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Heading Off Negative Impacts of Dam Projects

By ERICA GIES DEC. 8, 2015

Hydroelectric dams grace bank notes in developing countries, from Mozambique to Laos, Kyrgyzstan to Sri Lanka, a place of honor reflecting their reputation as harbingers of prosperity.

That esteem, now enhanced by hydropower's presumed low-carbon profile, continues to overrule concerns about environmental consequences and displaced people, as evidenced by a surge in dam-building in the developing world.

The phenomenon is perhaps most intense in the Mekong River Basin, in Southeast Asia, where 12 more dams are planned for the main stem of the river and 78 on its tributaries.

Because many of these projects seem inevitable, institutions, nongovernmental organizations and academics worldwide, from the World Bank to the German Corporation for International Development to the Nature Conservancy, are developing strategies for dams with softer environmental footprints.

The Mekong is the richest inland fishery in the world, with more than 60 million people who live along it surviving on subsistence fishing.

The dams would have "catastrophic impacts" on fish productivity and biodiversity, including species such as the Irrawaddy dolphin, according to a 2012 paper in the Proceedings of the National Academy of Sciences. Sediment mobility is also a concern. Vietnam, despite its own dams, is concerned that new upstream dams would deprive its low-lying delta — the country's rice basket and home to millions — of critical sediment replenishment in the face of sea-level increases and saltwater intrusion.

Nevertheless, the countries along the Mekong — China, Myanmar, Thailand, Laos, Cambodia and Vietnam — are eager to develop, and for now that means large dams.

Historically, dam builders sought to maximize hydroelectricity and profits. Aquatic scientists came in at the tail end of the planning process to assess the environmental impacts and try to mitigate them to some

The Xayaburi Dam under construction in Laos. It is an example of how public comment can lead to changes that are intended to reduce the potential harm of hydroelectric projects. In the Mekong River Basin, 12 dams are planned for the main stem of the river and 78 on its tributaries. Courtney Weatherby

degree.

A recent paper in the journal Nature Climate Change suggests a seemingly obvious yet novel approach: Bring in aquatic scientists at the beginning so that engineers can consider ecological principles first, not last.

The paper came out of meetings organized by the National Socio-Environmental Synthesis Center in Annapolis, Md., in 2013. Engineers and aquatic scientists discussed their core requirements for a hypothetical case study of the Iowa River in the United States.

For the engineers, it was revolutionary to get quantitative environmental variables at the beginning of the process that they could put into a model to address ecosystem issues. “I can work with that,” said Casey Brown, an engineering professor at the University of Massachusetts Amherst and a co-author of the paper.

John H. Matthews, an ecologist and secretariat coordinator for the Alliance for Global Water Adaptation and a co-author of the paper, said: “Engineers are native problem solvers. If you can define a problem accurately and broadly, they will come up with a solution.”

Called ecological engineering decision scaling, the framework models tradeoffs between power loss and environmental gain to find the sweet spot. That approach can work especially well if planners consider the entire river basin rather than just a single dam, a strategy that is also atypical, Mr. Brown said.

For example, a 2012 study considered 26 dams proposed for the Mekong’s tributaries and found that building them all would reduce migratory fish by 20 percent. Forgoing just a few dams could minimize fish losses to 3 percent, while still producing 75 percent of the energy, according to the study.

Taking a holistic look at the river system is also economically advisable because multiple dams have a cumulative impact not just on the environment but also on energy performance. “Projects can end up interfering with each other,” said Jeff Opperman, senior freshwater scientist with the Nature Conservancy.

Nevertheless, there are ways to reduce the impact of a single dam by softening the barrier it creates to fish and sediment moving through the river.

After the Xayaburi Dam in Laos came under heavy public criticism, planners widened the fish passage channel, put switchbacks in the fish ladder to make it easier to climb, and added several entry points at different flow velocities to attract different species of fish, according to a report from the Stimson Center, a public policy institute in Washington.

To allow sediment through the proposed Sambor Dam in Cambodia, the Natural Heritage Institute in San Francisco advocates a bypass channel for environmental releases of water to help river ecology and the full opening of dam gates in certain seasons to flush sediment.

The way a dam is operated can also soften its impact. Typically, dam operators respond to energy demand by moving a lot of water through, then rapidly cutting off the flow when demand drops.

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“It’s a very unnatural stream flow that has many negative impacts to the ecosystem,” said N. LeRoy Poff, professor of biology at Colorado State University in Fort Collins and a co-author of the Nature Climate Change paper. One remedy is “a second dam downstream that re-regulates the river flows out of the dam, mimicking on the downstream side the flow of water that’s coming in on the upstream side.”

Dam developers may be growing more receptive to some of these strategies because water flows are becoming more unreliable as the climate changes, said Mr. Matthews, the ecologist. That raises questions about the risk of such large investments.

Increasingly organized social and environmental opposition to large dam projects are also raising financial risks.

Reducing the risk of controversy by engaging stakeholders in early planning and environmental impact studies can lower risk for investors, reducing financing costs, said Mr. Opperman, at the Nature Conservancy.

Nevertheless, even as hydropower booms, its days may be numbered because of the rapidly decreasing price of more agile alternatives like wind and solar.

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