Discover®
Innovative Battery Solutions

AES $LiFePO_4$ Battery

POSITIONING AND MARKETECTURE FOR

SOLAR ENERGY STORAGE APPLICATIONS

PRODUCT BENEFITS AND FEATURES

Rev C

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PRODUCT FAMILY OVERVIEW

Discover Battery's Advanced Energy System (AES) $LiFePO_4$ batteries offer your customers the lowest cost of energy storage per kWh.

Designed for 100% depth of discharge, >95% round-trip efficiency, lightning fast 1C continuous charge/discharge and a 10 year warranty combined with zero maintenance provide your customers with bankable performance and dramatic total cost of ownership savings.

Voltage Specific Models of 48V, or 24V, with high peak surge and BMS communication integrate easily with the best known off-grid inverters turning a good system into a great one. Simple plug-and-play installation and the capability to be scaled to over 133 kWh of usable storage make AES $LiFePO_4$ batteries ideal for projects of all sizes.

With Discover AES $LiFePO_4$ batteries your customers will 'make the leap' to the new energy economy.

AEON
Extended Service Life

RAPI-CHARGE
Fast Charging

MISER
High-Efficiency

JUCE
Enhanced Run Time

RUSH
Surge Power

PARALLEL POWER
Scalable Energy Storage

SENTRY
Reliable, Safe, Certified

LYNK
Communication Gateway Device

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MARKETECTURE

AEON©

Extended Service Life

Feature

A Discover AES $LiFePO_4$ battery energy storage system will significantly outlast lead-acid batteries and dramatically reduce your customer's energy storage costs over the life of their system.

Value Proposition

You can tell a lot about a company by how it defines success and failure. Lead-acid battery manufacturers (including Discover) have conditioned you to look at Temperature vs. Cycle Life, or Cycle Life vs. Depth of Discharge (DOD) graphs to indicate expected life or, more accurately, their remaining time to failure, and to overlook the 'elephant in the room', which is that lead-acid batteries start to lose their original capacity nearly the moment they are put into service and that the total available capacity in cycle 500 will be much less than the total available capacity in cycle 10.

The industry aggressively contends that 'Cycle Life' is the measure of battery quality versus the competition and its suitableness for energy storage use. A successful high quality lead-acid battery bank will maintain its ability to deliver its original published capacity for 500 cycles (less than 18 months of daily cycling) only if the batteries are kept cool, not deeply discharged, recharged completely every cycle and watered regularly (flooded cells). In the real world, cycle counting is neither verifiable nor reflective of the real function of a battery bank, which is, storing energy.

Discover AES $LiFePO_4$ batteries with AEON© cycle life technology can be continuously operated in a partial State of Charge (SoC), or alternatively discharged and charged to 100% of its rated capacity without consequence. Discover AES $LiFePO_4$ batteries will provide >90% of original energy storage capacity for a minimum of 10x that of a high quality lead-acid bank.

Discover AES $LiFePO_4$ batteries are warranted by a 10 year, unlimited cycle, 38 MWh* total energy throughput warranty providing confidence that Discover batteries will provide your customers with the long term, reliable energy storage they are paying for.

Positioning

Discover AES $LiFePO_4$ batteries versus lead-acid batteries.

- Three Times the Life of Lead-acid Battery
- Unlimited Partial State of Charge Cycles
- 10 Year Energy Throughput Stationary Warranty

**AES 6.65kWh Battery*

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MARKETECTURE

RAPI-CHARGE©

Fast Charging

Feature

Discover's RAPI-CHARGE© charge source optimization allows Discover AES $LiFePO_4$ batteries to fully recharge up to 5x faster than new lead-acid batteries or up to 10x faster than aged lead-acid batteries.

Value Proposition

The Battery Management System (BMS) and charge control system of Discover AES $LiFePO_4$ batteries optimize charge current and voltage to safely recharge the battery at the highest and most efficient rate regardless of its state of charge.

Even the highest quality lead-acid batteries require lengthy absorption and equalization stages to achieve a fully charged state. Unlike flooded lead-acid batteries, Discover AES $LiFePO_4$ batteries accept a charge at maximum input throughout the charging process and don't require 'absorption' or 'equalization' over charge stages. Those charging stages waste energy, money and time, and the losses are further compounded as lead-acid batteries age.

The RAPI-CHARGE© capability of Discover AES $LiFePO_4$ batteries when compared to systems utilizing lead-acid batteries allows solar installers to design systems using smaller arrays and for homeowners to dramatically reduce diesel generator fuel consumption.

Positioning

Discover AES $LiFePO_4$ batteries versus lead-acid batteries.

- Reduces Generator Fuel Consumption
- 1C Continuous Charge Rate, Regardless of SoC
- Up to 5x Faster than New Lead-acid Batteries
- Up to 10x Faster than Old Lead-acid Batteries

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MARKETECTURE

MISER©

High-Efficiency

Feature

With round trip efficiency measured at >95%, MISER© technology by Discover saves homeowners at least 15 - 30% of their stored energy capacity, each and every time they cycle their system when compared to lead-acid batteries.

Value Proposition

To borrow an old cliché, a penny saved is a penny earned. In the solar industry, inverter and module manufacturers have been competing around conversion efficiency since the turn of the century. They beat each other up mercilessly over fractions of % efficiency gains and, to their credit, the modules and inverters on the market today are far superior to what was available even 10 years ago.

There are three major component investments in any off-grid or micro-grid system. Current inverter and module technologies are nearly fully optimized for efficiency leaving batteries as the only component offering a real, tangible opportunity for improvement.

In the energy storage business, Round Trip Efficiency (RTE) is the measure of the energy wasted each and every charge/discharge cycle. New high quality lead-acid batteries have at best an 80% RTE, which can decline rapidly as the batteries age resulting in a life-time average of 65%.

Discover AES $LiFePO_4$ batteries with MISER© offer your customers the ability to save up to 30% or 3 kWh in energy cost for every 10 kWh of battery capacity they own, each and every cycle. With an average electricity tariff of 0.18 $/kWh in the United States, 3kWh saved is $0.54 per cycle, or $200 per year with only a single cycle use per day.

In Japan, Australia and Northern Europe the savings per year would be even greater. Everyone knows there is a dollar value for the cost of energy. Why is it that lead-acid batteries are let off the hook? They don't even bother to report RTE on their product specification sheets.

Discover AES $LiFePO_4$ batteries with MISER© technology allows homeowners to store and utilize the solar energy they harvest from their panels with >95% efficiency. Compare that to the best case 80% RTE of new lead and 65% RTE of aged lead-acid batteries, and you can give the inverter guys a break for a while.

Positioning

Discover AES $LiFePO_4$ batteries versus lead-acid batteries.

- 30% Less Energy Waste Compared with Lead-acid Battery
- 95% Round Trip Efficiency

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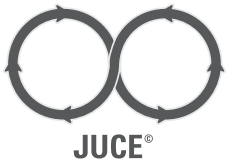
MARKETECTURE

JUCE©

Enhanced Run Time



Feature

Discover AES $LiFePO_4$ batteries have JUCE©, doubling runtime and energy output over lead-acid battery banks of the same capacity.

Value Proposition

'400Ah L16 has 200Ah in usable capacity'. The math used by solar installers is so well known that it's just accepted as the truth. Because deeply discharging lead-acid batteries decreases life expectancy, a design maximum of 50% Depth of Discharge (DoD) is typically factored into sizing every lead-acid battery bank.

With Discover AES $LiFePO_4$ batteries and JUCE©, what you see is what you get. Discover's 100% DOD battery ratings represent the actual usable energy output available from a fully charged battery. This means Discover AES $LiFePO_4$ batteries will provide at least 2x the usable energy in a single cycle versus an equivalent high-quality lead-acid battery without any risk of damaging the battery.

Positioning

Discover AES $LiFePO_4$ batteries versus lead-acid batteries.

- Double the Run Time of Lead-acid Battery
- 100% Usable Capacity
- 100% Depth of Discharge

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MARKETECTURE

RUSH©

Surge Power

RUSH©

Feature

Discover's RUSH© technology embedded in the Battery Management System (BMS) design enables an AES $LiFePO_4$ battery to handle the high discharge current requirements common to applications using off-grid solar inverter chargers.

Value Proposition

Discover AES $LiFePO_4$ batteries with RUSH© allow your customers to run the same loads they could with lead-acid while enjoying the advantages of the advanced $LiFePO_4$ lithium technology.

The BMS of most lithium batteries can only handle steady, low current loads over long durations. They overload or restrict their output when they are hit with inductive in-rush from inverters and demanding motor loads. RUSH© by Discover is the capability, unique to our BMS design, that allows our $LiFePO_4$ batteries to handle the high current charge and discharge demands of highly equipped off-grid homes and businesses.

Discover AES $LiFePO_4$ batteries are the only advanced storage batteries with 1C continuous charge and discharge capability and 2.3x peak current handling.

When a system design calls for multiple batteries, RUSH© ensures that the current handling capabilities scale with your storage capacity: doubling with two batteries, tripling with three, and so forth.

Positioning

Discover AES $LiFePO_4$ batteries versus other Lithium batteries.

- Power for Off-Grid Inverter Surge Demand
- Peak 2.3C Discharge Rate
- 1C Continuous Discharge Rate

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MARKETECTURE

SENTRY©

Reliable, Safe, Certified

SENTRY©

Feature

Discover AES $LiFePO_4$ batteries with SENTRY© are cleaner and safer than lead-acid batteries. Stable and high-performing $LiFePO_4$ cells managed by our proprietary, 3rd generation BMS design have been tested and certified to the stringent UL1973 standard for battery packs and the UN38.3 standard for safe transport.

Value Proposition

Off-grid solar installers have been using lead-acid batteries a long time and, regardless of the benefits lithium batteries offer, there is familiarity and comfort in those traditional lead batteries. To be successful replacing lead-acid for residential energy storage applications we knew we'd need to convince those installers that Discover AES $LiFePO_4$ batteries not only outperformed lead-acid batteries, but that they are safer too.

The first and most important consideration in designing a safe lithium-ion battery is the selection of cell chemistry. When Discover decided to develop an advanced battery for residential solar applications we considered each lithium chemistry before finally committing to $LiFePO_4$.

Lithium Cobalt (LCO) is an advanced lithium battery type and is commonly used in consumer electronics because of its high, power density. For residential solar applications however, LCO has a relatively short life span, limited load capabilities (specific power) and low thermal stability which make it susceptible to thermal runaway.

We also considered NMC (Lithium Nickel Manganese Cobalt Oxide), another chemistry common to electric cars, light electric vehicles and power tools. It's versatile, in that it can be tailored for high specific energy or high specific power, but for solar applications we needed both. Another concern is that high charge current promotes thermal runaway in NMC batteries and fast recharge times are critical for off-grid applications.

With the application knowledge gained from years of observing Discover's own lead-acid batteries in the field, we chose to use Lithium Iron Phosphate (LFP or $LiFePO_4$) cells as they are ideally suited to the demands of the off-grid customers we serve.

$LiFePO_4$ works for stationary / solar applications because it:

- is very thermally stable with no risk of thermal runaway;
- offers the longest cycle life;
- can be recharged at 1C rate;
- and can handle heavy loading and rapid discharge rates.

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The second critical component in the design of safe, high-performance, lithium batteries is the Battery Management System (BMS). Unlike lead-acid batteries, Discover AES $LiFePO_4$ batteries are managed by a sophisticated BMS internal to each battery which continuously monitors and manages all electrical inputs and outputs, as well as monitoring the status of all cell temperatures.

Highly engineered power electronics controlled by proprietary firmware and device drivers protect the cells and ensure our batteries provide the performance and safety your customers demand. Compared to lead-acid batteries, there is no risk of arcing from shorted terminals because the BMS simply disengages a relay and interrupts power. There is no exposure to corrosive electrolyte and no off-gassing from overcharging. Even the highest quality, sealed batteries can't make that claim.

How do we know? Since 2009, Discover has been developing its range of Advanced Energy Systems suitable for the extremes of motive power, industrial and renewable energy applications. Securing regulatory approvals, like UL 2271, is an extremely expensive process so you've got to have complete confidence in your battery design before you start. Even then, the testing process is designed to expose flaws that are only revealed once these agencies start to shake, drop, bake, and abuse products under the most extreme conditions.

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Discover AES $LiFePO_4$ batteries are certified to UL1973, the regulatory standard applicable for battery packs used in solar home applications, and UN38.3, which is required to legally and safely transport lithium batteries. Certifications represent a serious commitment to quality, technical integrity and robust design. Above all else our investment in certifications demonstrates our own belief in our product, down to the last nut and bolt. You can be comfortable in the knowledge that the performance and design of our Discover AES $LiFePO_4$ batteries have been independently validated and approved.

From the choice of chemistry in the cells that make up our batteries, to the regulatory markings on their labels, Discover AES $LiFePO_4$ batteries are safer and will perform better than the lead-acid batteries you are used to selling and installing.

Positioning

Discover AES $LiFePO_4$ batteries versus other Lithium and lead-acid batteries.

- $LiFePO_4$ is Safe and Maintenance Free
- Integrated High Current BMS
- Field Serviceable BMS
- IP 55 Rated
- IEC 62133 Safety
- UL 1973 Safety Certified
- UN 38.3 Transport Certified

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MARKETECTURE

PARALLELPOWER©

Scalable Energy Storage

PARALLELPOWER®

Feature

Discover AES $LiFePO_4$ batteries easily scale to meet the runtime and autonomy requirements unique to off-grid solar and whole home backup power.

Value Proposition

Discover AES $LiFePO_4$ batteries are system voltage specific: 24V or 48V models. Discover AES $LiFePO_4$ batteries can be paralleled, no external BMS is required.

The intelligent Battery Management System (BMS) capabilities of Discover AES $LiFePO_4$ batteries provide communication and coordination of up to 20 units in parallel over our proprietary AEBus allowing for usable capacities between 6-133 kWh per battery string. Paralleled batteries communicate, coordinate and synchronize over AEBus which manages cell balancing, allows for linear scaling of charge and discharge current capacities, and limits external network traffic to a single BMS.

AEbus is Plug and Play configured and standard CAT5 cable is used to connect between the RJ45 port of each battery in parallel.

In comparison to batteries designed for residential self-consumption and short duration backup applications, Discover AES $LiFePO_4$ batteries with PARALLELPOWER© provide system designers with easily scalable, energy storage capacity to size their stored energy to the load and autonomy requirements of grid defectors and truly off-grid homes.

Positioning

Discover AES $LiFePO_4$ batteries versus other Lithium batteries.

- Voltage Specific Models 24V / 48V
- $LiFePO_4$ Energy Storage to Over 120kWh
- Linear Scaling of $LiFePO_4$ Charge and Discharge Capacity
- Integrated System Wide BMS Communication

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PRODUCT DEVICE

LYNK COMMUNICATION GATEWAY DEVICE

LYNK®

State of Charge for Discover AES LiFePO$_4$ Batteries

Feature

Discover's LYNK Communication Gateway aggregates and displays in real time the State of Charge for Discover AES LiFePO$_4$ batteries.

Remotely monitor the aggregate SoC for a string of AES LiFePO4 batteries and data log multiple sites using the data monitoring services offered by multiple brands of off-grid inverter systems.

Value Proposition

Unlock the full potential of a Discover AES LiFePO4 Battery by enabling the internal Battery Management System (BMS) to optimize and dynamically manage the charge and discharge configurations of the world's best off-grid inverter chargers and solar charge controllers. Turn a good system into a great one with up to 25% improvement in 0% to 100% SoC recharge time.

By utilizing a LYNK Communication Gateway, installers can design systems with smaller arrays and smaller backup generators, or increase the usable power from any existing array and significantly reduce the diesel fuel consumption of an existing backup generator.

Installation of a LYNK Communication Gateway is plug-and-play between Discover AES LiFePO$_4$ batteries and the inverter and parameter configuration is automatic.

LYNK Communication Gateway enables the remote monitoring of aggregate SoC for a string of AES LiFePO$_4$ batteries and data logging of multiple sites using the data monitoring services offered by multiple brands of off-grid inverter systems. Plug and play, closed loop communication provides adaptive, real time interaction between the Discover AES LiFePO$_4$ battery and connected power electronics.

Positioning

Discover AES LiFePO$_4$ batteries versus other Lithium batteries.

- Real-Time Optimization of the Charge Rate
- Up to 25% Faster Recharge from 0% to 100% SoC
- Internal BMS and Plug-and-Play Configuration with Power Conversion
- BMS Reports SoC and kWh Logs, Fault Logs to System