

By Lee Copeland

# ENERGY

# Entrepreneurs

*BizTech* spotlights three green startups with the technology, innovation and drive to change the way utilities, consumers, automakers and notebook owners think about energy.



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**RECORD OIL PRICES** and pollution. Dwindling natural resources. Off-the-charts carbon emissions. Landfill waste. Add to that a Mother Earth that's none too happy, and you've pretty much summed up the situation the entire planet is facing. It's not a mix that lends itself well to launching a business, unless of course that new company intends to tackle environmental issues.

*BizTech* spoke with leaders at three innovative technology startups that aren't slinging vaporware. These trailblazers — Boston-Power, Mascoma and Silver Spring Networks — have products on the market, customers who use the products and additional innovations for sustainable energy usage in the pipeline.

Traditionally, we think of four major fuel sources: steam, oil, water and wind. But as Scott Lang, president and CEO of Silver Spring Networks, points out, there is another untapped fuel source that isn't on the periodic table: "We like to think of energy efficiency as the fifth fuel."

He speaks for his two green startup counterparts when he talks about the role of energy efficiency, as each of these companies is making a unique and meaningful contribution to the sustainability challenges we face. "The cleanest power plant is one that was never required," Lang says. "We waste an enormous amount of power, and if we could get more efficient, we could actually prolong the availability of our natural resources."

## POWER PACK

This battery maker charges up the power market with its green, prismatic Lithium-ion battery.

**CHRISTINA LAMPE-ÖNNERUD** is a long way from her old home. The Swedish native left Oslo in the early 1990s to pursue post-doctorate work in inorganic chemistry at the Massachusetts Institute of Technology; she became a U.S. citizen in 2008.

"The world went through an energy crisis in the 1970s when I was about 10 years old, and I heard a lot about the issues," Lampe-Önnerud recalls of her initial interest in the field of energy. "I knew then I wanted to try and contribute to the greater good."

After earning 15 individual patents and innovating in the field of portable power, Lampe-Önnerud launched Boston-Power four years ago. It produces longer-lasting and environmentally sustainable rechargeable Lithium-ion batteries for notebook computers and other electronic devices. One of the company's first customers is Hewlett-Packard, which will base its new Enviro Series battery on Boston-Power's Sonata technology and offer it as an upgrade option on some of its notebook computers. The battery will cost consumers about \$25

to \$30 more than a standard notebook battery, but should continue to perform like new for three years, officials say, because of its unique technology.

"If you've ever been a little irritated with a laptop that shut down in the middle of your work, you should consider Sonata just for the productivity gains," Lampe-Önnerud says. "And if you care about global warming and want to reduce waste and utilize more energy-efficient products, then you definitely want to go with us."

### Thermal Dynamics

What Boston-Power has created is a battery with higher energy density that maximizes energy capacity in the battery cell and also generates less heat; both factors contribute to improved efficiency.

"Think of a battery as a chemical factory" of about 50 inert and active chemicals, explains Lampe-Önnerud. "One reaction dominates the battery the entire time. The Lithium-ion ion shuttles between anode and cathode. In the older technology, there were a lot more side reactions, and the Lithium would get stuck in these side reactions, which shortened the cycle time."

With its prismatic shape, as opposed to the cylindrical shape of most batteries, and engineering to reduce those side reactions, Sonata can handle approximately 1,000 charge-discharge cycles — the trip between anode and cathode — before it begins to degrade.

The typical notebook battery experiences an 80 percent degradation in charge capacity after about 800 cycles, Lampe-Önnerud says. Sonata degrades much more slowly, and also recharges more quickly: It can charge up to 80 percent in about 30 minutes and 40 percent in 10 minutes, she says, a key incentive for road warriors who charge up at the airport or local coffee shop.

**3 years**  
Length of time that a Boston-Power Sonata battery will power a notebook before it begins to degrade

"We wanted to become the voice of consumers, who were frustrated with batteries that died on them," says Lampe-Önnerud. "We've created a battery that works and delivers on the promise of sustainability and performance."

### Another Type of Green

Boston-Power won't talk about its financial relationship with computer and notebook kingpin Hewlett-Packard, but the startup is powered by \$125 million in venture capital funding from Foundation Asset Management, Oak Investment Partners, Venrock Associates, GGV Capital and Gabriel Venture Partners. It has filed 61 patents in the past five years and produces its batteries in China.

Boston-Power also works closely with its manufacturing customers to ensure that its batteries make the most of the overall product design. "A lot of battery manufacturers are asked to just fulfill a spec," she says. "We've broken that paradigm. We integrate directly with electronics producers."

By partnering with HP, the company built a battery that is the centerpiece of

HP's new Enviro Series of notebook batteries that come with a three-year warranty. HP wanted to produce a battery with a longer lifespan and one that would help reduce the amount of technology waste that ends up in landfills, says Jonathan Kaye, HP's director of consumer notebook marketing. HP is also giving consumers a three-year warranty on the battery — the longest battery warranty on the market.

### Boston-Power

Website: [boston-power.com](http://boston-power.com)

Location: Boston

Employees: 400



Even as a young girl, Boston-Power CEO Christina Lampe-Önnerud says she knew she "wanted to try and contribute to the greater good."

# THREE TIMES THE POWER

Using sustainably harvested wood and plant waste, this fuel maker blends a next-generation replacement for petroleum.

**MASCOMA PERSONIFIES WHAT** renewable energy is all about. The startup created a single-step method to convert cellulosic biomass (or plant waste) into ethanol. Going a step further, the raw materials used to create the fuel come from nonfood plant sources, such as switchgrass or wood residue discarded from forestry operations.

Not only does the company produce a clean-burning fuel from organic leftovers, it also incorporates raw materials into its own manufacturing processes. To make ethanol, Mascoma cooks wood chips in water and later adds an enzyme-releasing strain of bacteria called ALK2 that helps the brew ferment.

“Since the ethanol fuel is derived from plant matter, you reduce the carbon

output in other ways,” Chief Technology Officer Mike Ladisch says. Unlike ethanol made from corn, he says, Mascoma’s cellulose ethanol process generates a net energy content that is three times higher and emits lower levels of greenhouse gases than its chemically identical ethanol cousin.

## Forged in Friendship

The idea of working with cellulose plant waste arose out of conversations between co-founders and fellow chemical engineers Charles Wyman and Lee Lynd. When both were professors at Dartmouth College, had been researching biofuels for 30 years. Late one summer evening in 2004, as Wyman and Lynd sat and talked near Mascoma Lake in northern New Hampshire, they decided it was time to apply their research to making better, cheaper and more sustainable fuel sources.

“Mascoma’s consolidated bioprocessing technology promises a quantum leap in efficiency for cellulosic biofuel production,” says Brent Erickson, executive vice president of the Industrial & Environmental Section at the Biotechnology Industry Organization, a Washington, D.C., association that has more

**25% to 30%**  
Amount of wood left over from the fuel-making process that’s reused to heat the plant’s boiler

than 1,200 members. “The advantage of a single organism that can turn biomass into sugar and then ferment it is one of the breakthroughs that will make cellulosic biofuels cost-competitive with other fuels and help the industry expand to new areas of the country where there is abundant nonfood biomass.”

That’s a strategy that has served Mascoma well since it was founded in late 2005 with initial funding from Khosla Ventures. To date, the company has raised approximately \$100 million in equity funding from investors such as General Motors and Marathon Oil and has subsequently received commitments of more than \$100 million in state and federal grants. This includes a combined \$49.5 million the company received last October from the U.S. Department of Energy and the state of Michigan to build a new manufacturing plant in Kinross, Mich.

## Future Fill-ups

Once the plant has been built and is fully operational, it’s expected to produce 40 million gallons of ethanol and other fuel products each year and employ more than 50 additional workers. Mascoma also operates an R&D center in Lebanon, N.H., and a scale-up facility in Rome, NY which can produce up to 200,000 gallons of cellulosic ethanol per year.

The fuel will help power cars built to burn E85, a blend of 85 percent ethanol and 15 percent gasoline. By 2012, major U.S. automakers General Motors, Ford and Chrysler pledge to make 50 percent of their vehicles E85-capable.

“It’s not enough to create biofuels,” says Ladisch. “We also need to think about the costs of ethanol production and the carbon emissions generated in the production process. With our process, Mascoma does both.”

### Mascoma

Website: [mascoma.com](http://mascoma.com)

Location: Boston

Employees: 108

CTO Mike Ladisch says Mascoma aims to create both a biofuel and an energy-efficient process for its production.

# PLUG & POWER PLAY

Power grid developer serves up a smart approach to managing the nation’s electric utilities.

**CAN YOU IMAGINE** going to your local gas station and having no idea what the cost per gallon was or how much money you spent filling your tank, only to get a bill 30 days later for \$68.37? And perhaps getting a bill the month after that for \$45.12? Who in their right mind would want to roll the dice every time they pulled up to the pump?

But that’s what consumers and businesses do each month when it comes to electricity. We pull up to the metaphorical pump — in this case the electric socket — fuel up our notebooks or power our refrigerators with electricity and then get a bill 30 days later from the friendly neighborhood utility. How much it costs on any particular day, no one really knows.

That’s the quandary that motivates CEO Scott Lang and his team at Silver Spring Networks. The startup is pioneering the concept of a smart power grid. The company builds and offers the technology service to help major electric and gas utilities such as Florida Power & Light (FPL) and Pacific Gas and Electric (PG&E) transform the way they deliver energy, not just to consumers but also through their own infrastructure of distributors, current transformers and capacitor banks that connect to their power plants.

“This is a complex challenge,” Lang says. “We are working with utilities to transform the relationship with the consumer and bridge a gap that no one has yet attempted to bridge.”

## Analog Versus Digital

Electric utilities operate much as they did a century ago, piping power through their major equipment without the real-time monitoring and capacity gauging now used by other traditional industries, such as oil and gas, and new services, such as cellular

phones. Imagine the difficulty of tracking minutes and rates on an analog telephone system; that’s the challenge faced by what is essentially an analog utility grid.

The barrier that prevents utilities from making accurate usage and cost data available to consumers will come down when these companies migrate to an IP infrastructure, or smart grid, which will track the flow of electricity from home meters, distributors, transformers and capacitor banks in real time. Today, that information is tracked manually.

But not in Northern California, where PG&E has begun their deployment of advanced networking products and services to serve its five million electric customers. It’s the first time a utility will be offering real-time, two-way communications to its customers. The networked meters also help the utility identify power outages.

## Curbing Consumption

Electricity use peaks in the summer months, particularly in California. And while the peak season’s duration is only about 2 percent of the year, powering homes and devices during that period accounts for about 20 percent of energy costs.

“By having intelligent devices, consumers and businesses can shift their consumption by shutting down their load,” Lang says. “If the utilities alerted consumers to when the peak was commencing, they could make a choice about whether they wanted to pre-cool their homes or lower consumption or operate as they typically do, but pay the premium for the electricity.”

As electric vehicles gain traction, Lang anticipates that consumers will want to understand the costs associated with fueling their cars, and will expect to see the cost per watt displayed and calculated in real time, similar to filling up at a gas station.

“Utility companies are starting to realize that they need to focus on the demand side

**5 million**  
The number of electric meters that California utility PG&E plans to replace with Silver Spring digital-meter technology



CEO Scott Lang says Silver Spring Networks’ smart grids will “bridge a gap that no one has yet attempted to bridge.”

## Silver Spring Networks

Website: [silverspringnetworks.com](http://silverspringnetworks.com)

Location: Redwood City, Calif.

Employees: 200

of this challenge and not just the supply side because there isn’t an unlimited ability to build new power plants and treat the atmosphere as a landfill,” he says.

Although technically a startup, Silver Spring is lighting up the utility industry. Its customer list reads like an A-list of utility elites, including industry electric giants such as PEPCO. Kleiner Perkins Caufield & Byers recently led a \$75 million investment in Silver Spring, bringing the startup’s venture capital investment to \$167.5 million. The company also has a commitment backlog of more than \$500,000.

As Lang notes, however, Silver Spring is in it for more than monetary reward. “It’s not just about economics. We’re actively damaging the environment, so there is an urgent need,” he says. “And second, while oil prices may be down today, we need to get the world thinking about the cost of carbon emissions and cost of generating and consuming energy.”