FINANCIAL MODELLING OF SMALL HYDRO PROJECT (3X750 KW) & MAKING ITS INVESTMENT PROPOSAL

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ABSTRACT

India is booming. It is predicted that soon India will be one of the largest economies in the near future. With the fruits of liberalization slowly trickling down, a need has been felt for infrastructure, specifically power sector. With the enactment of Electricity Act 2003 and major thrust into power sector by Government of India, generation, transmission and distribution will witness radical changes in the years to come. Power is the lifeline of modern societies. It is base for the development of any economy in the world. There is a large demand-supply gap in the country. To reduce this demand and supply gap there is a need to increase our installed capacity. This requires huge money for implementation of various projects and thus the need for IPP's, which was further, strengthened by Electricity Act 2003. In order to encourage power generation in the private sector the Government of India has liberalized its policies. The private sector has risen to this challenge by showing a very positive attitude.

The SHP has been proposed to be developed for augmenting the power generation especially using renewable energy source and for helping in rural electrification of the Country. After Small Hydroelectric Project, the electrical energy produced shall be utilized for augmenting the energy supply in the local rural distribution network and shall provide electricity to un-electrified villages. The energy availability will also improve the voltage profile and reliability of the power system in the remote area.

Keywords:
SHP, IRR, DSCR, MNES, ROE, CDM

Description

The power plant is proposed to have three (03) turbine – generating units each of 750 Kw_e output at generator terminals. The project has been conceived as a run of the river project with diurnal storage. The turbines shall operate under a net head varying between 3.64 m to 4.53 m. The generation voltage shall be at 3.3 KV which shall be stepped upto 11 KV through a common step-up transformers of 3000 KVA capacity. There is an existing 11 KV line upto the barrage site which shall be used to evacuate the power generated. The likely energy to be produced in a 90% dependable year is 8.099×10^6 kWh. With 95% availability the design energy is 7.6×10^6 kWh, and net energy available for sale i.e. 7.524×10^6 kWh. On average, the annual energy expected to be produced from the proposed project is 10.27×10^6 kWh. With 95% availability, the likely average annual energy is 9.76×10^6 kWh. It has been agreed that during the first fifteen years of operation of the power station, the power producer shall provide free power to the extent of 25 KVA for the power requirements of the Irrigation Department in their colony and works and 7.5% of the energy produced thereafter. After accounting for the free power, the net energy available for sale in 90% dependable year is 7.35×10^6 kWh (PF of .79) during the first fifteen years and 6.96×10^6 kwhrs thereafter. Similarly, on average the net energy available for sale is expected to be 9.48×10^6 kWh during the first fifteen years and 8.93×10^6 kWh thereafter. The cost of generation in the first year of operation is estimated at Rs. 3.76 per kWh and on levellised cost basis over a 30-year period works out to Rs. 3.11 per kWh. The return on equity after meeting all operating expenses, interest and tax is estimated at 21.48% on levellised cost basis over a 30-year period.

Financial viability of the project including calculation of various financial indicators such as:
IRR of the project
Equity IRR
DSCR

In this project i had to make Financial Model of SHP. For this i calculated the Levellised Tariff as per the CERC guidelines and after that it was preparation of P&L Account, Cash Flow Statement, Balance Sheet and calculation of IRR and DSCR.

This was one part of my project, now for Making Investment Proposal; valuation of the Hydroelectric Project is to be done. Valuation is carried out under various methods, which are normally used for business valuation and also suggested by the Ministry of Disinvestment Government of India to be followed in case of strategic disinvestments.

NATIONAL POLICIES SUPPORTING THE PROJECT

Electricity Act 2003

- Section 3 - National Electricity Policy and Plan for development of power system based on optimal utilization of resources including renewable sources of energy.
- Section 4 - GOI to prepare a National Policy permitting stand alone systems (including those based on renewable sources of energy and non-conventional sources of energy) for rural areas.
- Section 61(h) - Tariff Regulations by Regulatory Commission to be guided by promotion of generation of electricity from renewable energy sources in their area of jurisdiction.
- Section86(1)(e)- Regulatory Commission to specify purchase obligation for licensee from renewable energy.

National Tariff Policy:

- National tariff policy prefers procurement of power from NCES based on preferential tariff
- Future procurement of power from NCES through competitive bidding under section 63 within suppliers offering energy from same type of non-conventional sources
- In the long-term, these technologies need to compete with other sources in terms of full costs

The government of India and the state government have announced a number of incentives for development of small hydro in the country which are stated below:

- The government has permitted a minimum of 14% return on investment.
- The government has permitted private sector to participate in power generation through the implementation of the Indian electricity act 2003.
- The MNES supports SHP development, both in the government and private sectors. Apart from the financial support to new, renovation and modernization (R&M) of existing SHP stations and government projects that have been developed for the promotion of SHP programmes in the northern-eastern states, Jammu and Kashmir, Himchal Pradesh, and Uttaranchal.
- Soft loan by Indian renewable energy development agency.

Eligibility criteria and level of subsidy for SHP project:

Note: 'C' Stand for capacity of project

Eligibility	**Special category state (NE region, Sikkim, J&K, HP and Uttaranchal)**	**Other state**
Maximum permissible installed cost	Rs 7 crores/MW	Rs 5 crores/MW
Cost of electricity generation	Rs. 2.50-3.30/unit	
Minimum permissible capacity utilization factor	Canal based: 30% Others:45%	
Standards	All project to conform to relevant international/national codes of practices and standards	
Subsidy	**Rs.2.25 cr X (C MW)$^{.645}$**	**Rs.1.5 cr X (C MW)$^{.645}$**

To improve the economic viability of SHP projects and to give impetus to the programme, the MNES provides a onetime subsidy for commercial SHP projects. The subsidy is utilized by the promoter towards repayment of the term loan availed from a financial institution. The subsidy is released after the project performance parameters are attained as laid down in the MNES scheme. The subsidy scheme covers projects of capacity up to 25MW each.

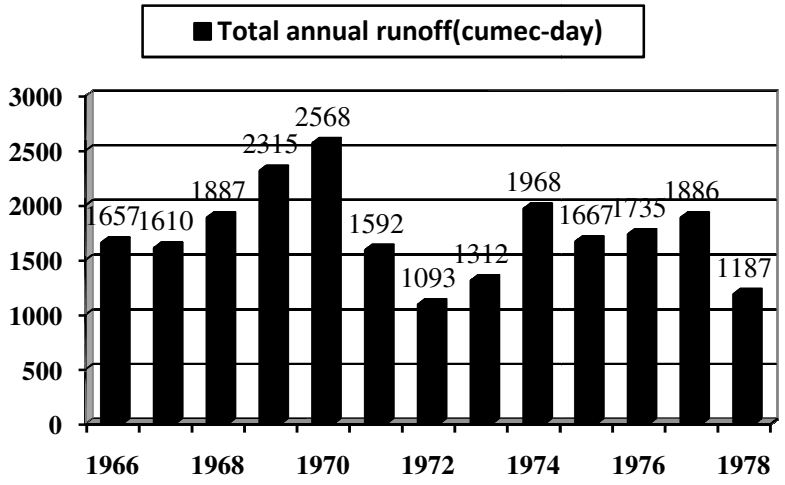
HYDROLOGY

The discharge data of the river is available for 13 year from the 1966 to 1978.For the estimation of hydro power potential, The discharge data corresponding to these 13 years have been tabulated in table the water available for power generation has been calculated.

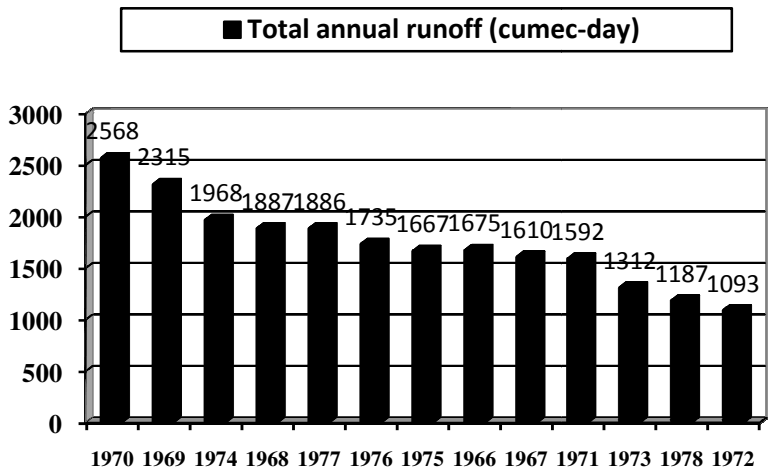
Dependable Discharge

In figure, the year wise total annual runoff, and determination of 50% dependable year (1975) have been graphically presented. the ninety (90) percent, fifty(50) percent and seventy five(75) percent dependable discharge available for power generation have been determined and are stated below based on thirteen-year discharge data.

90% dependable discharge : 10 cumec
75% dependable discharge : 17.8 cumec
50% dependable discharge : 28.7cumec



Year wise total annual runoff



Year wise total annual runoff arranged in descending order
50% dependable year-1975

WATER AND POWER STUDIES

$$P_{MW} = (9.81 \times Q \times H \times \eta_{t \times g}$$

Q = Discharge in m^3/s
H = Head in metre
$\eta_{t \times g}$ =Overall efficiency

DESIGN ENERGY

The design energy is the energy likely to be produced in the 90% dependable year with 95% availability. From the hydrological data for the Champamati barrage, 1978 is the 90% dependable year. From the power generation simulation studies conducted for this year with 3 unit of 750KW each, the energy likely to be produced is 8.099×10^6 kWh. With 95% availability, the design energy is calculated to be 7.6×10^6 kWh.

PROJECT COST

The total cost of the project is estimated at Rs 1491 Lakhs without escalation in cost and interest during construction, and Rs 1675.79 lakhs with escalation in cost and interest during construction. The cost of civil work and electro-mechanical works are stated below:

- Cost of civil works: 740.21
- Cost of electro-mechanical: 738.58
- Cost of power evacuation : 10 lakhs

GUIDELINE FOR DETERMINATION OF TARIFF

Input taken for calculation of levellised tariff

- **Gross annual fixed charge**

Gross Annual Fixed Charges (GAFC) shall consist of:

- Interest on Loan Capital
- Depreciation
- Return on equity
- Operation & Maintenance expenses
- Interest on working capital
- Tax on ROE

- **Installed Capacity**

The Installed capacity of Champamati Hydro Electric Project is 2250 KW (3 X 750 KW).

- **Free power to state government**

It has been agreed between the IL&FS and the Bodoland Territorial Council that during the first fifteen years of operation of the power station,

the power producer shall provide free power to the extent of 25 KVA for the power requirements of the Irrigation Department in their colony and works and 7.5% of the energy produced thereafter.

➢ **Net energy available for sale**

After accounting for the free power, the net energy available for sale in 90% dependable year is 7.35 x 10^6 kWh (PF of .79) during the first fifteen years and 6.96 x 10^6 kwhrs thereafter. Similarly, on average the net energy available for sale is expected to be 9.48 x 10^6 kWh during the first fifteen years and 8.93 x 10^6 kWh thereafter.

➢ **Depreciation**

For the purpose of tariff, depreciation shall be computed in the following manner, namely

- ❖ Depreciation shall be calculated annually based on staright lime method over the useful life of the asset. The residual life of the asset shall be considered as 10% and depreciation shall be allowed up to maximum of 90% of the historical capital cost of the asset. It should be taken 2.86% per annum
- ❖ No advance against depreciation shall be considered as tariff is being levellised for multiple years.

➢ **Auxiliary consumption**

For Champamati hydro electric project auxiliary consumption and transformation losses are taken 0.5%.

➢ **Taxation**

As per norms a tax holiday of 10 years, from the date of commercial operation, has been taken into account and after that a tax rate of 33 % including surcharge is taken

➢ **Financial norms**

- ❖ **Debt-Equity ratio**
  It is proposed that the phasing of expenditure shall be as follows with debt to equity ratio as 70:30
- ❖ **Return on equity**
  As per the CERC guidelines Return on Equity has been taken @14% per annum
- ❖ **O & M Expenses**
  In general operation & Maintenance expenses include the following
  (i) Consumption of Stores and spares
  (ii) Administration expenses
  (iii) Repair and Maintenance
  (iv) Employee cost
  (v) Corporate Office Expenses allocated
- ❖ **Interest rate for working capital**
  Interest Rate is taken @ 11% per annum
- ❖ **Interest rate for Loan**
- ❖ Interest on Loan has been taken @ 10% per annum. Repayment has been considered within 10 years from the commissioning of the project.
- ❖ **Working capital norms**
  For calculation of working capital for tariff

1) O & M expenses for 1 month of same have to be taken.
2) Receivables equivalent to 2 months have to be taken
3) Maintenance spares @ 1% of the historical cost escalated @ 6% per annum from the date of commercial operation.

- ❖ **Discount rate** @ 11.1% per annum is considered.
- ❖ **Escalation rate:** rate of escalation per year is taken 5%.
- ❖ **Phasing of expenditure :**
  2007-08 – 40% of project
  2008-09 – 60% of project
- ❖ **Life of plant:** life of the plant considered is 30 years.
- ❖ **Average per Unit Tariff: Average** Per Unit Tariff is calculated as ratio of Total Revenue to Total Saleable Units.

BASIC PARAMETER

Cost Estimate

PARTICULARS	AMOUNT (in Lakhs)
Civil work	740.21
E & M cost	748.58
Land	2
IDC	140.34
Total project cost with IDC	1675.79
Total equity amount	460.63
Total debt amount	1215.16

	1st year (lakhs)	2nd year (lakhs)
Promoters contribution	298.76	161.88
External borrowing	298.76	776.06
Total	597.52	937.94

FINANCIAL ANALYSIS

➢ **Debt service coverage ratio**

The debt Service coverage ratio (DSCR) indicates an average of 1.27 over a period of 10 years till the repayment of loans.

- **Internal rate of return**

Analysis reveals that the internal rate of return of the project over a period of 30 years is 13.92 % and Equity IRR would be 16.88%.

FINANCING OF THE PROJECT THROUGH CDM

The CDM is a financing instrument defined in article 12 of the Kyoto protocol. A project in a developing country that reduces GHG emissions, relative to a baseline project, generate emission reduction (ER) , CDM enables the project owner to sell the ER credit, ones there are certified, to an interested buyer.

It is estimated the annual energy production from the SHP shall be 9.76X 10^6 on kWh and the energy available for sale be of the order of 9.56X10^6 kWh per annum. The coal being used in thermal power station in India not being of very good quality, it may be appropriate to assume that the carbon dioxide being emitted shall be of the order of 987 gms per kWh. On this basis the carbon dioxide emission reduced by generating same amount of electricity energy from SHP works out to 9435 tonnes per annum. On this basis over the life time of power plant the carbon dioxide reduction is expected to be of the order of 283050 MT. since the SHP is a renewable energy project and its operation can provide energy for social and sustainable development without contributing to GHG emission is eligible for financing under CDM facility as envisaged in article 12 of the Kyoto protocol. This will generate additional revenue stream of 55.77 Lakhs per annum, which will further improve the project and equity IRR.

MAKING INVESTMENT PROPOSAL

Valuation of power project

Making a valuation requires an examination of several aspects of a project's activities such as analyzing inherent strengths / weaknesses of the project and the opportunities / threats presented by the environment, forecasting operating performance, estimating the cost of capital, estimating the continuing value, calculating and interpreting results, analyzing the impact of prevailing regulatory frame work, impact of technology and several other environmental factors.

Based on the recommendations of the Disinvestment Commission of Government of India and in keeping with the best market practices the following five methodologies are being used for valuation of the project:

- ***Discounted Cash Flow (DCF) Method.***
- ***Profit earning Capacity Valuation (PECV)***
- ***NAV Method***
- ***EBITDA Multiple Method***
- ***Replacement Cost Method***

- **Discounted Cash Flow (DCF) method**

While a number of alternative DCF frameworks are conceivable, we have adopted the Returns to company Method.

The Free Cash Flows to Firm (FCFF) has been computed as the estimated cash profits. The FCFF so derived reflects the cash flow generated by the project that is available to the providers of equity capital of the project.

For the purpose of determining the value of the project, based on the discounted cash flow method, the key factor to be considered is the discount rate, i.e. the cost of capital, which is estimated on the basis of the weighted average of the cost of equity and debt at the end of the financial year. Discounting the FCFF at the cost of capital, the present value of the project for the discrete period is estimated.

The Continuity Value has been calculated by assuming appropriate growth rates of the free cash flows projected for the last financial year of the explicit forecast period.

Thus the value of the shares represents the sum of the value of the discrete period and the continuity value.

The Discounted Cash Flow (DCF) methodology expresses the present value of a project as a function of its future cash earnings capacity. This methodology works on the premise that the value of the project is measured in terms of future cash flow streams, discounted to the present time at an appropriate discount rate.

The discount rate applied to estimate the present value of explicit forecast period free cash flows as also continuing value, is taken at the "Weighted Average Cost of Capital" (WACC). One of the advantages of the DCF approach is that it permits the various elements that make up the discount factor to be considered separately, and thus, the effect of the variations in the assumptions

can be modelled more easily. The principal elements of WACC are cost of equity (which is the desired rate of return for an equity investor given the risk profile of the company and associated cash flows), the post-tax cost of debt and the target capital structure of the company (a function of debt to equity ratio).

- **PECV Method**

The "future maintainable profits" for the project under study has been determined on the basis of the profits earned after considering the adjustments for net of tax depreciation in value of investments. We have considered an appropriate tax rate for the project under the study. The value so obtained is discounted by the cost of capital to arrive at the PECV value.

- **NAV Method**

The Net Asset Value was determined based on the shareholder's fund in the project. Fair value of the share has been assumed @ Rs. 10.00.

We have considered the replacement value of the assets of the company as a separate Method of Valuation.

- **Earnings before Depreciation Interest Tax and Amortisation (EBIDTA)**

Maintainable EBIDTA for the forecast period has been arrived by taking average of present value of future EBIDTA discounted at WACC

EBIDTA multiple of 4.61 is considered to arrive at enterprise value. The multiple is based on the multiples of comparable power generating companies.

- **Replacement Value Method**

Under this method, Replacement cost of various assets is considered. Historical cost is same as the total project cost of hydro power plant as this project has been allotted on BOOT basis.

RESULTS OBTAINED

- **Discounted Cash Flow (DCF) Method**

Free cash flows for the forecast period have been discounted at weighted average cost of capital i.e. 15.69% for arriving at the present value.

- For calculation of the terminal value, growth rate of 1% has been assumed.
- For calculation of WACC the cost of equity is assumed as 18.94%.
- The enterprise value under DCF method is Rs. 1765.57 Lakhs.

- **Price Earning Capacity Value (PECV) multiple methods**

Maintainable Net Profit (PAT) for the forecast period has been arrived by taking average of present value of future PAT discounted at WACC.

- Project P/E multiple is taken at 18.7 times, based upon the P/E multiple for the listed power generating companies, as given in Capital Market Magazine (July 10th –July 28rd 2008 issue).
- The value of enterprise under this method is Rs. 637.84Lakhs.

- **Net Asset Value Method**

The historical cost of the share capital has been considered based on the debt equity ratio of 70:30.

- The value of enterprise under this method is Rs. 460.64 Lakhs.

- **Earnings before Depreciation Interest Tax and Amortisation (EBDITA)**

Maintainable EBIDTA for the forecast period has been arrived by taking average of present value of future EBIDTA discounted at WACC.

- Project EBIDTA multiple is taken at 4.61 times, based upon the P/E multiple for the listed power generating companies, as given in Capital Market Magazine (April 10th - 23rd 2008 issue).
- The value of enterprise under this method is Rs. 299.75 Lakhs.

- **Replacement Value of method**
  - The Replacement cost of fixed assets is arrived at net of accumulated depreciation, by considering the cost of new plant @ Rs.3.50 Crores/MW.
  - Outstanding debt is reduced from the above.
  - Net working capital is added.
  - The Enterprise value according to this method is Rs. 124.11 Lakhs.

ASSUMPTIONS

S.no.	Parameter	Assumption
1	Cost of equity	18.94%
2	P/E Multiple	18.7
3	EBIDTA Multiple	4.61
4	Face value of share	10

5	Provision for tax	33.66%
6	Replacement cost of plant	Rs.3.5 Cr/MW
7	Growth rate	1%

LIMITATIONS

- The EBIDTA and P/E multiple as on particular date has been considered for valuation. However fluctuations in the same with the changes in the market have not been factored
- The assumptions for projections are made on the basis of data given in the Detailed Project Report of Champamati power project and hence actual results may vary significantly from projected results.
- The calculation of per unit tariff for Champamati SHP was based on information memorandum given. DPR was available for the project.
- The project lacked practical touch, as interaction with officials of company which made DPR, was minimal.

CONCLUSION

The choice of installed capacity is governed not only by power optimization but also by the type of facility proposed (base load or peaking station), planned investments and other factors depending upon policies of the nodal agencies/Government. Optimization study is only one of the guidelines governing the choice of installed capacity. It only helps in identifying a range within which a project would yield attractive returns. The ultimate selection would be governed by other factors as well.

It has been concluded above that an installed capacity of 2250KW would be optimal. Hence, it is proposed to adopt an installed capacity of 2250 KW and design various components of the project accordingly.

Further, it is proposed to install 3 units of 750 KW each so that plant operates optimally as per the incoming discharge.

Installation of multiple units also eliminates the possibility of complete closure of powerhouse for repairs/ maintenance and provides flexibility of operations at varying load conditions.

Main conclusions which are drawn from the tariff calculation and financial modelling are:

- Project is financially viable and can be implemented.
- Per MW cost of the project is bit high then the industrial average for the same MW installed capacity
- From the calculations the valuation of shares under various methods ranges from Rs. 2.69 to Rs. 13.84
- However, considering the merits and limitations of the valuations under each of the above methods, I have arrived at fair valuation giving appropriate weights to the value arrived under each of the methods. The fair value of the share is Rs. 10.34

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QUESTION REMAINS UNANSWERED:

Q.1 What about Sharing of CER benefit & MNRE benefit?

Q.2 What about Taxes on CER's?

Q.3 Why AAD being drop?