Bloomberg Businessweek

The Secret to a Greener, Longer-Lasting Battery Is Blue

By David Stringer | SEPTEMBER 22, 2020, 6:00 AM EDT

A sodium-based technology is proving more effective for some uses.

A material that gave a vibrant blue to the foaming breaks of the **famous** Japanese print The Great Wave off Kanagawa and instilled the same color in works by Picasso and Monet is being used today for an entirely different but equally creative task: keeping energy-hungry U.S. data centers running.

Prussian blue, the pigment developed by a Berlin color maker in the early 18th century, is a key component in batteries made with sodium rather than lithium, which are intended for industries other than electric vehicles.

"It's been used as a pigment, as a **dyestuff**, and has been a consumer product for centuries," says Colin Wessells, chief executive officer of **Natron Energy Inc.**, in Santa Clara, Calif., the battery maker behind the technology. "It also turns out to be excellent at storing sodium ions," he says, resulting in a battery with high power and long cycle life.

Lithium-ion batteries have become **ubiquitous** in the past three decades, used in smartphones and electric vehicles—including automobiles from the likes of **Tesla** and **Volkswagen**, as well as **buses** from **BYD**—and to **store renewable energy** from solar or wind plants. Even so, they're **not the best option** for all potential applications, because they prioritize energy density, which helps cars travel farther, over longevity or stability. That leaves room for alternative technologies to meet some of the world's rising battery demand.

"Lithium-ion is not a one-size-fits-all solution," says Mitalee Gupta, a senior energy storage analyst in Boston for **Wood Mackenzie**. "Different technologies are starting to make their way in and will start to gain market share."

Alternatives to lithium-ion using materials such as **zinc**, **vanadium**, or **sodium** are proving themselves well-suited for many tasks, especially stationary storage used by utilities to capture renewable energy and deliver electricity to consumers hours later or to power telecommunications towers and remote industrial sites such as mines. The sector is poised for surging growth, with annual installations projected to rise from 6 gigawatt-hours last year to about 155 gigawatt-hours in 2030, according to data from **BloombergNEF**, Bloomberg LP's primary research service on energy transition.

Natron, spun out of Stanford University in 2012, has raised about $70 million from investors including oil and gas giant **Chevron Corp**. and this month **won $19 million** in **Department of Energy** funding. It's targeting battery sales for the backup power systems that keep data centers online in outages and will begin shipments this quarter to telecommunications and internet service provider customers, says Wessells, who declined to name the clients. The startup also is testing the technology's deployment in electric-vehicle charging at a demonstration site at the University of California at San Diego.

Prussian blue powder, produced by combining iron salt and hexacyanoferrate salt—which in the earliest recipes dating to the 1720s involved igniting and boiling mixtures of dried cattle blood and chemicals—offers battery producers key advantages. It's cheap and widely available, and its properties are well-understood. Most important, its chemical structure is ideal for battery electrodes, the components that store and release energy. All electrodes act like sponges, Wessells says, soaking up ions and then releasing them when charged and discharged. Prussian blue, however, allows ions to pass back and forth more easily than other materials. That quality makes its electrodes much longer-lasting than lithium-ion batteries' carbon and metal-based electrodes, which fall apart over time.

The low-cost sodium-ion battery is fast to recharge, often within minutes, and can quickly deliver short bursts of energy. It's a different set of strengths than that of lithium-ion batteries, prized for their ability to cram in large amounts of energy in small volumes. "Our technology is not appropriate for EVs, for electric airplanes, for consumer electronics," Wessells says.

There's also a cost advantage from using more plentiful, and cheaper, raw materials. Natron sells battery systems to data center customers at a similar price to both existing lead-acid packs and lithium-ion products, but it says its technology winds up being three times cheaper over the long term because of the life span of the battery.

"Sodium is the sixth-most-abundant element on Earth, it's essentially unlimited, and it's sustainable. You harvest it—you don't mine it so much," says James Quinn, CEO of **Faradion Ltd.**, a developer of sodium-ion batteries in Sheffield, England, that's recently struck agreements to supply Australia's residential energy storage market and to produce batteries for commercial vehicles in India.

In lithium-ion products, combinations of expensive metals such as **nickel** and cobalt mean raw materials can account for about 60% of the entire cost of the battery cell, according to BNEF. Cobalt's **murky supply chain** also continues to unsettle some end users. Still, prices of lithium-ion packs have fallen almost 90% since 2010, as manufacturing volumes have risen and the technology has advanced. Even if competitors squeeze them out of some markets, they'll remain the dominant battery technology.

But as batteries are added to an array of products—potentially even inside clothing to power cooling systems—accelerating demand will spur a need for a broader range of battery types, using a suite of raw materials, says Venkat Viswanathan, associate professor of mechanical engineering at Carnegie Mellon. "Eventually, basically every device you interact with will probably have a battery inside it," he says. "And once you get to that scale, you'll need a vast variety of cells." —With Akshat Rathi