How A California Company Is Recycling Waste Slag To Deliver A Cheaper Advanced Battery
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A California firm called Imergy believes it's hit on a new chemistry that can drastically reduce the costs of certain advanced battery systems.

In this case, it's what's called a "flow" battery. Most batteries create an electric current by shuttling ions between two positively and negatively charged solids. Flow batteries use two positively and negatively charged fluids, and create the ion reaction by pumping the fluids across either side of a membrane. This comes with several advantages: they're long-lasting, they can be built to different scales and uses, and the tanks can be easily swapped to recharge the battery. And because we don't control when solar and wind power produce electricity, flow batteries and other forms of energy storage will be a critical and widespread part of any grid that relies fully on renewable energy.

The downside of flow batteries is that their liquids currently rely on a solution of a mined material called vanadium — and the purer forms of vanadium that flow batteries require are also used by the steel industry. So the competition and constrained supply make vanadium expensive and hard to come by, which drives up the costs of the batteries. What Imergy did, according to reports byGreenTech Media, was come up with a chemistry that requires less pure forms of vanadium that it can purchase for much lower costs. The company is keeping the exact process under wraps and has filed multiple patents. But the upshot is that, instead of the 99.5 percent purity or higher most flow batteries need for their vanadium, Imergy can get by with 98.5 percent. That means Imergy doesn't need to compete in the same markets as the steel industry, and instead can buy vanadium that's been recycled from mining slag, oil field sludge, and other sources that come with a bit more contaminants.

"We basically take the contaminants, and we can mask it with our formulation," Imergy CEO Bill Watkins told GreenTech Media. "We don't have to go to the commodity vanadium markets around steel — we can create our own markets."

That would also make Imergy's batteries more environmentally friendly, since they'll be using materials that would otherwise just be disposed of as waste.

"We've tested about four different sources [of recycled vanadium], each with different origins, whether it's iron-based, or more of a carbon link, or even ammonia-based," added Tim Hennessey, the company's president. "They're all working for us."

Imergy thinks cheaper vanadium will allow them to drop the cost of their flow batteries down from their current $500 per kilowatt-hour to $300 per kilowatt-hour in a year or so — and maybe down to $220 per kilowatt-hour in two years. The company also believes the new process will deliver batteries that can hold more energy per pound.

Imergy is already selling its current flow batteries as backup power for telecom towers in India. Because flow batteries can be built with either large tanks or small ones, or with large reaction areas between the liquids or small ones, they can be designed for lots of different uses: delivering either high power over a short time or low power over an extended period. That means they can be usedas backup storage for homes and buildings, demand smoothers for microgrids, and a host of other applications.

That in turn means batteries of all types will need to become cost-competitive with the fossil fuels like natural gas and coal that currently supply most of the grid's busload power. Jeff Chamberlain, the Deputy

Director of Development and Demonstration for the Joint Center for Energy Storage Research at Argonne National Labs, told ThinkProgress that crossing that threshold of cost-competitiveness will require getting batteries' cost down to around $100 per kilowatt-hour.

At that point, "it makes financial sense to the grid operators and the electricity producers to have some infrastructure there to store that energy," Chamberlain said.

So flow batteries have some ground yet to cover. One thing that could help is further increases in the supply of vanadium — which would drive the cost down further — like the anticipated opening of a new vanadium mine in Nevada. A more ambitious step would be ultimately getting flow batteries off vanadium entirely, and onto liquids that aren't water-based. That would significantlyincrease the amount of voltage the batteries could deliver without breaking down the fluids.