Bioenno Power®

Overview of LiFePO4 Batteries for Solar/Radio Applications

Presented to URAC – San Pedro, CA
October 21, 2016

Bioenno Power®
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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!

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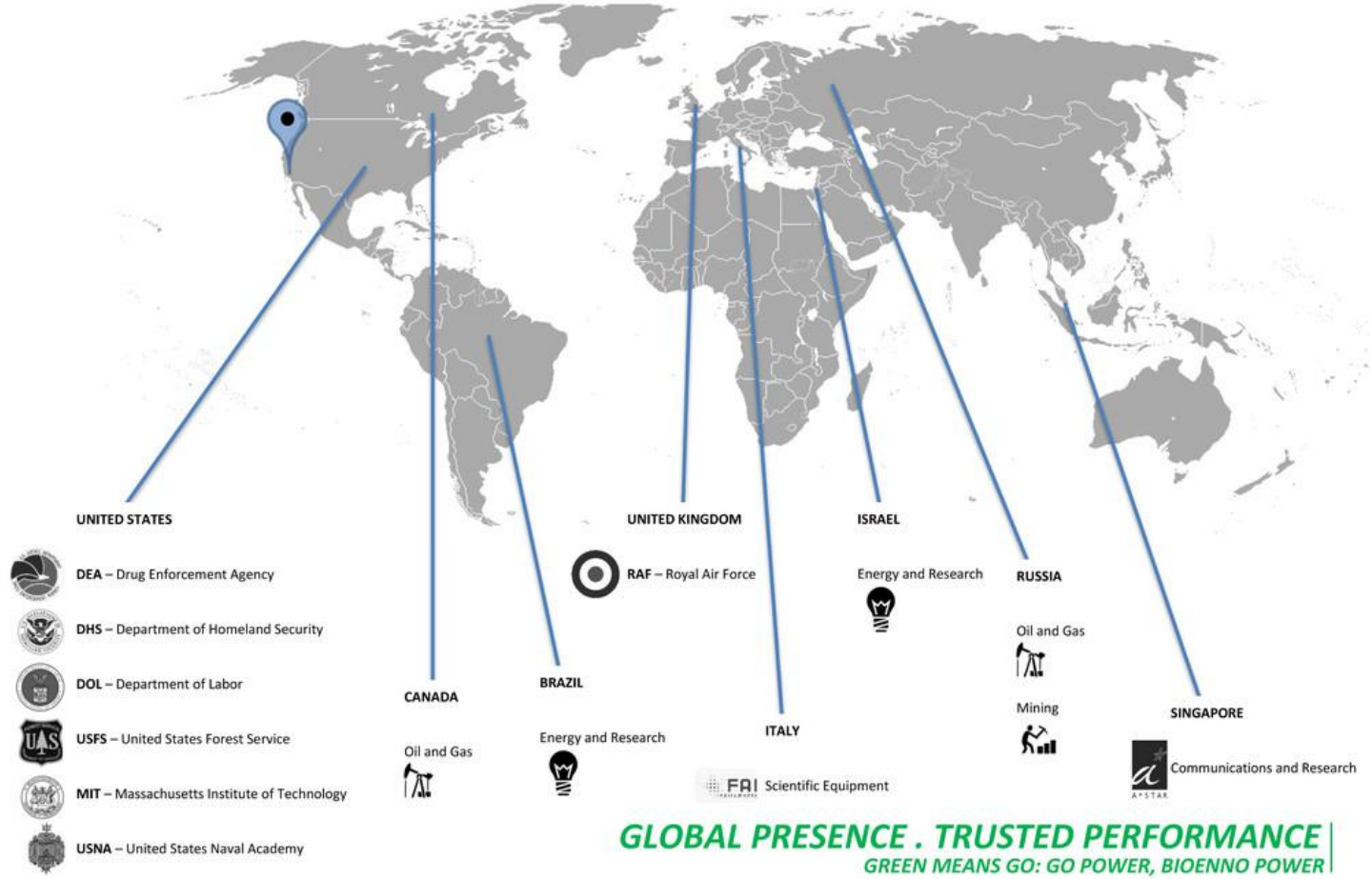
World-Wide Customers



GLOBAL PRESENCE . TRUSTED PERFORMANCE

GREEN MEANS GO: GO POWER, BIOENNO POWER

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What is LiFePO4?

- Also known as “LFP”, “Lithium Iron Phosphate”, “Lithium Ferrous Phoshpate”, “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

	Bioenno Power LiFePO4	Sealed Lead Acid
Safety	Inherently Safe as a result of strong chemical bonds and non-toxic	Sulfating, Venting, Leaking, Lead is toxic
Weight	50% to 60% lighter compared to SLA batteries	Heavy!
Life Cycles	>2000+ Cycles	< 200 to 300
Protection Circuitry	Built-in and advanced protection circuit module (PCM) and battery management system (BMS) Prevents overcurrent, overdischarge, undervoltage/ overvoltage, thermal	No protection – Can easily overdischarge SLA batteries, or overcharge them
Capacity	Get nearly 100% of the full capacity out of the battery	Can only discharge 50% of the written capacity!

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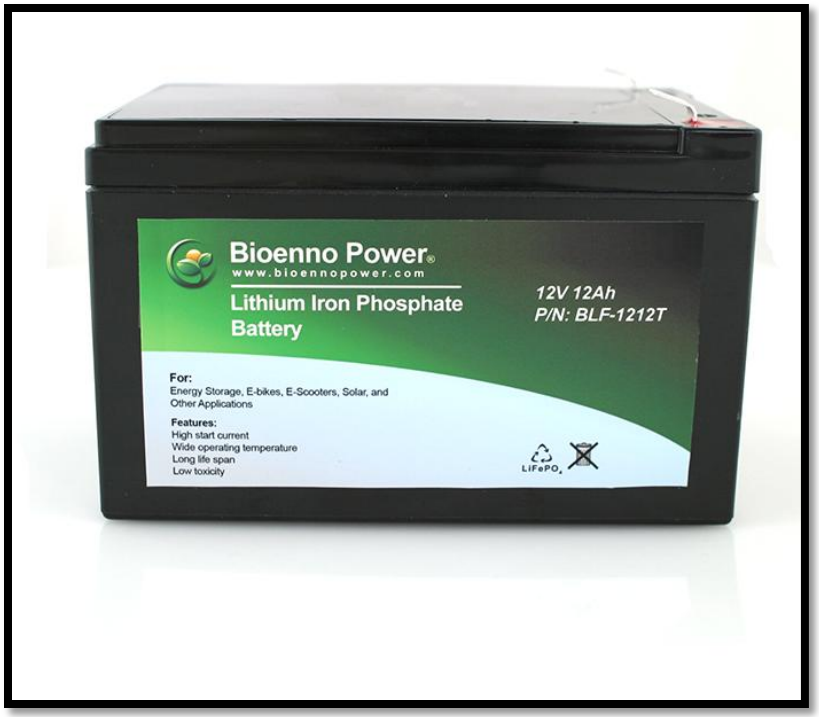
LiFePO4 Full Capacity Advantage!

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

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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

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Weighted Average Calculations

- Weighted Average:
  - $(x)*(Power_1) + (1-x)(Power_2) =$ 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*10 + 0.80*2 = 3.6 Watts
    - 12V, 12Ah LiFePO4 → ~36 hours of run-time ([12Vx12Ah]/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*100 + 0.80*2 = 41.6 Watts
    - 12V, 40Ah LiFePO4 → ~11 hours of run-time ([12Vx40Ah]/41.6)

    - *Note: Power consumption is the electrical consumption of the power amplifier

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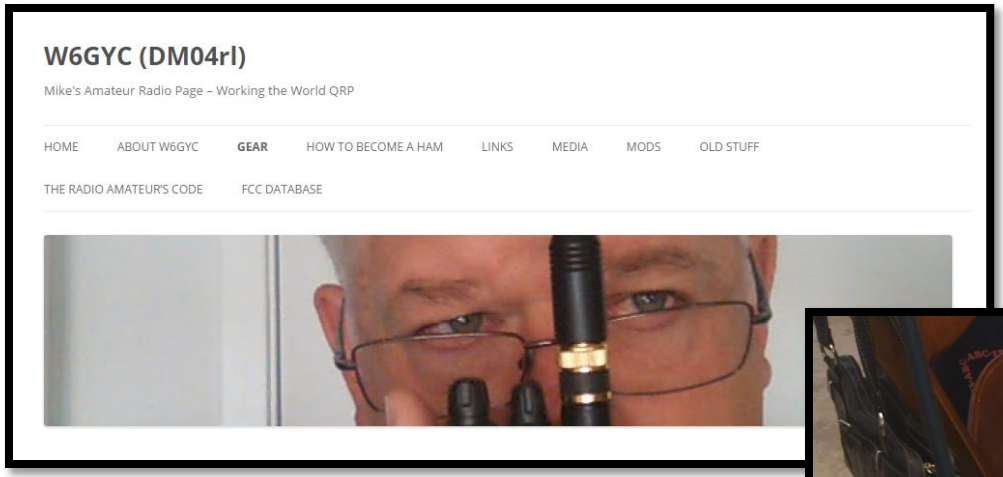
Growing Ham Radio Base…



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Growing Ham Radio Base…

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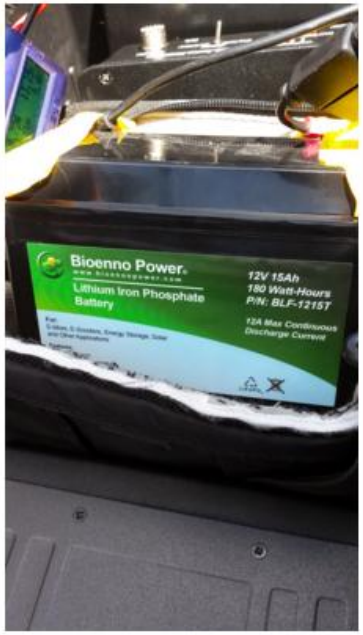
Growing Ham Radio Base…

N4KGL

Greg Lane
730 Brandeis Ave
Panama City, FL 32405
Bay County, USA
Loc: EM70de

Slim Jim Antenna.



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Growing Ham Radio Base…

Norwegian Amateur Radio Station LA9XGA

Lisenced since 1989

This SOTA hike started from my home (Eikesaas 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.

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Building a Solar System Setup

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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)

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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.

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FAQ For LiFePO4 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

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FAQ For LiFePO4 Batteries for Ham Radio QRP / QRO

Transmit Power	Receive Power	Weighted Average (20% Tx + 80% Rx)	Battery Run-Times
10 Watts	5 Watts* *Modern radios have a receive power < 5 Watts	6 Watts	6 Ah -> 12 hours 8 Ah -> 16 hours 12Ah → 24 hours 15Ah -> 30 hours 20Ah -> 40 hours
20 Watts		8 Watts	6 Ah -> 9 hours 8 Ah -> 12 hours 12Ah → 18 hours 15Ah -> 22 hours 20Ah -> 30 hours
50 Watts		14 Watts	6 Ah -> 5 hours 8 Ah -> 7 hours 12Ah → 10 hours 15Ah -> 13 hours 20Ah -> 17 hours

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FAQ For LiFePO4 Batteries for Ham Radio QRP / QRO

Transmit Power	Receive Power	Weighted Average (20% Tx + 80% Rx)	Battery Run-Times
100 Watts	5 Watts* *Modern radios have a receive power < 5 Watts	24 Watts	12Ah → 6 hours 15Ah -> 7.5 hours 20Ah -> 10 hours
150 Watts		34 Watts	15 Ah -> 5 hours 20 Ah -> 7 hours 40 Ah -> 14 hours
200 Watts		44 Watts	20 Ah-> 5 hours 40 Ah -> 10 hours 60 Ah -> 16 hours

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Events/News

- OCARC, OCRACES, SOARA, MTARA, PAPA, Pasadena ARC/ARES
- Palm Springs Hamfest
- HamNation - Episode 241
- DX Convention (Visalia, CA)
- Nevada State Convention (Las Vegas, NV)
- Dayton Hamvention (through HamSource-[East Hall])
- Texas HamComm
- Ham Radio Outlet Ham Jam (Anaheim / San Diego / Portland)
- PacificCon (October 2016)

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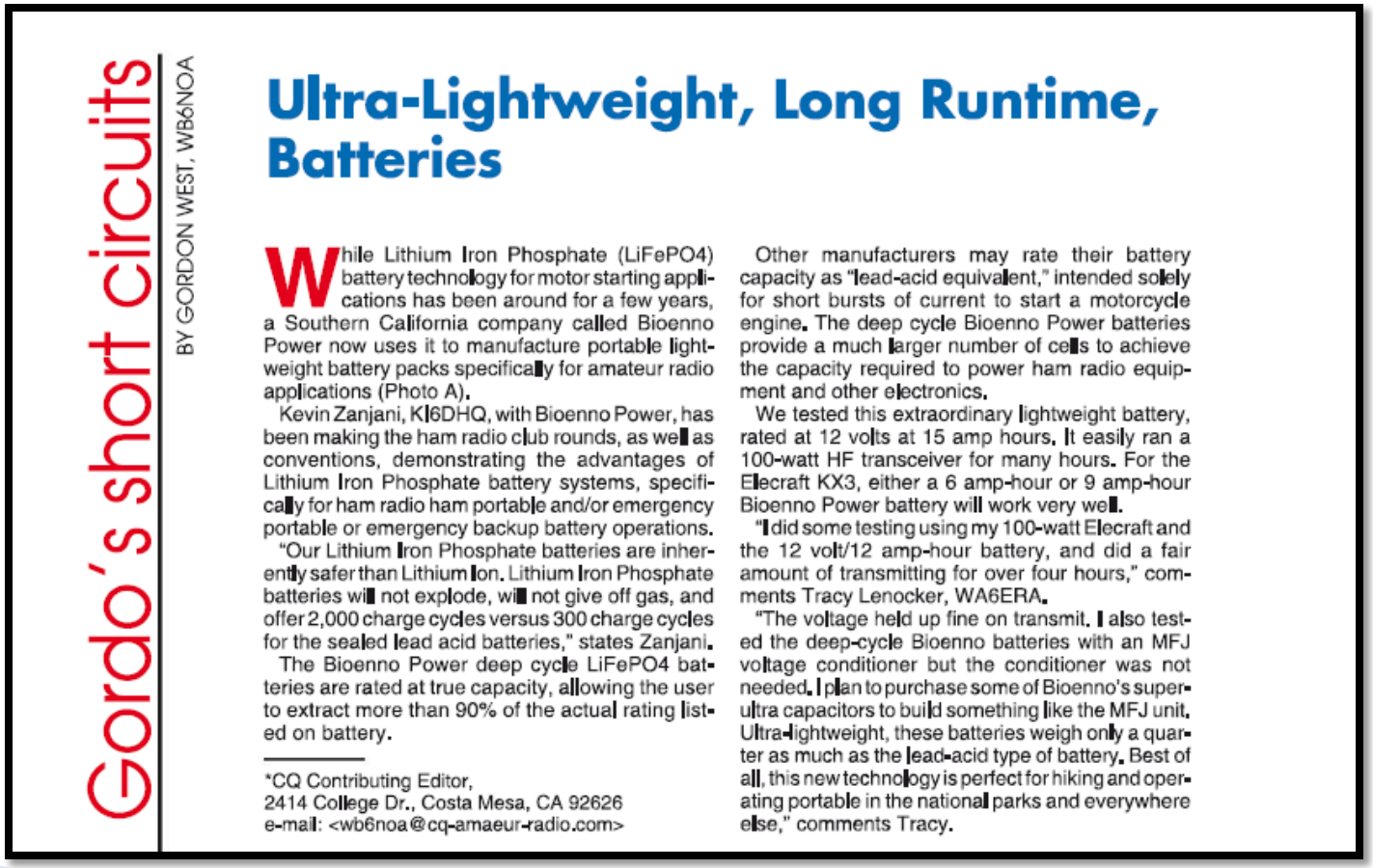
Events/News

- CQ Magazine Article



Gordo's short circuits

BY GORDON WEST, WB6NOA*

Ultra-Lightweight, Long Runtime, Batteries

While Lithium Iron Phosphate (LiFePO4) battery technology for motor starting applications has been around for a few years, a Southern California company called Bioenno Power now uses it to manufacture portable lightweight battery packs specifically for amateur radio applications (Photo A).

Kevin Zanjani, KI6DHQ, with Bioenno Power, has been making the ham radio club rounds, as well as conventions, demonstrating the advantages of Lithium Iron Phosphate battery systems, specifically for ham radio ham portable and/or emergency portable or emergency backup battery operations.

"Our Lithium Iron Phosphate batteries are inherently safer than Lithium Ion. Lithium Iron Phosphate batteries will not explode, will not give off gas, and offer 2,000 charge cycles versus 300 charge cycles for the sealed lead acid batteries," states Zanjani.

The Bioenno Power deep cycle LiFePO4 batteries are rated at true capacity, allowing the user to extract more than 90% of the actual rating listed on battery.

Other manufacturers may rate their battery capacity as "lead-acid equivalent," intended solely for short bursts of current to start a motorcycle engine. The deep cycle Bioenno Power batteries provide a much larger number of cells to achieve the capacity required to power ham radio equipment and other electronics.

We tested this extraordinary lightweight battery, rated at 12 volts at 15 amp hours. It easily ran a 100-watt HF transceiver for many hours. For the Elecraft KX3, either a 6 amp-hour or 9 amp-hour Bioenno Power battery will work very well.

"I did some testing using my 100-watt Elecraft and the 12 volt/12 amp-hour battery, and did a fair amount of transmitting for over four hours," comments Tracy Lenocker, WA6ERA.

"The voltage held up fine on transmit. I also tested the deep-cycle Bioenno batteries with an MFJ voltage conditioner but the conditioner was not needed. I plan to purchase some of Bioenno's super-ultra capacitors to build something like the MFJ unit. Ultra-lightweight, these batteries weigh only a quarter as much as the lead-acid type of battery. Best of all, this new technology is perfect for hiking and operating portable in the national parks and everywhere else," comments Tracy.

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Variety of Power Solutions….

- 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

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Thank You!

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