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ENERGY & ENVIRONMENT

Liquid Batteries for Solar and Wind Power

By HENRY FOUNTAIN APRIL 22, 2015

In an industrial park on the outskirts of Pullman, Wash., 10 white storage trailers sit side by side, neatly arranged in two rows.

These are no ordinary storage units. Arranged on racks inside are the guts of a large rechargeable battery, the kind of device that can store and release utility-scale amounts of electricity.

But this is no ordinary storage battery, either. In contrast with the typical lead-acid batteries used to start car engines or the lithium-ion cells that power electric vehicles — both of which are largely solid — this battery is mostly liquid.

The chemicals that react to produce electricity are dissolved in water and circulated into and out of the heart of each cell, where the reaction occurs. For that reason, it is called a flow battery, and the one in Pullman, a demonstration project that will be tested over the next year and a half, is one of the largest in the world. It can store a megawatt of electricity and then discharge it over three to four hours. That is enough to keep 500 average homes going for an afternoon.

Flow batteries are not new (and they are similar, in some ways, to fuel cells), but they have never really caught on. They were invented in France in the 19th century and studied by NASA in the 1970s as potential power sources in space or on the moon.

Now, flow batteries are being viewed as a possible way to help the electrical grid handle greater amounts of renewable energy, and they are being developed further by companies like UniEnergy Technologies, the maker of the Pullman battery, and academic and government researchers.

Because solar panels and wind turbines produce varying amounts of electricity during the day, utilities and system operators must work harder to integrate the

renewable sources into the grid. Batteries are one way to do this, by storing excess electricity from solar panels during the middle of the day, for example, and releasing it in the evening.

Such batteries are being used mostly for purposes other than integrating renewables into the grid — for example, by providing short infusions of electricity to keep the grid stable. Only 60 megawatts of storage were in use in the United States last year. But storage is expected to grow rapidly as prices of batteries and related control equipment fall.

Other battery technologies — notably lithium ion, by virtue of its widespread use by Tesla Motors and other electric-car makers — have a head start in the market.

Experts say, however, that flow batteries have some advantages that make them well suited to grid storage.

“I see flow batteries as being increasingly important,” said Imre Gyuk, who manages an Energy Department program to help develop technologies for utility-scale electricity storage.

Lithium-ion and lead-acid batteries pack more power for their size, which makes them especially useful for tasks like turning over a gasoline engine or getting an electric car moving from a full stop. And watt per watt they are smaller than flow batteries, which have tanks for the liquid chemicals and equipment to pump them into the cells.

But on the grid, batteries do not need to supply a lot of power at once; instead, they need to provide energy steadily over time. And compact size is not as important.

“A smaller footprint is not as useful in a stationary battery,” Dr. Gyuk said.

Because the electricity-producing reactions take place in the liquids, increasing the size of the tanks allows flow batteries to store larger amounts of electricity. While there are practical and economic limits to their capacity, flow batteries are seen as having potential for situations where a battery system has to discharge a large amount of electricity for more than a few hours.

“If you’re talking six-hour batteries, you’re probably going to be looking at flow batteries,” said Matt Roberts, executive director of the Energy Storage Association, an industry group.

Rick Winter, chief operating officer of UniEnergy Technologies, which is based in Mukilteo, Wash., said flow batteries had other advantages as well. Compared with other batteries, which lose capacity as they go through many charge-discharge cycles