ADDRESSING WATER RESOURCE CHALLENGES

The UNDP's 2023 project in the Fergana Valley, equipped by Geolux, establishes an advanced, solar-powered water monitoring network using cutting-edge radar technology and Geolux HydroView software to enhance disaster risk reduction, agricultural management, and environmental resilience.

The Fergana Valley, which spans Uzbekistan and Kyrgyzstan, is Central Asia's most densely populated region, home to 13 million people. It is a region of critical importance for agriculture, ecological balance and the livelihoods of its inhabitants. The valley is a major producer of cotton, wheat, fruits and a variety of crops, relying heavily on a network of irrigation canals, rivers and reservoirs. Among these, the Great Fergana Canal stands out as a remarkable feat of engineering. Spanning 270km, it was constructed in 1939 by a workforce of 160,000 people in just 45 days. Disputes over water resources have historically marred relations between Uzbekistan and Kyrgyzstan, stemming from their mutual reliance on trans-boundary rivers that originate in the Kyrgyz mountains before flowing into Uzbekistan. Kyrgyzstan, positioned upstream, holds sway over the rivers' headwaters and has pursued hydroelectric projects to enhance its energy independence, entailing damconstructions and river flow regulations. Downstream, Uzbekistan relies on these water flows for its expansiveagricultural sector, especially for irrigating cotton fields, so its neighbor's plans have been met with apprehension. Changes in water flow patterns risk causing shortages, jeopardizing crop production, and escalating tensions between the two nations. Both nations face the challenge of balancing Kyrgyzstan's need for energy security with Uzbekistan's agricultural demands. The valley's geography also makes it prone to natural disasters such as floods and landslides. Notably, in 1998 the enclave of Shahimardan, which is situated within the valley and is part of Uzbekistan's territory, was struck by a catastrophic flood, resulting in the tragic loss of more than 100 lives. This disaster was precipitated by the abrupt discharge of water from a glacial lake.

Monitoring water levels

In response to the pressing need for improved water management and disaster risk reduction in the Fergana Valley, in 2023 the United Nations Development Programme (UNDP) launched a project to establish an advanced network for monitoring water levels and river discharge. To achieve accurate monitoring of river discharge, the project is using the innovative principle of surface-velocity radar for river discharge measurement, representing a cutting-edge approach to environmental monitoring. Through this project, UNDP hopes to enhance the region's capacity to mitigate the impacts of water-related disasters and support sustainable agricultural practices, ultimately contributing to the resilience and well-being of the valley's communities. In the first phase of the project, UNDP has strategically chosen 11 locations throughout the Fergana Valley to set up monitoring stations. At each site it plans to install water-level radar sensors and surface-velocity radars. The surface-velocity radars are designed to measure the speed of water flow at the surface. Then, the calculation of river discharge is undertaken by combining surface-velocity measurement with water-level data and the measurements of channel bathymetry. Additionally, each monitoring site is equipped with a standalone solar power supply to ensure operational sustainability, and a datalogger equipped with GPRS technology for the real-time transmission of data to central servers. Specifically, for the monitoring

station at the Kuykulak site on the Maylisay River, which is wider than other rivers, UNDP has required the deployment of three surface-velocity radars across the riverbed instead of a single device, to increase the accuracy of the discharge measurement.

Equipment and installation

Geolux has been selected as the supplier for the equipment needed in this UNDP project, owing to the superior technical specifications and cost-efficiency of its products. For water level and flow measurement, the company has provided its RSS-2-300WL combined radar flow instrument; for data acquisition and transmission, the Geolux SmartObserver datalogger was delivered. To provide the power supply for the monitoring stations' equipment, Geolux included 20W solar panels paired with 30Ah lithium-ion batteries. The low power requirements of the Geolux devices are a significant advantage, enabling the use of small solar panels. Their small size is an advantage because it makes them less likely to attract vandalism. The equipment installation methods were adapted to the specific conditions of each individual site. If there was a bridge over a river, the devices were mounted directly onto the bridge, leveraging existing infrastructure for stability and ease of installation. In locations without bridges, a mast with a cantilever was erected. The radar instruments were placed on the cantilever directly above the water surface, and the cabinet for the datalogger and the battery was installed on the mast.

Visualizing the data

Geolux HydroView is a data portal software that has been installed to receive real-time data from each station, with measurements being conducted and transmitted every 15 minutes. It not only facilitates the visualization of the measured data, providing an intuitive interface for analysis, but also offers advanced features that enhance operational flexibility and efficiency. The user interface for the HydroView portal has been localized for use in Uzbekistan by adding translations in Uzbek and Russian. Geolux HydroView not only displays the measured data but also provides additional features. Key among these is the capability for remote device reconfiguration. This enables remote adjustments to be made to the settings of the monitoring equipment, ensuring that the system can be adapted to changing conditions without the need for physical intervention at the site. For example, it is possible to remotely change the measurement interval or filtering parameters. Additionally, the platform supports remote firmware updates. All these features are crucial for maintaining the reliability, accuracy and security of the data collection process over time.

Setting new standards

The initiative to establish an advanced water monitoring network across the Fergana Valley, spearheaded by the UNDP and equipped by Geolux, represents a significant leap forward in sustainable water management and disaster risk reduction for the region. By using state-of-the-art radar technology, solar-powered solutions and the innovative Geolux HydroView software, this project sets a new standard for real-time environmental monitoring. The deployment of this network not only enhances the ability to manage agricultural demands and mitigate the impacts of natural disasters but also serves as a model for collaborative, technology-driven approaches to addressing water resource challenges, benefiting the Fergana Valley's environment and its inhabitants for generations to come.