

BATTERY STORAGE TECHNOLOGIES

Exploring Li-Ion Batteries

COMPARITIVE CHEMISTRY OVERVIEW AND DIVERSE STORAGE APPLICATIONS

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SIMPLIHIPOWER.COM | 805.640.6700

EVALUATING LITHIUM ION BATTERIES



LITHIUM ION BATTERY CHEMISTRY

Lithium Ion Chemistry Comparison	LFP Lithium Iron Phosphate	NMC Lithium Nickel Manganese Cobalt Oxide	LMO Lithium Manganese Oxide (May Contain Cobalt)	NCA Lithium Nickel Cobalt Aluminum Oxide	LCO Lithium Cobalt Oxide
 Danger of Thermal Runaway & Fire	NO	YES	YES	YES	YES
 Toxic Elements	NO	YES	YES	YES	YES
 Landfill Safe	YES	NO	NO	NO	NO
 Involves Abusive Mining Practices	NO	YES	YES	YES	YES
 Ventilation Required	NO	YES	YES	YES	YES
 Cooling Equipment Required	NO	YES	YES	YES	YES
 Safety Monitoring Equipment Required	NO	YES	YES	YES	YES
 Able To Withstand High Temperature Environments	YES up to 140°	NO	NO	NO	NO

LEVELIZED COST OF ENERGY- HOW TO EVALUATE TRUE COSTS OF STORAGE

What's the cost of every kWh I can get out of this system?

$$\left(\frac{\textit{Price}}{\textit{Capacity} \times \textit{Cycles} \times \eta \times \textit{DoD}} \right) + \textit{Ancillary Costs}$$

AKA Hidden Costs

- Square Footage → Installation Location
- Weight → Shipping Costs
- Forklift/Install Equipment → Rental to Site
- Maintenance → Truck Rolls
- Cooling → Additional Cost + Materials
- Ventilation/Setback Requirements → Area
- Construction Support → Weight Related
- Replacement Costs → Performance Related

LCOE COMPARISON: 10 YEAR- DOES NOT INCLUDE REPLACEMENT COSTS

PHI 3.8	FLA	VRLA
QTY 2	QTY 4	QTY 12
6 usable kWh (@ 80% DOD)/ C/2	~4.6 usable kWh (@50% DOD): C/20	~7.3 usable kWh (@ 20% DOD): C/8
77.5 lbs. per battery	114 lbs. per battery	211 lbs. per battery cell
155 lbs. total	456 lbs. total	2,532 lbs. total
13.9" x 13.5" x 8.1" per battery	11.66" x 6.94" x 16.74" per battery	13.3" x 8.04" x 27.12" per battery
3,039.93 total in ³	5,418.43 total in ³	34,799.95 total in ³



.09/kWh



.27/kWh



.80/kWh

DROP-IN REPLACEMENT FOR LEAD ACID

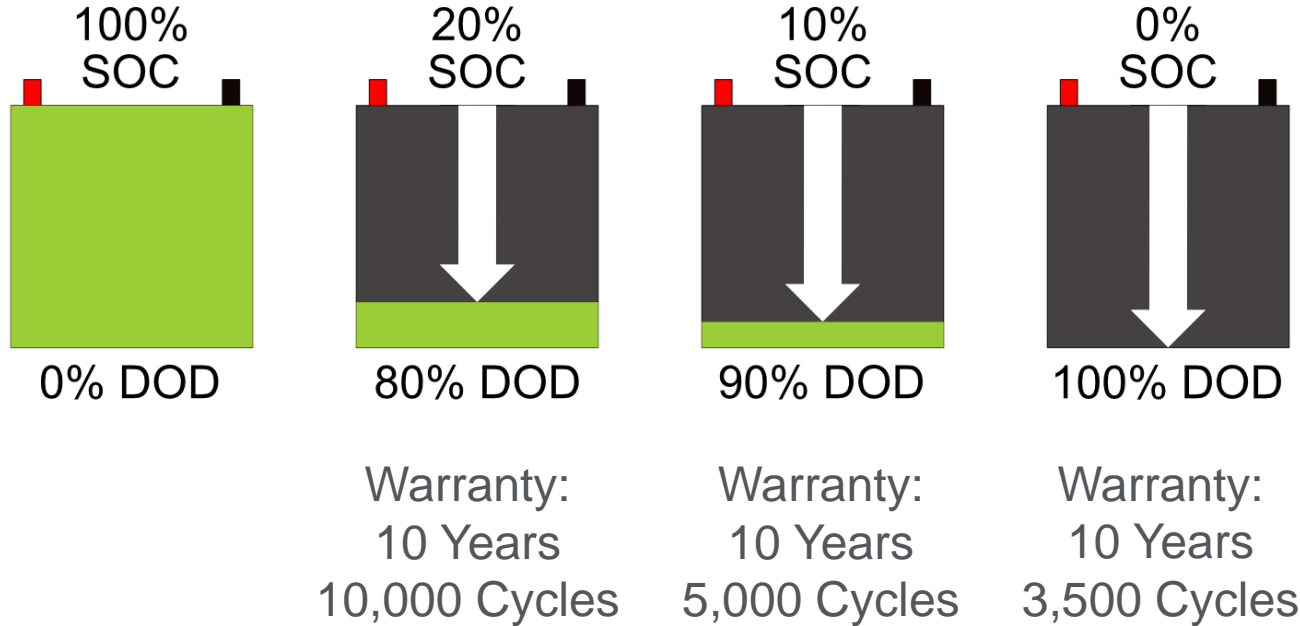


BEFORE



AFTER

DoD COMPARED TO CYCLE LIFE- WARRANTY

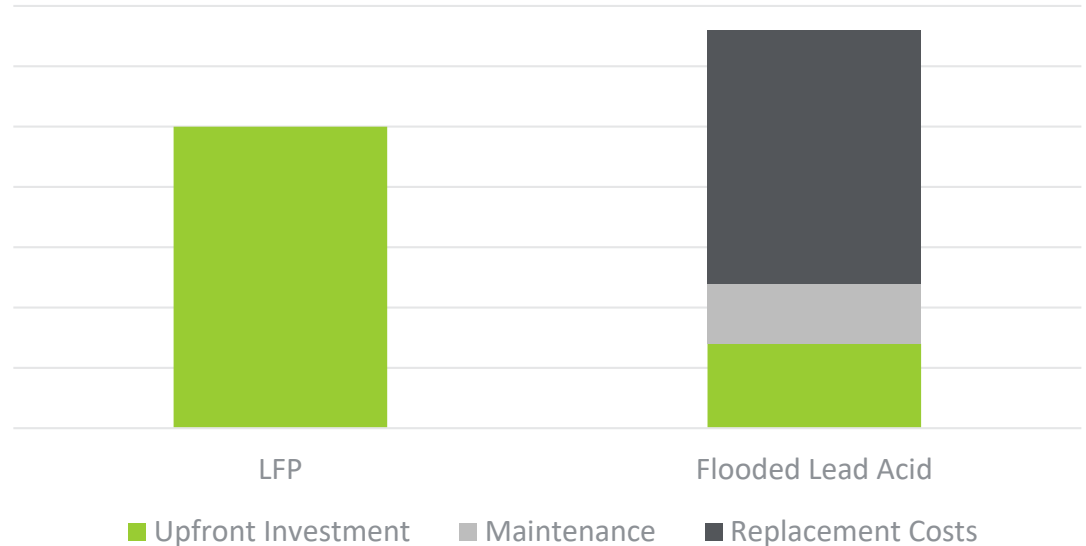


End of life (EOL) capacity: 80%

COST & PERFORMANCE COMPARISON LEAD ACID TO LITHIUM

- Higher upfront investment for LFP
- Lower DOA rates
- More usable capacity (100% v 30-50%)
- Very low self-discharge
- No maintenance
- Longer duration between replacement- FLA replaced 3X
- Overall lower cost over time (LCOE)
- Non-Toxic Chemistry

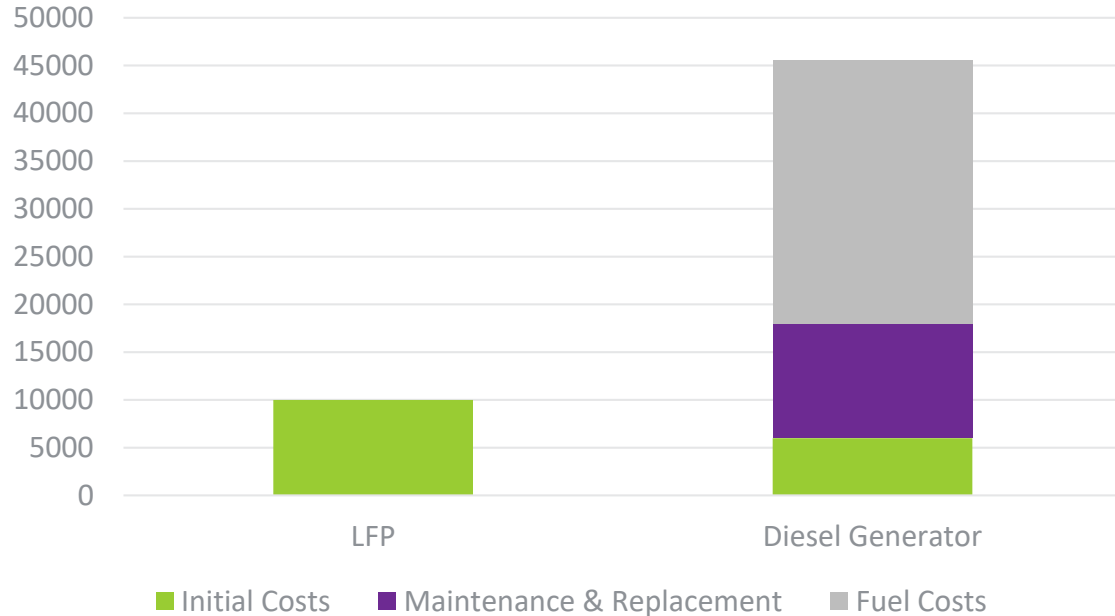
LFP (302Ah) v Flooded Lead Acid (420Ah):
10 years



GENERATOR OPTIMIZATION AND REPLACEMENT

- Reduce Fuel Costs:
\$2,759.40/year
- Extend Life-Span of Generators: Run less
- Reduce Maintenance
- 70% of diesel generators non-operational in field
- Fuel can be hard to source
- No Noise or Pollution

Costs LFP v Generator: 10 years



DIVERSE APPLICATIONS IN AFRICA



TANZANIA: RELIABLE 24/7 MICROGRID POWERS AN ORPHANAGE



TANZANIA: RELIABLE 24/7 MICROGRID POWER FOR SCHOOLS



BOTSWANA: RELIABLE OFF GRID POWER FOR CHEETAH PRESERVE



NIGERIA: RELIABLE POWER FOR 34 HOSPITALS & CLINICS IN CONFLICT ZONES



NIGERIA: 24/7 ENERGY ACCESS FOR DISPLACED CHILDREN AT 7 SCHOOLS



NIGERIA: COMMERCIAL – DIESEL OFFSET & 60% UTILITY BILL REDUCTION



SIMPLIPHI ENERGY STORAGE SOLUTIONS



A FULL RANGE OF STATIONARY AND MOBILE ENERGY STORAGE SOLUTIONS

- Commercial – Residential – Disaster Relief – Personal Power
- SimpliPhi Delivers:
 - Industry-leading cycle life even when fully discharged
 - Industry-leading efficiency eliminates the need for ventilation or cooling
 - Safest, non-toxic LFP cell chemistry reduces installation cost and risk
 - Widest operating temperature reduces integration costs
 - Balance of energy and power density is ideal for renewable energy systems



MILITARY-ENDORSED SOLUTIONS

- U.S. Marine Corps and Army were among first SimpliPhi customers
 - Demand for constant innovation, testing and rapid deployment now integral part of company DNA
- Testing at Camp Lejeune and Aberdeen Proving Ground more rigorous than any industry standard
- Proven performance in extreme temps, environments and use cases
- Official report: **ZERO** battery failure rate
 - 100+ systems deployed to power a wide range of military operations and equipment



PHI BATTERIES

Compatible: 24 V OR 48 V

- Simple parallel connection
- Scalability
- Drop in Lead Acid replacement
- 24V and 48V
- Integrated Battery Management System
- Integrated circuit breaker for protection



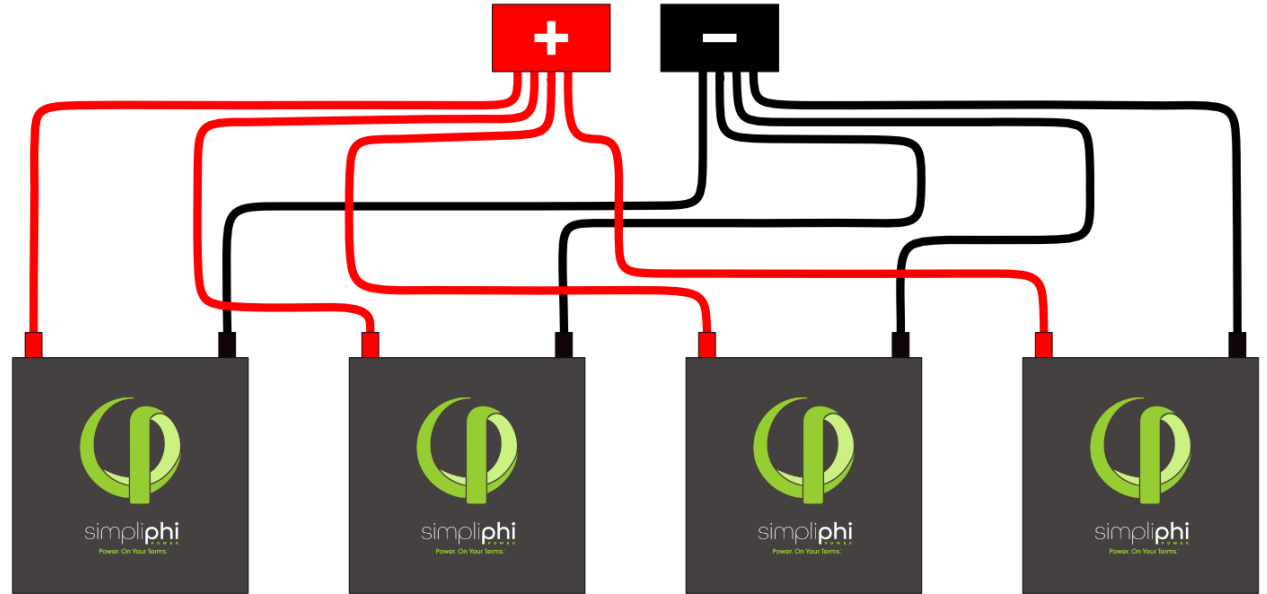
2.9 kWh
115 Ah @ 24 V
57 Ah @ 48 V



3.8 kWh
151 Ah @ 24 V
75 Ah @ 48 V

EASY-TO-BUILD BATTERY BANKS

- Simple parallel wiring configuration
- No communications lines to run
- Both energy and power scales up



Note: All conductors from battery terminals to DC busbars should be the same length.

MODULAR AND SCALABLE



~300 kWh

sideways
orientation

PORTABLE POWER- ENERGY DENSITY FOR SMALL APPLICATIONS

- Portable emergency power for LED lighting, mobile charging and powering smaller loads
- Small footprint
- Easily charged from solar
- Provides reliable power where it is needed
- Can be deployed to multiple households





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THANK YOU!