

Now, you can unify data silos and enable rapid data-sharing across OT and IT functions for better problem-solving and decision-making.

Problems Solved

While the **IQ** edge computing platform has been deployed across industrial verticals and diverse environments, it consistently delivers the same results: **new operational value derived from real-time insights, edge automation, and predictive optimization.**

What's Enabled with Edge Computing:

- ✓ **Remote visualization,** monitoring & control
- ✓ **Machine learning** & predictive analytics
- ✓ **Edge to cloud** data distribution & management
- ✓ **Protocol conversion**
- ✓ **Latency & bandwidth** improvements
- ✓ IIoT edge **software integration**

Let's take a closer look at all the ways FreeWave's platform puts industrial data to work more efficiently.

PRECISION AGRICULTURE

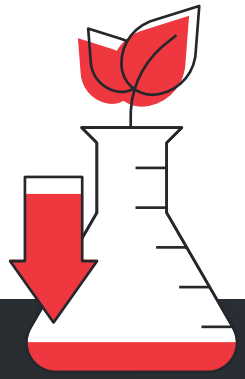
More yield from fewer resources: that is the problem that farmers worldwide are looking to solve.

With FreeWave, farms can seamlessly deploy an industrial IoT (IIoT) solution across their remote environments. ZumIQ and ZumLink IQ easily integrate with legacy devices and are able to operate continuously with limited power consumption to run advanced analytics and automation applications at the rural edge.

The use of **automated equipment and agricultural robots** can **reduce agrochemical use by as much as**

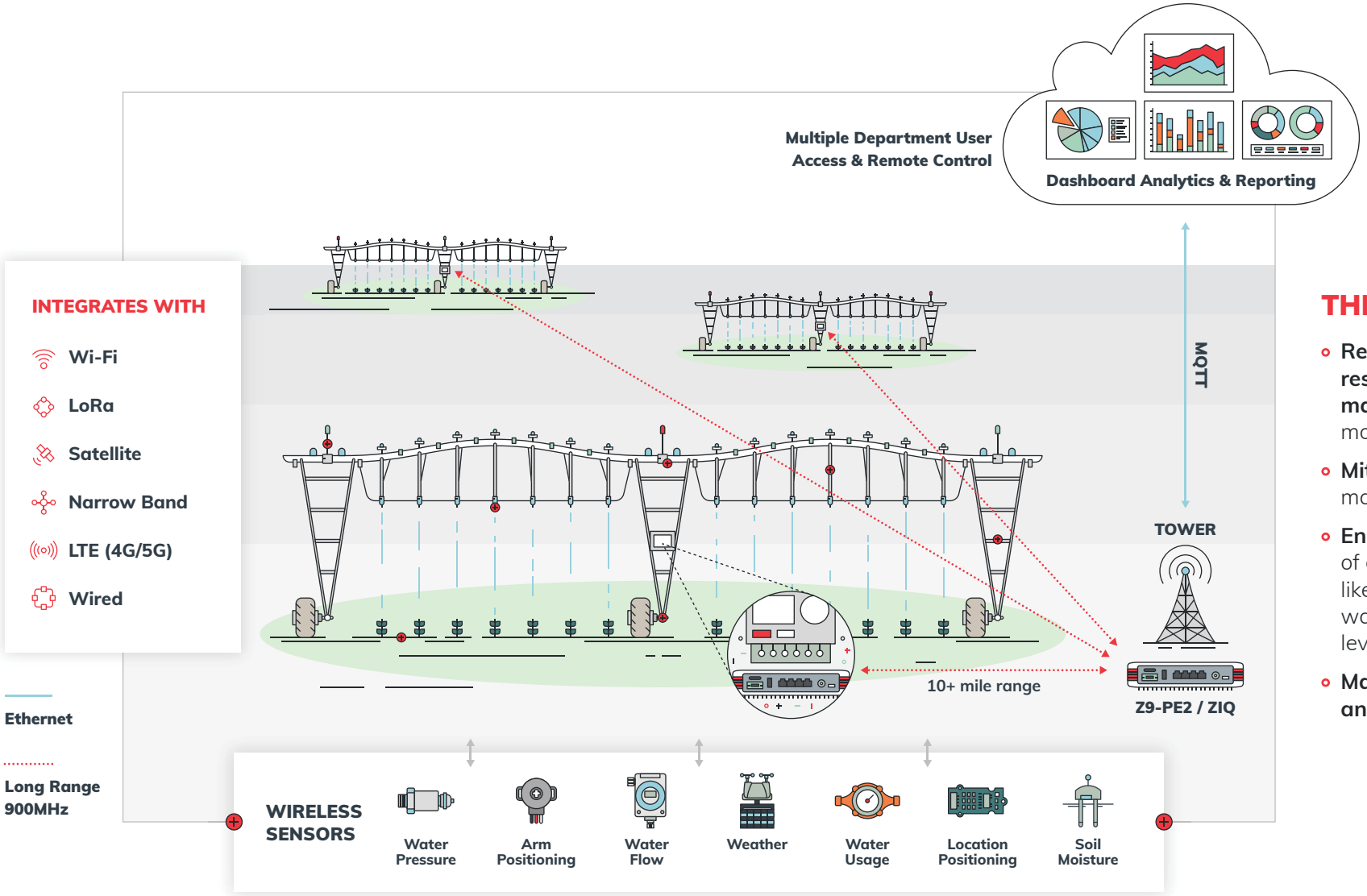
90%.

—Machine Design, 2018



PRECISION AGRICULTURE

Center Pivot Irrigation Automation

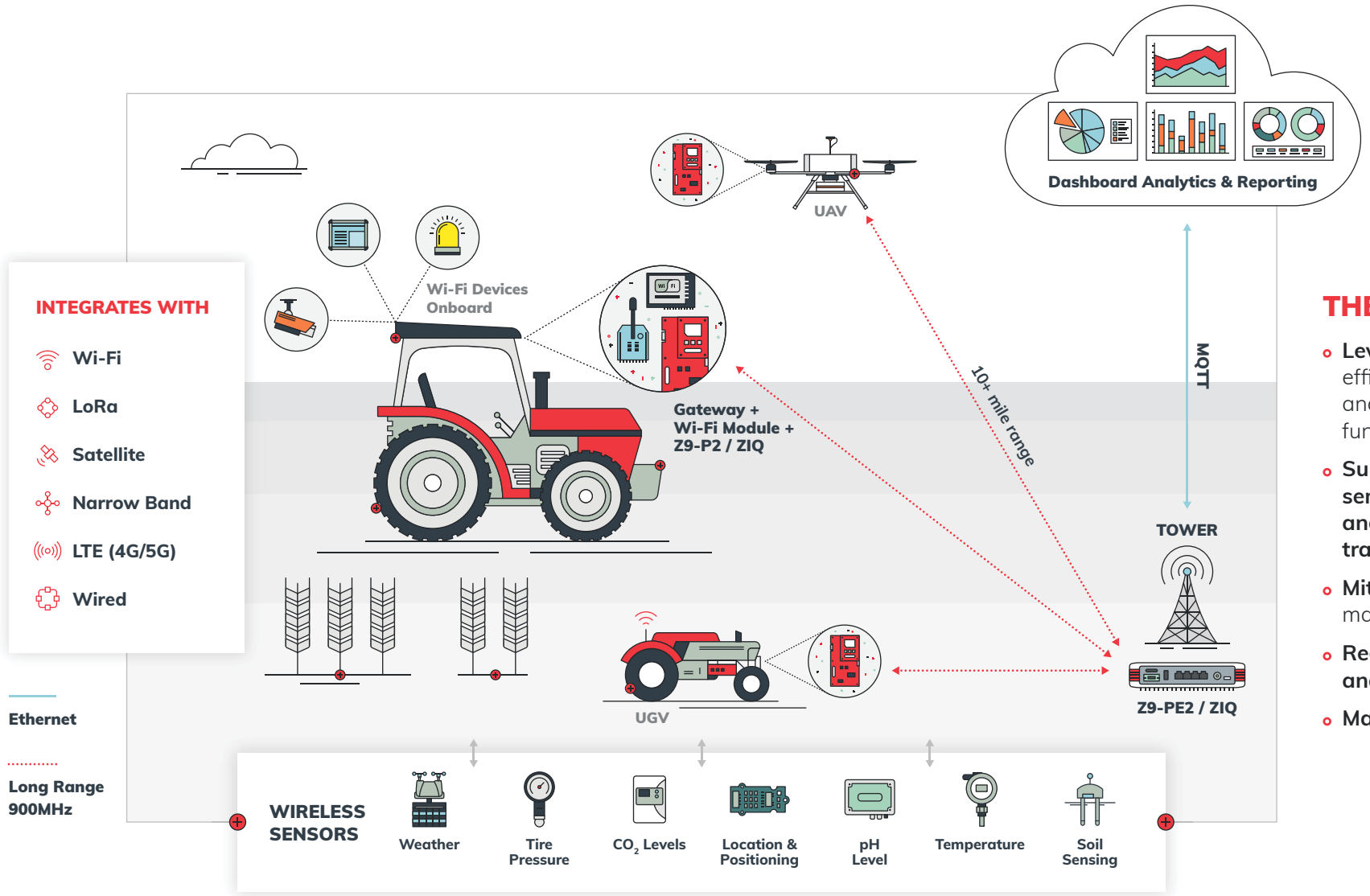


THE VALUE

- **Reduce water resources and manpower** via remote monitoring
- **Mitigate costs** of manual inspections
- **Enable real-time relay** of critical information like irrigation patterns, water pressure, and levels
- **Maximize crop yield and field productivity**

PRECISION AGRICULTURE

Enabling Smart Agriculture

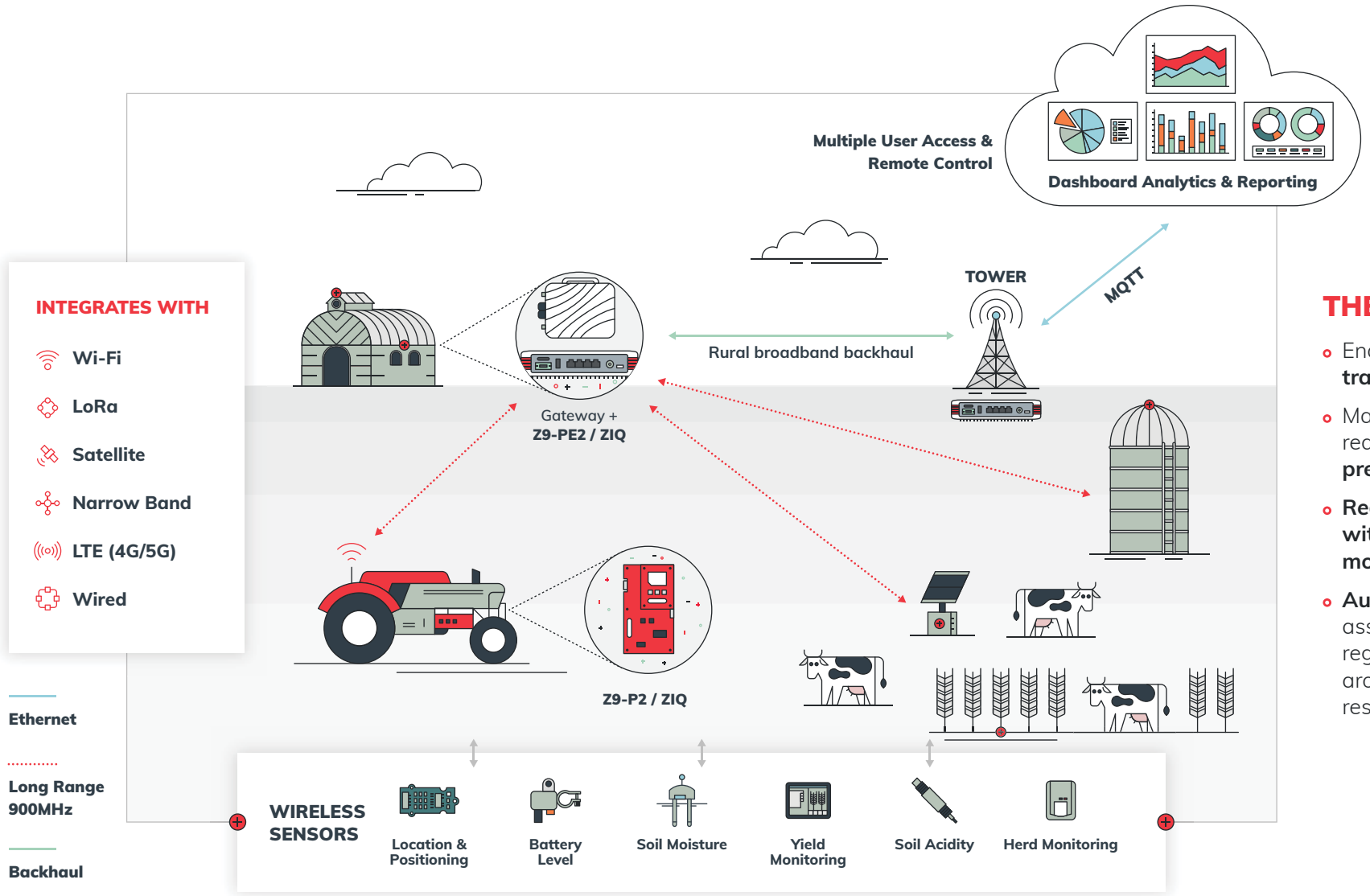


THE VALUE

- **Leverage drones** for efficient surveillance and monitoring functions
- **Support self-driving, semi-autonomous, and RTK-guided tractors**
- **Mitigate costs** of manual inspections
- **Reduce water usage and waste**
- **Maximize crop yield**

PRECISION AGRICULTURE

Monitoring the Rural Edge



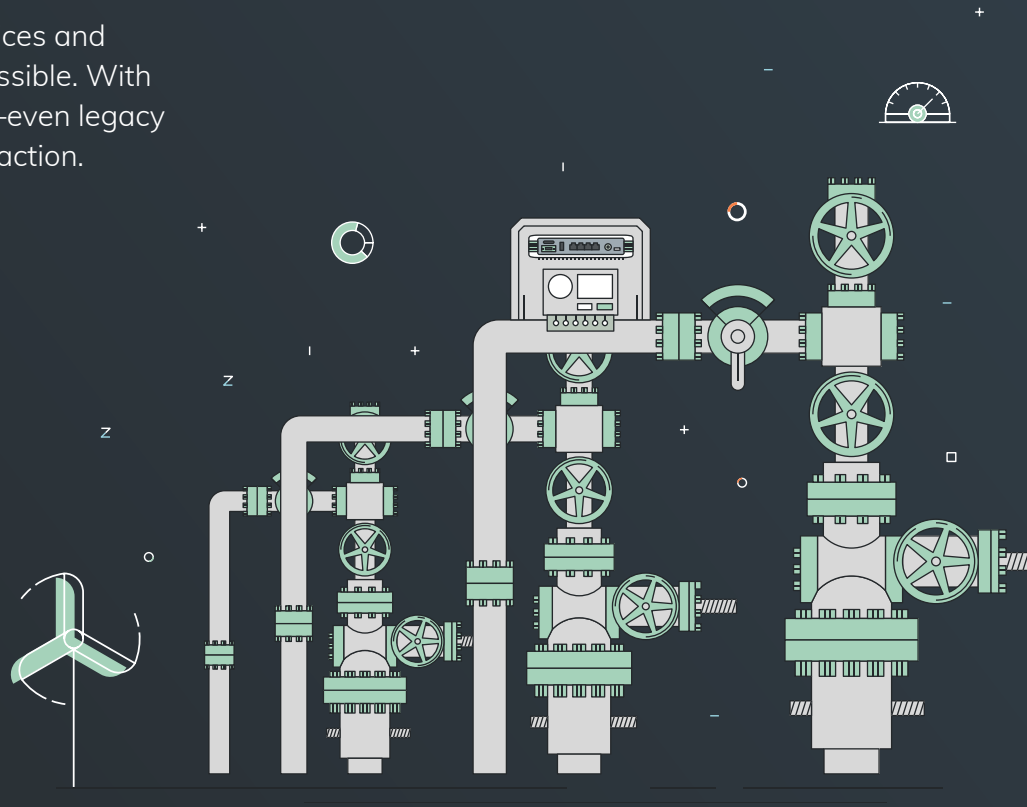
THE VALUE

- Enable **herd health tracking**
- Maximize growth while reducing costs with **precision fertilizing**
- **Reduce waste with grain bin level monitoring** and control
- **Automate irrigation** to assist with increased regulatory pressures around water and resource management

ENERGY

Oil & gas and other energy operations are deploying smart devices to digitize operations. The problem is that much of the new data they generate gets left stranded in the field, too much for the network to transport.

FreeWave enables energy leaders to capture the full value of new IIoT devices and applications by allowing data to be processed as close to the source as possible. With edge computing, operators can extract more data from the same devices—even legacy PLCs and RTUs—and deliver it all to the cloud for immediate analysis and action.



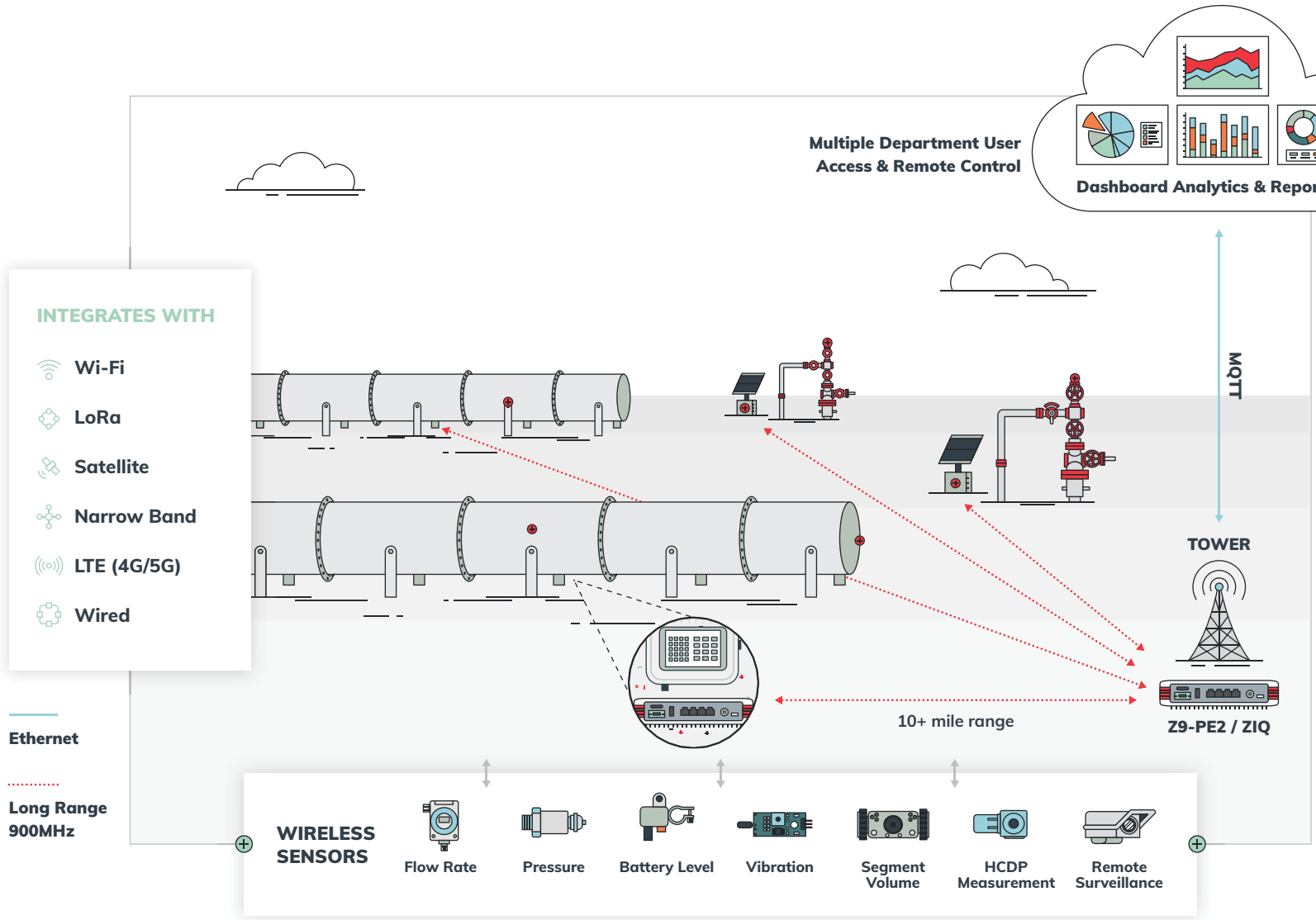
With oil & gas companies today **using less than 1%** of the data they have available, the **production potential of their assets is not being maximized.** Industry-wide, this shortfall represents around

10M barrels per day.

—McKinsey, 2017

ENERGY

Well & Pipeline Gas Measurement

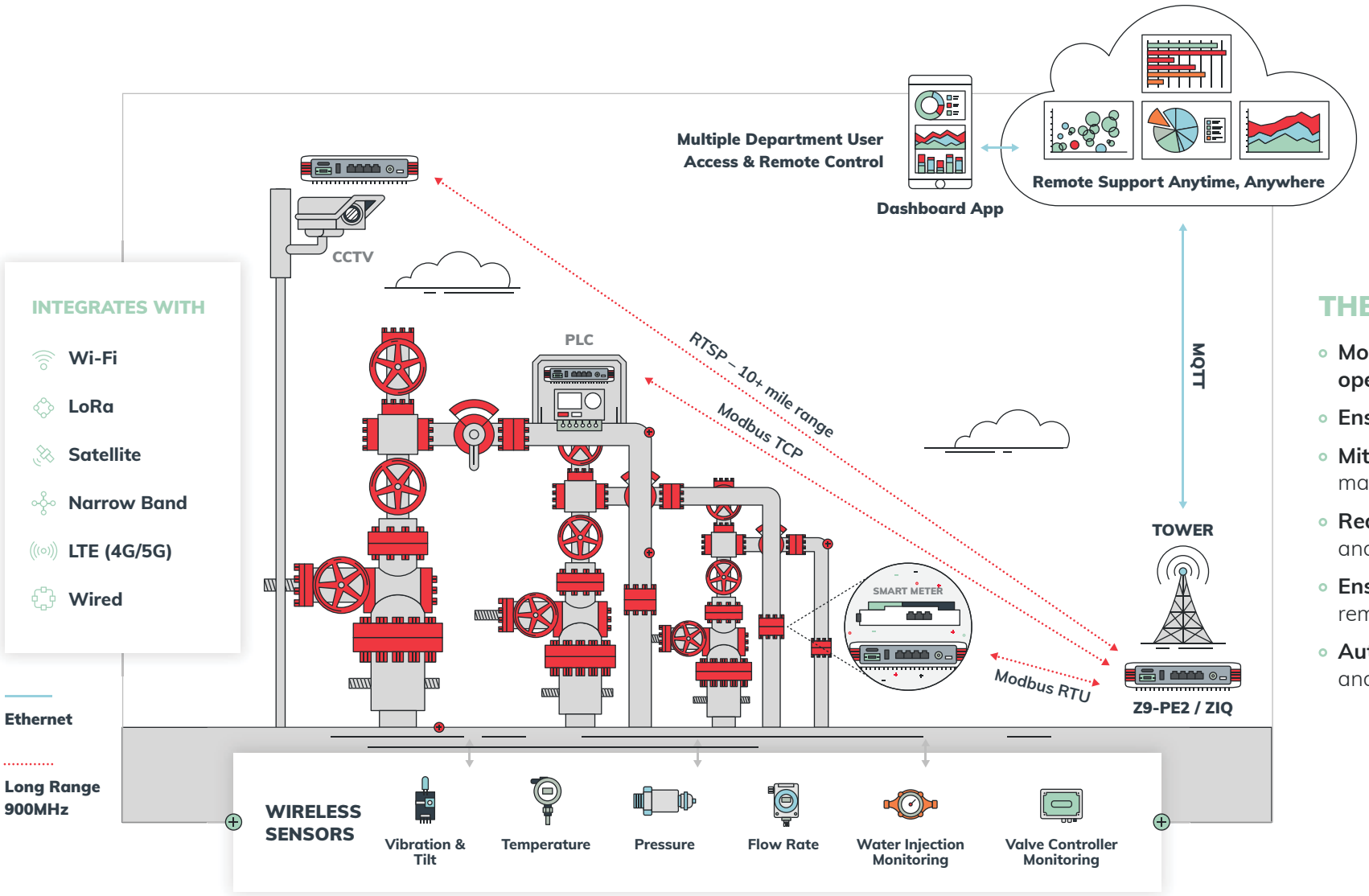


THE VALUE

- **Mitigate need for manual inspections** and truck rolls
- **Reduce equipment costs** and downtime via predictive maintenance
- **Automate segment volume reporting** with real-time values
- **Reduce energy costs**
- **Maximize production;** streamline operational efficiencies
- **Operate greener**

ENERGY

Real-Time Remote Monitoring



THE VALUE

- **Modernize field operations**
- **Ensure system uptime**
- **Mitigate costs** of manual inspections
- **Reduce water usage** and waste
- **Ensure security** of remote assets
- **Automate reporting** and compliance

WATER & WASTEWATER

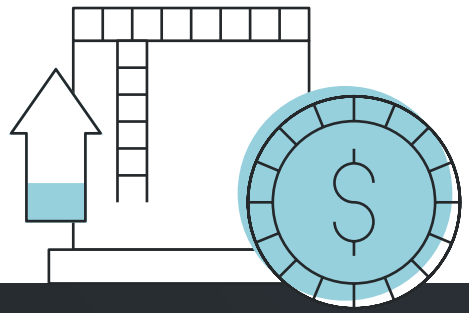
How can water and wastewater operations **meet rising energy conservation and regulatory demands** without completely overhauling their legacy infrastructure?

FreeWave helps water treatment and distribution plants solve the problem of system modernization by enabling them to immediately get more data from their existing assets and devices. Our platform can be deployed alongside PLCs and RTUs in the field to run advanced analytics and automation applications at the pump-, tank-, and station-level—at a fraction of the cost of system replacement.

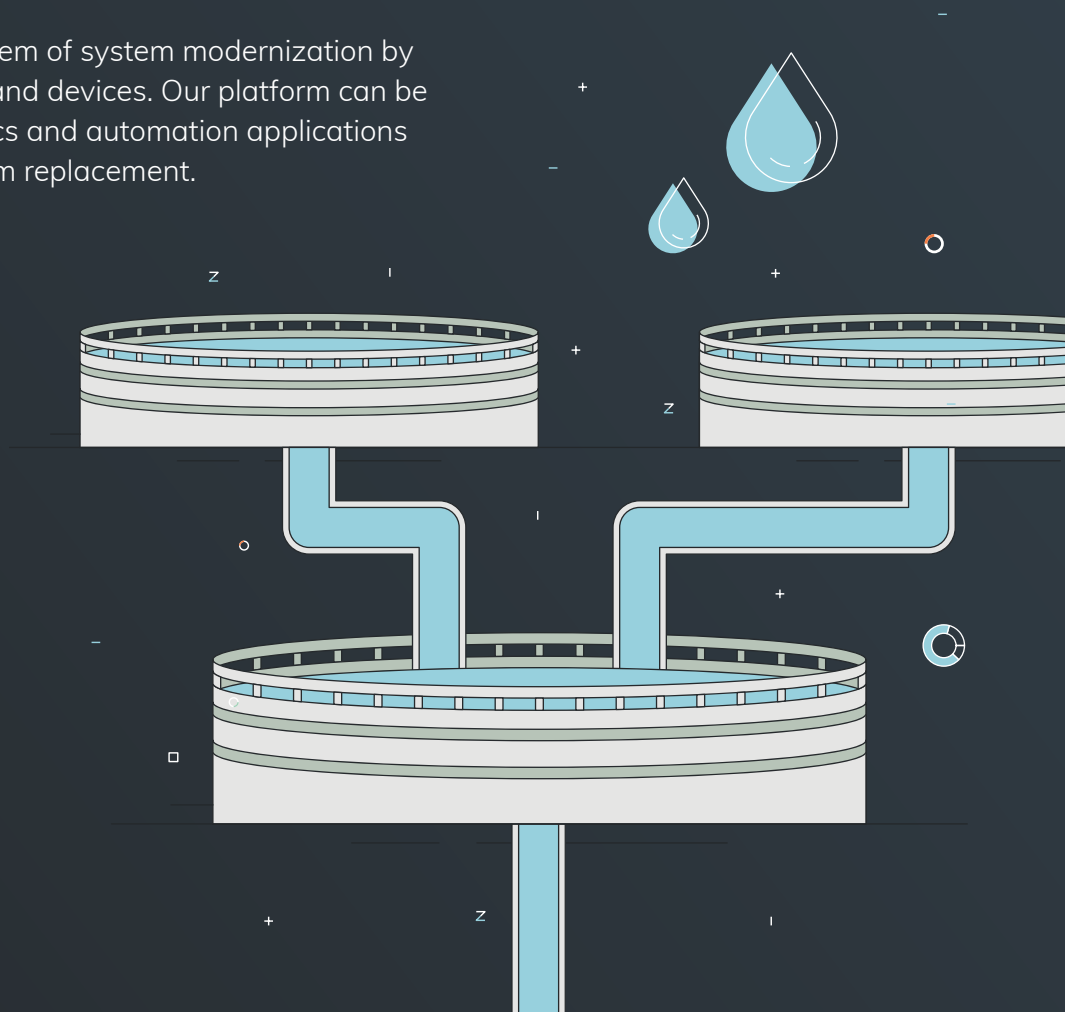
As much as

30% of water utility OPEX

can be immediately **improved with dynamic and real-time system monitoring.**

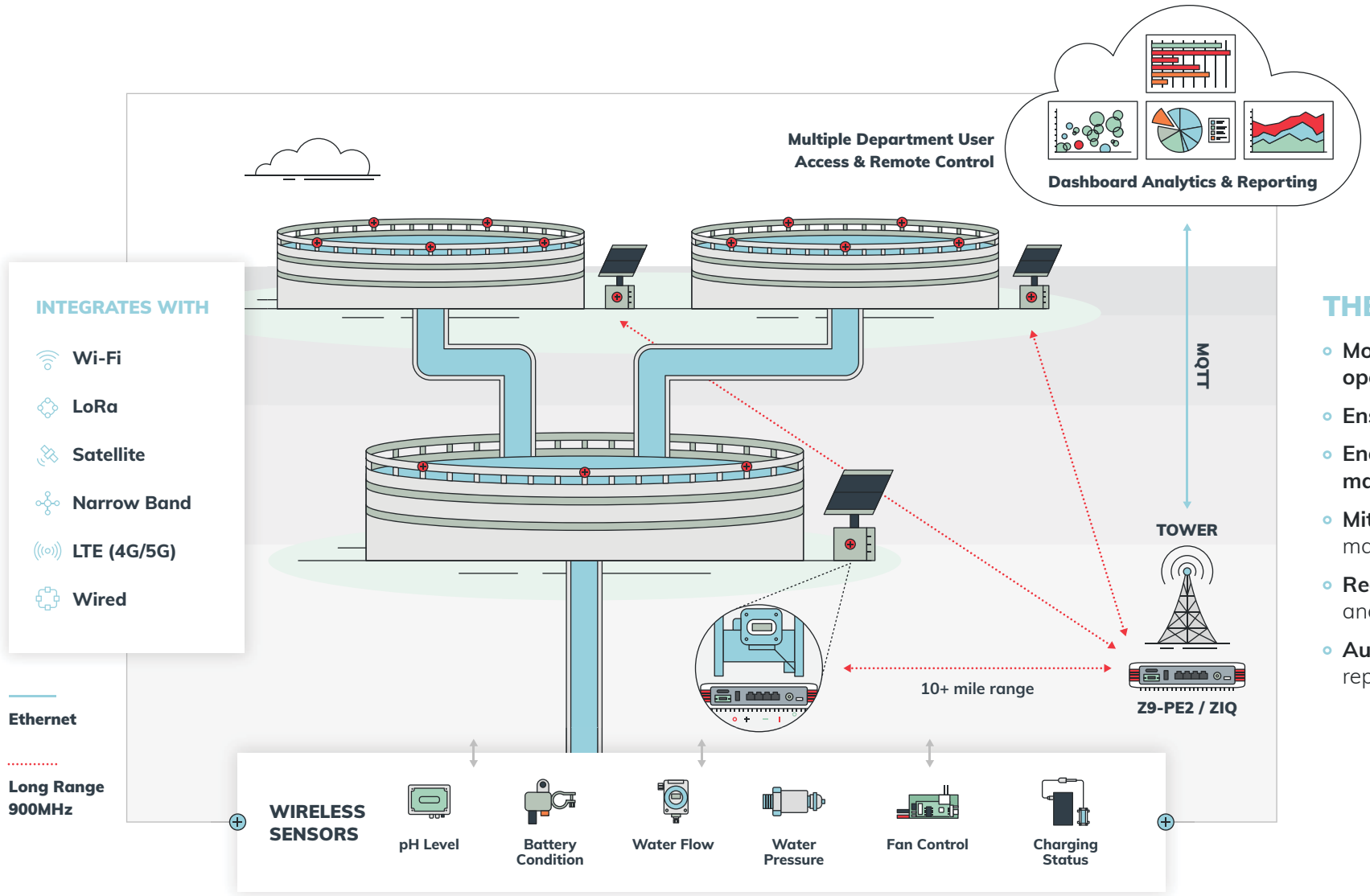


—Bluefield Research, 2017



WATER & WASTEWATER

Smart Water Management

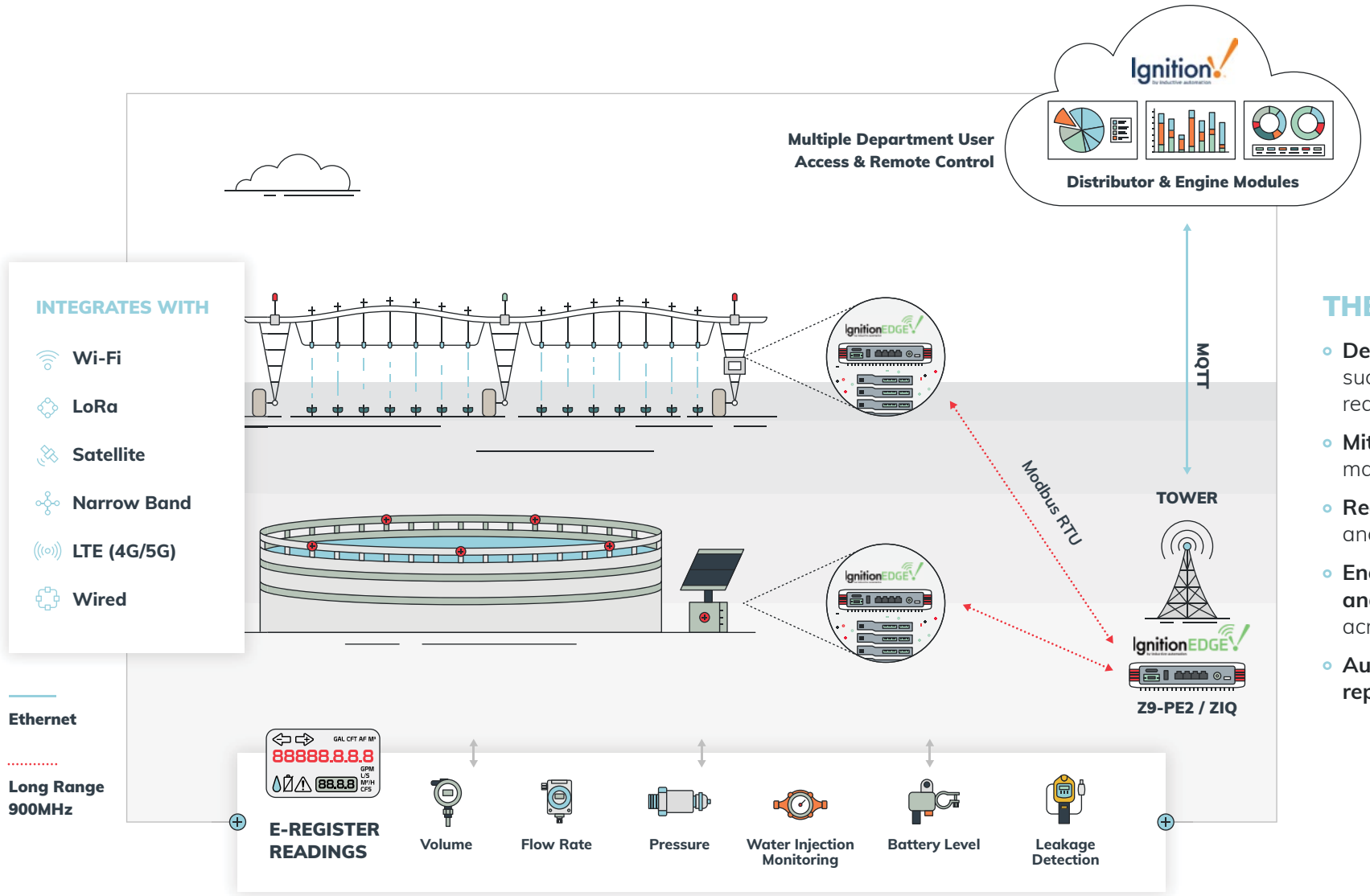


THE VALUE

- **Modernize field operations**
- **Ensure system uptime**
- **Enable predictive maintenance**
- **Mitigate costs** of manual inspections
- **Reduce water usage** and waste
- **Automate compliance** reporting

WATER & WASTEWATER

Remote Water Meter Reading



THE VALUE

- **Detect system issues** such as leaks in realtime
- **Mitigate costs** of manual inspections
- **Reduce water usage** and waste
- **Enable easy access and sharing** of reports across departments
- **Automate compliance reporting**

SMART CITIES

As cities grow, so too do their problems related to infrastructure management, energy efficiency, and ensuring public safety.

With FreeWave's **IQ** platform, cities and municipalities can address these challenges in a smart, automated manner. With edge connectivity, edge sensing, and edge computing combined, we connect multiple stakeholders to real-time data from distributed assets across the city, supporting automation, remote control, and robust analytics for better decision-making.

A recent global study revealed that of **cities deploying smart environmental and energy initiatives:**

45%
are improving citizen health

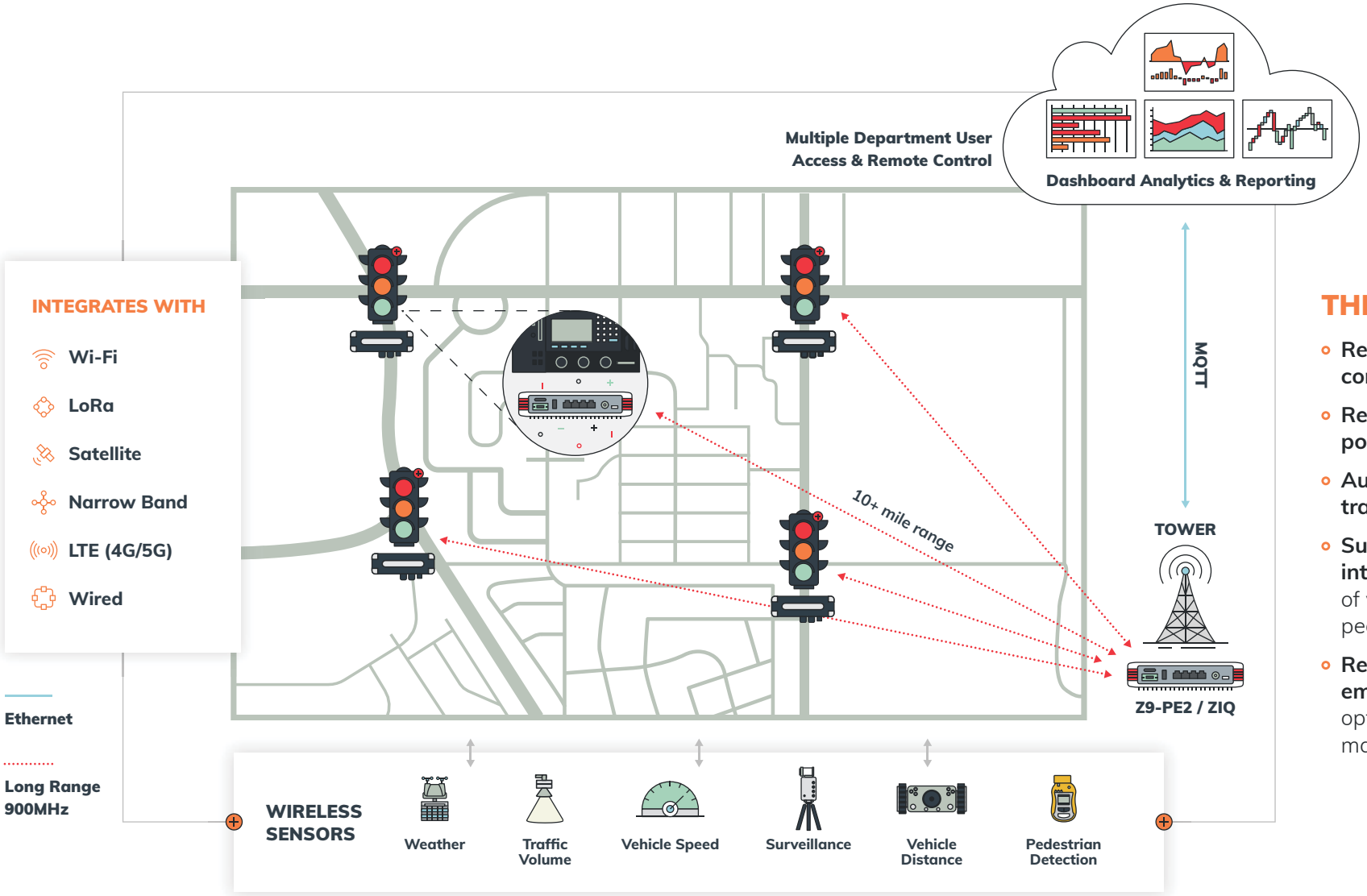
44%
are reducing pollution

43%
are stabilizing energy prices

—ESI ThoughtLab, 2019

SMART CITIES

Smart Signaling Systems

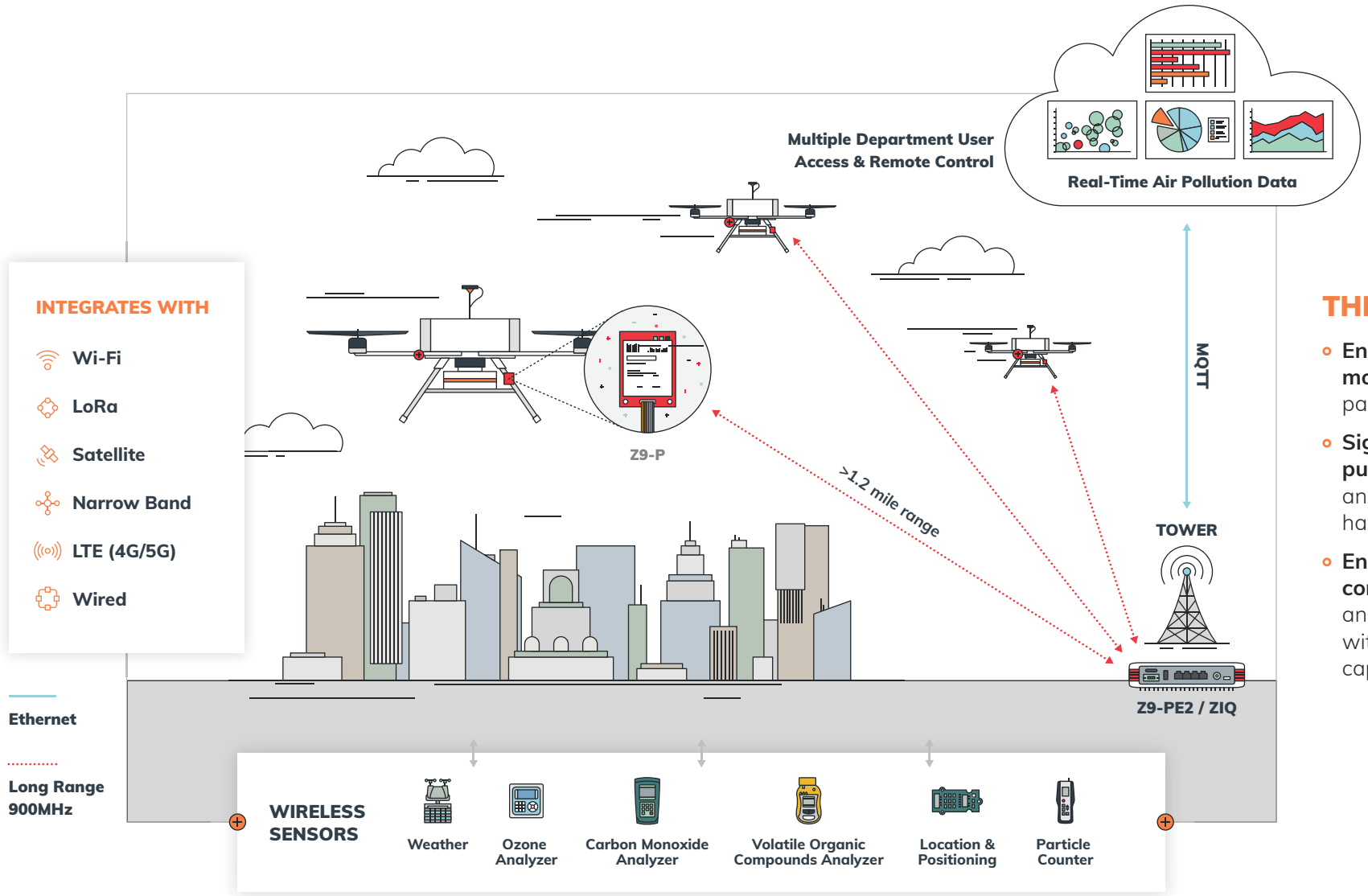


THE VALUE

- **Reduce traffic congestion**
- **Reduce city-wide pollution**
- **Automate real-time traffic** sensing
- **Support AI for intelligent routing** of vehicle and pedestrian traffic
- **Reduce carbon emissions** via optimized traffic management

SMART CITIES

Real-Time Air Pollution Monitoring



THE VALUE

- **Enable real-time monitoring** of harmful particulate matter
- **Significantly improve public health outlook** and reduce health hazard air factors
- **Ensure regulatory compliance with EPA** and other entities with 24x7 monitoring capabilities

PORTS

To solve the problem of remaining efficient and competitive in a real-time world, ports must modernize the technologies they use to move, track, and monitor cargo.

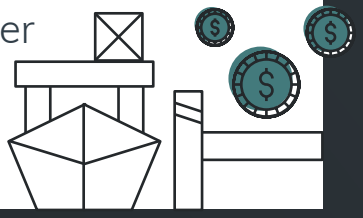
FreeWave's ruggedized, low-power platform is made to operate continuously in the harsh portside environment and integrates seamlessly with legacy devices to enable a true IIoT implementation, powering applications for real-time asset tracking, remote condition monitoring, autonomy, and more.

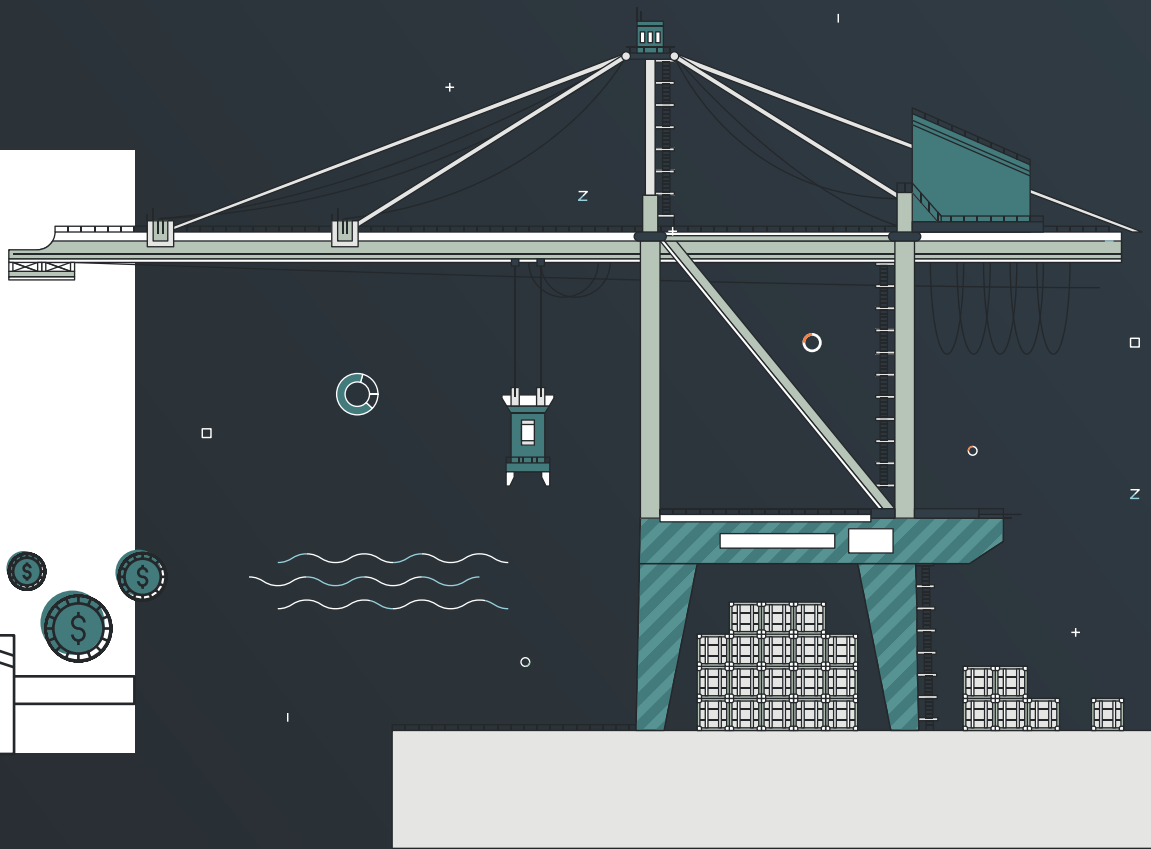
Technologies that enable shipping companies and the port to **save even 1 hour of berthing time** can amount to almost

$80,000 in savings

for ship operators, and enable the port to increase the number of ships docked per day.

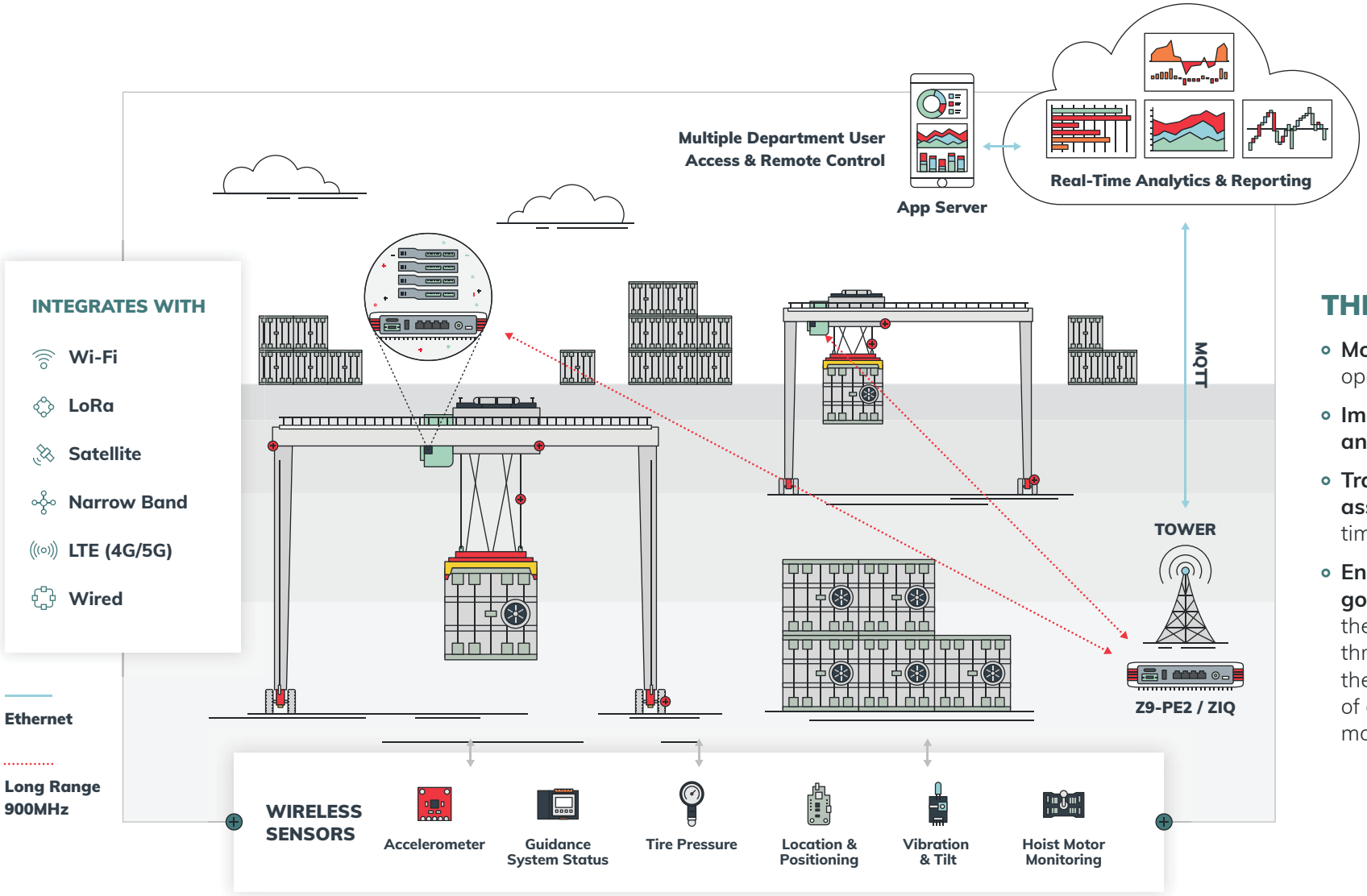
—IBM, 2018





PORTS

Hoist & Trolley Management

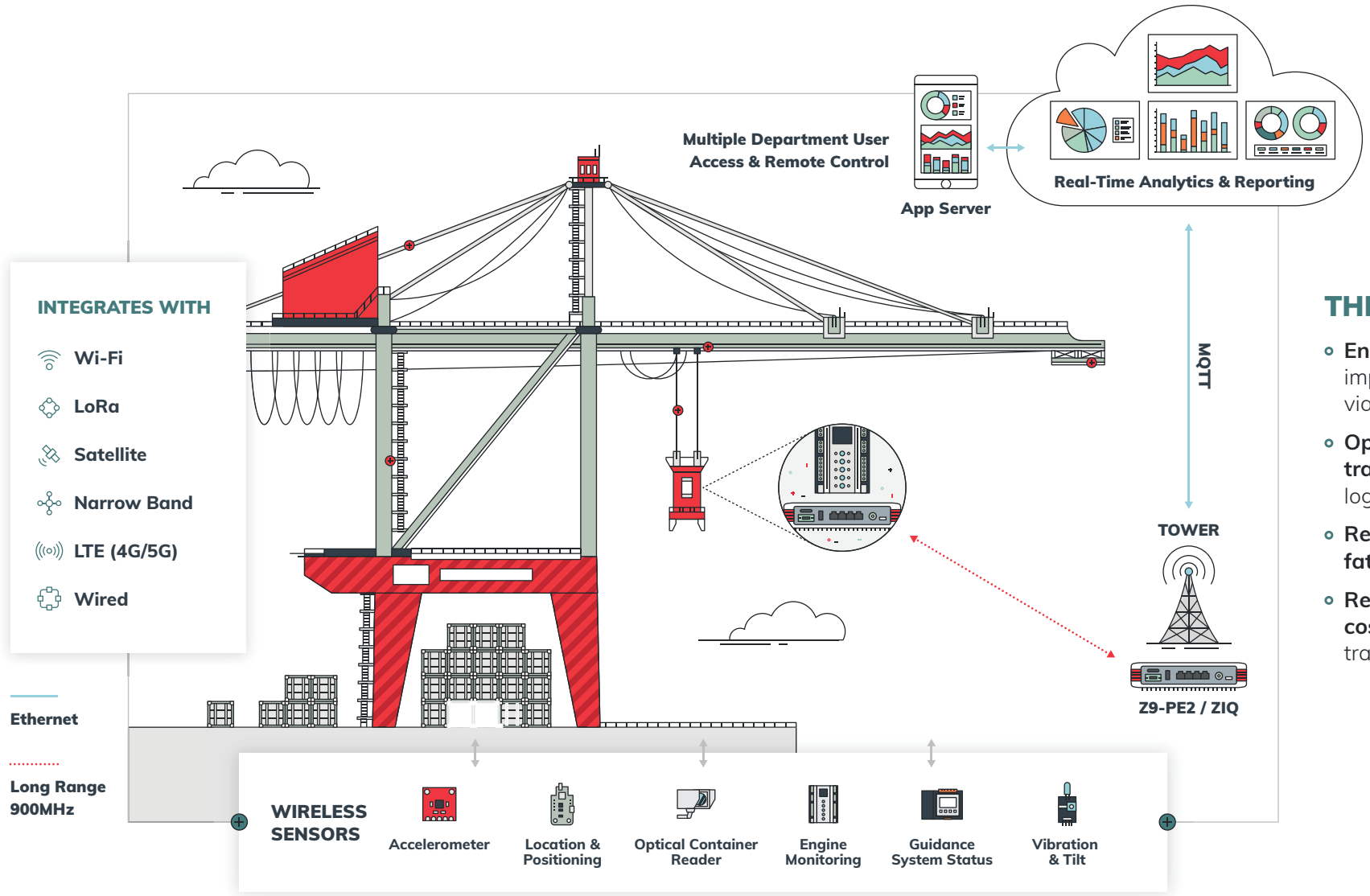


THE VALUE

- **Modernize BMS** operations
- **Improve employee and occupant health**
- **Track movement of assets** through to timely shipments
- **Ensure protection of goods** from damage, theft, spoilage, etc. through the around-the-clock tracking of assets via sensor monitoring

PORTS

Crane Automation & Control

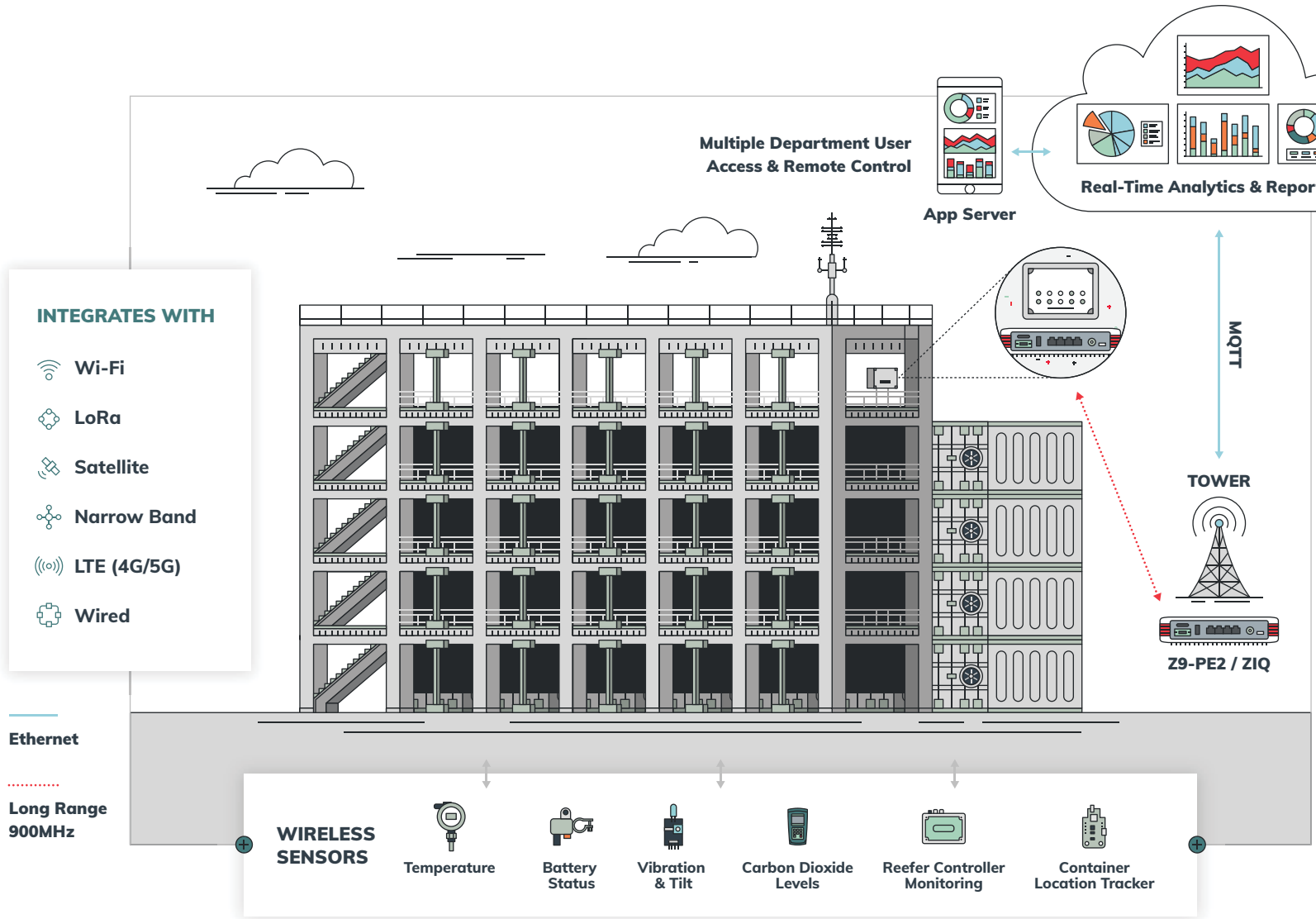


THE VALUE

- **Enhance safety** and improve productivity via automation
- **Optimize transportation** and logistics planning
- **Reduce operator fatigue**
- **Reduce labor costs** and inventory tracking time

PORTS

Refrigerated Container Management



THE VALUE

- **Support the optimal and safe delivery of a wide variety of refrigerated goods** that require various atmospheric environment containerization
- **Enable continuous remote monitoring** through to delivery of shipment
- **Implement comprehensive remote container management**

OTHER APPLICATIONS

With deployments in over 32 countries, **FreeWave's products are leveraged across diverse verticals to solve industry-specific problems** in ways that enable smarter actions, significant efficiency gains, and immediate cost savings.

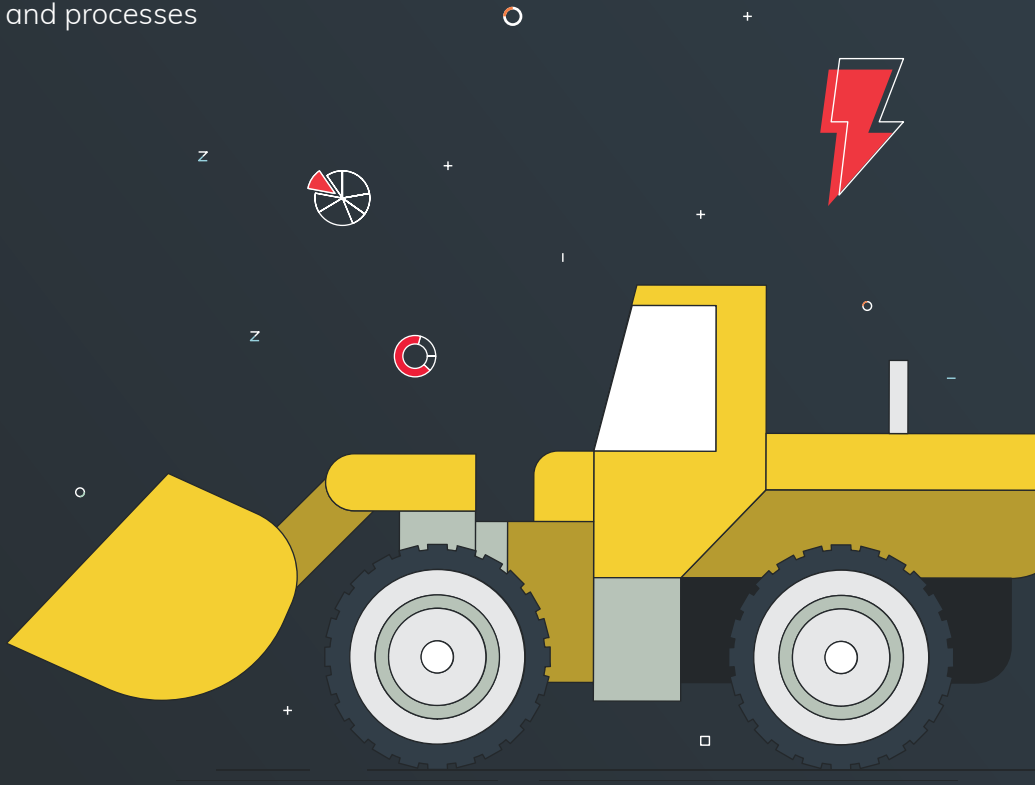
Any enterprise seeking to connect, control, and optimize remote machines and processes will benefit from the **IQ** that FreeWave's platform brings to operations.

By 2022,

75% of enterprise-generated data

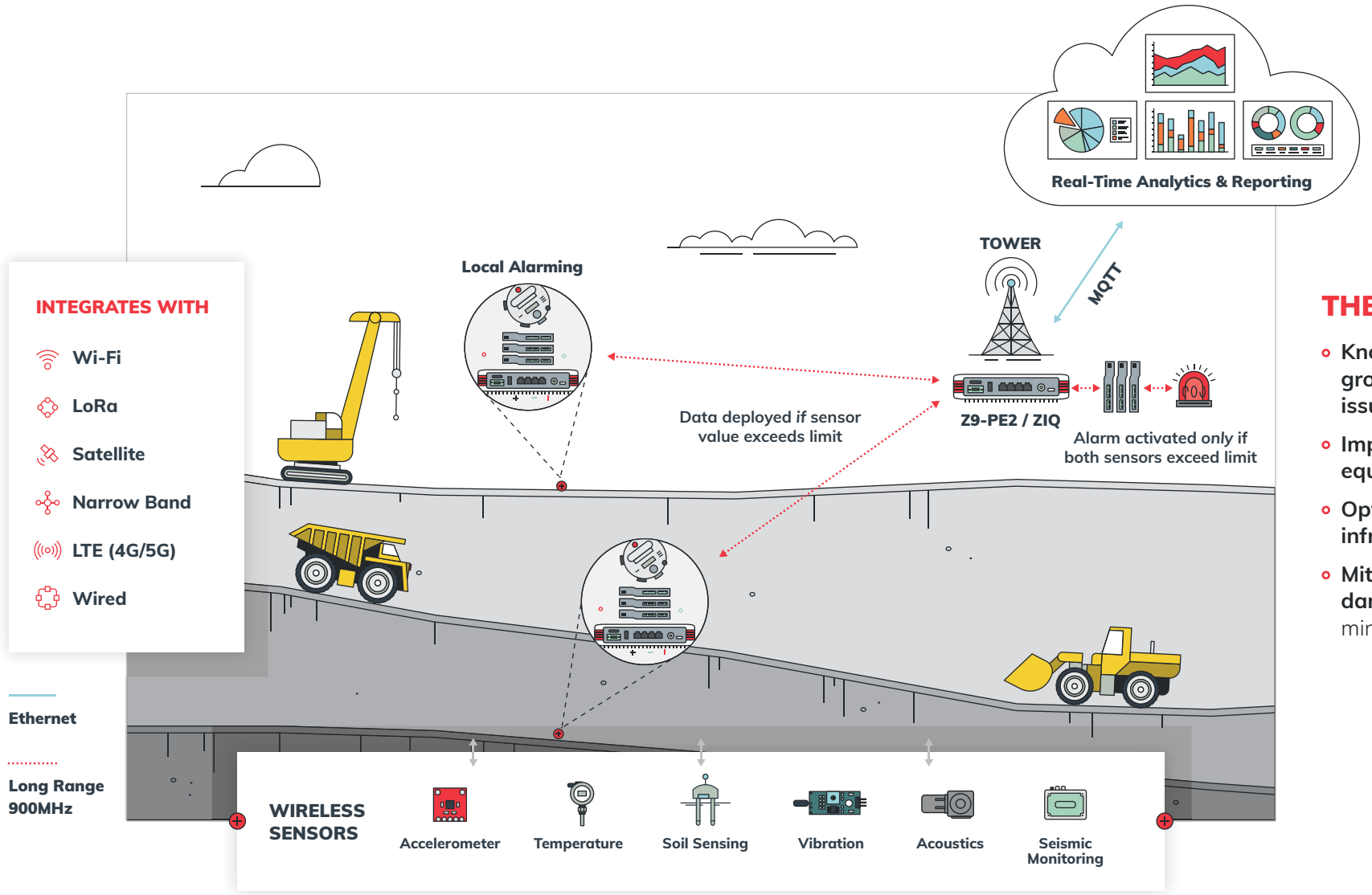
will be created and processed ***outside*** of a traditional centralized data center.

—Gartner, 2018



OTHER APPLICATIONS

Earth Movement Monitoring



THE VALUE

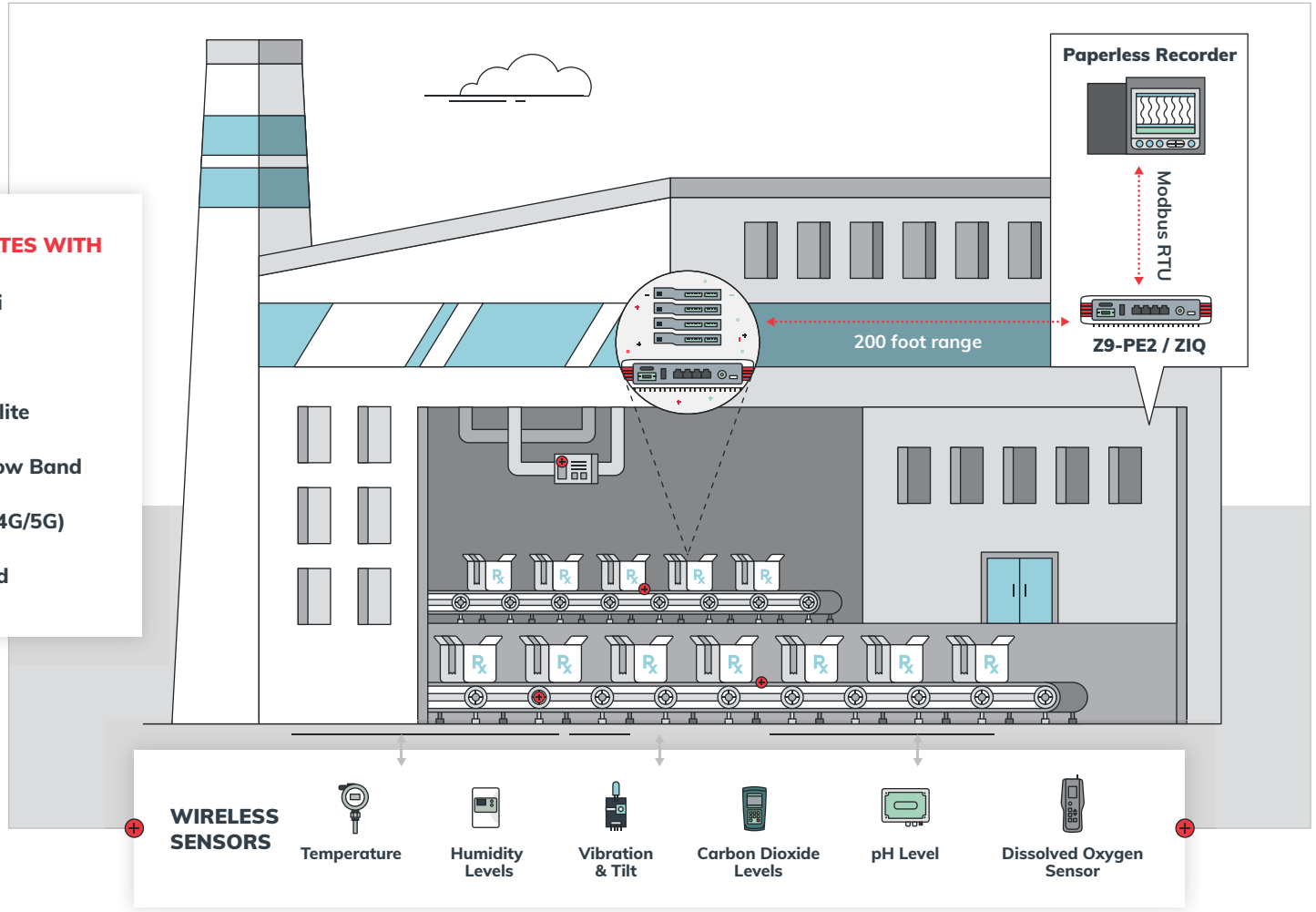
- **Know potential ground movement issues** in realtime
- **Improve worker and equipment safety**
- **Optimize infrastructure design**
- **Mitigate equipment damage** and minimize downtime

OTHER APPLICATIONS

Pharmaceutical Manufacturing

INTEGRATES WITH

- Wi-Fi
- LoRa
- Satellite
- Narrow Band
- LTE (4G/5G)
- Wired



THE VALUE

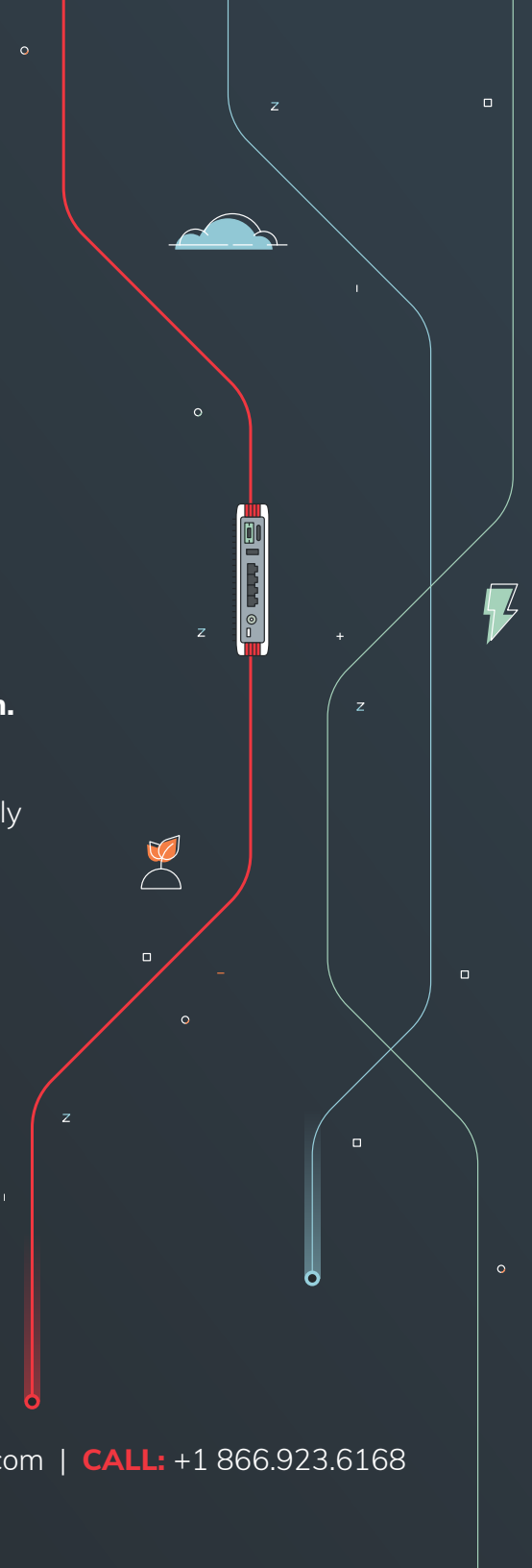
- **Mitigate pharmaceutical drug loss** due to supply chain deficiencies
- **Improve consumer and patient safety** with trackable and effective monitoring of pharmaceuticals from manufacturing to destination
- **Use analytics-enabled data management** to benefit the entire pharma supply chain

Smart Operations Enabled

To achieve transformative operational optimization, you need data visibility, but that is only part of the battle. You also need to ensure that every relevant stakeholder has the ability to access, assess, and act on that data too.

FreeWave gives you the power to do it all, delivering a complete, cloud-enabled edge ecosystem.

Designed to build upon and enhance existing infrastructure, our **IQ** platform immediately provides expanded capabilities for high-fidelity industrial data capture, analysis, control, and automation. Readily scalable as edge computing needs evolve, it provides a future-ready solution to solve today's pressing operational problems, and to capitalize on future opportunities that come with a smart edge.



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FREEWAVE

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