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The Forever Battery

A Silicon Valley startup run by old-school technologists has invented an energy storage device that could take an entire neighborhood off the grid.

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Todd Woody

Imergy Power Systems' headquarters in an office park in one of Silicon Valley's less glamorous precincts is the type of place where the future used to be invented. There are no Beats headphones-wearing 20-somethings on scooters. No foosball tables, rooftop beer garden or ironically named conference rooms. No birdhouses. Just a sea of drab, blue-gray cubicles. The median employee age appears to be around that of the typical software engineer who files an age-discrimination lawsuit. There are scientists wearing white lab coats. Some have white hair. The chief executive is 61 – that's 120 in Silicon Valley years.

Needless to say, Imergy is not developing the next $19 billion app that Facebook will acquire, but the startup could end up powering Facebook.

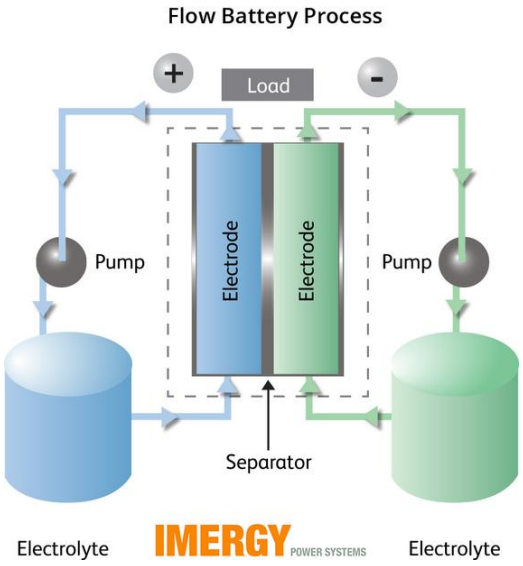
"Basically, our battery lasts forever."

Imergy has spent years perfecting an energy storage device that, if it lives up to its billing, will help accelerate the big green future by allowing companies and homeowners to pull the plug on their local utility by banking electricity from solar arrays and wind farms for use when the sun is not shining or the wind is not blowing. A 250-kilowatt battery system installed in a 40-foot container, for instance, could store solar energy from the rooftop arrays of a 40-home neighborhood for later use.

This magic box is called a Vanadium redox flow battery. The heart of a flow battery are two electrolyte solutions – one positive, one negative – contained in separate tanks. When the solutions are pumped through a power cell containing a membrane, a chemical reaction takes place that generates electricity. When the process is reversed, the electrolyte stores energy.

The key component is Vanadium, a naturally occurring element that can exist in positive and negative states, eliminating the contamination and degradation that occurs when two different elements are used to create a chemical reaction. Flow batteries are not as efficient as solid-state lithium-ion batteries. But unlike lithium-ion batteries that lose their capacity over time as they charge and discharge, the non-toxic electrolyte in a vanadium flow battery is endlessly reusable and never loses its efficiency.

“Basically, our battery lasts forever,” says Bill Watkins, Imergy’s chief executive and a Valley veteran who served as the CEO of LED lighting startup Bridgelux and before that Seagate, a manufacturer of hard drives (remember those?).



And while adding storage capacity to lithium-ion batteries increases the price exponentially – hence the near six-figure sticker of the 265-mile range Tesla Motors Model S – increasing the capacity of flow batteries just means adding bigger tanks.

Imergy is one of a growing number of companies, from automaker Honda to solar installer SolarCity and Tesla, that see a big market in taking homes and businesses off the grid.

“As more people go solar, they’re going to tell their utility, ‘I’m not going to sell you my electricity. I’m going to get a battery at low cost to run my home and I don’t need the grid,’ ” says Watkins.

Vanadium flow batteries are not new – an Australian scientist named Maria Skyllas-Kazacos invented the technology in 1985. But there was a catch. Two, actually. The battery needed pure and pricey Vanadium to work. And the fact that the electrolyte became unstable at 35 degrees Celsius (95 Fahrenheit) limited the usefulness of the batteries.

“The electrolyte was always the one cost you couldn’t squeeze because you needed pure Vanadium,” says Tim Hennessy, Imergy’s president, who previously ran a Vanadium battery company in China. “So the batteries ended up being about 50 percent more expensive.”

But Imergy claims it has made a big breakthrough. First, chief technology officer Majid Keshavarz developed a novel electrolyte chemistry that allows Imergy to use a lower-grade of Vanadium that can be extracted from iron ore waste, oil sludge or fly ash generated by coal-powered power plants.

That lets Imergy cut its Vanadium costs by a third, according to Watkins, and ensure a supply of the metal. (A competitor, American Vanadium, plans to operate its own Vanadium mine in Nevada.)

Plus the new chemistry lets Imergy’s batteries operate in temperatures as high as 55 degrees Celsius (131 degrees Fahrenheit) without an expensive cooling systems, opening up markets in India, Africa and other hot, electricity-starved regions that rely on pollution-spewing diesel generators for power.

Imergy won’t begin commercial production of its batteries until this summer but for the past two years it has been operating 5-kilowatt versions of the battery in India. In a control room at Imergy’s Fremont, California, headquarters, a video screen monitors the operation of the 70 battery units, many of them at telecommunications installations.

The room also contains a 5-kilowatt battery – which will sell for between $10,000 and $20,000 – and a bigger 30-kilowatt box. While you might put the smaller battery – it's about the size of a big tool cabinet – in your garage, flow batteries are too bulky to power cars or computers.

“We know everyone in the Valley,” says Watkins.

Imergy executives claim that once their 30-kilowatt battery is in production they will be able to generate electricity for $500 a kilowatt-hour. That’s expensive but competitive with lithium-ion battery storage.

Dean Frankel, an energy storage analyst with market research firm Lux Research, doubts Imergy will hit that number, noting that the company has yet to secure a supply of low-grade vanadium from fly ash or sludge.

“I believe that they claim they can extract vanadium from sludge but what I don’t believe is that they can do it cost-effectively at scale today,” Frankel told The Atlantic.

Apparently Imergy’s customers think they can. Watkins says paying clients include telecommunications firms in India and deals have been signed with well-known U.S. companies, though he declined to name them.

“We know everyone in the Valley,” says Watkins.

Real estate often tells the tale of the rise and fall of Silicon Valley tech firms. Back when Watkins ran Seagate, the company acquired a rival Silicon Valley hard drive maker called Maxtor. That company’s headquarters, a few miles away from Imergy’s offices, was subsequently occupied by Solyndra, the ill-fated high-tech solar panel maker that went bankrupt in 2011 after securing a half-billion-dollar government loan guarantee. Solyndra’s fate was sealed by the rise of Chinese solar manufacturers who flooded the market with cheap solar panels. Solyndra simply could not compete.

To avoid a similar destiny, Watkins already is creating a Chinese operation with Chinese partners, much like he did at Seagate.

“I always get China on your side,” says Watkins. “Look, everybody steals. Americans steals, the British steal, the Germans steal, the Chinese steal. We just all steal less from our friends. And our goal as a company is to make friends.”