

# **DISCOVER AES LIFEPO4 BATTERY STORAGE PRODUCT POSITIONING DOCUMENT**

## MARKETECTURE

### AEON<sup>®</sup>

#### Feature

Discover AES LiFePO<sub>4</sub> batteries energy storage systems 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 or failure. Lead acid 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 "big 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 "life cycles" are the measure of a batteries quality versus the competition and its suitability 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.

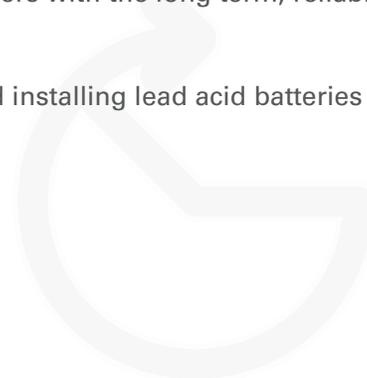
Discover AES LiFePO<sub>4</sub> batteries with AEON<sup>®</sup> cycle life technology can be continuously operated in a partial State of Charge (SOC), or alternatively discharged and charged to 100% of its rated capacity without consequence. Discover AES LiFePO<sub>4</sub> batteries will provide >90% of original energy storage capacity for a minimum of 10x that of a high quality lead acid bank.

Discover AES LiFePO<sub>4</sub> batteries are warranted by a 10 year, unlimited cycle, 38 MWh total energy throughput warranty providing confidence that Discover's batteries will provide your customers with the long term, reliable energy storage they are paying for.

Take it from a company that has been designing, manufacturing, distributing and installing lead acid batteries since 1949: Your customers can't afford lead.

#### Positioning

Discover AES LiFePO<sub>4</sub> batteries versus lead acid batteries.



## MARKETECTURE

## RAPI-CHARGE<sup>®</sup>

### Feature

Discover's RAPI-CHARGE<sup>®</sup> charge source optimization allows Discover AES LiFePO<sub>4</sub> 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<sub>4</sub> 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 batteries, Discover AES LiFePO<sub>4</sub> batteries accept a charge at maximum inputs 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<sup>®</sup> capability of Discover AES LiFePO<sub>4</sub> batteries allows solar installers to design systems using smaller arrays and for homeowners to dramatically reduce diesel consumption when compared to systems utilizing high quality, lead acid batteries.

### Positioning

Discover AES LiFePO<sub>4</sub> batteries versus lead acid batteries.



## MARKETECTURE

### MISER<sup>®</sup>

#### Feature

With round trip efficiency measured at >95%, MISER<sup>®</sup> technology by Discover saves homeowners at least 15% of their stored energy capacity, each and every time they cycle their system when compared to high quality, lead acid battery options.



#### 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 optimized for efficiency leaving batteries as the only component offering real, tangible improvement.

In the energy storage business, RoundTrip 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.

Discover AES LiFePO<sub>4</sub> batteries with MISER<sup>®</sup> offer your customers the ability to save 1.5 kWh in energy cost for every 10 kWh of energy storage they own, each and every cycle. With an average electricity tariff of 0.15 \$/kWh in the United States, that is \$1.50 savings per cycle or \$547.50 per year with only a single cycle use per day.

In Japan & Australia the savings per year would be over \$1,000 and in Northern Europe the average annual savings would be greater than \$1,300. Everyone knows there is a dollar value for the cost of energy. Why is it that lead acid battery manufacturers get let off the hook? They don't even bother to report RTE on their product specification sheets.

Discover AES LiFePO<sub>4</sub> batteries with MISER<sup>®</sup> 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 60% RTE of aged lead-acid batteries, and you can give the inverter guys a break for a while.

#### Positioning

Discover AES LiFePO<sub>4</sub> batteries versus lead acid batteries.



## MARKETECTURE

### JUCE<sup>®</sup>

#### Feature

Discover AES LiFePO<sub>4</sub> batteries have JUCE<sup>®</sup>, doubling runtime and energy output over lead acid battery banks of the same capacity.



#### Value Proposition

“This 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 maximum of 50% Depth of Discharge (DOD) is typically and responsibly factored into sizing every lead acid battery bank.

With Discover AES LiFePO<sub>4</sub> batteries and JUCE<sup>®</sup>, 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<sub>4</sub> batteries will provide at least 2x the usable energy in a single cycle versus an equivalent high quality lead acid string without any risk of damaging the battery.

Discover AES LiFePO<sub>4</sub> batteries with JUCE<sup>®</sup>: Your customers can’t afford lead.

#### Positioning

Discover AES LiFePO<sub>4</sub> batteries versus lead acid batteries.



## MARKETECTURE

### RUSH<sup>®</sup>

#### Feature

Discover's RUSH<sup>®</sup> technology enables Discover AES LiFePO<sub>4</sub> batteries to handle high charge and discharge current requirements common to industrial, telecom/UPS and solar applications.



#### Value Proposition

Unlike the lead acid batteries, Discover AES LiFePO<sub>4</sub> batteries are designed to replace most lithium batteries that 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<sup>®</sup> by Discover is the capability, unique to the Battery Management System design, that allows our LiFePO<sub>4</sub> batteries to handle the high current charge and discharge demands of highly equipped off-grid homes and businesses.

Discover AES LiFePO<sub>4</sub> batteries are the only advanced storage batteries with 1C continuous charge and discharge capability and 4x peak current handling. When system designs call for multiple batteries, RUSH<sup>®</sup> ensures that the current handling capabilities scale with your storage capacity: doubling with two batteries, tripling with three, and so forth. Discover AES LiFePO<sub>4</sub> batteries with RUSH<sup>®</sup> allow your customers to run the same loads they could with lead acid while enjoying the advantages of the advanced LiFePO<sub>4</sub> lithium technology.

Discover has been designing and building batteries for commercial, industrial and solar applications for a long time. Discover has learned a thing or two about the devices lead acid batteries have been powering and Discover AES LiFePO<sub>4</sub> batteries with RUSH<sup>®</sup> capability reflect that knowledge.

#### Positioning

Discover AES LiFePO<sub>4</sub> batteries versus other Lithium batteries.



## MARKETECTURE

### SENTRY<sup>®</sup>

#### Feature

Discover AES LiFePO<sub>4</sub> batteries with SENTRY<sup>®</sup> are cleaner and safer than lead acid batteries. Stable and high-performing LiFePO<sub>4</sub> cells managed by our proprietary, 3<sup>rd</sup> generation BMS design have been tested and certified to stringent UL1973 and UN38.3 standards for safety and 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<sub>4</sub> batteries not only outperformed lead, 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<sub>4</sub>.

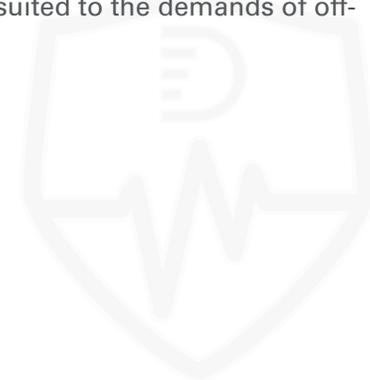
Lithium Cobalt (LCO) is one of these advanced battery types and is commonly used in consumer electronics because of its high, power density. For residential solar applications however, LCO has a relatively short life span, limited load capabilities (specific power) and low thermal stability which make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

We also considered NMC (Lithium Nickel Manganese Cobalt Oxide), another chemistry common to electric cars, EV's 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 currents promote thermal runaway in NMC batteries and fast recharge times are critical for off-grid applications.

With application knowledge gained from years of observing Discover's own lead acid batteries in the field, we chose to use Lithium Iron Phosphate (or LFP or LiFePO<sub>4</sub>) cells as they are ideally suited to the demands of off-grid homes.

LiFePO<sub>4</sub> 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.



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<sub>4</sub> batteries are managed by a sophisticated BMS which continuously monitors and controls all electrical inputs, outputs and cell status.

Highly engineered power electronics controlled by proprietary firmware and device drivers protect the cells and assembly, 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.

It is fairly easy to build a lithium battery. A quick Google search will show you a market awash with product built using "second life" cells, without any validation or testing at prices that are too good to be true. On the other hand, it's incredibly difficult to design and build a robust, safe lithium battery. One that's survived serious destructive testing and manufactured with scrutiny required to meet rigorous UL and UN standards.

How do we know? Since 2009, Discover has been developing a range of Advanced Energy Systems suitable for the extremes of motive power, industrial and residential applications. Securing regulatory approvals is an extremely expensive process so you've got to have complete confidence in your 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.

Discover AES LiFePO<sub>4</sub> batteries are certified to UL1973, the regulatory standard applicable for energy storage 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<sub>4</sub> 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<sub>4</sub> batteries are safer and will perform better than the lead you are used to selling and installing.

That's why we sleep well when we put our heads on the pillow at night.

## Positioning

Discover AES LiFePO<sub>4</sub> batteries versus other Lithium and lead acid batteries.



## MARKETECTURE

# PARALLELPOWER<sup>®</sup>

### Feature

Scalable energy storage to meet the runtime and autonomy requirements unique to off-grid solar and whole home backup power.

### Value Proposition

The intelligent Battery Management System (BMS) capabilities of Discover AES LiFePO<sub>4</sub> batteries provide communication and coordination of up to 20 units in parallel over the proprietary AEBus allowing for usable capacities between 6-120 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.

In comparison to batteries designed for residential self-consumption and short duration backup applications, Discover AES LiFePO<sub>4</sub> batteries with PARALLELPOWER<sup>®</sup> 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<sub>4</sub> batteries versus other LiFePO<sub>4</sub> manufacturing companies.



PARALLELPOWER<sup>®</sup>



## MARKETECTURE

### LYNK<sup>®</sup>

#### Feature

Discover's LYNK<sup>®</sup> enables remote reporting of system level status through existing web portal and cloud monitoring services. Plug and play, closed loop communications provides adaptive, real time interaction between the Discover AES LiFePO<sub>4</sub> battery and connected power electronics.



#### Value Proposition

By partnering with the leading off-grid inverter and charge controller manufacturers to integrate direct communications over both proprietary and industry standard communication protocols, Discover AES LiFePO<sub>4</sub> batteries are able to optimize charge and discharge cut-off points and to relay current-state and historical data to allow for remote control, monitoring, diagnosis and troubleshooting.

Laboratory testing has shown >25% improvements in 0% to 100% State of Charge recharge times by employing closed loop communications where the Battery Management System is able to dynamically control the chargers voltage and current output to match the battery's Volts Per Cell Module readings throughout the recharge cycle.

Using LYNK<sup>®</sup>, installers can design systems with smaller arrays or increase the usable power from any existing array and expect significant reductions in supplementary diesel consumption. Additionally, LYNK<sup>®</sup> simplifies system installation and allows installers seamless, plug-and-play connection between their Discover AES LiFePO<sub>4</sub> batteries and the inverter, avoiding the time and human error involved in inverter set point and parameter configuration.

#### Positioning

Discover AES LiFePO<sub>4</sub> batteries versus other LiFePO<sub>4</sub> manufacturing companies.

