RETScreen® International
Clean Energy Decision Support Centre

CASE STUDY

ASSIGNMENT 05

SMALL HYDRO PROJECT

HIGH-HEAD / ZACAPA, GUATEMALA

DESCRIPTION OF ASSIGNMENT

You have been hired by an independent power producer to prepare a pre-feasibility study of a small hydro project in Guatemala. The independent power producer is considering the development of a project in Guatemala where the electricity generated would be sold into the central electricity grid under the terms of a 15-year Electricity Purchase Agreement.

SITE INFORMATION

The site is located in the municipality of Río Hondo within the department of Zacapa in the Republic of Guatemala approximately 125 km north of Guatemala City. The site is easily accessible by road and a reconnaissance survey of the site has already been completed.

Based on the results of the reconnaissance study it was determined that a small concrete dam approximately 10 m high and 70 m long could be constructed and would provide approximately 125,000 m^3 of daily pondage and maintain an average water level elevation of 880 m. A suitable powerhouse location was identified near an existing hot spring resort where the river elevation is 280 m under normal flow conditions. Flooding in the river near the proposed powerhouse location has been known to raise water levels by at least 5 m.

An environmental assessment has determined that a minimum flow requirement of 0.035 m^3/s is to be maintained annually. Based on the available topographic mapping, development of the site will involve several sections of canal and tunnel (operating as an underground canal) totalling approximately 4.1 km. Preliminary estimates indicate that an above-ground canal can be constructed for about 2.4 km through rocky terrain with an average side slope of about 30 degrees. The remaining 1.7 km will have to be tunnelled due to extremely steep mountain slopes. A 2.2 km pipeline/penstock will be required between the end of the tunnel/canal conveyance structures and the powerhouse. A tailrace of approximately 30 m will be required. The independent power producer has indicated a preference for two identical turbines to facilitate maintenance and reduce the cost of downtime caused by mechanical failures.

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Canada

The independent power producer has provided you with the following flow-duration curve data, obtained from the reconnaissance survey:

Time	0%	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%
Q (m^3/s)	5.60	4.10	3.35	2.90	2.66	2.50	2.35	2.20	2.00	1.80	1.65
Time	55%	60%	65%	70%	75%	80%	85%	90%	95%	100%	
Q (m^3/s)	1.58	1.50	1.37	1.25	1.00	0.80	0.70	0.62	0.52	0.45	

A 2.5 km access road will be necessary; borrow pits are located 5 km away and the nearest connection to the utility's grid (69 kV line) is located approximately 4.4 km away. For the greenhouse gas calculations assume that the energy from the small hydro plant will displace #6 oil.

FINANCIAL INFORMATION

The independent power producer wishes to analyse the project using conservative financial parameters. A decision to invest further in the project will only be made if the pre-feasibility analysis indicates that the project is attractive assuming that the project life is no longer than the length of the available power purchase agreement (15 years), no more than 20% equity is required and the debt portion will be financed at 9% and completely paid within 10 years. The utility is currently offering an electricity purchase price of US$0.055/kWh escalated annually at 2.5%, the same rate as general inflation. For simplicity, the project is to be analysed on a before-tax basis. A minimum pre-tax return on investment of 15% is required. All amounts are to be in US dollars.

An exchange rate of 0.63 US$/CDN$ can be assumed. Equipment, fuel and equipment manufacturer costs in Guatemala can be assumed to be equal to those in Canada. However, labour costs in Guatemala should be assumed to be approximately 70% of Canadian labour costs.

The cost of purchasing the necessary land for the project has been estimated at US$300,000. Annual operation & maintenance (O&M) costs would include insurance (0.5% of total project cost), transmission line maintenance (5% of transmission line and substation cost), spare parts (0.5% of total project cost) and labour cost of US$70,000. An additional 10% (of the annual operation and maintenance budget) should be allowed for administration and 10% for contingencies. It is anticipated that major maintenance costing approximately US$1,000,000 will be required after approximately 10 years.

The objective of the analysis is to determine the optimum installed capacity and the financial feasibility of the project. Prepare a RETScreen study, documenting any assumptions that you are required to make, and report on the significant conclusions from this analysis.