Tajikistan data center energy storage

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Tajikistan"s vast water resources drive the country"s cheap electricity, but much of the population experiences energy shortages during winter when freezing temperatures cause soaring demand for home heating.

A team of researchers, led by Akita University, is working with the National Academy of Sciences of Tajikistan"s Center for Innovative Development of Science and New Technologies and Hokkaido University to pilot ground source heat pump (GSHP) technology in the central Asian country. GSHPs offer an alternative, sustainable source of energy to heat and cool buildings, alleviating the load on the electricity grid.

"Outside the capital city of Dushanbe, many people only have access to electricity for two or three hours a day," says project lead, Fumiaki Inagaki at Akita University, an institute with broad GSHP expertise. "GSHP can reduce electricity consumption by about 50%," he says.

The collaborative project -- which involves researchers and businesses from Japan and Tajikistan, and which runs until 2027 -- will install GSHP technology at pilot sites at the Academy of Sciences and a Dushanbe hospital or school. "More than 900 small coal boilers operate in Tajikistan"s hospitals and schools, which we hope will eventually be replaced by heat pumps," Inagaki says.

GSHPs -- already widespread in Japan -- exploit the constant warm temperatures found hundreds of meters below ground. The system pumps water underground, where its temperature equalizes with the surroundings, then draws the water back to the surface. Connected buildings are sustainably warmed in the winter and cooled in summer.

To help translate the technology to Tajikistan, project participants, led by Youhei Kawamura at Hokkaido University, are creating a virtual replica, or "digital twin", of the Tajik GSHP system, using real-time data from sensors. This digital twin will enable engineers and operators in Japan to monitor and optimize performance of the physical system.

The project will also use AI to develop a "potential map" to identify areas with good GSHP installation potential. There is not a lot of geological information about Tajikistan available, Kawamura says. "That"s where AI can help us."

On the ground in Tajikistan, an Akita-led team of engineers from Japan is working with local companies to drill wells and install wireless smart sensors -- not easy in such a remote country where equipment and technology is quite outdated. So far, they have drilled two wells, with up to four further wells to be installed.

"Drilling is a challenge as the technology in Tajikistan is very old, meaning what would take one week in Japan takes three months to complete there," says Kawamura. For the next well, the team will import a drilling rig from Japan.