Overview of LiFePO4 Batteries for Solar/Ham Radio Applications
Presented to Orange County Amateur Radio Club (OCARC)
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About Bioenno Power

- Founded in 2010
- OEM of various products
  - Lithium Iron Phosphate (LiFePO4) Batteries
  - Solar products
  - Lithium Polymer (LiPo) Batteries

- Facilities located in Santa Ana, California for small scale manufacturing

- Company/contract manufacturers have implemented ISO 9001:2008 and ISO 14001 quality and environmental standards

- World class–technology

- Best in class, after–sales service and outstanding warranty

- Customers world–wide!
World–Wide Customers

GLOBAL PRESENCE . TRUSTED PERFORMANCE
GREEN MEANS GO: GO POWER, BIOENNO POWER
What is LiFePO4?

- Also known as “LFP”, “Lithium Iron Phosphate”, “Lithium Ferrous Phospate”, “LIFE–PO”, “LiFE”
- State-of-the-art battery chemistry
- Tremendous thermal and chemical stability
- Intrinsically safer because of the ultra-stable Fe–P–O bond
- Enhanced charge cycles; over 2000+ charge cycles! 5+ years of service life!
- Totally different than LiCoO2 and Li–Ion Polymer or LiPo! Don’t confuse them!
## Advantages of LiFePO4 Batteries

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<tr>
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<th>Bioenno Power LiFePO4</th>
<th>Sealed Lead Acid</th>
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<tbody>
<tr>
<td><strong>Safety</strong></td>
<td>Inherently Safe as a result of strong chemical bonds and non-toxic</td>
<td>Sulfating, Venting, Leaking, Lead is toxic</td>
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<tr>
<td><strong>Weight</strong></td>
<td>50% to 60% lighter compared to SLA batteries</td>
<td>Heavy!</td>
</tr>
<tr>
<td><strong>Life Cycles</strong></td>
<td>&gt;2000+ Cycles</td>
<td>&lt; 200 to 300</td>
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<tr>
<td><strong>Protection Circuitry</strong></td>
<td>Built-in and advanced protection circuit module (PCM) and battery management system (BMS)</td>
<td>No protection – Can easily overdischarge SLA batteries, or overcharge them</td>
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<td></td>
<td>Prevents overcurrent, overdischarge, undervoltage/overvoltage, thermal</td>
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<tr>
<td><strong>Capacity</strong></td>
<td>Get nearly 100% of the full capacity out of the battery</td>
<td>Can only discharge 50% of the written capacity!</td>
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</table>
12V, 12Ah Lead Acid
Only can be discharged 
50%. So in reality you get 
Only 6Ah out of the battery!
12V, 12Ah Lead Acid
is basically a 6Ah battery

12V, 12Ah LiFePO4
You get nearly 100% capacity!
12Ah LiFePO4 = 12Ah of True Capacity
Run–Time Calculations

- How to calculate run–time based on power for LiFePO4
- Simple:
  - Find out the average continuous power of your equipment
  - Power (Watts) = Voltage (Volts) x Current (Amps)
  - Example:
    - 10 Watts (continuous)
    - Voltage x Capacity of battery: 12V x 12Ah = 144 Watt–Hours (unit of energy capacity)
    - Watt–Hours / Watts = 144 Watt–hours / 10 Watts = 14 hours
Weighted Average Calculations

- **Weighted Average:**
  \[ (x) \times \text{Power}_1 + (1-x) \times \text{Power}_2 = \text{Weighted Average Power} \]
  - Example 1:
    - 20% of the time: Transmit at 10 Watts
    - 80% of the time: Receive at 2 Watts
    - Weighted Average Power = 0.20\times10 + 0.80\times2 = 3.6 Watts
    - 12V, 12Ah LiFePO4 → \sim 36 hours of run-time ([12V\times12Ah]/3.6)
  - Example 2:
    - 20% of the time: Transmit at 100 Watts
    - 80% of the time: Receive at 2 Watts
    - Weighted Average Power = 0.20\times100 + 0.80\times2 = 41.6 Watts
    - 12V, 40Ah LiFePO4 → \sim 11 hours of run-time ([12V\times40Ah]/41.6)

  *Note: Power consumption is the electrical consumption of the power amplifier*
Growing Ham Radio Base...
Growing Ham Radio Base...

N4KGL
Greg Lane
730 Brandeis Ave
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Bay County, USA
Loc: EM70de
Growing Ham Radio Base...

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Slim Jim Antenna.
This SOTA hike started from my home (Eikesas Ranch) at 06:00 UTC, and it took me around 3 hours to get to the summit. The weather today was almost unbelievable with minus 10 degrees and a clear blue sky, and the view from the summit almost indescribable. On this activation I was using my Elecraft KX3 with 5-10W output, 2 x Bioenno Power LiFePo4 12V 8Ah battery and a Buddistick multi-band vertical antenna. I made a total of 153 QSO's on this remote summit activation.
Building a Solar System Setup

[Images of solar panels, battery, and control unit]

Bioenno Power

Lithium Iron Phosphate Battery

12V 12Ah
144 Watt-Hours
PN: BLF-1212WS
24A Max Continuous Discharge Current

[Logo: Bioenno Power]
FAQ for Solar Panels

**Common Question:** How many Watts for the Solar Panel?

**Answer:**
Depends on Size of the Battery!
12V 12Ah LiFePO4 Battery = 144 Watt–Hours

Need a 60 Watt Panel to Charge the battery in ~2 hours
(144 Watt–Hours / 60 Watts = 2.4 hours)
FAQ For Solar Charge Controller

Common Question: Do I really need a solar charge controller? I want to just hook up the panel directly to the battery

Answer: Solar charge controller is a must to regulate the solar panel voltage (which can range anywhere from 15VDC to 22VDC for a “12V solar panel”). The solar charge controller steps down the voltage from the solar panel so that the battery can accept it for properly charging the battery.
Common Question:
What size of battery do I need? How do I know?

Answer:
First, you need to know the total power consumption. Second, what’s the desired run-time.

Example: 50 Watts total power
12V 12Ah -> ~3 hours run-time
12V 20Ah -> ~5 hours run-time
12V, 40Ah -> ~10 hours run-time
12V, 100Ah -> 24 hours run-time
Bioenno Power provides a variety of advanced power solutions:

- Audio/Visual/Film
- E-Bikes / E-Scooters
- Electric Golf Caddy
- Energy Storage
- Gardening Tools
- Green Energy (Solar and Wind)
- Photography
- Radio Communications (including Amateur Radio)
- Replacement for SLA (sealed lead acid) batteries
- Robotics
- UPS (uninterruptible power supply)
- Wheelchairs
Thank You!

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