Batteries of ice, iron and glass store renewable power

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Some unusual materials are being turned into batteries to allow us to increase our reliance on renewable energy

WHEN the wind stops blowing and turbines slow down, we have to resort to coal and gas-powered stations for our energy needs. This unpredictability makes it hard to rely on renewable sources for a constant energy supply. Storage is one solution, but traditional batteries that can hold enough power are expensive. So Portland General Electric (PGE) in Oregon has turned to ice. The company will soon start a pilot programme using icy slush to store energy from wind turbines when they overproduce, tapping into it when the turbines fall still.

It is just one innovative solution to a growing problem. Last year California passed legislation requiring the state's energy companies to create more than 1.3 gigawatts of energy storage between them by 2020. Lithium ion batteries might seem like the obvious solution. These batteries are a mature technology, and last week Elon Musk announced plans to spend $2 billion on a "Gigafactory" to develop huge quantities of them for his electric car firm Tesla Motors. But while they are great for electric sports cars, the batteries aren't cheap and aren't flexible enough to cope with wildly different loads for power grid storage.

PGE's icy solution, a Thermal Approach to Grid Energy Storage (TAGES), was developed by a company called Applied Exergy. It uses a heat pump, driven by excess energy from wind turbines or solar panels, to cool water into a pumpable icy slush, which is then stored. The slush is run through the heat pump the other way to retrieve the energy, powering a turbine as it melts. Using waste heat from a coal plant to power the heat pump can mean 80 per cent of the energy put into the slush can be retrieved.

And Energy Storage Systems (ESS), also in Portland, Oregon, is using a flow battery containing a solution of iron and water. Electricity is stored in the system by seeding iron ions with excess electrons. When that electricity is needed, the iron is pulled between two electrodes, which strip it of the excess electrons.

The company is planning to fit an iron ion battery at a local vineyard to help the growers balance their energy more effectively and get more out of their solar panels and wind turbines.

An even more familiar material is being used for energy storage – glass. Halotechnics of Emeryville, California, has developed a phosphate-based glass with a melting point low enough for it to become a storage medium. "We're developing a glass that you can pump like a liquid," says Halotechnics CEO Justin Raade. "It has a viscosity orders of magnitude below traditional window glass, and at 400 °C is about the viscosity of honey." The glass could be pumped to where energy is needed. As it cools and solidifies, it releases heat that drives a steam turbine to make electricity.

Raade is planning to install a pilot version at an aluminium plant. The glass energy capture system will recycle waste heat from the smelting process to increase energy efficiency. Chris

Dieterle, a power analyst at PGE says these new batteries hold a lot of promise for handling the energy from renewable sources. California's legislation has been a game changer, he says: "That's sending a message out to everyone else that this is a very serious matter and there need to be some breakthroughs."

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