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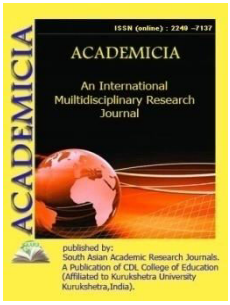


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# SELECTION OF BEST LOCATION FOR SMALL HYDROPOWER PLANT (SHP) ALONG CHAMKHAR RIVER, BHUTANUSING ANALYTICAL HIERARCHY PROCESS (AHP)

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## ABSTRACT

*Hydropower development activities have been playing an indispensable role in enhancing Bhutan's economy and driving towards its goal of becoming a self-reliant nation. Hydropower being a renewable source of energy with minimal environmental impacts has always synchronized with Bhutan's strict environmental regulations and policies. Despite having remarkable hydropower potential, it has been able to harness only a fraction of the total potential hydropower production only due to various challenges faced by the hydropower sector. There is a lack of in-house resources and experienced local expertise to carry out the specific assessment. Large-scale hydropower projects not only have high upfront cost and risk but also posing severe threats to the environment of terrestrial and riverine ecosystems. Run-off-river small hydropower plants (SHP) are considered to be most cost-effective and more importantly, they have relatively lesser impacts on the environment. It has been understood that river systems in Bhutan have numerous potential sites for SHPs despite facing a challenge in the selection of a suitable location. Hydropower development is a multi-dimensional approach that pivots on various factors and requires a multi-criteria decision analysis (MCDA). This study focuses on criteria prioritization of seven different criteria of locating an SHP along Chamkharriver that has been notable of its potentiality. The analytical hierarchy process (AHP) of MCDA is the most suitable method for selecting the most feasible locations of a hydropower plant in this study. From the total of ten potential sites that have been considered feasible through technical studies, eventually, seven were taken for further suitable analysis. Hence, the five quantitative and two qualitative criteria were used to scale down to the most suitable location using the AHP method. This paper's model resulted that among the criteria, the sanctuary buffer distance*

*(environmental aspect) to be a top priority criterion, followed by heritage (social aspect) and the next was the project cost (economic aspect).*

**KEYWORDS:** *SHP, Alternatives, AHP, Weight Age, Decision-Making*

**REFERENCES**

1. Dendup, T. (2019). Chamkharchhu hydropower plant scrapped. *BBS*.
2. Electric, T., & Company, P. (2019). *Project on Power System Master Plan 2040 in Bhutan Final Report*.
3. Gawel, A., & Ahsan, I. (2014). *Review and compendium of environmental policies and laws in Bhutan: Input to the Asian Judges Network on Environment*. https://www.adb.org/sites/default/files/publication/150136/review-compendium-environmental-policies-and-laws-bhutan.pdf
4. Lata, R., Rishi, M. S., Kochhar, N., & Sharma, R. (2013). Impact analysis of Run of the river type hydroelectric power plants in Himachal Pradesh, India. *International Journal of Civil, Structural, Environmental and Infrastructure Engineering Research and Development (IJCSEIERD) ISSN*, *3*(2), 77–82.
5. Mishra, M.K.; Khare, N.; Agrawal, A.B. Small hydro power in India: Current status and future perspectives. Renew. Sustain. Energy Rev. 2015, 51, 101–115. [CrossRef]
6. OEZA. (n.d.). *4 . S MALL H YDRO P ROJECT R ANGJUNG , B HUTAN*. 72–147.
7. Rana, S. C., & Patel, J. N. (2020). Selection of best location for small hydro power project using AHP, WPM and TOPSIS methods. *ISH Journal of Hydraulic Engineering*, *26*(2), 173–178. https://doi.org/10.1080/09715010.2018.1468827
8. Ranjan, A. (2018). India-Bhutan Hydropower Projects: Cooperation and Concerns. *Institute of South Asian Studies*, *October*(309), 1–10. https://www.adb.org/sites/default/files/
9. RGoB. (2020). *Bhutan Sustainable Hydropower Development Policy*. 22.
10. Rosso, M., Bottero, M., Pomarico, S., La Ferlita, S., & Comino, E. (2014). Integrating multicriteria evaluation and stakeholders analysis for assessing hydropower projects. *Energy Policy*, *67*, 870–881. https://doi.org/10.1016/j.enpol.2013.12.007
11. Saaty, R. W. (1987). The analytic hierarchy process—what it is and how it is used. *Mathematical Modelling*, *9*(3–5), 161–176. https://doi.org/10.1016/0270-0255(87)90473-8
12. Supriyasilp, T., Pongput, K., & Boonyasirikul, T. (2009). Hydropower development priority using MCDM method. *Energy Policy*, *37*(5), 1866–1875. https://doi.org/10.1016/j.enpol.2009.01.023

Walker, B. (2016). Bhutan's PM defends hydropower dams against blistering report. *The Third Pole*