A suburban Philadelphia firm bets on new technology to store solar power 24/7

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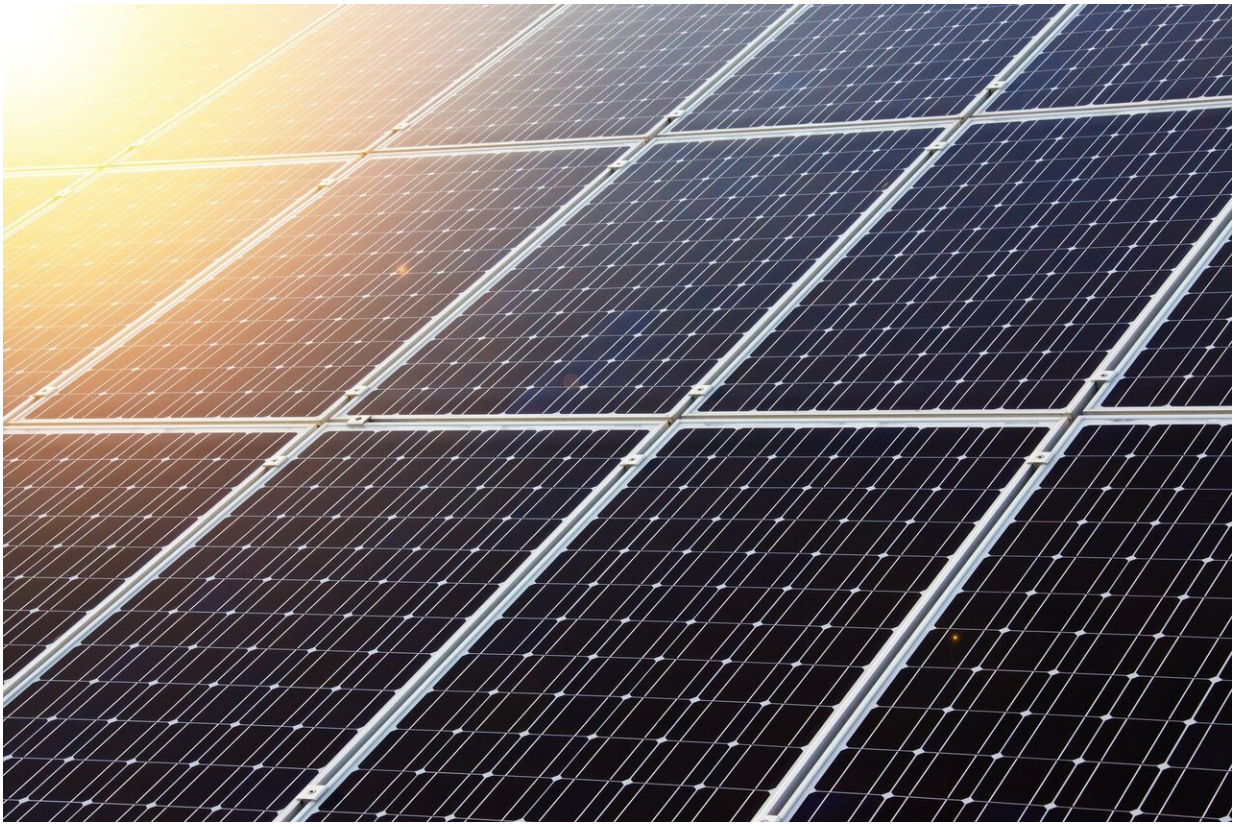

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In a repurposed mushroom barn in Chester County, Sycamore International Inc. recycles electronic equipment, including refurbishing 30,000 old laptops a month for resale. Steven Figgatt, Sycamore's chief

executive, says his West Grove company is all about the circular economy.

In keeping with its sustainable mission, Sycamore earlier this year installed a rooftop solar system to convert its operations to renewable energy. But Figgatt, 36, only declared his company's freedom from the electric grid in late August, when he commissioned a new innovative battery storage system that assures his business is supplied by solar power even when the sun isn't shining.

"We're calling it our Energy Independence Day," he said.

Figgatt went out on a limb with his choice of energy-storage technology, selecting a novel system called an iron-flow battery, the first of its kind on the East Coast.

Iron-flow batteries are among many promising grid-scale energy storage technologies that are vying for acceptance in a market where renewable energy is expanding quickly to replace greenhouse-gas emitting power sources.

As renewable generation grows in importance, the market for energy-storage systems is expected to play a key role. Wind and solar systems produce power intermittently, depending upon the weather, and grid operators say they will need more storage systems as renewable energy takes a bigger share of the power-generation market.

Makers of battery storage devices anticipate a boost from the Inflation Reduction Act, which President Joe Biden signed into law Aug. 16. The law contains tax incentives for buyers of energy storage devices.

Longer life span. No explosions.

An iron-flow battery is significantly different from a lithium-ion battery, the device commonly used in electric vehicles, mobile devices and some commercial applications.

The iron-flow battery's big selling point is that its electrolyte, the material that conducts an electrical charge, is not a metal mined in an unfriendly country. Instead, the electrolyte is made of ferrous chloride, which is basically iron, salt and water, all widely available. Unlike lithium, it's nontoxic and doesn't overheat and explode.

Sycamore's long-duration battery can discharge its power over 12 hours, about three times longer than a lithium battery, or roughly corresponding to the time when the sun isn't shining. It can hold about 400 kilowatt hours of power, enough to supply about 28 homes for 12 hours.

The iron-flow battery is also warrantied to withstand 25 years of charging and discharging cycles without deteriorating. It promises to be operating long after the Energizer Bunny wheezes to the sidelines.

"It was exciting, trying something new," Figgatt said. "I mean, I love that there's no toxic chemicals, there's no risk of fire hazards that you have with lithium-ion batteries. And also you can cycle it all the time, unlike lithium-ion batteries that have a finite number of cycles before they need to be replaced. This is kind of limitless, so we're going to run off it all the time."

The downside of flow batteries is that they are big, heavy and stationary—Sycamore's battery is housed in a 40-foot shipping container that weighed nearly 20 tons before 19,000 liters of electrolyte are added. They're not designed for automobiles or mobile devices, but for large-scale support of the power grid.

A second battery on order

Most of the nations' long-duration energy storage is located in pumped-storage hydropower plants, such as Constellation Energy's Muddy Run facility in Lancaster County, where water is pumped into a reservoir at a higher elevation and then released to generate power when needed.

Flow batteries store energy in tanks of electrolytes, which pass through an electrochemical membrane to extract electrons during the charging and discharging process.

The iron-flow device Sycamore acquired is called an Energy Warehouse, manufactured by ESS Tech Inc. of Wilsonville, Ore. The company has been developing a commercial iron-flow battery for more than a decade, and last year went public in a merger with a special purpose acquisition company, becoming the first publicly listed manufacturer of long-duration batteries. Like many tech start-ups, its stock has fared poorly this year and is down 60% since its launch last October.

But its fortunes may improve. It has a backlog of orders, including one for another unit for Sycamore International, whose business is picking up more institutional clients who want to dispose of old electronic devices and permanently erase any traces of data in Sycamore's secure process. Sycamore plans to break ground this fall to expand into a new building in West Grove, also equipped with its own solar system.

ESS has installed several batteries for San Diego Gas & Electric in Cameron Corners, California, a town at risk of getting cut off from the grid from wild fires. It's also working with Portland General Electric, a utility company, to build a half-acre Energy Center with about eight times the storage capacity as West Grove unit. Last month it announced an agreement to ship 70 Battery Warehouses to Australia, and to open an assembly plant in that country by 2024.

But the biggest news in the last month was the Inflation Reduction Act,

which contains tax incentives for buyers of energy storage devices that are boosted by 10% for domestically produced devices, such as the ESS Energy Warehouse. The IRA also provides credits to buyers of standalone battery storage units, while previous tax incentives applied only to energy storage directly associated with renewable generation.

"It helps level the playing field for us versus our competitors," Eric Dresselhuys, the chief executive of ESS, said in an interview. ESS's competitors are usually Chinese lithium battery makers, who Dresselhuys says receive state support. While the IRA tax credits are available for all batteries, he said, "it's worth more if you buy U.S. made products."

'The battery is basically an insurance product'

The seeds for Sycamore International's move into solar were planted more than five years ago at Millersville University, when Figgatt attended the launch of a solar system at the university's new Lombardo Welcome Center. There, Figgatt met Dave Santoleri, president of TerraSol Energies Inc., a Chadds Ford firm that designed and installed the 175-kilowatt Millersville system. Figgatt enlisted Terrasol to explore doing a solar installation at its West Grove plant.

"I knew flow batteries were a cool idea," Santoleri said. "I did a search and found five companies that made them. Three of them were out of business." He did find that ESS was still in business and the only manufacturer located in the U.S. He and Figgatt visited the company in Oregon and were sold.

"We did our due diligence," Figgatt said. "We do know it's a newer technology, so we went through a whole vetting process with ESS."

The battery system basically doubled the cost of Sycamore's solar

installation—the battery itself is in the neighborhood of $200,000, though Figgatt is vague about his total investment in the system. Figgatt figures the whole system will pay for itself in six to nine years, depending upon what happens with market energy prices. Meanwhile, Sycamore's energy costs are fixed.

For Figgatt, the battery backup provides more than just savings off his Peco bill. When the second battery system is installed, Sycamore International will be able to sell some of its surplus power back to the regional grid operator to help keep power levels in the area consistent, an important background role known as frequency regulation.

It will spare his business from long storm-related outages. And the voltage produced from his solar system is also finely tuned, which is critically important to Sycamore's operations, where his 70 employees may be erasing the delicate hard drives of as many as 600 laptops simultaneously as they undergo refurbishment.,

The importance of energy storage to a decarbonized energy future is so significant that U.S. Energy Secretary Jennifer M. Granholm visited ESS's plant in Oregon last month, part of a tour touting the climate benefits of the IRA.

In West Grove, Sycamore International's ribbon-cutting of its battery storage system on Aug. 25 also drew praise from U.S. Rep. Chrissy Houlahan, a Democrat who represents Chester and Berks Counties. "This project represents the kind of forward-thinking solution we need to build a decarbonized, resilient energy system," she said.