WHITE PAPER

TELECOM SITES POWER CONTROL & MANAGEMENT

Improving the Efficiency and Resilience of Telecom Network Base Stations

Asentria®

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Introduction

Power issues are the most fundamental item that network operators need to monitor and manage at remote sites. The ability to remotely monitor and reboot equipment contributes to both network resilience and network efficiency. Effective monitoring of various power-related sub-systems (AC meters, generators, DC rectifiers, batteries, fuel cells, solar arrays, or other newer hybrid power systems) can give a complete picture of power-related issues at a site. This allows for better troubleshooting and reduced downtime of the network due to power-related faults. Automation, like an immediate reboot of malfunctioning DC or AC powered equipment at a remote site, reduces network downtime and also saves a costly truck roll.

This white paper report provides details of the leading cause of telecom power outages, and the benefits of more advanced cell site automation applications involving power management.

What We'll Cover in This White Paper

Across a network of base stations, you'll find a variety of different equipment and power sources available to keep the network up and running. We will look at situations that telecom site automation can help with during power outages across either individual or multiple sites, as well as how telecom site automation can be beneficial during times of "normal" operation. The report will also expand on the following topics:

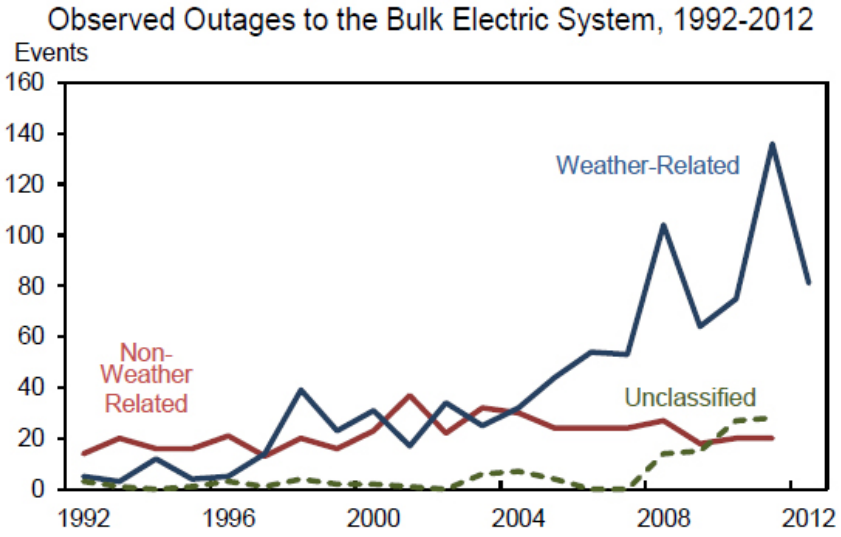
- The leading cause of telecom site power outages in different geographic regions of the world.
- Methods to reduce the impact on a telecom network caused by power outages.
- Reducing costs of operating a communication network with automation.
- Dispatching service personnel less often, and with valuable data regarding what problems they may encounter once they reach the site.

Methodology

Regarding power management during mass power outages, we have worked with mobile network operators, public safety officials, and tower companies domestically in the United States and internationally across multiple sites. Our solutions have helped them with their goals of saving costs, increasing network resilience, and have provided valuable data for future decision-making about the network. The cost of network failure data points and additional network details for this white paper are acquired from 3rd-party reports, surveys, and studies listed in the resources.

The Number One Cause of Power Outages in the US

In the United States, the number one cause of power outage is severe weather. Weather such as thunderstorms, hurricanes, and blizzards account for 58% of outages observed since 2002[2]. Weather-related power outages have increased significantly since 1992 and will continue to increase due to climate change.



(Source: Energy Information Administration)

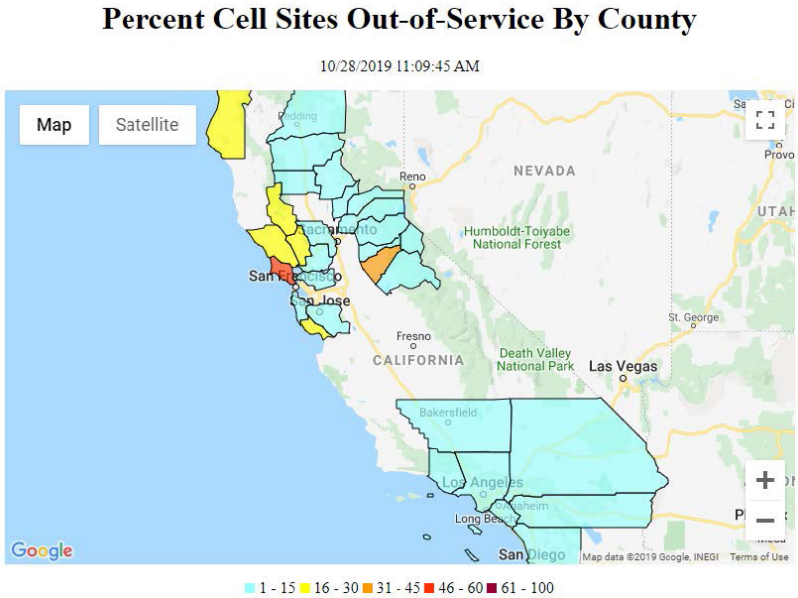
> *"Grid resilience is increasingly important as climate change increases the frequency and intensity of severe weather. Greenhouse gas emissions are elevating air and water temperatures around the world. Scientific research predicts more severe hurricanes, winter storms, heat waves, floods and other extreme weather events being among the changes in climate induced by anthropogenic emissions of greenhouse gasses.[2]"*

Understanding Telecom Sites Mass Power Outages

Wildfires

More recently, in the past two years, the destructive “Camp Fire” and “Kincade Fire” that started in California caused power cuts to many cell towers and led mobile carriers to work on minimizing disruption[1].

During the fires, mobile network carriers most often resort to batteries when they lose power. When the batteries run out, the cell towers are powered by generators that rely on the tanks to be refueled. It can be a complicated process due to conditions on the ground and extremely inefficient for the Network Operation Center (NOC) if it has no visibility on fuel levels.



(Source: A screenshot of the cell site outages on Monday, Oct. 28, 2019, in California, according to data voluntarily provided by telecom companies to the Federal Communications Commission)

Hurricanes

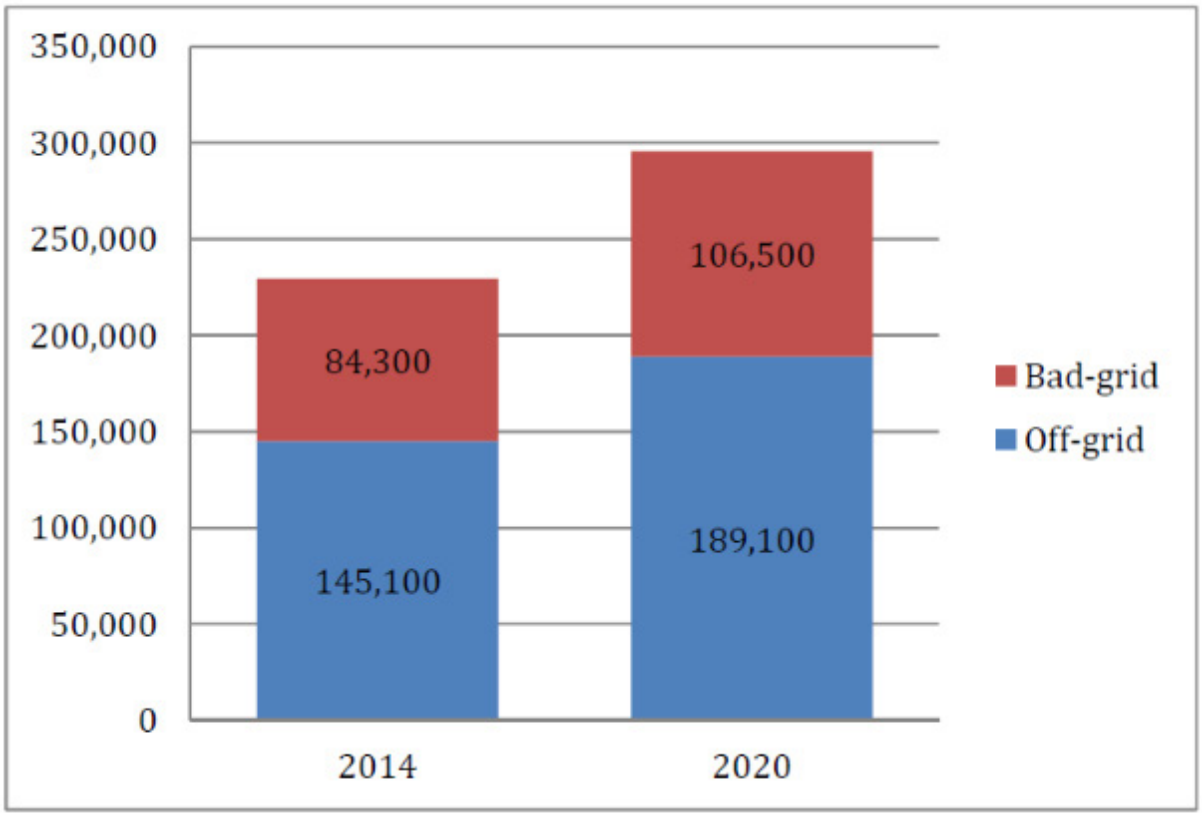
In 2012, Hurricane Sandy inflicted nearly $70 billion in damage and knocked out 25% of cell towers[4] in the northeastern United States. Many cell site locations that were still working were forced to operate on backup power sources for up to several weeks, leading to generators running beyond their fuel storage capacity.

By monitoring the usage of fuel per site, a network can establish a priority of which sites needed refueling first and have a detailed fuel consumption rate and manage truck rolls efficiently.

Power Outages in the Developing World

AC grid power is often unreliable in other parts of the world, causing telecom sites to deploy and run on some form of backup power for some period of almost every day.[5] This lack of grid reliability means that sites will fail if there is any problem with batteries or generators at sites.

Figure 10: Tower Sites by Off-grid and Unreliable-grid



(Source: GSMA Tower Power Africa Report, 2014)

Weather conditions in different parts of the world vary greatly, with typhoons, hurricanes, and other weather calamities being possible, as well as extreme cold or heat. In many parts of the world, telecom site equipment or resources like batteries or diesel fuel can lead to theft, which besides being a considerable expense in its own right, can also lead to sites failing when site damage due to theft is not detected.

For more information on how telecom site automation can improve telecom site security, see our "Telecom Sites Physical Security" white paper **here**.

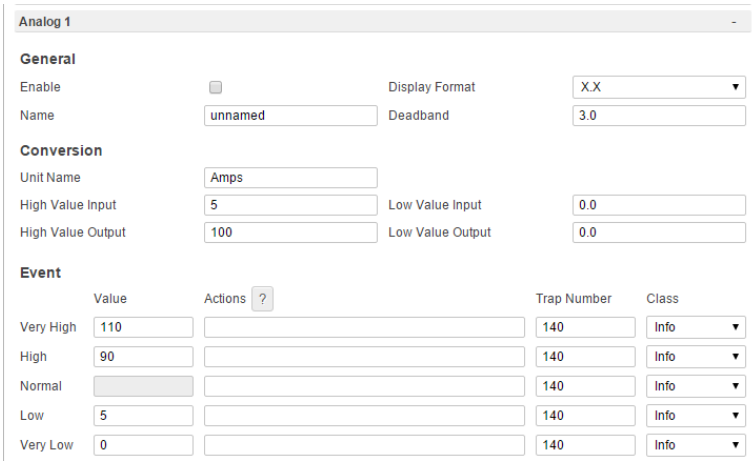
Improving Telecom Site Power Control and Management with Telecom Site Automation

Weather-related power outages and unreliable AC grid power can not be avoided in some regions in the world. In these situations, telecom site automation can help during power outages across either individual or multiple sites and be beneficial during times of "normal" operation.

Below is a list of common power-related abilities that a telecom site automation solution can provide:

AC Power Monitoring/Metering

The first link in the chain of power to a site is the AC grid. A solution might do something as simple as detecting the presence/absence of AC power. Telecom site automation can also interface to many different AC meters that might be present or added at a site. This interface can give detailed data on AC power, both to determine the health of the power, but also to potentially compare sites power consumption, or with revenue-grade meters for multi-tenant billing.



DC Variables

It is also possible to measure many different DC power variables (voltage, current, total power in DC power systems; and in single-, split-). Typically the best way to do this if for a telecom site automation appliance to pull the data from DC rectifier controllers at the site. Simple methods of measuring DC circuits are also available.

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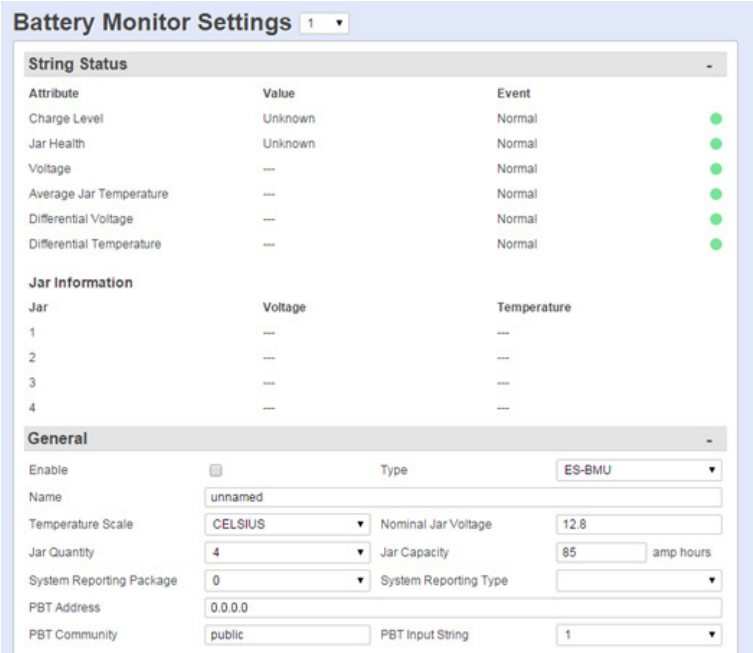
Battery Monitoring

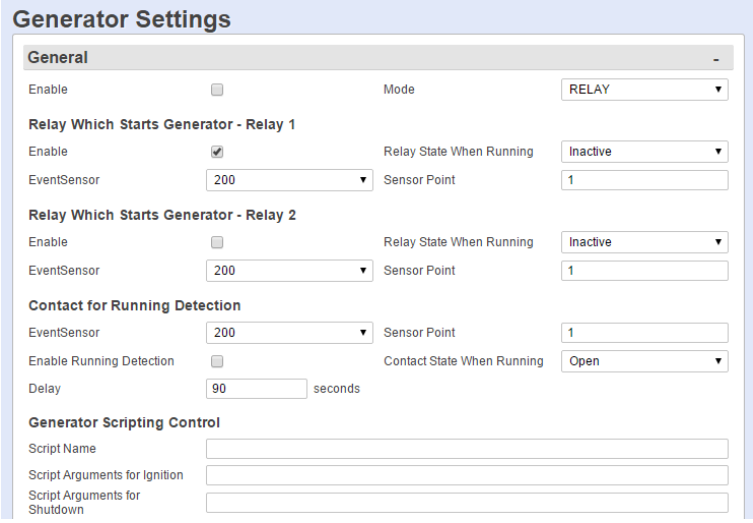
Various forms of battery monitoring are also possible, from simple measurements to interfacing to specialized battery monitoring sub-systems.

One example of telecom site automation is for a telecom site appliance to watch battery charge levels during a power loss. A SiteBoss unit can alternate between running a site on backup batteries or running the generator to make a site last as long as possible on its back up power sources in the event of an extended loss of AC grid power.



Generator/ATS Monitoring and Control

A telecom site automation solution can centralize the control and management of generators of all makes and models across telecom sites. Operational data can gather fuel levels, fuel level changes that indicate theft, generator run times, generator battery voltages, and other parameters. Direct control can be taken to start generators remotely. This ability can exercise generators immediately before a weather event like a hurricane to locate any generators that fail to start. Alternately, this same ability can suppress generator exercising under certain regulatory issues like poor air quality or noise ordinances.



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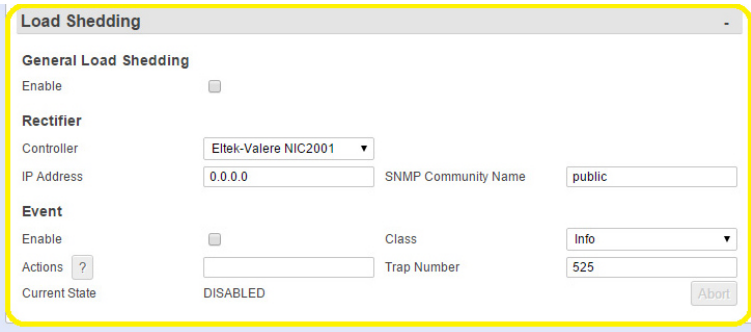
COW's, COLT's, GOAT's (Cell on Wheels, Cell on a Light Truck, Generator on a Truck)

Specialized telecom site automation appliances are available to be deployed on a telecom network operator's mobile disaster recovery vehicles. These specialized appliances can do many of the functions described above, but also add GPS tracking, wireless modems, accelerometers, and "sleep" modes to fit applications in mobile vehicles.

AC or DC Reboot/Load Shedding

Telecom site automation solutions can also control power circuits by allowing for remote reboot of devices in a telecom site. This concept referred to as "load-shedding" where different devices at a telecom site are selectively shut off to connected equipment in a particular order. This can occur after the main power is lost. The purpose is to preserve site battery/backup generator fuel to extend site life, or to turn off equipment before complete site battery failure occurs, which will prevent damage to equipment when site AC power is restored. It is also possible to shut down certain equipment during times of lower site traffic to simply save on energy consumption.



Conclusion

Preparing your network for power outages caused by weather and natural disasters with advanced technology will increase the resilience, reliability, and efficiency of your telecom sites. As climate change poses an increasing frequency of events, we recommend automating your telecom sites now to minimize the impact of network failures and avoidable operating costs.

Asentria is a 30-year-old company based in Seattle, Washington, and has multiple hardware deployments of 10,000 or greater sites in the largest mobile network operators worldwide.

References

[1] Chen, Brian X. Pogash, Carol."California Blackouts Hit Cellphone Service, Fraying a Lifeline." New York Times, https://www.nytimes.com/2019/10/28/business/energy-environment/california-cellular-blackout.html. Accessed 3 December 2019.

[2]"Economic Benefits of Increasing Electric Grid Resilience to Weather Outages." US Department of Energy, https://www.energy.gov/sites/prod/files/2013/08/f2/Grid%20Resiliency%20Report_FINAL.pdf. Accessed 3 December 2019.

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[4]"Hurricane Sandy Knocked Out 25 Percent Of Cell Towers In Its Path." Business Insider, https://www.businessinsider.com/hurricane-sandy-knocked-out-25-percent-of-cell-towers-in-its-path-2012-10. Accessed 11 December 2019.

[5]"Tower Power Africa: Energy Challenges and Opportunities for the Mobile Industry in Africa" GSMA, https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2014/11/Africa-Market-Report-GPM-final.pdf. Accessed 16 December 2019.