

The Wonders of Compressed Air

A ROUTE TO ENERGY STORAGE

BY SALVATORE SALAMONE

USING COMPRESSED AIR FOR ENERGY

storage has been discussed for decades. And several plants around the world – notably one opened in the 1990s in Alabama – use the technique to squirrel away excess energy for later use. But the idea never really took hold on a massive scale.

The situation is about to change. Compressed air storage is now getting a second look. The reason: the growing use of wind energy. The issue with generating energy with wind is there is often a mismatch between supply and demand. Because of the variable nature of wind, new large-scale wind projects can produce more energy than is needed at certain times.

In some cases, distribution and transmission systems are already showing signs of strain in handling these highly variable sources of electricity. For example, an August *New York Times* article reported that the Maple Ridge Wind farm in upstate New York had to shut down at times because the “regional electric lines have been so congested.”

Worse still, the article noted that this is becoming a problem in many parts of the country, resulting in some wind projects being put on hold for lack of a means to carry the electricity to regions that need it.

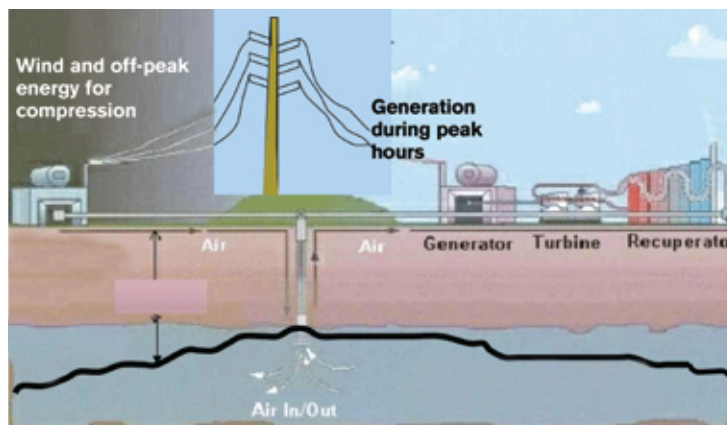
Unfortunately, the situation is only going to get worse. Only a small percent of the total electricity produced in the United States today comes from these wind and solar farms. But many states envision – and some are mandating – a day soon when 20 percent of the total electricity will come from these and other renewable sources.

Compressed air energy storage can help address the mismatch between wind energy production and capacity to handle the electricity by the local grid.

A compressed air storage system works like a large battery. When a wind farm produces excess electricity, this excess is used to compress air and store it underground in an excavated salt mine, aqueduct or cavern. The compressed air can also be held in tanks on the surface, but most efforts use underground storage. When the wind dies down and electricity is needed, the compressed air can be used to drive turbines to regenerate electricity for the grid.

Several efforts are now under way to leverage this technology.

In August, PSEG Global, a subsidiary of PSEG Energy Holdings and an indirect subsidiary of PSEG,



When electricity is not needed, a compressor is used to inject air underground which is available to generate electricity when needed.

SOURCE: SANDIA NATIONAL LABORATORIES

and Michael Nakhamkin announced a new company called Energy Storage and Power. Nakhamkin, who will serve as chief technology officer of the joint venture, led the work on the compressed air storage plant in McIntosh, Ala.

According to the company, it will develop second-generation technology that reduces the startup time for generators powered by compressed air and cuts the amount of emissions they produce. Facilities built using the new technology would also use more standard components than was the case with past efforts.

The promise of compressed air storage is also at the heart of an effort under way in Iowa. The Iowa Stored Energy Park will use wind and off-peak energy from other sources to compress air and store it underground.

The project, estimated to have a budget of \$200 million, is being undertaken by 100 municipal utilities located in Iowa, Minnesota and the Dakotas. Additional funding comes from the U.S. Department of Energy. The plan is to have a 268-megawatt system online in 2011.

And another joint effort in Texas has TXU Energy working with Shell WindEnergy. Together, they plan to build a 3,000-megawatt wind farm that would be connected to a compressed air energy storage system.

While the renewed interest in compressed air energy storage is being driven primarily as a way to address wind's variability, the technology is also gaining favor for use in other applications.

The storage technology can be used with any electricity generation technology. So a natural gas or coal plant could produce extra electricity in off-peak hours, convert that energy and store it in a compressed air system, and then use the stored energy to help meet demands during peak hours.

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