Himalayan hydropower 'clean but risky,' warn scientists

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Singoli Bhatwari, one of the hydropower projects in Uttarakhand that have been severely affected by floods and landslides. Credit: Vaibhav78545 (https://commons.wikimedia.org/wiki/File:Singoli_Bhatwari_HEP.jpg), CC BY-SA 4.0 (https://creativecommons.org/licenses/by-sa/4.0/deed.en)

With its steep topography and abundant water resources the Himalayas offer sustainable, low-carbon hydropower for energy-hungry South Asia. But there is a catch—the mountain range falls in one of the world's most

seismically active regions.

A group of 60 top Indian scientists and environmentalists wrote an open letter to Prime Minister Narendra Modi earlier this month seeking his intervention in stopping "any more hydroelectric projects in the Himalayas and on the Ganga whether under construction, new or proposed."

The letter cites the Intergovernmental Panel on Climate Change's sixth assessment report which says that the Himalayas have been affected by warming. The report warns that "rising temperature and precipitation can increase the occurrence of glacial lake outburst floods and landslides over moraine-dammed lakes" in high mountain Asia. Moraine consists of rocks and soil left behind by moving glaciers.

Hydropower, the world's largest source of renewable electric power with1,308 gigawatts of installed capacity in 2019, is expected to play a critical role in decarbonising power systems, according to the International Energy Agency (IEA), an inter-governmental body.

Stretching 2,400 kilometers in an arc that includes the world's highest peaks, the Everest in Nepal and K2 in Pakistan, the Himalayas rank high among global hot spots for developing hydropower, though only 20 percent of the estimated 500 gigawatt potential has been tapped so far.

But that situation is rapidly changing with hydropower projects mushrooming along the Himalayan arc—which covers territory in Bhutan, China, India, Nepal and Pakistan—despite proven risks from quakes, landslides and glacial lake outburst floods.

The immediate trigger for the appeal to Modi was a decision by India's Ministry of Environment, Forest and Climate Change to allow the restarting of seven controversial hydropower projects in the Himalayan

state of Uttarakhand.

Three of these projects—Tapovan-Vishnugad (520 megawatts), Phata Byung (76 megawatts) and Singoli Bhatwari (99 megawatts)—have already been severely damaged by floods and landslides in 2013 and in February 2021. Several other hydropower projects in the Himalayas have also suffered similar damage.

In February, a glacial avalanche set off flash floods in the Rishi Ganga and Dhauli Ganga valleys in Chamoli district, leaving 250 people dead and extensively damaging land and infrastructure, including the Tapovan-Vishnugad project.

C. P. Rajendran, a paleo-seismic specialist and adjunct professor at the National Institute of Advanced Studies, Bangalore, says: "The great height of the Himalayas makes them inherently unstable. These disasters are early warnings that hydropower projects, infrastructure building and tourist activity are making the mountains more unstable."

Additionally, says Rajendran, temperature rise from climate change could increase rockfalls in the Himalayas. "Mountain permafrost holds rocks together and helps stabilize the steep slopes but warming over the last few decades may have affected its role as a slope stabilizer."

A signatory to the letter to the prime minister, Rajendran is the author of a palaeo-seismological study, published in August, which examines the effects of past earthquakes that have hit the eastern Himalayas. A quake in 1950—rated at 8.6 on the Richter scale and the largest continental event ever recorded—devastated Tibet and India's Assam state, killing thousands and causing extensive landslides and flash floods, Rajendran recalls.

"The 1950 quake, which also impacted Bangladesh and Myanmar, is a

grim pointer to what we can expect in the north-eastern bend of the Himalayas where massive hydropower projects are coming up, in Tibet and the adjoining Indian state of Arunachal Pradesh," says Rajendran.

Maharaj K. Pandit, professor at the Delhi University and director of the Centre for Inter-Disciplinary Studies of Mountain and Hill Environment tells SciDev.Net that the risks of building hydropower dams in the Himalayas need to be balanced against the growing demand for clean, renewable energy.

Pandit believes that precipitation in the cold and dry Tibetan plateau is too scanty to justify a mega dam while "the area around the Brahmaputra on the Indian side is tropical and among the wettest in the world."

The starkest example of the effects of a major quake on hydropower projects comes from Nepal where the April 2015 temblor that killed 9,000 people temporarily knocked out 20 percent of the country's hydropower capacity and damaged 30 dam projects.

According to Basanta Raj Adhikari, assistant professor at Tribhuvan University's Institute of Engineering, in Nepal, one solution is to construct small, run-of-river hydropower projects that produce electricity from the natural flow of river water without the need for large dam or reservoir.

"Studies show that there is a 500-year seismic gap in the western Himalayas and 300 years in the eastern Himalayas with energy from continuous northward movement of Indian plate beneath the Eurasian plate storing up," says Adhikari. A seismic gap is an active fault in a segment of a structure that has not slipped for a long time, compared with other segments.

"We don't know the magnitude of the anticipated large Himalayan

earthquake," says Adhikari, a known disaster risk reduction expert. "In my view, we are not prepared for the consequences of failure of high dams and large reservoir-based hydropower projects along the whole Himalayan chain."

Provided by SciDev.Net