

SECTION 14: FINANCIAL AND ECONOMIC EVALUATION

14.1 OUTLINE OF APPROACH

The financial and economic evaluation of the project has been prepared in a three-step approach as follows:

- Step 1: Financial analysis and determination of the least cost hydro power plant option
- Step 2: Cash flow analysis for the preferred hydro power plant option
- Step 3: Economic analysis and economic viability test

The first step consists of the financial analysis and determination of the levelised unit costs of the respective technical options. The criteria for the selection of the preferred site option are:

- Financial levelised unit costs (**FLUC**).
- Financial internal rate of return (**FIRR**).
- Financial net present value (**FNPV**).
- Financial benefit/cost ratio.

In the second step, the preferred technical option is investigated in detail in a cash flow analysis. Whereas the financial analysis deals with the general viability of the project over the entire analysis period based on the weighted average cost of capital (**WACC**), the cash flow analysis shows the impact of the project on the cash flow to the implementing agency and the financing institutions. In the cash flow analysis, the assumptions for financing of the project are specified and the ability of the project to pay interest and principal is investigated. The performance indicators calculated in the cash flow analysis are as follows:

- Pre-tax internal rate of return on equity
- Pre-tax net present value
- Debt service coverage ratio (**DSCR**)
- Payback period.

In the third step, the preferred option is investigated in an economic analysis. The purpose of the economic analysis is to evaluate costs and benefits from the perspective of the entire Namibian economy and bring about a better allocation of resources. Furthermore, the economic analysis takes into account the project's external costs and benefits, e.g. the level of greenhouse gas emissions. The economic analysis comprises two steps:

- 1) The comparison of the project's economic levelised unit costs with other options for the supply of power to the north-eastern load centres. The least cost analysis seeks to verify that the project is the least cost option in the context of north-east Namibia.
- 2) The determination of the economic performance indicators in a cost-benefit analysis. The cost benefit analysis seeks to verify that the discounted benefits of the project are greater than the discounted costs of the project.

The economic performance ratios are those given at the beginning of this Section, namely the economic levelised unit costs, the economic internal rate of return, the economic net present value, and the economic benefit/cost ratio.

14.2 GENERAL DATA AND ASSUMPTIONS

14.2.1 EXCHANGE RATE

All costs given are in US\$ and, where necessary, were converted from Namibia Dollars to US\$ at an exchange rate of US\$ 1.00 = N\$ 9.00.

14.2.2 REFERENCE DATE AND INVESTIGATION PERIOD

The reference date for all NPV and IRR calculations is 01.01.2004. It is assumed that the commercial operation date is 01.01.2008. Thus the first year of operation is a full calendar year with 365 days of operation. The analysis period comprises the years 2004 until 2037. The planning, tendering and construction period has been assumed to commence on 01.01.2004 and end on 31.12.2007, i.e. a construction period of 4 years. The operation period has been assumed to commence on 01.01.2008 and end on 31.12.2037, covering in total 30 years. Since most of the civil structures and transmission lines could be used for a period of 50 years, a residual value of 40% for the entire plant, less environmental mitigation costs and hydro-mechanical equipment is left in the 2037 balance.

14.3 FINANCIAL ANALYSIS

14.3.1 GENERATING CAPACITY AND ENERGY OF THE SITE OPTIONS

The generating capacity and energy data of the hydro power options are described in detail in chapter 7. The Project's distance to prospective load centres is considerable with the result that the calculation of the benefits must take into account the transmission losses to Rundu and Otjikoto. It is assumed that in 2008, 44% of the generation will be consumed in Rundu and 56% in Otjikoto. This is a conservative assumption, since it does not take into account the prospective increase of consumption in the close vicinity of the Project and deliveries to consumers between Rundu and Otjikoto. Prospective supplies to the 33 kV network on the right bank of the Okavango River as well as exports to rural load centres in Angola and Botswana are not considered. The proportion of generation transmitted to Otjikoto reduces from approximately 56% in 2008 to 24% in 2037. Hence the value of generation increases over time since the transmission losses are decreasing as a function of the increase of the load

at Rundu. Supplies to Rundu and to Otjikoto account for 3% and 5% transmission losses respectively over the entire period of analysis.

14.3.2 BENEFITS

In the financial analysis, the benefits consist of the revenues and avoided transmission costs attributable to the project. The revenue calculation is based on the energy delivered to the load centres, multiplied by the figures of the price projection for the South African Power Pool (SAPP). The price projection has been provided by NamPower in real 2003 Namibian Dollar terms. The figures were escalated by an amount of 2% p.a. in accordance with the inflation rate of the US\$. The price projection is made on the assumption that the SAPP will experience a demand for new capacity around 2007 and that most of the added capacity beyond 2006 will be made up of thermal power plants. Thus the market price for electricity in the SAPP will rise in real terms from 16.91 US\$/MWh in 2008 to 32.22 US\$/MWh in 2019, and then remain constant thereafter.

The avoided transmission costs of the Project arise from the deferred upgrade of the Otjikoto-Rundu transmission line, which is scheduled for 2015. The benefit from this deferment in nominal 2015 US\$, amounts to 15,346 TUS\$. However, these transmission costs savings are only attributable to hydro power plant options and sluicing regimes that provide firm capacity for supplies to Rundu.

14.3.3 CAPITAL COSTS

All capital cost items are given in **Section 13** of this report. The local capital costs are subject to VAT at a rate of 15%. However, since value added tax is a reimbursable cost item for NamPower, the value-added tax was not included in the analysis. Interest during construction is not considered explicitly in the financial analysis, since all interest related impacts are considered by the application of a weighted average cost of capital.

14.3.4 OPERATION AND MAINTENANCE COSTS

The annual operation and maintenance costs (O&M) have been estimated at 0.75% of capital expenditures, excluding social and environmental mitigation costs. The O&M costs are made up of personnel costs associated with the staff permanently employed by the scheme, plus expenditure for regular operating and maintenance material and services, and have been escalated at an estimated US\$ rate of inflation of 2% p.a.

14.3.5 TRANSMISSION COSTS

The transmission costs of the project have been included in the analysis by incorporating the interconnection costs to the Rundu load centre as well as the transmission losses to Rundu and Otjikoto in the analysis. O&M costs of the transmission line amount to 1% of the transmission investment whilst transmission O&M costs have been escalated on the basis of 2%p.a based on the rate of inflation of the US\$.

14.3.6 WEIGHTED AVERAGE COST OF CAPITAL (WACC)

The WACC is calculated by multiplying the cost of each capital component by its proportional weighting and then totalling the results. Included in the WACC calculation are all capital sources: common stock, preferred stock, bonds, and any other long-term debt. In project finance for small and medium sized hydro projects, usually only equity contributions and the long-term debt of the project, are considered. The WACC of the base case scenario amounts to 7.50%. The calculation is based on the following data:

- Equity: 50%
- Debt: 50%
- Equity costs: 8%
- Average interest rate of loans (in nominal US\$ terms): 7%

14.3.7 RESULTS OF FINANCIAL ANALYSIS

The financial performance indicators for the alternative hydro power plant options and configurations are summarised in **Table 14-1** on the following page. Options 3, 4, 6, 7, 8 and 9 yield a financial internal rate of return above the WACC of 7.5%, indicating that these options are financially viable. The ranking of the hydro power plant options according to the levelised unit cost (**LUC**), shows that Option 8 is the financially least cost option. The levelised unit costs amount to 31.51 US\$/MWh, the FIRR to 10.18 %, the FNPV to 13,091 TUS\$, and the benefit/cost ratio amounts to 1.38.

Second ranked is Option 9. Since the differential in the LUC between Option 8 and Option 9 is considerable, 2.09 US\$/MWh, and Option 8 is significantly superior in terms of compliance with environmental considerations over Option 9, the Consultant recommends selecting Option 8 as the preferred option for the project which provides for the construction of a 9.75 m high weir at Site 5 to an elevation of 1010.0 m.a.m.s.l. and for a sandtrap at the head of the weir basin. This option is therefore henceforth called the “base case”. Furthermore, Option 6 is the only alternative that provides firm capacity for the supply to Rundu. which therefore allows the benefits from the deferment of the upgrade of the Otjikoto-Rundu transmission line to be attributed to the Project, which, in turn, provides a significant advantage in the economic analysis. The best ranked option on sites other than site 5 is option 4 on site 4. The levelised unit costs of option 4 amount to 34.96 US\$/MWh, FIRR is 9.12%, a FNPV of 9,436 TUS\$, and a benefit/cost ratio of 1.22. The difference of the key performance indicators to option 8 is considerable and, as outlined in **Section 7**, Option 4 could not be considered further as a real option, on account of the excessive inundation of upstream islands and the Andara Mission Station.