SimpliPhi vs Lead Acid

Comparing a rocket engine to a steam engine.

	SimpliPhi - Lithium	Lead Acid
		
Usable capacity	100% DoD – 5,000 warranted cycle life 80% DoD – 10,000 warranted cycle life, Ten years warranty or whichever comes first	30% to 50% DoD – 2,000 to 3,500 cycle life
C rating	Design with $C/_2$ rating. YES – the batteries are designed to work like this without losing capacity! For short peak loads design with $C/_1$. Peak output 60A, cont. 30A.	Design as historically with $C/_5$, $C/_{10}$, and $C/_{100}$ ratings etc. Maximum discharge typically C/5 before losing capacity
Space & Weight	Wall mounted	Floor mounted – 3 times the volume and 5 times the weight estimated. OHS issues.
Ventilation & Cooling	No Ventilation or cooling required, cycle life unaffected by temperature <60°C	Ventilation and some cooling in hot climates required, cycle life halves every 10°C above 20°C
Connection	In parallel	Typically in series, parallel strings present balancing problems
Can Add Batteries	Yes - Within a certain time period	No
Equalisation	Not required	Required for flooded cells
Partial SOC cycling?	Yes, no problem	Not recommended. Leads to rapid deterioration of cells
Calculating State of Charge SOC	Inverter calculates via amps in and out. (no communications cable required)	Inverter calculates via amps in and out.
2 / 3 stage charging	2 stage is sufficient – Bulk and Absorb	3 Stage Charging – Bulk, Absorb, Float (long term floating can cause problems)
Charging Inertia	Low – batteries accept charge quickly	High – the battery is less able to accept all charge available at all times
Round trip efficiency	98% not including inverter etc.	80% indicative
Self Discharge	Minimal – less than 1%-2% per month when stored between 30% and 60% SOC	5 to15% or more per month (Trojan)
Retained cap at EOL	80% retained by End of Life (5,000/10,000 cycles)	80% retained by End of Life (2000-3500 cycles)
Storage life	Can be stored for long periods of time	Requires periodic charging to maintain health
Glossary: DoD - Depth of Discharge, SOC State of Charge, DoA - days of autonomy, kW- kilowatt, kWh- kilowatt hour		

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Off Grid – How much installed capacity do we need: Lithium VS Lead?

Battery Application: A small off-grid house	
Household Details	• 10 kWh average daily load • 48V off-grid system with generator (no assumptions on ac/dc coupling) • 2 days of autonomy (DoA) before generator comes on • 2 effective sunshine hours only, per day in winter.
Load Profile	Day time: 50% of load (5 kWh) is used during sunshine hours Night time: 50% of load (5 kWh) is used after the sun goes down Loads: 60 sec-50 amps/12kW, 30 mins-35 amps/8.5kW, cont. 28 amps/6.8kW

Simple Comparison	SimpliPhi Lithium	Lead Acid
First, calculate the usable storage required for 2 Days of Autonomy DoA.	5kWh for one night-time load + 20kWh for two consecutive Days of Autonomy = 25 kWh (or 500 amp hours at 48v)	
Then, look at DoD and round trip efficiency and inverter losses:		
Depth of Discharge (Before generator kicks in) Then include: Batt round trip efficiency Inverter, charger, etc. eff	100% DoD for 5,000 cycles or 80% DoD for 10,000 cycles 98% (2% loss) 94% (6% loss)	Using 40% DoD for around 5,000 cycles 80% indicative (20% loss) 94% (6% loss)
Results: Storage Size (Required for 2 Days of autonomy)	**27.1** kWh -based on 100% DoD **34.0** kWh -based on 80% DoD **8** units of the 3.4kWh batteries at 100% DoD **10** units of the 3.4kWh batteries at 80% DoD	**84.0** kWh, - based on 40% DOD This is ignoring any de-rating due to heat, charging inertia or life cycle issues if charged/discharged outside specifications. For 2DoA use C/50.
Solar Panels Required (Assuming 2 effective hours of sunshine in mid winter and optimally tilted array)	10kWh ÷ 92% round-trip efficiency = 10.9kWh then divide by 2 effective hours = 5.5 kW of solar for winter time insolation. Minimum. **5.5** kW of Solar PV	10kWh ÷ 74% round-trip efficiency = 13.5kWh then divide by 2 effective hours = 6.75 kW of solar for winter time insolation. But potentially higher due to the inertia of the batteries * no assumptions on ac or dc coupling Minimum. **6.75** kW of solar PV

CONCLUSION: It will take **2½** to **3** times more capacity of Lead Acid batteries than SimpliPhi batteries to achieve the same result. And up to 20% more solar!

NOTE: For 1 Day of Autonomy, the minimum number of SimpliPhi batteries required is reduced to 5 and 6 for 100% and 80% DoD respectively.

Note: Actual calculations are required by your professional off grid installer before purchasing systems.

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