# CHAPTER 3

# METHODOLOGY

This chapter discusses the methodology used in attaining the objective of this study, which is to discover whether degeneration of the power generation sector increases the operating efficiency of the power plant. Data collection methods are described, as are methods of data analysis.

## 3.1 Data Collection

The data used for this are mainly secondary data obtained from periodicals in the industrial/business domain, newspapers, textbooks, and TNB annual reports (1997 and 1998). Interviews were conducted with the Operational Managers of both companies involved in this study (Serdang Power Station and PD Power) in order to obtain input related to the operational efficiency of the power plants, and to verify some of the data obtained from the other sources.

## 3.2 Selection of the Power Plants

As stated earlier, two power plants were chosen for purposes of comparison, namely, Serdang Power Station (under TNB), and PD Power (a member of the Sime Darby group of companies).

The basis for selection was that both had to have the same technical and operating criteria which are:

- both plants had an open cycle configuration operating system;
- both operate as peaker plants, meaning that they supply power during peak load demand.

Another chief factor that aided the selection of both power plants was that there was only a 6-month age difference between the two - Serdang Power Station commenced operations in June 1994, while PD Power did so in January 1995.

## 3.3 Data Analysis

This comprises basically two processes: ascertaining unit generating cost, and calculating NPV per installed capacity (which subsumes WACC and Cost of Equity [$k_e$]).

### 3.3.1 Generating Cost

Generating cost is the cost that is required to produce per kW of electricity. It encompasses fixed cost, fuel cost and variable cost, and is found using the following equation:

Generating cost = (fixed cost + fuel cost + variable cost) / output[6] (3a)

The unit for generating cost is sen per kWh.

### 3.3.2 Net Present Value per installed capacity

The NPV is defined as the sum of all discounted cashflow from operations and capital expenditure of a project at the required rate of return. It is calculated using the following equation. (Brigham & Gapenski , 1997)

$$NPV = \sum_{t=0}^{n} (CF_t/(1+k)^t \qquad 3(b)$$

Where :

NPV = Net Present Value

$CF_t$ = Expected net cashflow at period t

k = Discounted rate (cost of capital)

t = Number of period

Since the capacities of power generation are different in both the plants, there is a need to have a common basis for evaluating their performance. The NPV per installed capacity is calculated in order to meet this need.

### 3.3.3 Weighted Average Cost of Capital

According to Brigham and Gapenski (1997), the WACC is the weighted average cost of capital of each new dollar of capital raised at the marginal. Hence WACC is not the average cost of all the dollars the firm has raised in the past, nor is it the average cost of all the dollars the firm will raise during the current year. Brigham and Gapenski (1997) add that the WACC should be used to discount project cashflow because the project is financed by shareholder's equity and debts. The calculation of WACC rests on the following assumptions:

i. The debt equity ration is not changed for the duration of the operation plants.

ii. There is change in the financial risk.

iii. There are no new projects.

---

[7] This is the equation used by the Operation Managers of both the power plants.

The amount of equity required for the development of a power plant is dependent on the lender's perceived risk for the project, and typically ranges between 20% to 35 % in developing countries.[8] For the evaluation of the objective of this study, debt equity ratio is taken as 0.8 : 0.2.

$$WACC = W_d k_d(1\text{-}T) + W_e k_e \qquad 3(c)$$

Where:

$W_d$ = the weight of debt

T = the tax rate that is used 28%

$W_e$ = the weight of equity

$k_e$ = the cost of equity

### 3.3.4 The Marginal Cost of Equity ($k_e$)

To estimate the marginal cost of equity ($k_e$) for this study, Capital Assets Pricing Model (CAPM) is used. The general formula for CAPM is

$$\text{Cost of equity} = \text{Risk Free rate} + \text{Risk Premium}$$

$$k_e = k_{RF} + (k_M - k_{RF})\, b \qquad 3(d)$$

Where :

$k_{RF}$ = risk free rate

$k_M$ = rate of return on the market

b = firm beta

Beta is the measurement of sensitivity of a form's return to the market-index's return (Brigham and Gapenski, 1997). Since both Serdang Power Station and PD

[8] World Bank Group – FPD Energy Note No. 2, May 1995

Power are subsidiaries of TNB and Sime Darby, respectively, the beta is based on the parent company.

The risk free rate ($k_{RF}$) is taken as 6.32 percent from the 10-year Malaysian Government Securities, November 1999 (Bank Negara Malaysia).

For the equity market return, the KLSE Emas all share indexes is used, and it yields a compounded monthly return of 3.18 percent from December 1998 to December 1999. [9]

### 3.4 Revenue

The revenue for Serdang Power Station and PD Power is based on the sale of electricity to TNB. The tariff rates are fixed in the in the PPA for energy payment; as for capacity payment, this has to be met, regardless of whether the plant is running or not.

i. Energy payment – recovery of variable operating cost for running the power plants, consisting of costs of items such as fuel, spare parts, electricity, water, telephone, and direct and indirect labour that are involved in power generation.

ii. Capacity cost – recovery of and on capital investments in plant, and equipment and maintenance that must be performed whether or not the plant is in operation. The formula to calculate the capacity cost is stipulated in the PPA between the generator and purchaser.

$$\text{Revenue} = \text{Capacity payment} + (\text{Tariff rate} \times \text{output})$$

[9] Investors Digest – Mid December 1999 (p.46)

## 3.5 Fixed Costs

The fixed costs of an IPPs such as capital investments in plant, incense fee, administrative overhead, insurance fee and equipment and maintenance that must be performed whether or not the plant is in operation.

## 3.6 Variable Costs

The variable operating costs of an IPPs such as fuel cost, spare parts, electricity, water, telephone, direct and indirect labour to generate power.

## 3.7 Depreciation

Capital expenditure is depreciated on a straight-line basis over the operation period.

## 3.8 Projected Free Cash Flow

To analyse the financial viability of Serdang Power Station and PD Power, free cash flow was projected throughout the life span of the power station, which is 21 years. The equation of free cash flow is as follow:

Free cash flow = Revenue – cost - investment

To prepare the free cash flow, profit and loss statement was established. The profit and loss statement contains the revenue, operating cost, profit and tax charges over the period of the concession. The assumption for revenue and operating cost for the year 2000 to year 2015 was based from the information provided by Serdang power station and PD power station Operation Managers.