www.northstarbattery.com

Energy Storage Challenges for Telecom

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About Northstar

Established in 2000, NorthStar quickly became an industry leader in designing, manufacturing and deploying premium Lead Acid **batteries** and **site solutions**..

Our batteries and systems have been deployed in more than 150 countries worldwide.

NorthStar employs over 600 people, with headquarters in Sweden and major operations in USA where we built the **most advanced** lead-acid battery manufacturing facility **in the world**.

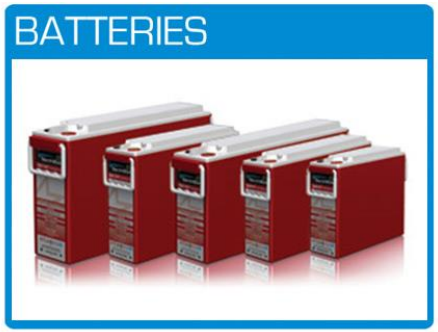
MARKETS







PRODUCTS







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NorthStar Business Units

NorthStar is **two** business units under **one** common brand.

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NorthStar BATTERY



NorthStar SITETEL



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The world's most advanced Battery Manufacturing
Springfield MO - USA

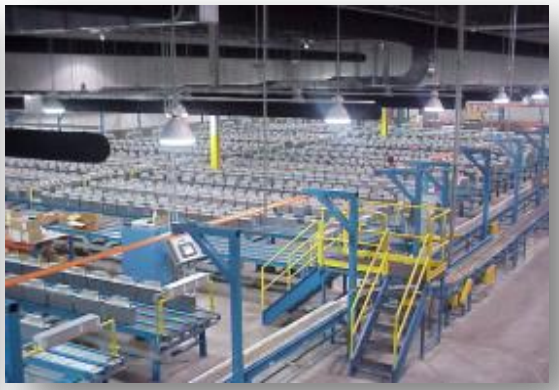








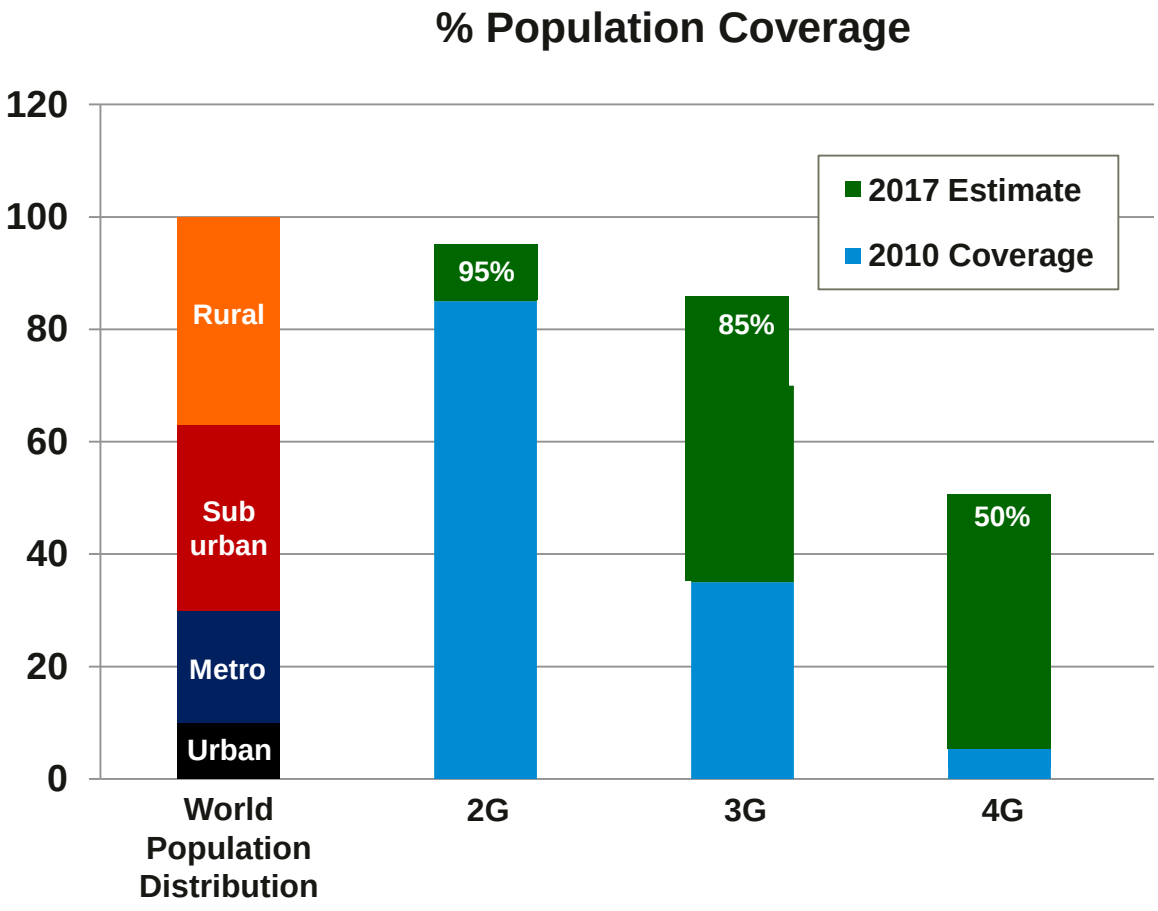




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Telecom Coverage expansion drive need for more Back up solution

3G will expand, especially in rural areas, where the power grid is either unreliable or non-existent. This means more demand for lead-acid batteries to back up power during long power outages or when running with Hybrid Off Grid Solutions.





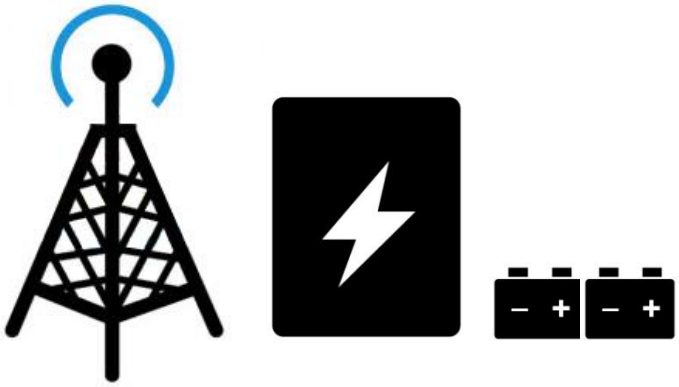
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The evolution of telecom power systems

A shift to developing markets is driving the need for alternative power solutions, where batteries are becoming the key element of power generation

Before

Developed Markets:
Stable grid, normal temperatures



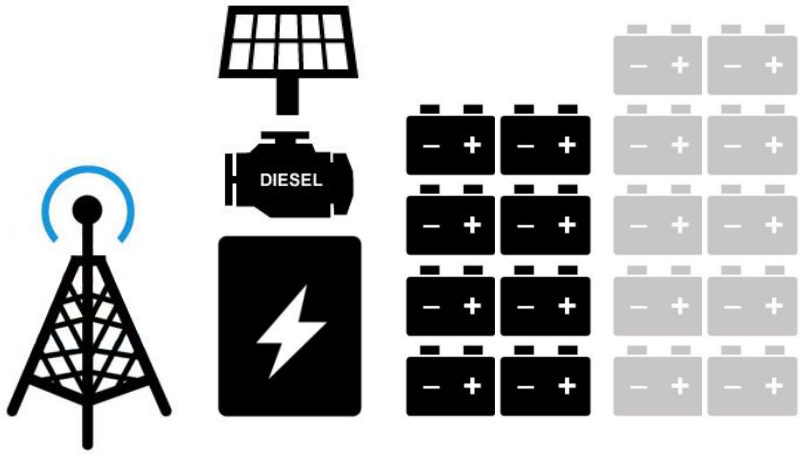
Large base station

Large DC system

2 hours battery backup
8 year life

Now

Developing Markets:
Unstable or no grid, high temperatures



Smaller base station

Power system, generator or renewable energy

8-10 hours battery backup
2 year life

Frequent battery replacement

Battery usage has been evolving over years driving need for higher performance battery

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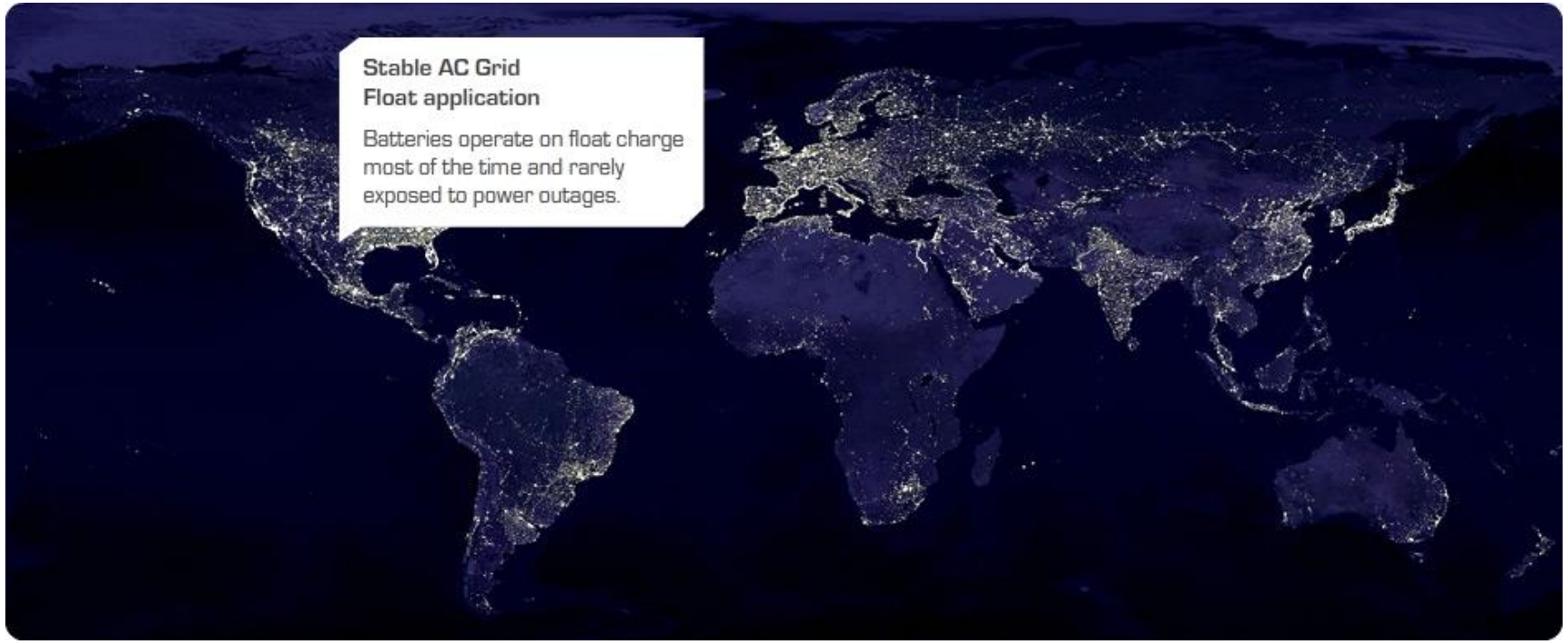
The global power challenge



Each country poses a unique challenge in terms of grid availability, operating temperatures and power availability.

Electric AC grids and applications drive the need for different batteries

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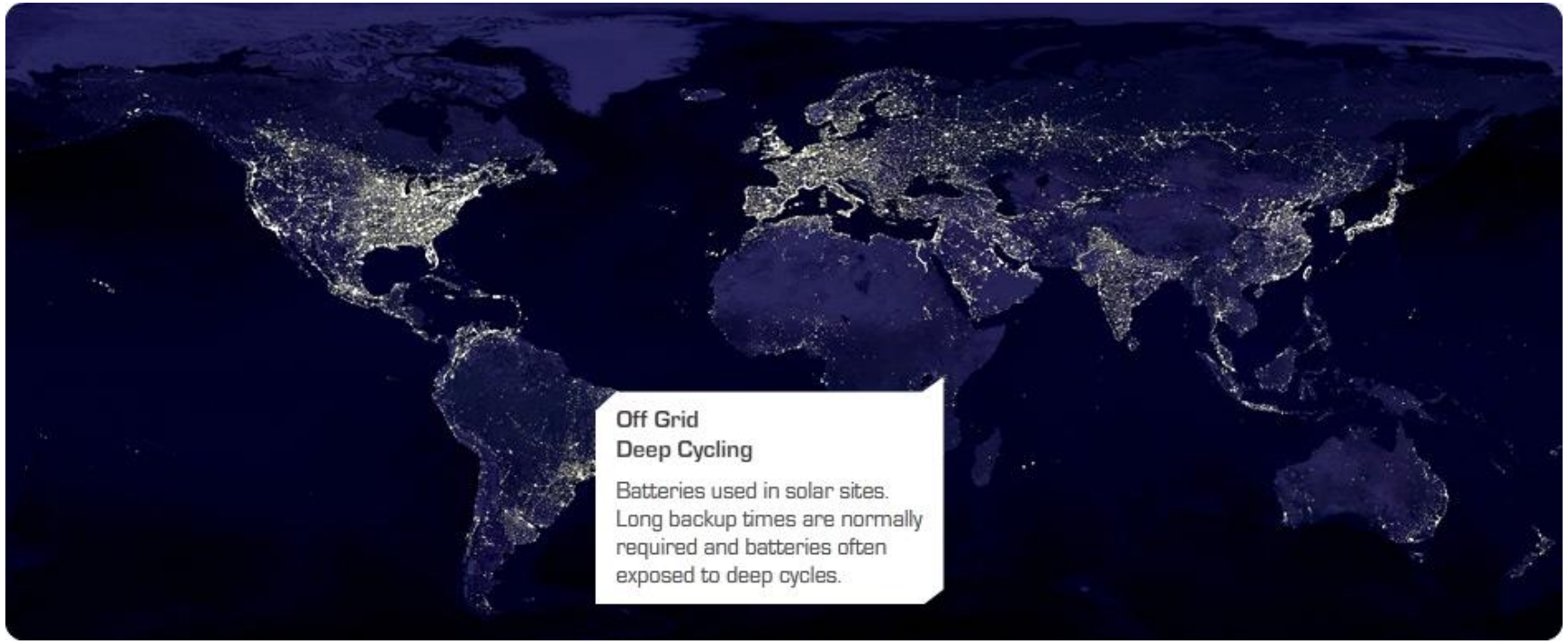
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Electric AC grids and applications drive the need for different batteries

The main challenges for Telecom Back Up



Exposure	Typical Problems	Solutions
Battery Performance	Low cost batteries have extremely low performance at high temperature and/or in cycling conditions. (typically ¼)	Select right batteries depending on temperature and grid conditions .
High Ambient Temperature	Both Battery design life and Cycle life are reduced (Typ 50% at 30-35C)	Temp Controlled Storage and Installation in Cooling Cabinet or Ultra long life batteries
Repeated Power Outages	Battery does not have time to recharge due to Repeated Cycles.State of Charge will decline and Batteries will dry out and fail.	Use New Battery can fast recharge or operate in partial state of charge
OverCharge	Incorrect rectifer settings (ie Boost) can significantly shorten battery life. Battery is overheated (risk of Thermal runaway/ leaking) Design life reduced to 1/5.	Review Rectifier settings or use Float Voltage recharge

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The NorthStar telecom battery range

Built around grid reliability with **specific battery electrochemistry**.



AGM
Red Star Technology

- Designed for very stable grids
- Cost effective solution
- Extended float life of 15 years at 20ºC
- Pure lead positive grid alloy
- Operating -40ºC to +65ºC



AGM
Silver Star Technology

- Designed for semi-stable grids
- High cyclic performance
- Long float life of 10+ years at 20ºC
- Advanced positive grid alloy
- Operating -40ºC to +65ºC



AGM
Blue Star Technology

- Designed for unstable grids
- Advanced PSOC cyclic performance
- Fast recharge and charge acceptance
- High potential fuel savings when used with gensets
- Operating -40ºC to +65ºC



OPZV
Solar Technology

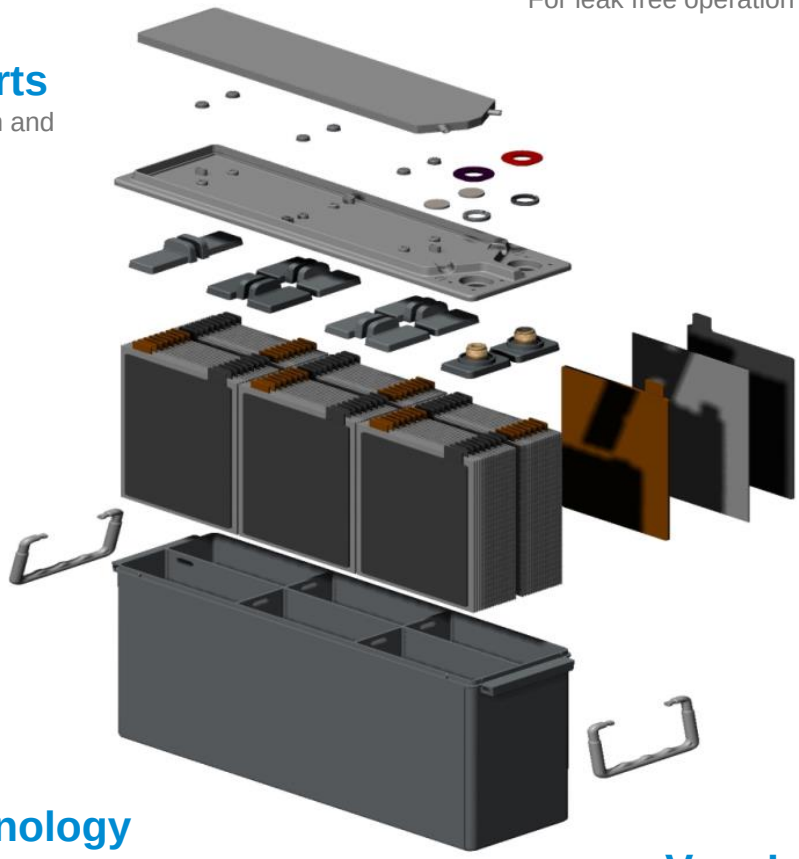
- Designed for off grid
- OPZV tubular gel plate technology
- Deep cyclic performance
- Ideal for use with solar power system

STABLE GRID **UNSTABLE GRID** **OFF GRID**

NorthStar Battery Advanced Construction

Advanced 3 Stage Terminal
For leak free operation

Dual Venting Ports
For optimum gas evacuation and easy installation



Thin Plate Technology
<1mm stack = higher specific surface and higher capacity density

Fixed Solid Handles
For easier installation

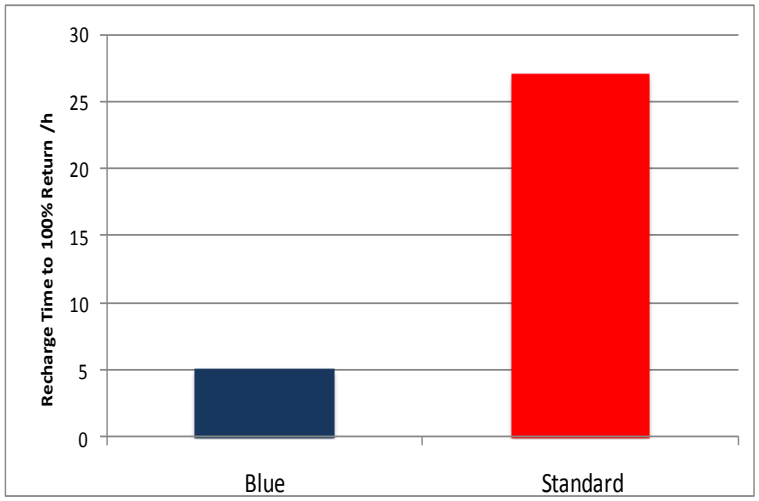
Very High Pack Compression
For higher cycling capability

PPO Plastic Technology
High temperature resistance
Operating temp -40°C to +65°C
Halogen free V0

Very Low Internal Resistance
High volumetric and gravimetric power density
Rapid recharge capability
Superior low temp performance

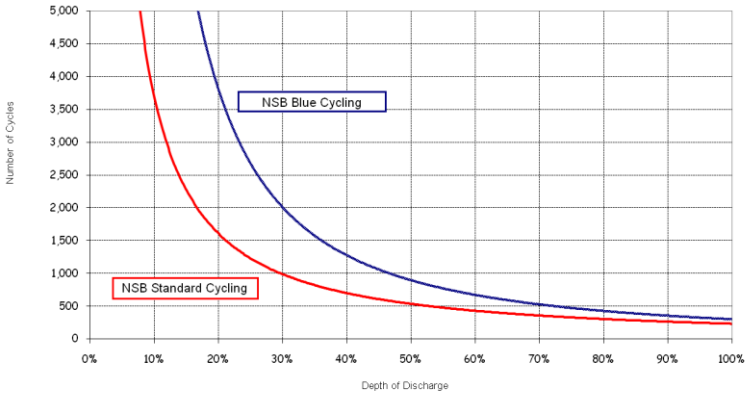
Blue Technology – Designed for Unstable Grid

- **Easy and Safe Set up**
  - No Boost Voltage required
  - No Full recharge required after each cycle - PSOC Capable
- **Faster recharge**: up to 5 times when compared to Standard technology with float recharging
- **High cyclic capabilities** - Up to 2500 cycles at 25% DOD



5 Times faster recharge.





Up 2 to 3 Times more cycles than NSB Standard .

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In Genset Hybrid Blue Fast charge Technology increase System efficiency and reduce fuel consumption

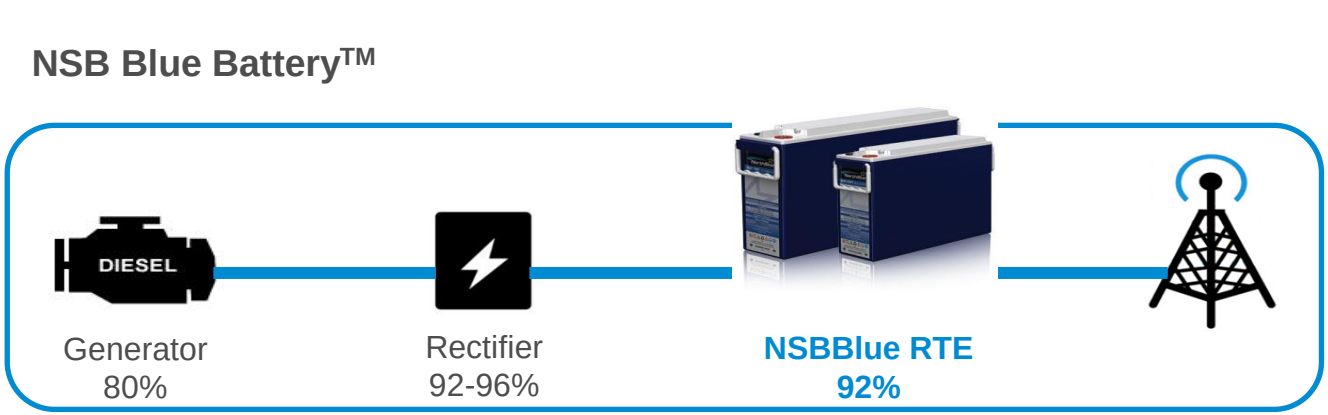
System Efficiency

Std OPzV Solution



55%

NSB Blue Battery™



70%

Hybrid comparison

Blue Battery vs OPzV Battery

Blue Battery		OPzV Battery	
CAPEX		CAPEX	
▪ Initial Investment	**Low**	▪ Initial Investment	**High**
OPEX		OPEX	
▪ Battery Exchange	**High**	▪ Battery Exchange	**Low**
▪ DG Life time	**High**	▪ DG Life time	**Low**
▪ Fuel & Main.	**Low**	▪ Fuel & Main.	**High**
▪ Temp. Effect	**Low**	▪ Temp. Effect	**High**
TCO		TCO	
▪ 10 Years	**Low**	▪ 10 Years	**High**

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Blue Battery		vs	OPzV Battery	
1.	Cyclability @ High Temp reduced by	**0 - 5%**	1. Cyclability @ High Temp reduced by	**30%**
2.	Internal resistance	**Low**	2. Internal resistance	**High**
3.	PSOC ability	**Yes**	3. PSOC ability	**NO**
4.	RTE*	**High**	4. RTE*	**Low**
5.	Price per Ah	**Low**	5. Price per Ah	**High**

* Round Trip Efficiency

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SiteStar™ Technology

The most advanced telecom cabinets in the world have one thing in common: they all use **SiteStar™ Technology**, a combination of advanced components, design innovations, and state-of-the-art manufacturing processes.

Exceptional Cooling

Active compressors ensure optimal battery operating temperature, which multiplies battery life, reducing replacement costs

Robotic Construction

90% of each cabinet is constructed using automated robotics to ensure reliability and lower maintenance costs



High Efficiency

Cut electricity costs by up to 95% compared to other cabinet solutions

Swedish Design

Our cabinets are designed to lower your TCO, as well as being easy to install

Innovative Insulation

Ensures optimal battery operating conditions inside the cabinets, no matter what the temperature is outside

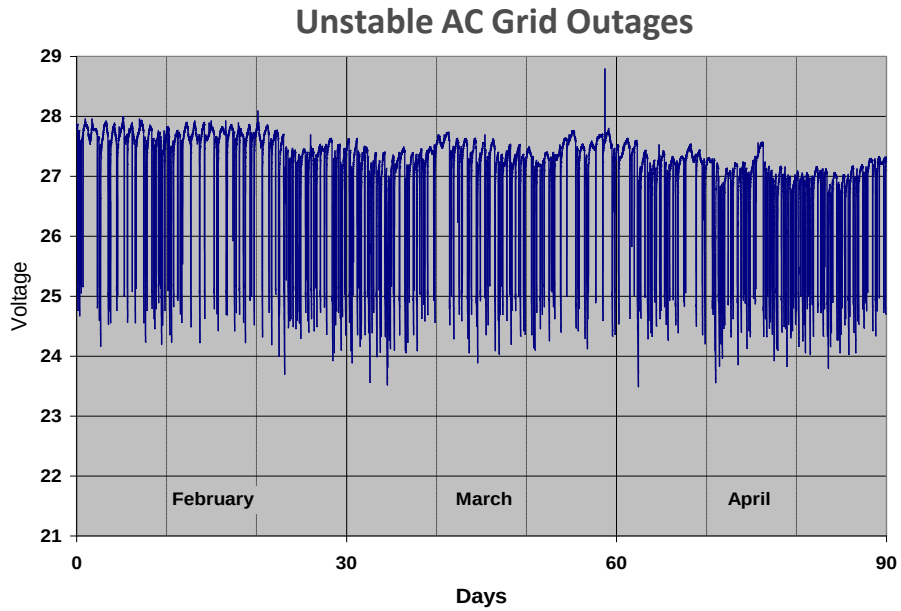
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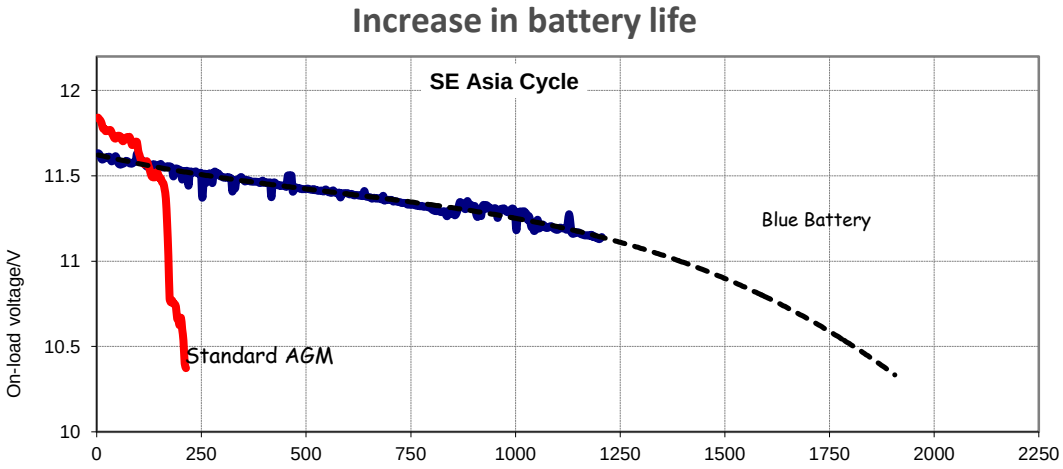
Unstable Grid Field Trial - Bangladesh

In these conditions, Standard AGM will fail after few months. The Blue Battery has completed over 1800 cycles in 1 year of operation and is still working



Simulated laboratory cycling confirms the large increase in cycle life with the Blue Battery





Case Study: Sumatra Indonesia – Axis Network

- 3 strings NSB 170FT Blue
- DC SiteStar™
- Locally supplied power
- 1500W load with 8.5hr discharge and 2.5 hour recharge
- 10kW diesel generator max load
- 8kW rectifiers (approximately 6kW to charge batteries)





Fuel consumption reduced from 40 liters to 8 liters per day with this setup

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Case Study: Payback

Initial Setup	Fuel Use	Maintenance Cost	**Annual Cost**
100% generator	40 l per day $0.84 l delivered	$200 after every 250 hours	**$19, 272**
22% generator SiteStar™ Cabinet NSB 170 Blue Batteries	8 l per day	$200 after every 250 hours	**$4,000**

<12 month payback from just the savings of diesel and reduction of the maintenance costs

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Summary

A	Telecoms market will continue to grow mainly in rural area where grid is a challenge for Batteries
B	Wrong choice of Batteries or operating error can drive enormous Opex increase to Telecom operators
C	Battery AGM Technology has been improved over past few years to meet Unstable and off grid conditions and reduce Opex to operators