Source: *The Straits Times,* pB8
Date: 4 July 2022

High-altitude hydropower systems face climate change threat: Study

Urgent need for better adaptation measures, more robust planning and tracking systems

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Power generation through harnessing water, one of the world's largest renewable sources of electricity, is increasingly coming under threat in the Himalayan mountains and neighbouring ranges because of climate change-related disasters.

Many new hydropower projects are planned near glaciers or glacial lakes at high altitudes, which are vulnerable to global warming, and better adaptation measures and more robust planning and monitoring systems are urgently needed, said a new study led by the National University of Singapore (NUS).

Known collectively as High Mountain Asia, this region has the largest reserves of water in the form of ice and snow outside the polar region. Its glaciers, which provide water for drinking and agricultural use, also represent largely untapped potential for hydropower.

Currently, there are over 650 hydropower projects either under construction or planned in the Himalayan region, with the hydropower potential in the High Mountain Asian region exceeding 500 gigawatts (GW) of energy, which could support over 350 million homes.

Only about 20 per cent of the estimated 500GW potential has been tapped so far.

Dr Dongfeng Li, lead author of the study and a research fellow at NUS' department of geography, said the study was motivated by recent hydropower plant failures in the Himalayas. The team wanted to study the link between these mountainous hazards and climate change.

In February last year, an avalanche hit a Himalayan glacial valley in the Chamoli district of Uttarakhand, India, resulting in a cascade of debris and disastrous flooding that swept away two hydropower projects.

>650

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Conducted in collaboration with scientists from countries like Britain, Nepal and Australia, and published in the journal Nature Geoscience on June 23, the study offered recommendations for climate change-resilient hydropower systems in high mountainous areas. It found that global warming-induced melting of ice systems is severely altering the volume and timing of water supplied from High Mountain Asia to downstream areas, which people rely on for food and energy.

The construction of more reservoirs designed to regulate streamflow and produce hydropower is a critical part of strategies for adapting to these changes.

However, these adaptation projects are vulnerable to a complex set of interacting processes, which include melting glaciers, the thawing of the permafrost which results in landslides, and associated landslides, debris flows and floods from glacial lakes.

These processes can mobilise large amounts of sediments which then fill up reservoirs, causing dam failure and degrading power turbines.

Professor Xixi Lu, also from NUS' department of geography and the second author of the study, said that future reservoirs should have additional storage space to cope with increased sedimentation from potential climate-related hazards.

The study also suggested that maps be created to better delineate current and future hazard-prone regions. These maps should inform policies for maintaining current hydropower plants and planning for new ones.

In addition, monitoring, forecasting and early-warning systems for future disasters should also be further developed and implemented.

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