Application Brief

Asset monitoring for Power Transmission Towers

Challenge: Global Warming and Vandalism Risk Critical Power Transmission Assets

High voltage power transmission networks are made of high rising metal towers (pylons) that span vast distances along diverse terrain. Global warming creates increasingly extreme weather conditions that risk the proper ongoing operation of these critical infrastructure assets. In addition, intentional sabotage, such as transformer vandalism and fiber or copper theft, leads to prolonged power outages and heavy financial loss.

Given these threats, the demand for regular and meticulous monitoring of power transmission towers has increased. Detecting issues earlier can prevent structural damage, reduce downtime, and prevent costs. Hence, effective monitoring allows the pylons to work at optimal capacity reducing risks of power outages and disruptions to electricity supply.

Safety is another aspect of observation that is equally as important. Hence, many regions have regulations and standards for the maintenance and safety of power utility infrastructure. Preventative maintenance ensures compliance with these regulations, avoiding penalties and legal issues. Additionally, you can gain valuable data on performance, stress levels, weather conditions, and more. This can help identify vulnerable pylons in areas prone to natural disasters, such as earthquakes, hurricanes, or severe weather. Strengthening or reinforcing these pylons can enhance the overall resilience of the power grid. Hence, reduce risks to nearby communities and workers. This could happen if the tower fell. Furthermore, without observing, it could cause detrimental environmental damage, including fires and oil spills.

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The most advanced inspection method currently relies on visual aerial images, typically collected by helicopters. The problem with this method is that it's costly, time consuming and does not provide actual updated information.

An alternative approach involves remotely monitoring power utility towers using IoT technology and sensors. This eliminates workers physically inspecting, which is safer and more efficient. Moreover, you gain trust with your partners and stakeholders as it displays a well-maintained power infrastructure.

The utilization of movement, or tilt, sensors, combined with vibration detectors helps operators to detect human presence, movement and climbing in monitored towers and respond in time to prevent acts of vandalism and sabotage that would compromise the operational safety and security of the high-voltage grid.

Solution: RAD's Secure IIoT Gateway for Transmission Tower Monitoring

The Industrial Internet of Things (IIoT) can significantly improve pylon monitoring. It involves the use of connected devices, sensors and analytics to gather data from physical assets. This data is then used to optimize operations, improve efficiency and security and reduce costs.

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RAD's ruggedized SecFlow IIoT Gateway is installed on each pylon, together with relevant sensors and a solar powered battery pack. SecFlow serves as an all-in-one connectivity and Edge Computing unit, featuring all necessary functionalities for a secure, effective and economical asset monitoring:

Connectivity -

The SecFlow features a variety of connectivity technologies, for both Wide Area Network (WAN) and IIoT sensors. On the WAN side, the SecFlow offers options to connect via fiber LTE, 5G, Anterix, CBRS, and 450MHz wireless networks. On the IIoT side, the SecFlow offers LoRaWAN (Long Range Wide Area Network), Wi-Fi and Wi-Fi Halow wireless technologies, as well as serial and Ethernet interfaces for sensors and SCADA connectivity. LoRaWAN capabilities include support for LoRa Server and Slave to Master connectivity. This allows users to use LoRa to connect the SecFlow gateways when no other WAN option is available. Similar capabilities are also available using Wi-Fi Halow technology. When using LoRa slave to master capabilities, the distance between SecFlow gateways can reach 10-15km (6-9Mi) and covers many towers, depending on the location of antennas and the surrounding terrain.

Sensors -

The SecFlow connects to a variety of sensors that are installed on transmission towers to monitor their condition and detect any potential issues before they lead to outages or other problems. These include vibration and strain sensors that detect structural damage, temperature and humidity sensors, Infrared movement detection, surveillance CCTV cameras, and more. The sensors are connected to the SecFlow using RS-485 connectors, Ethernet, Wi-Fi, Halow Wi-Fi, or LoRa. LoRa-based and Wi-Fi Halow sensors can also be used for anti-vandalism, security and other purposes, covering wide areas and long grid segments from a single master SecFlow gateway.

Docker-based IoT agent -

The SecFlow features a Docker container, which hosts an advanced IoT agent. The agent polls and retrieves data from the sensors using MODBUS protocol, then converts the MODBUS data to MQTT messages that are sent to a central collector on the backend servers. The IoT agent also queues the messages locally until a scheduled LoRaWAN transmission window is available. The SecFlow edge computing capabilities support a variety of additional functionalities upon demand, such as containers for controlling PTXZ and storing data from surveillance cameras, cyber security functionalities and much more.

Solar-based battery pack -

The gateway and sensors are powered using a battery power bank, whose status is also monitored by the SecFlow. If power down/up of the battery is needed (e.g., due to poor weather), the SecFlow reboots and seamlessly resumes communication, transmitting any queued sensor data.

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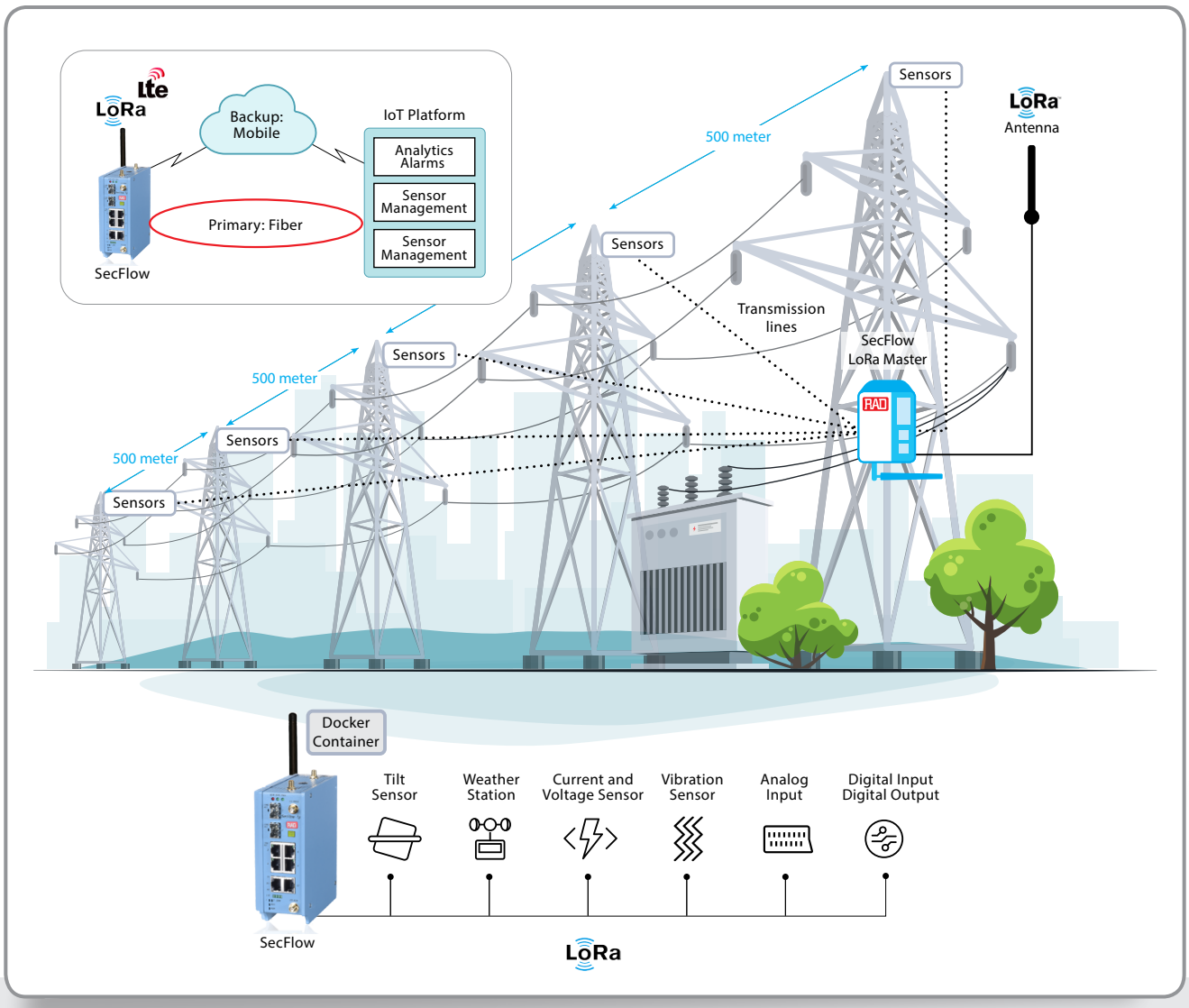

Value Proposition: Reliability, Flexibility & Efficiency

- Robustness in extreme conditions
- Super-low power consumption by design
- Docker-based Edge Computing, flexible software selection
- Compatibility with any IIoT platform, LoRa LNS or packet forwarder
- No hidden licensing costs
- Unique LoRaWAN and Wi-Fi Halow master & slave architecture for large area coverage
- eSIM support
- Real time geo-location support
- Flexible wireline and wireless connectivity options

Learn more about RAD's SecFlow here»

To discuss your Remote monitoring needs for power transmission towers, contact us at market@rad.com.

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