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# Financial Analysis of Small-Hydro Power Project in Malaysia from the Investor Perspective

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**Abstract.** Malaysia has an abundant potential for generation of the electrical power by using renewable energy resources, particularly hydro resources. Although the Government of Malaysia has aimed to promote the development of Small-Hydro power projects under the Small Renewable Energy Power Program (SREP) since 2001, only a few Small-hydro power projects has been developed and operated by private sectors and the most of the licensed projects have not been financially attractive for financiers and investors. Recently, by instituting the Renewable Energy Act & provisions thereof, particularly new Feed-in-Tariff together with several fiscal incentives, the Small-Hydro power projects are more aggressive for private investors as well as debt financiers. Since the Small-Hydro power projects are developed based on BOO model, a projected cash flow model for the project lifecycle is very helpful for the investors and financiers to make decision at early stage of development. This paper presents preliminary financial analyses of Small-Hydro power development (under SREP program) from the perspective of investors based on the provisions of RE Act. Then, a sensitivity analyses is done to determine the degree of importance of different parameters to the returns of investment in a SHP project.

**Keywords:** Feed-in-Tariff, Small-Hydro Power Plant, Financial Analysis

## 1. Introduction

Hydropower is the most widely used source of energy in electricity power production worldwide as 16% of the world's electricity power are generated by using both large and small hydropower plants and it is accounted for about 83% of electricity from renewable sources [1]. REN21's, Renewables Global Status Report (2011), states that total hydropower capacity grew by 3% in 2010 to 1010 GW. By a realistic figure, the future hydropower production totals from 2.5 to 3 times the current production.

Recently, Government of Malaysia (GoM) has instituted Renewable Energy Act to provide a platform for developing the renewable energy projects under SREP program in a more aggressive manner. Indeed, GoM has turned to Feed-in Tariff (FiT) – a mechanism that allows electricity produced from RE resources like solar, biomass, biogas, mini-hydro, solid waste and wind to be sold to power utilities at a fixed premium price for a specific duration. Based on Renewable Energy Act and quota, power generation in total capacity of 490 MW has been targeted by Government via small hydropower development by 2020. So there is a huge amount of need for private capital to rise in debt and equity financing for Small-Hydro power plant (SHP) development in Malaysia. Having a preliminary financial model and analysis is very helpful for investors, as the equity financier of these projects, to make decision on the potential Small-Hydro power projects. This paper will provide a preliminary financial analysis from the equity financier's perspective for developing the SHP projects under SREP program in Malaysia. The challenge in moving forward is to promote and attract local and foreign private investors to contribute in development of Small-Hydro power projects in Malaysia.

## 2. Small-Hydro Power Plants

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The hydropower plants in regard to their size have generally been classified to large, medium and small power plant. In Malaysia, small hydro generation capacity is considered in the range of 1MW to 30MW, although there are no definite international values for size of small hydro power plants. In addition to utilize a renewable resource which is made continually available through the hydrologic cycle by the energy of the sun, SHP usually has minimal reservoirs and civil construction work, minimal heat/chemical pollutions and releases. Moreover, SHP can be designed and built within two years' time.

## 3. RE Act & FiT/ GoM Incentives

SREP program was launched by GoM in May 2001 to encourage and intensify the utilization of RE in power generation. Small power generation plants which utilize RE such as Biomass, Biogas, Municipal Waste, Solar, Small-hydro and Wind can apply to sell electricity to the utility through the distribution grid system. However, the exported electricity power to the grid is limited to 30 MW. Under this program, electricity generated by using renewable energy resources are being sold to the national utility companies through the RE Power Purchase Agreement (REPPA). The RE electricity producers will be given a license of 21 years effective from the date the plant is commissioned [2].

Meanwhile, SEDA - the Sustainable Energy Development Authority- was recently launched to act as the national authority on RE. SEDA will be fully responsible and serve as a central body for all national RE and FiT matters. This statutory body is expected to work closely with various government agencies and local authorities towards the success of RE, and will have to make available, publicly, the report of annual RE progress [3].

In addition, GoM have introduced several fiscal incentives outlined as followings [4]:

- Pioneer Status with income tax exemption 100% of statutory income for 10 years; OR
- Investment Tax Allowance (ITA) of 100% on qualifying capital expenditure incurred within a period of 5 years. This allowance can be set-off against 100% of statutory income for each year of assessment; AND
- Import duty and sales tax exemption on equipment used to generate energy from renewable sources not produced locally and sales tax exemption on equipment purchased from local manufacturers.

Moreover, a SHP project may benefit from the Green Technology Financing Scheme, another fiscal incentive promoted by GoM. Under this scheme, the projects which are developed within Malaysia by legally registered Malaysian-owned companies (at least 51%), utilizing the Green Technology could benefit from up to RM 50 million loan with 15 years tenure provided by participating local financial institutions . In addition, the Green Technology developers will benefit by Interest subsidies of 2% from the total interest rate charged as well as Government guarantee of 60% from the total approved loan [5].

## 4. Financing Structure

There are three general sources of capital available for a SHP project: equity, debt, and grant financing. An equity investment is to purchase ownership in the project. A debt investment is a loan to the project. In addition, since most SHP projects cannot compete with conventional fossil power technologies today, governments offer some fiscal incentives and grant financing to increase the margin of profitability of the SHP projects.

The Independent Power Producers' (IPP) ultimate goal is to arrange a borrowing for a project which will be beneficial for the private investor and at the same time be completely non-recourse to the other activities of the parent company and in no way affecting their credit standing or balance sheet. So, the heart of each IPP project is the "project company" which is normally established in the host country. An IPP's debt and equity investment is secured by only the one project, not by a pool of projects or other corporate assets. Indeed, as a special purpose entity, the project company has no assets other than the project. Project finance is the primary financing structure used by all independent power producers (IPPs).

In view of the flexibility of the IPP structure and its variants, the legal and company structure differs from project to project. The most common IPP model is BOO- Build, Own, Operate [6].

## 5. Financial Model

The financial analysis estimates the returns to an individual project participant, usually the investor. Therefore, the financial model of the project is somehow a mathematical model which represents the performance of a financial asset, herein the SHP project.

Assuming that the SHP project is financed based on Project Financing Structure; the financial model of the project is established based on the projected cash flow statement (PCFS). Mathematically, the PCFS is developed by the annual estimation of the revenues (Inflow) and the expenses (Outflow) from the operation of SHP project. The estimated annual net flow from the operation, after considering the tax payments, can be discounted to the net present values. It is worthwhile to mention that there are two benefits from operation a SHP project: (1) tangible benefits and (2) intangible benefits. The tangible benefit is the sale of electrical energy, while the intangible benefits cover the positive environmental effects, flood control, agriculture and irrigation, fish farm pools, camps and recreation centres, etc. [7]. For purpose of this paper, the financial analyses are done just by considering the tangible (direct) benefits of the project.

The performance of an investment in a power project can be gauged by some financial indicators and from different perspective [8]. An investor or developer may use a variety of figures of merit to evaluate the financial attractiveness of a power project. In this study, the following four primary figures of merit are used:

- ***Net Present Value (NPV):*** is the sum of all years' discounted after-tax cash flows.
- ***Internal Rate of Return on Equity (IRR):*** is defined as the discount rate at which the after-tax NPV is zero.
- ***Debt Service Coverage Ratio (DSCR):*** Ratio of net operating income to total debt service (Instalments). Financiers will require that a project meet a minimum debt service coverage ratio (DSCR) of 1.5-2.0 [8].
- ***Payback Period (PBP):*** The length of time required to recoup the initial investment. As implemented in this study, Payback Period is often calculated without regard to the time value of money.

## 6. Financial Analysis of a SHP Project in Malaysia

As mentioned in section 3, the SHP projects are being developed in Malaysia under SREP program and provisions of recently instituted RE and SEDA Act. To pursue the objectives of this paper, a typical SHP project is considered as reference and it is analysed to find out the merit of the SHP project development in Malaysia, from the perspective of investors.

### 6.1. Reference Project

Based on the existing legislations and background of SHP project development in Malaysia, the parameter of the reference project is set based on the assumptions in Table-1.

Table 1: Basic Assumption

| Parameter | Value | Parameter | Value |
|---|---|---|---|
| Developer Structure | SPV-Pvte. Ltd. | Loan Repayment Period | 15 Years |
| Development Model | BOO | Capacity Factor | 75% |
| PPA Period | 21 Years | Salary Incremental Rate | 5% |
| FiT for capacity less than 10 MW | RM0.24 /Kwh | Inflation Rate | 3.5% |
| FiT for capacity more than 10 MW | RM0.23/Kwh | Depreciation of Asset | 4.76% |
| Development Period | 24 months | Investment Tax Allowance | 100% |
| Debt/Equity Ratio | 80/20 | Generation Capacity | 6.5 MW |
| Debt Service interest Rate | 7% | Taxation ( considering tax holiday in first 10 years of operation) | 25% |
| Grace Period | 0 | | |

Although the figures have been estimated very roughly, for the purpose of this study and to be able to consider and compare different size of SHP projects, it is reasonable solution. By considering the above mentioned assumptions (Table-1), the financial analysis of the reference project is done.

Fig. 1 to 4 shows the values of financial indicators (discussed in sec.5) for the reference project with different capacity of power generation, from 1 MW to 30 MW.

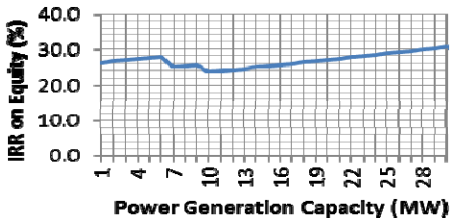


Fig. 1: IRRE versus Power Gen. Capacity

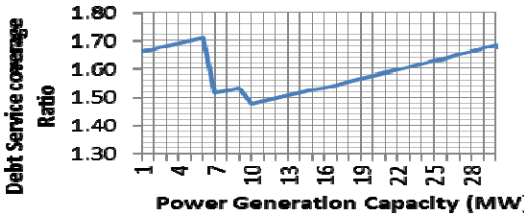


Fig. 2: DSCR versus Power Gen. Capacity

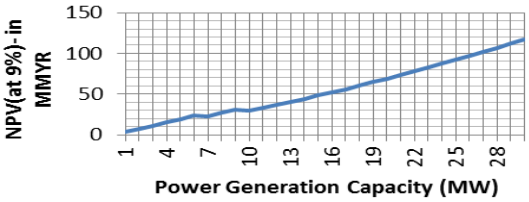


Fig. 3: TNPVI versus Power Gen. Capacity

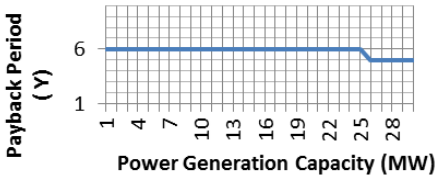


Fig. 4: PBP versus Power Generation Capacity

## 6.2. Sensitivity Analysis

For the purpose of sensitivity analysis in this study, the financial analysis is simply recomputed using the new estimates of assumptions outlined in Table-1 to investigate the invest feasibility of a target project with respect to the project financial parameters. However, during the sensitivity analysis, only one parameter in the analysis is changed at a time. Moreover, the reference SHP project in these sensitivity analyses is deemed to have the grid transmitted power capacity of 6.5 MW. The IRRE (Internal Rate of Return on Equity) is accepted to be the reference indictor in these sensitivity analyses.

Fig. 5 to 11 shows the values of IRRE with respect to variation in values of different parameters.

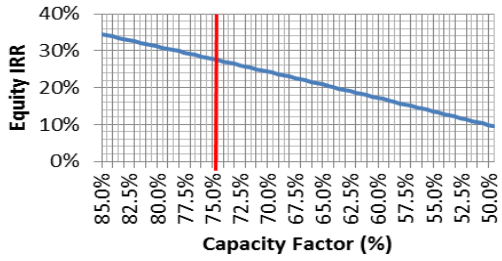


Fig. 5: IRRE versus Average Annual CF

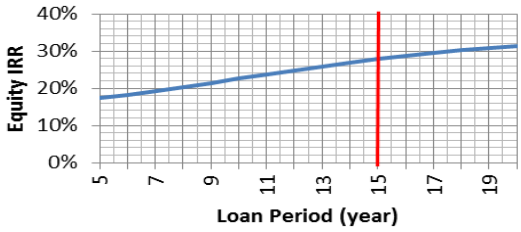


Fig. 7: IRRE versus Loan Period

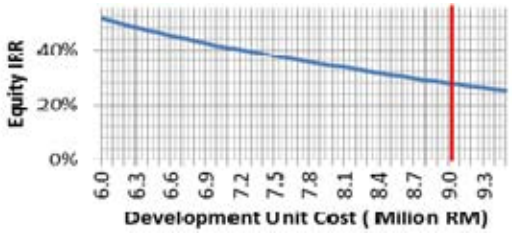


Fig. 8: IRRE versus DUC

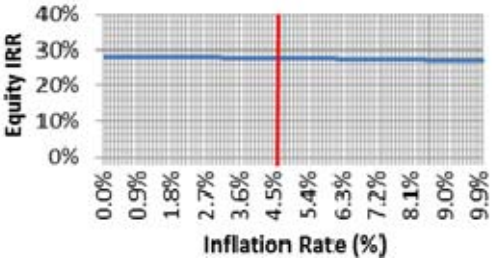


Fig. 9: IRRE versus Inflation Rate

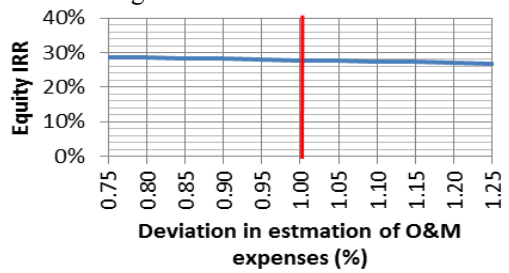


Fig. 10: IRRE versus O&M Expenses

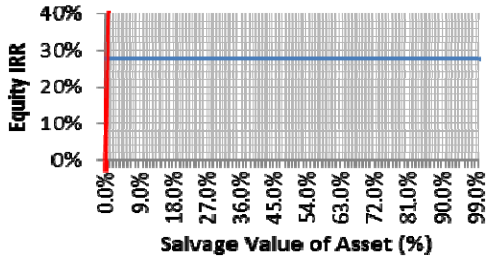


Fig. 11: IRRE versus SVA

## 7. Conclusion

Power generation by using renewable energy resources is demanding in 21 century, particularly after lots of irreversible damage to environment and society by conventional power generations with fossil fuel resources in last century. Availability of abundant natural hydro energy resources together with comparable

low impacts of the hydropower developments on environment and society make an increasing share in power generation mix for this type of power generation.

Although IPPs have played an active role in hydro power generation, particularly small hydropower market since last decades, still a lot of supports are needed to be provided by government incentives and research projects to reduce the technical and financial barriers of these development projects.

The government of Malaysia has launched SREP program since last decade and recently instituted RE Act to encourage private sectors and investors for developing the small power projects. The evaluation of performance of those regulations and incentive packages on the financial return of the relevant projects is very helpful for all payers, either legislators and enforcer or project developers and investors.

This paper presents a financial analysis of small hydropower development projects under SREP program to provide investors and developers with some facts and figures that it investigates and declares the footprint of the above mentioned new governmental incentives and policies on financial aspects of those projects.

The result of this study can be outlined as followings:

i) By instituting the new FiT mechanism under RE Act in Malaysia, development of SHP projects will make an attractive financial return for the investors (Fig. 3 & 4), while the project can provide a reasonable margin of confidence for the other financiers (Fig. 2), e.g. lenders and financing institutes.

ii) In views of predicted returns of a SHP project, the impact of some economical parameters, like Inflation Rate, O&M expenses, and Salvage Value of asset (after project life) can be neglected (Fig.9 to 11). In contrast, the financial return in a SHP project is dramatically impacted by debt financing package, e.g. loan period, loan interest and Debt/Equity ratio (Fig.6 & 7).

iii) The projects with generation capacity between 6 to 11 MW are deemed to have not relative merit/attractiveness, from the perspective of investors and financiers, both (Fig. 1 & 2).

iv) Capacity Factor of the power plant has a considerable effect on financial return of the project (Fig. 5). This factor is highly depended on characteristic of the SHP site. A careful site selection study at early stage of a SHP project development may reduce the financial impacts of risk factor.

v) The estimation of project development cost is highly important in preliminary financial analyses of the SHP project, Indeed, its deviations has tremendous effect on financial analyses of the project and it may somehow misdirect the investors to wrong conclusion. Only 1% overestimation/underestimation in project cost may cause almost 0.56% error in estimated rate of return on equity (IRRE) of the project (Fig.8).

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