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Prospect of Small Hydropower Projects for Sustainable Development of Water Resources in Karbi Anglong District, Assam, India

Manash Protim Baruah[1]*, Devojit Bezbaruah[2], Uttam Goswami[b] and Tapos Kumar Goswami[2]

[1]*Geological Survey of India, Raipur-492010 (CG), India*

[2]*Department of Applied Geology, Dibrugarh University, Dibrugarh-786004(AS), India*

(**Corresponding Author, Email: manashprotim.baruah@gsi.gov.in*)

Abstract

The North Eastern Region (NER) of India has the highest hydropower potential, i.e., almost 40% of the country's total potential (55929 MW), out of which only 7027 MW has been harnessed so far. Contrary to the currently emphasized large hydro projects, which impart significant ecological changes on the river dynamics, the NER offers enormous Small Hydropower (SHP) potential which can be harnessed with a much lesser outlay cost. One of the objectives of India's small hydropower program is to encourage SHP projects, as these can provide an energy solution to rural, isolated, and hilly areas where the extension of the grid system would be relatively expensive. The present study area falling in Karbi-Anglong District of Assam has been selected for identification of potential sites for SHP through detailed hydrological study of the available water resources. The hilly district of Karbi-Anglong falls under Sixth Schedule Areas of the Constitution of India where majority of the population belongs to Scheduled Tribe Communities, is both industrially and economically backward. A total of 46 potential sites have been selected on eight streams present in the area. The results show that these watersheds can generate 48.4 MW of power via development of small to mini multipurpose hydropower projects. Using canal networks attached to these multipurpose projects, the natural gradient available in the hilly watershed can best utilized to irrigate downstream areas at a lower cost. These irrigation-based multipurpose projects will boost agriculture activity in the tribal areas of Karbi-Anglong and nearby districts and also be able to meet the captive requirement of power. Increased rural electrification can facilitate the development of industries dependent on agriculture and forestry, which will improve the area's economy and social upliftment of the whole area.

Keywords: North Eastern Region (NER), Small Hydropower (SHP), Water Resources, Karbi-Anglong, Assam

Introduction

A renewable source of energy in the form of hydropower is more sustainable (Siri *et al.,* 2021) with zero carbon footprints unlike the fossil fuels (Kusre *et al.,* 2010; Levasseur *et al.,* 2021) mainly in developing countries like India. India is blessed with immense amount of hydroelectric potential with estimated 1,33,410 MW of installed capacity, a major portion of which i.e., 55929.7 MW is estimated for the Northeastern region (NER) (CEA, 2023). But only 7027 MW has been harnessed or under various stages of construction, leaving bulk of the potential remains untapped. Usually, the large reservoirs associated with conventional large hydroelectric power plants have been responsible for large scale shifting of populations, damage to flora and fauna, downstream risk of flood and most importantly dramatic ecological changes in the river. However, hydroelectric power plants can also be constructed in an area by diverting flow of water from a river with no dam or water storage (Saraf and Kumar, 2006; Ramachandra *et al.,* 2004; Goyal *et al.,* 2015). These are known as Small Hydropower (SHP) projects (Subrahmanyam, 2013; Goyal *et al.,* 2015) and could be an effective alternative to the mega dams.

Northeastern States of India have a fairly good potential to develop SHP projects of about 3261.49 MW (MNRE, 2024). Despite this huge potential perceptible emphasis is given only to large hydropower projects. These large hydro projects are being criticized because of the geographical disadvantage of the region which experiences more often the problem of compound catastrophes like earthquake, landslide, and floods *etc.* (Baruah *et al.,* 2024a). On the other hand, small multipurpose hydro projects (less than 25 MW) could ensure the socio-economic upliftment, livelihood, water and food security (Quaranta *et al.,* 2022). These could be effective alternatives to mega dams. The hilly areas of the Assam have significant SHP potential (Baruah *et al.,* 2024a), particularly in the two hill districts – Karbi Anglong and Dima Hasao, which account for nearly 83 MW and 23 MW power generations respectively (Nath, 2015). However, very little work is being done to explore these hidden treasures of power so far.

The state of Assam, being an agro-based economy, irrigation plays an important role in the crop production. Most of the irrigation projects in Assam are lift based irrigation which are either

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