EGU21-3781
https://doi.org/10.5194/egusphere-egu21-3781
EGU General Assembly 2021

In-stream turbines for sustainable hydropower development in the Amazon river basin

Suyog Chaudhari, Erik Brown, Raul Quispe-Abad, Emilio Moran, Norbert Mueller, and Yadu Pokhrel
Michigan State University, United States of America (chaudh56@egr.msu.edu)

Given the ongoing and planned hydropower development projects in the Amazon River basin, appalling losses in biodiversity, river ecology and river connectivity are inevitable. These hydropower projects are proposed to be built in exceptionally endemic sites, setting records in environmental losses by impeding fish movement, altering flood pulse, causing large-scale deforestation, and increasing greenhouse gas emissions. With the burgeoning energy demand combined with the aforementioned negative impacts of conventional hydropower technology, there is an imminent need to re-think the design of hydropower to avoid the potentially catastrophic consequences of large dams. It is certain that the Amazon will undergo some major hydrological changes in the near future because of the compounded effects of climate change and proposed dams, if built with the conventional hydropower technology. In this study, we present a transformative hydropower outlook that integrates low-head hydropower technology (e.g., in-stream turbines) and multiple environmental aspects, such as river ecology and protected areas. We employ a high resolution (~2km) continental scale hydrological model called LEAF-Hydro-Flood (LHF) to assess the in-stream hydropower potential in the Amazon River basin. We particularly focus on quantifying the potential and feasibility of employing instream turbines in the Amazon instead of building large dams. We show that a significant portion of the total energy planned to be generated from conventional hydropower in the Brazilian Amazon could be harnessed using in-stream turbines that utilize kinetic energy of water without requiring storage. Further, we also find that implementing in-stream turbines as an alternative to large storage-based dams could prove economically feasible, since most of the environmental and social costs associated with dams are eliminated. Our results open multiple pathways to achieve sustainable hydropower development in the Amazon to meet the ever-increasing energy demands while minimizing hydrological, social, and ecological impacts. It also provides important insight for sustainable hydropower development in other global regions. The results presented are based on a manuscript under revision for Nature Sustainability.