EVALUATING INVESTMENT COST FOR HYDRO POWER PROJECTS IN UGANDA

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Overview

With about 80% of power installed capacity at the of 2021, hydropower dominate electricity generators in Uganda. The fleet of hydro power in the country currently in operation consists of 28 small-scale hydropower plants (SHPs) and 6 large-scale hydropower plants (LHPs). One of the main challenges facing development and operation of hydro power in Uganda is high investment and operation cost. This is compounded with take or pay contracts between independent power producers and Government of Uganda. These high costs and contracts have lead to high tariff for ende-users of electricity in the country, and thereby discouraging most users (especially, residential users) to maximise the use of elelctricity. This trend is having impact on hydropower economic viability in the country.

This paper evaluates investment cost for hydro power projects (HPPs) in Uganda. It is motivated by social economic benefits of HPPs. This is because they offer access to quality power (Deng, 2019), reliable power supply (Kimbowa & Mourad, 2019) and have high sustainability levels (Tagliapietra et al., 2019) as well as HPPs are environmentally energy resources, and dispatchable (large-scale HPP) power systems. Even though there are studies on evaluating investment cost of HPPs but financial viability of the HPPs has received less attention in least developed countries context. Studies like Roy & Roy (2019) and Braeckman et al (2019) focus on developed economies while study in Uganda (such as Kimbowa & Mourad, 2019) have not explained the evaluation methods. Therefore, we focus on examining the appropriate methods for evaluating investment cost for large hydropower projects in Uganda.

The paper is organised as follows: After the introduction, the second section gives a brief overview about the financial methods for evaluating investment costs for Hydro power projects from a theoretical point of view. The third section addresses the methodological gaps for the evaluation of the investment costs. In Section four we describe evaluated Hydro power projects in Uganda and the results are presented. In the final section policy implications are derived.

Methods

This study utilized a cross-sectional research design to address the study objective. The research question was answered through financial analysis and appraisals of the four large hydro power plants currently operating in Uganda. In this study, an evaluation of investment costs as well as projects viability are undertaken using an integrative approach. In our integrated methodology, we employed various financial management techniques such as net present value (NPV), internal rate of return (IRR), discounted payback period (DPB), and the benefit cost ratio (BCR). Mathematica expressions for these parameters are given respective, as follows:

$$NPV = -I_o + \sum_{t=1}^{n}\left(\frac{R_t - O\&M_t - T_t}{(1+i)^t}\right) + \frac{SV_{n+1}}{(1+i)^{n+1}} \qquad (1)$$

$$0 = -I_o + \sum_{t=1}^{n}\left(\frac{R_t - O\&M_t - T_t}{(1+IRR)^t}\right) + \frac{SV_{n+1}}{(1+IRR)^{n+1}} \qquad (2)$$

$$DPP \rightarrow \sum_{t=1}^{n}\left(\frac{R_t - O\&M_t - T_t}{(1+i)^t}\right) + \frac{SV_{n+1}}{(1+i)^{n+1}} = I_o \qquad (3)$$

$$BCR = \frac{PV_{Expected\ benefit}}{PV_{Project\ cost}} \qquad (4)$$

where: I_o represents the initial outlay

R_t is the revenue in period t

$O\&M_t$ is the operations and maintenance costs

T_t tax charged

SV_{n+1} represents the salvage value of the investment.

i is the discount factor (interest rate) otherwise known as the hurdle rate of return.

IRR is the internal rate of return.

BCR is the benefit cost ratio

$PV_{expected\ benefit}$ is the Present value of the expected benefits

$PV_{expected\ project\ cost}$ is the Present value of the expected costs.

Results

First, NPV, IRR, DPB and BCR are presented as effective financial methods to empirically evaluate the investment cost for Hydro Power Projects.

Second, the financial evaluation methods revelead variances in the viability; the Net present value (NPV) showed that investing in the Large Hydro power projects is not viable. However, the analysis of IRR, BCR, LCOE and the DPP showed that investing in the projects is highly viable.

Third, the results of the financial evaluation with the Uganda's Large Hydro power projects suggest that the viability is relatively high.

Conclusions

Investing in the Large Hydro power projects is relatively viable, however the viability differs across the financial methods for investment analysis. The study focused on large power projects, however considering both large and small power projects would offer more insights on evaluating investment. Also, the paper focused on financial (quantitative) indicators of viability, however there are qualitative indicators such as (displacement, food insecurities) that affect indigenous communities. Hence future studies could as well focus on these non-financial methods of evaluating project investment cost.

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