

Cutting edge: Changing the energy game for Cell Site Management

Reducing network OPEX and driving down CO₂ emissions to make your business more resilient against the energy crisis



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Executive summary

Due to rising energy costs, CO₂ emissions targets, falling margins and the perpetual need to upgrade radio access network (RAN) technology, improving operational efficiency has never been more critical for the mobile industry.

The emerging Tower Company (TowerCo) model focuses on the efficient operation of passive infrastructure which is essential but only part of the solution. The need to measure, report and invoice based on energy consumption and resource utilisation gives rise to new challenges.

To achieve the industry's ambition of becoming carbon neutral by 2050, operators are planning to deploy energy-intensive 5G technology whilst increasing cell density. This solution puts cost control and allocation at the top of the agenda for both MNOs and TowerCos.

The volume, age, diversity and accessibility of assets are usually the key obstacles that prevent businesses from becoming more energy efficient. Many companies with sites dispersed across wide geographical areas and hard-to-reach locations are considering the implementation of IoT-enabled remote management but IoT initiatives based on hub-and-spoke architecture often fail to deliver the expected benefits in the base station environment. These solutions are unable to process vast amounts of data, extract decision-ready insights, deploy automation or execute policies remotely and in real time.

The answer lies in the combination of IoT, Edge Computing and Big Data.

Combining these technologies makes it possible to collect, ingest, normalise and orchestrate huge volumes of structured and unstructured data. This enables operators to gain full visibility over their passive infrastructure and provides them with the ability to:

- Monitor and control energy consumption in real time
- Adopt a data-driven maintenance regime to reduce outages and site visits
- Monitor environmental conditions and optimise cooling strategies
- Track asset location, performance and undertake remote testing
- Collect data required for auditing and client billing

The combination of Edge Computing and IoT has the potential to finally bring passive infrastructure management into line with active infrastructure management practices. This allows operators to move oversight and control from the field to network operations centres (NOC).



Efficient Cell Site Management for reduced costs

Operators have already started their digital transformation to support their transition from traditional telcos to digital service providers before the pandemic hit. While their need to reduce operating costs is becoming increasingly important, their vision remained unaffected: delivering new premium services using 5G and optimising their operations with Big Data.

The trend of transferring cell sites into TowerCos is also accelerating on a global basis. As the TowerCo model itself is evolving 'from steel and concrete to signal and service' (Tower Exchange, 2019), executives are also giving more and more strategic priority to cost reduction and digital transformation.

To reach the UN-backed Race to Zero net zero emissions target by 2050, both operators and TowerCos have to reduce their cell sites' energy consumption, especially in off-grid sites where diesel generators often run 24/7.

The first step is to make sure that their passive infrastructure can underpin advanced cellular networks.

Operators remain optimistic about their ability to use 5G technology to deliver new premium services, while focusing on reducing operating costs.

What's the challenge?

A well-managed passive infrastructure is crucial to improve operational efficiency and optimise costs. Maintenance of these large electrical and mechanical equipment as well as their subsystems requires a nationwide maintenance operation or a maintenance contract with capable service providers which poses a real challenge for operators.

They have invested to improve their remote management capabilities but the results often fall short of expectations. In many cases, only part of the passive infrastructure is managed remotely which makes it difficult to track the overall efficiency or identify faults in time. As operators need to visit the site to carry out manual interventions, adopting a reactive approach results in avoidable downtime and unnecessary costs.

Maintaining a large field services team to support the network 24/7 is also a huge commitment. Recruiting, training and retaining exactly the right combination of skilled workers, vehicles, equipment and spares in all locations can lead to rising but unproductive OPEX.



More and more operators are adopting data-driven predictive maintenance strategies, but they're still experiencing avoidable downtime and struggling to become more cost-efficient. Even if they decide to outsource maintenance activities, it won't help them solve the core issue: the lack of comprehensive, reliable data.

That's why **operators no longer regard cell site passive infrastructure as a core asset** but more as a financial burden. Many of them decide to sell off their towers and lease them back, or carve them out as subsidiary companies and buy access to them as a service to get rid of maintenance obligations.

TowerCos are better qualified to operate passive infrastructure thanks to their strategic focus on operational efficiency. However, growth through acquisition recreates a challenge as they seek to establish common systems and practices across their estates both at a national and international level.

Benefits of predictive maintenance

Benefit	Range
Cost savings in operations and materials spend	5-10%
Increased equipment uptime and availability	10-20%
Reduced overall maintenance costs	5-10%
Reduced efforts on maintenance planning	20-50%

Deloitte Consulting GmbH

Keeping pace with the mobile industry evolution

Digital transformation is a catalyst to make cell site management operations more efficient. Thanks to Edge-Computing-powered CSM, operators and TowerCos finally have the tool they need to take the next step and reduce OPEX, improve their carbon footprints and optimise CAPEX investments.



Paving the way for 5G

5G will bring a new era of opportunities for operators, but they also need to address the challenges that come with it.

Although the energy intensity (energy consumption per data bit) is much lower than in case of 4G, Vodafone's own research estimates 5G RAN energy consumption to be 40% of the total site load. What's more, ¹it will require carriers to add 3 to 10 times more sites to their networks.

This means that 5G sites will require significant infrastructure upgrades to address issues with grid and back-up power capacity, cabinet heat dissipation, and power distribution. In addition, the need for greater cell densification will result in increasing energy consumption.

Improving Cell Site Management is becoming a strategic imperative to help operators and TowerCos prepare for 5G's impact. New generations of cellular technology are designed to be energy-efficient from the start, but the efficiency issues related to old and often poorly optimised passive equipment need to be addressed.

According to Boston Consulting Group, "The ability of current 4G technology to handle fast-rising traffic demand... is rapidly approaching its end". And with ²Ericsson projecting average monthly smartphone data consumption rising from 10GB to 35GB by 2026, it's easy to see why.

¹<https://www2.deloitte.com/content/dam/Deloitte/us/Documents/technology-media-telecommunications/us-tmt-5g-deployment-imperative.pdf>

²Mobile data traffic outlook, Ericsson, 2021

Revolutionising CSM with IoT and Edge Computing

Despite the high failure rate of many IoT projects, the Internet of Things is still key for Cell Site Management deployment. But we have to learn the lessons of past experiences to get the most out of this technology.

Industry best practices suggest that the three key rules of digital transformation are:

1. Secure C-Level support early in the process
2. Establish clear business objectives and a robust approach to measure business value
3. Focus on the critical few use cases

However, unlike most IoT projects, a nationwide CSM deployment involves the collection, aggregation and normalisation of structured and unstructured data from a wide variety of assets, subsystems and sensors in real time and on a 24/7 basis. So, simply collecting the data from the sites and transporting it into a central database are just the first of several technical challenges.

A vast amount of data needs to be analysed and visualised, it simply cannot be done by humans – operators need to apply Big Data technology to draw useful insights.

Without remote control capabilities, a monitoring-only solution almost always requires local action to fix problems or exploit opportunities for optimisation, preferably without delay. Edge Computing can address all these issues and bring additional capabilities to transform cell site operations and generate business value.

³Gartner defines Edge Computing as “a part of a distributed computing topology in which information processing is located close to the edge, where things and people produce or consume that information.”

Installing intelligent IoT gateways with computing power instead of simple access device gateways opens up numerous possibilities:

1. Data aggregation and normalisation

Data can be aggregated, normalised and analysed without transporting it back to the cloud. This saves costs and reduces the delay caused by cloud computing and network traffic.

2. Policies and business rules

Pre-defined policies and business rules can be executed immediately to maximise cost savings.

3. Data flow optimisation

Additional Edge Computing deployed close to groups of cell sites can further minimise the cloud computing and network impact and ensure that data analytics and data visualisation tools can harness pre-processed data. Machine Learning brings the computing power closer to passive infrastructure to improve efficiency and resolve alarm overload. It performs root cause analysis on the fly to reduce fault resolution time or outages, determine the cause of the issue and suggest a solution on the trouble tickets. This ensures that engineers are provided with the right parts at the right time to improve first time fix rates.



4. Digital Twins

Access to comprehensive real-time data makes it possible to create digital twins. A digital twin is an intuitive digital representation of a physical site and it collects information about its operating environment, configuration, asset condition and performance.

Applying data analytics provides operators with real-time insights on performance information from multiple subsystems combined with environmental data, such as internal and external temperature. This enables operators to establish benchmarks, detect anomalies, establish common failure modes and undertake root cause analysis to identify further opportunities for cost savings.

⁴ **47%** of organizations say they will increase their investments in IoT despite the impact of COVID-19

³Gartner, 2021 Strategic Roadmap for Edge Computing, Bob Gill, 3 November 2020

⁴<https://www.gartner.com/en/newsroom/press-relae/2020-10-29-gartner-survey-reveals-47-percent-of-organizations-will-increase-investments-in-iot-despite-the-impact-of-covid-19>

Addressing key cell site challenges with IoT and Edge Computing

Cell sites use many types of equipment provided by multiple manufacturers. Each part requires different approach due to its unique issues. How can an intelligent IoT solution help operators deal with these challenges to improve Cell Site Management?

1. Energy consumption and greenhouse gas reduction

Operators can connect ambient temperature sensors and cooling systems with intelligent IoT systems to automate and optimise cooling methods. These systems can draw cool air from outside using low-energy DC fans instead of power-hungry HVAC systems. This solution reduces maintenance requirements and extends the life of assets while it also enables remote control of device-setting, performance and configurations.



2. Operational efficiency

Access to live asset condition and performance data enables operators to adopt data-driven predictive maintenance capabilities. This approach can eliminate unnecessary site visits and optimise engineering resources. The right data helps operators identify anomalous system performance to reduce unplanned outages and improve asset utilisation. Economy mode can be enforced on rectifiers remotely to enhance energy efficiency.

Live asset data also enables operators to generate work orders automatically as it provides them with information on priority and probable root causes to improve first time fix rates and repair performance. Automation of certain tasks, such as rebooting of malfunctioning equipment and remote testing of batteries and generators can further reduce the need for truck rolls and site visits.

3. Safety, security and compliance

By integrating inputs from fire and intrusion alarms and CCTV systems, operators can verify root causes much earlier to reduce both false and missed alarms. They can also implement two-way audio or recorded voice alarms to ensure faster security response, reduce outages and remediate costs.

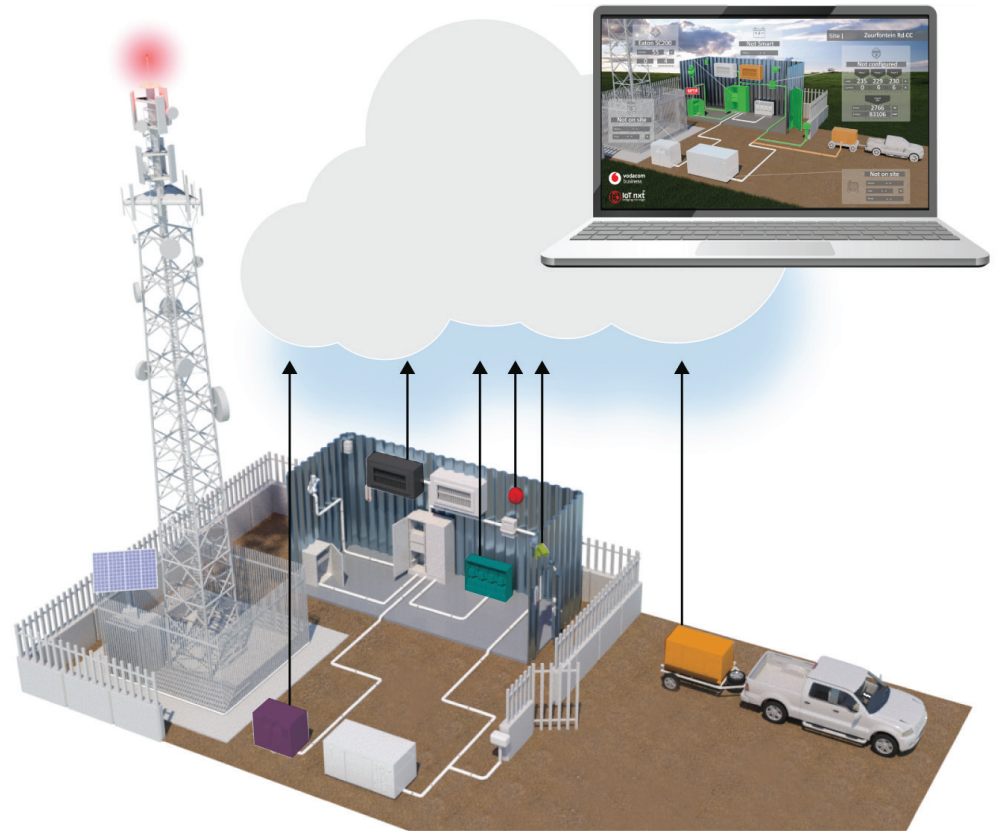
Smart access control and integration with video verification systems can prevent unwanted access and allows active monitoring of aircraft warning lights, wind, water ingress or other environmental threats to reduce the risk of outages and ensure compliance with local regulations.

Maximising energy efficiency with digital twins and AI

Operators and TowerCos need to forecast the impact of their decisions to ensure that their investments will pay off. Using digital twins and artificial intelligence not only enables them to understand the cause of any equipment failure and get real-time insight into the status of their passive infrastructure. These technologies also help them determine the next steps to make their operations more cost-efficient and reduce their carbon footprint.

Creating digital representations of their sites provides businesses with quick access to structured data in a readable format to see how they can maximise savings on energy and maintenance costs while prolonging asset life. They often struggle with the management of thousands of decentralised sites but using AI and digital twins allows them to obtain centralised control over their assets, bring separate data points together and monitor every essential part of their infrastructure that could affect network quality.

By leveraging predictive analytics and visualising their strategic plans, operators and TowerCos can take the necessary actions to get the most out of their passive infrastructure in terms of costs and sustainability. These capabilities also make it possible to adopt predictive maintenance which helps them foresee equipment failure, perform root cause analysis, prescribe remedies and schedule maintenance.



- Grid energy
- Renewable energy
- Security systems
- Back-up power
- HVAC systems
- Safety & security



Leveraging CSM for more efficient operations and a greener future

Rising energy prices and the deployment of 5G networks have forced operators and TowerCos to prioritise the optimisation of their energy usage and costs. Sleep mode and intelligent power management can contribute to the solution, but they need to adopt a holistic approach to avoid huge increases in energy costs and keep their commitments towards sustainability objectives.

Remote monitoring of cell sites can help businesses cope with the energy challenge posed by the increasing post-pandemic demand and the current global conflict. Digital transformation is a long-term investment which allows them to take control of their passive infrastructure.

Bringing together the latest technologies such as IoT, Edge Computing, Big Data, AI and digital twins allows operators and TowerCos to visualise, manage and control their passive infrastructure remotely. Deploying an end-to-end Cell Site Management solution can generate ROI in no more than 8 months from the deployment. This enables businesses to save 15-20% on energy and 5-10% on maintenance costs while it also increases savings by 20-40% thanks to asset-life extension.

Intelligent Cell Site Management is ready to change the energy game by providing operators and TowerCos with the desired benefits and having a positive impact on the environment.





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