Using data and computer models to store wind energy underground
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The Pacific Northwest National Laboratory has completed a study that comes up with two ways to use compressed air technology to store wind energy in underground chambers, the national lab said Monday. The two ways both use data and computer modelling to figure out the best sites that could successfully bank wind energy to be used at a later time.

Compressed air, as its name suggests, makes use of an electrically powered air compressor that sends pressurized air into a storage facility, which can be man-made or an underground reservoir. The pressurized air is let out later to run a turbine and generator to produce electricity. As much as 80 percent of the electricity used to compress air can be recovered when the pressurized air is used to generate energy, the lab said. Power losses are common when converting one form of energy to another.

Power in under ground caves

Utilities in the Northwest have a good reason for taking a look at energy storage technology. Wind power makes up about 13 percent (8.6 GW) of the power supply for the Northwest, the national lab said. Wind power tends to be most plentiful at night, when demand is at the lowest. Storing wind power for use during the day would help utilities meet their customers' demand and manage their grids, which run smoothly when there is a balance of supply and demand. That prompted the Bonneville Power Administration to work with the lab to look into whether compressed air would be a good fit.

Many U.S. utilities or power producers have done preliminary studies or even pilot projects to check out different types of energy storage technologies, including various types of batteries. Often their regulators require them to gradually increase the amount of renewable energy they supply to their customers. Wind and solar have been popular choices, but they don't generate a steady supply of electricity around the clock. Here is where energy storage comes in handy to help utilities manage their supply and demand.

The researchers were looking for two suitable underground sites for storing compressed air. They used data from gas exploration in Washington state and a computer model that simulates the flow of fluids underground. The idea is to see how much air a site can hold and how easy it'd be for the air to be harvested for power generation. For the study, an ideal underground storage would be at least 1,500 feet deep and 30 feet thick, and it should be close to transmission lines, the lab said.

Pacific Northwest

They found two locations, a place by the Columbia River, just across from Boardman, Ore., and another one in the Yakima Canyon that is roughly 10 miles north of Selah, Wash.

The scientists then sketched out two different processes for storing and re-using energy. At the Columbia River location, which is close to a natural gas pipeline, a compressed air storage plant can use natural gas to heat the compressed air and in the process boost the amount of electricity that can be produced.

At the Yakima location, the facility can use geothermal heat to run a chiller, which will in turn cool the air compressor to make it run more efficiently. Geothermal energy also can heat up the compressed air when it's released from storage.

Bonneville will now take the results of the $790,000 study and do a round of cost-and-benefit analysis to figure out if compressed air makes for a good business case.

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