Russia gravity energy storage

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There is no doubt that renewable energy sources are the future. They’re available in all countries, but their potential is yet to be fully harnessed. According to The International Renewable Energy Agency, 90 percent of the world’s electricity should come from renewable energy by 2050.

Now, sources like sunshine and wind are inconsistent so finding innovative ways to store energy in an accessible and efficient way is crucial. There are effective solutions for daily energy storage, like batteries, but a cost-effective long-term solution is lacking.

In a new International Institute for Applied Systems Analysis-led study, a team of researchers has developed a novel way to store energy by transporting sand into abandoned underground mines. Called Underground Gravity Energy Storage (UGES), the new technique proposes an effective long-term energy storage solution utilizing now-defunct mines, which number in the millions globally.

“Mines already have the basic infrastructure and are connected to the power grid, which significantly reduces the cost and facilitates the implementation of UGES plants,” Julian Hunt, a researcher in the IIASA Energy, Climate, and Environment Program and the lead author of the study, said in a statement.

The primary components of UGES are the shaft, generator, upper and lower storage sites, and mining equipment. UGES generates electricity when the price is high by lowering sand into an underground mine. The potential energy of the sand is then converted into electricity via regenerative braking. Then, the sand is lifted from the mine to an upper reservoir with the help of electric motors to store energy when electricity is cheap.

Since the energy storage medium of UGES is sand, there is zero energy lost to self-discharge, unlike normal batteries. This permits ultra-long time energy storage ranging from weeks to several years.

The researchers note the investment costs of UGES to be about one to 10 USD/kWh and power capacity costs of 2.000 USD/kW. And the technology is estimated to have a global potential of seven to 70 TWh, with most of this potential concentrated in China, India, Russia, and the USA.

“To decarbonize the economy, we need to rethink the energy system based on innovative solutions using existing resources. Turning abandoned mines into energy storage is one example of many solutions that exist around us, and we only need to change the way we deploy them,” said Behnam Zakeri, study coauthor and a researcher in the IIASA Energy, Climate, and Environment Program.

Renewable energy sources are central to the energy transition toward a more sustainable future. However, as sources like sunshine and wind are inherently variable and inconsistent, finding ways to store energy in an

accessible and efficient way is crucial. While there are many effective solutions for daily energy storage, the most common being batteries, a cost-effective long-term solution is still lacking.

In a new IIASA-led study, an international team of researchers developed a novel way to store energy by transporting sand into abandoned underground mines. The new technique called Underground Gravity Energy Storage (UGES) proposes an effective long-term energy storage solution while also making use of now-defunct mining sites, which likely number in the millions globally.

UGES generates electricity when the price is high by lowering sand into an underground mine and converting the potential energy of the sand into electricity via regenerative braking and then lifting the sand from the mine to an upper reservoir using electric motors to store energy when electricity is cheap. The main components of UGES are the shaft, motor/generator, upper and lower storage sites, and mining equipment. The deeper and broader the mineshaft, the more power can be extracted from the plant, and the larger the mine, the higher the plant"s energy storage capacity.

"When a mine closes, it lays off thousands of workers. This devastates communities that rely only on the mine for their economic output. UGES would create a few vacancies as the mine would provide energy storage services after it stops operations," says Julian Hunt, a researcher in the IIASA Energy, Climate, and Environment Program and the lead author of the study. "Mines already have the basic infrastructure and are connected to the power grid, which significantly reduces the cost and facilitates the implementation of UGES plants."