



Controlling Telecom Tower Costs Using Lithium Batteries

System Overview

Where generators provide power at remote telecommunications sites, system reliability is critical. Many commercial systems include two generators that operate in rotation. System operators realized they could decrease engine runtime by including a battery and charger into the DC bus.

The battery provides constant power for the electrical loads. The generator runs three to five hours every time a lead acid battery needs to be recharged.

Challenges

In remote areas, the price for fuel delivery can exponentially increase costs. Routine site maintenance is often limited by seasonal access. Emergency generator maintenance can require very expensive labor and transport costs. Lead acid batteries require regular onsite testing and maintenance, in addition to relatively short cycle life. This is not ideal.

The Solution is Lithium

Battery choice is the most critical decision to control the telecom tower's costs. Lithium batteries feature fast charge, higher energy density, and remote monitoring that make this new battery an ideal fit for reliable remote power.

Lithium Iron Phosphate (LiFePO_4) batteries are the safest type within the family of lithium batteries. **Lithium Iron batteries are superior in energy efficiency and cycle life compared to lead acid batteries, lowering labor costs for replacement and decreasing generator runtimes.**

Each individual cell in Lithium Iron battery can be monitored remotely through an online portal. This saves the cost of onsite resistance testing which lead-acid batteries require to monitor

Benefits of energy storage at sites powered by generators:

- Reduce or eliminate costs of fuel and maintenance
- Increase reliability and visibility of site's performance

Lithium advantages over lead acid:

- 75% reduction in generator run hours
- 4x longer cycle life
- Higher energy density
- Smaller physical footprint
- Maintenance-free
- Remote monitoring

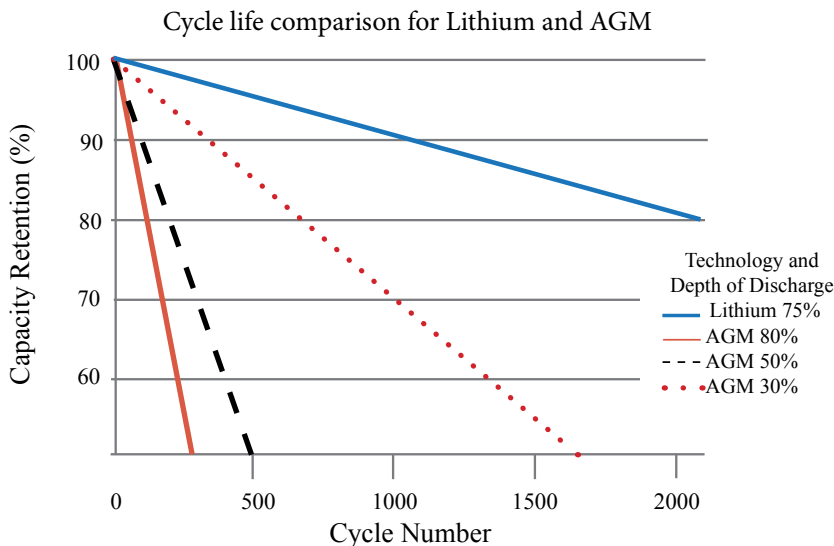


battery health and performance.

Lithium batteries have revolutionized consumer electronics in the 21st century with their reliability and energy density, and now this proven technology is poised for further market penetration in mission-critical remote telecom sites.

Improved Efficiency and Longer Cycle Life

Lithium Iron batteries offer three-times the usable life of a lead-acid battery in daily cycle applications. Longer cycle life eliminates site visits to replace failing battery banks, freeing up company time and resources.



Battery charge efficiency is greatly improved with Lithium Iron, which reduces generator run time — saving fuel and maintenance costs. Lead acid batteries waste as much as 30 percent of energy put into them due to efficiency losses, so if you provide 100 amps of power you're only storing 70 amps in the battery.¹ Lithium is able to hold more of this power, storing between 95 and 100 amps of the same charge current thanks to improved efficiency.²

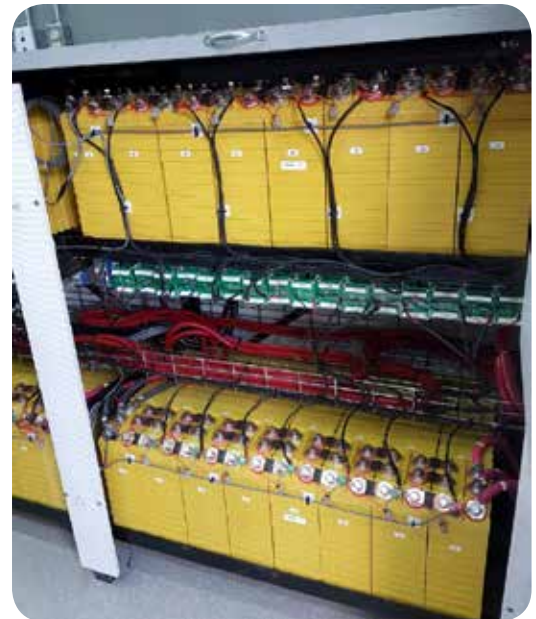
Lead acid batteries suffer from slow charging in the top half of the battery — which is the part used the most during daily use. The final 20% of a charge cycle requires an "absorption" stage, which tapers charge current while holding a set voltage. This requires a longer generator run, and if charging with solar, the sun may set before the battery is able to reach full charge. Failure to complete a full charge cycle can result in premature aging and reduce the usable life of a lead acid battery.

¹ J. Stevens and G. Corey, "A Study of Lead-Acid Battery Efficiency Near Top-of-Charge and the Impact on PV System Design," [Online Document], Available at HTTP: http://www.otherpower.com/images/scimages/7427/Lead_Acid_Battery_Efficiency.pdf

² J. Electrochem. Soc, 2005, 152, A191-A196.



Carrier-grade microwave radios and multiplexers are supported for 24/7 operation by an Iron Edison Lithium Iron 5000Ah 52V battery. Inverters from Schneider Electric (right) provide AC power for other site loads.



1000Ah single format prismatic cells are used for fewer parallel connections. Each cell has a cell board card from the BMS, which keeps the pack balanced and provides real-time data that can be monitored online.

☀ 50% of lead acid life is at low efficiency, causing longer generator run times and increased costs of fuel and maintenance.

Lithium Iron batteries do not require this wasteful absorption stage, can be fast charged, and are able to hold more of the incoming power thanks to better efficiency.

Reduce or Eliminate Generator Runtime

Sites that are powered only by generator can benefit greatly by adding a battery to reduce generator run time. A lead acid battery may seem like an economical choice, but requires a three to five hour generator run to fully recharge the battery.

A battery with high efficiency will charge faster which decreases generator runtime, and Lithium Iron batteries can accept a much higher charge rate compared to lead acid. **Charge acceptance efficiency in the Lithium Iron battery is the cornerstone to vastly improving the overall system performance, reducing generator run time and associated maintenance costs.**

For example, a generator with a rectifier or charger that is capable of delivering high output can fully charge a Lithium battery in just two hours, at a rate of C/2.

Lead acid batteries cannot be charged as fast as Lithium Iron. The recommended lead acid battery charge rate is C/10, which translates to 10 hours to recharge a lead acid battery from empty to full.³ This is five times slower than the Lithium Iron charge rate of C/2, meaning the battery can be fully charged in just two hours.

Thus, there is room for an immediate and significant reduction in generator runtimes by implementing a faster-charging Lithium Iron battery.

Remote Monitoring of Battery & System

Every Iron Edison Lithium Iron battery includes a Battery Management System (BMS) which measures and reports cell resistance, cell voltage, cell temperature, pack current, pack resistance and many other critical performance metrics.

The BMS connects to an internet-enabled computer for easy online monitoring of each cell's performance. This saves regular site visits required by lead-acid batteries to measure resistance by physically clamping a device to each cell. With hundreds of cells at a single site, this process can take hours or days.

³ Rolls Battery Inc. "State of Charge & Charging - Flooded Lead Acid Batteries," [Online document] 2016, Available at [HTTP://support.rollsbattery.com/support/solutions/articles/428-state-of-charge-charging-flooded-lead-acid-batteries](http://support.rollsbattery.com/support/solutions/articles/428-state-of-charge-charging-flooded-lead-acid-batteries)

Why choose Lithium over lead-acid?

Quality	Impact
<i>Higher efficiency</i>	Less generator run time
<i>Longer cycle life</i>	14+ years at 50% DOD 3-4x lead acid cycle life
<i>Faster charge acceptance rate</i>	4x faster than lead acid. Full charge in 2 hours
<i>Shorter charge cycles</i>	More fuel efficient per kWh
<i>Less generator run time</i>	Increase interval for on-site maintenance
<i>Higher energy density</i>	More energy stored in same footprint
<i>Proven chemistry</i>	Safest of Lithium family



An Iron Edison Lithium Iron battery supports the telecom equipment at this site in Alberta, Canada. The site was converted to all renewable energy, eliminating the need for generators completely.

For further performance tracking, the battery inverter and solar photovoltaic charge source (if present) can connect to the same online portal. New equipment offers hardware-level encryption of system performance data that can be securely viewed anywhere with an internet connection.

Custom Solutions for Telecom Sites

Iron Edison Battery Company designs and assembles Lithium Iron batteries to meet the unique power needs of each site or application. Located near Denver, CO, Iron Edison is family-owned and takes pride in delivering exceptional customer service, including lifetime technical support with every battery.

The sales and design team are dedicated to an education-based approach. The team can also offer assistance in the selection of solar panels, charge controllers, and battery inverters, thanks to years of experience in off-grid solar and battery system design.

Lithium Iron batteries offer a clear reduction in costs at remote telecom sites, while also providing increased visibility and reliability. Let the Iron Edison team show you how this cutting-edge solution can be applied to your specific site or energy need.



The Iron Edison team provides on-site technical support during installation, if needed. Batteries are pre-assembled and tested at Iron Edison's production facility before arriving on-site to ensure immediate performance.

Questions? We are happy to help!

Call 720-432-6433 for a free consultation or email to info@IronEdison.com.

Inside the control room of an off-grid telecom site powered by renewable energy



(24) MidNite Classic charge controllers regulate solar power to battery charging.

Telecom repeater equipment (Alcatel-Lucent MDR-8000) and Schneider Electric battery inverter for AC loads.

Iron Edison 5000Ah 52V Lithium Iron Phosphate (LiFePO4) battery and cladded enclosure. Battery has 260 kWh total capacity.