Chapter 4 : Research Analysis

4.1 Table 1 : Cost of Stock as at 30th September 1995

This is an extract of report produced by TNB to reflect "Stock Report" in September 1995 for stock level in various power station.

For SSAA Power Station, this reflect substantial stock is kept at the station. The breakdown of stock as below :-

			percentage value %
Coal (Fuel)	-	*RM 13,848,425.00*	***9.5***
Fuel Oil	-	*RM 8,703,748.00*	***6.0***
Spare parts	-	*RM 122,645,387.00*	***84.5***
	Total	*RM 145,197,560.00*	*100*

The analysis is to emphasize that plant spare parts has the highest percentage when the report was published.

The present of spare parts is the essential ingredient in order to ensure machine maintenance and reliability to provide the competitive advantage. Each unit (300 MW unit) is taken out for 30 days every 2 years to perform maintenance work. The same unit is taken out for major or complete overhaul every 4-5 years. Each overhaul lasted for 60 days. For every week of delay due to unavailability of spares the lost in revenue is about RM 4 million. Station management has been cautions in the past with respect to inventory management when impact of spares is highly significant.

The current level of inventory exists due to handing over of spare parts as required by contract during project implementation. The past practice is that the cost of spare parts is 10% of contract value of project. The cost of mechanical and electrical equipment for two phases is about RM 1000 million and the cost of Gas Turbine project under phase IV is about RM 300 millions.

Therefore the present cost of spare parts over initial value is about 9.5% (depreciation is not considered). Typical power plant, the useful life is 25 - 30 years.There is no comparative data that can be used to justify the quantity of inventory held at SSAAPS. The policy to purchase 10% of spare at the project stage is due 1) Original Equipment Manufacturers (OEM) are from overseas, 2) long lead time to procure spares and 3) OEMs recommend such spares.

For phase III that is under construction, the cost of mechanical and electrical works is RM 1400 million.

4.2 Table II - Summary of total value of inventory in the station (SSAAPS)

This table shows main stock on inventory is spare parts and fuel (oil, coal and distillate)

		percentage - %.
I) station spare	*RM 79,012,130.83*	*65*
ii) fuel	*RM 36,712,371.81*	*30*
iii) common spare	*RM 5,739,257.76*	*5*

For inventory control , station spares will the focal point for the material management. Common spares could be reduced drastically as the spares are locally obtained (examples of such spares are batteries, paint, bolts and nuts, bearings, lighting equipment and stationaries)

4.3 Table III - The breakdown of station spares (SSAAPS) into various subgroups as per plant function between phase I and phase II.

The intention of this table is to show sections that have high value of inventory. By continuously monitoring this format, say on half-yearly basis, some control could be exercised if there is tendency for specific section to over stock its inventory. Inventory may be stocked because impending major overhaul of a particular unit. It is also to monitor that inventory is not

accumulated or purchased at early date. Inventory should be purchased just at the right time prior to major overhaul.

Ownership of inventory is a fundamental aspect of its control. It is a general tendency among sections to assume responsibility of inventory control lies with top management. By breaking down into various subgroups, identification is made simple and consolidated effort could be achieved in handling inventory problem.

4.4 *Table IV - Regrouping of spares as per main section (maintenance groups) for whole section.*

As mention earlier, the responsibility of ensuring sufficient spares lies on respective engineer that manages the maintenance section. The table would provide each maintenance section "global" view on inventory status of his section and the others. This type of report should be published frequently as inventory management is a dynamic process. In this way we could make people conscious on the role each has to play towards good inventory management.

Balance of plant spares is managed by Workshop section.

The percentage holding level of each section as follows :

Turbine section	-	*18.5%*
Boiler section	-	*23.5%*
Electrical section	-	*7.4%*
Control and instrument section	-	*13.5%*
Coal Handling section	-	*14.5%*
Gas Turbine section	-	*19.6%*
Workshop section	=	*3%*
Total :		*100%*

4.5 *Table V - Stock of Fuel oil for the year 1995*

This is for a combined usage of two units of 300MW generating set. The average monthly consumption is 78,000 metric tonnes (MT) for the two units. A unit consumption is 1300 metric tonnes of fuel per day. The fuel consumption is monitored by Operation Department on daily basis. The safety stock for this station is for 15 days of operation. This is equivalent to 39,000 MT of oil. In the past the safety stock is for 20 days.

Base on average oil price of RM 235/MT, the reduction in holding stock is :

5 day X 1,300 MT oil per day per unit X RM 235 per MT X 2 units

= RM 3.055 millions .

The oil stock is kept within two control lines , I) the monthly consumption line of 78,000 metric tonnes of oil and II) the safety stock line of 39,000 MT. The current safety stock level is due to lead time that is required to inform Petronas on the oil delivery. Petronas needs two months of advance notice before they could plan their shipping route. This condition does not favour station at all. If delivery period can be reduced , station could reduce further the holding stock. Additional reduction of 5 days could save TNB RM 3 millions. The oil contract is managed between Generation Department at Headquarters (HQ) and Petronas. Station should continue impress HQ on the need of tight inventory control.

4.6 *Table VI - Stock of distillate for emergency operation of 3 x 110MW Gas Turbine*

Distillate is a high quality grade of diesel oil. Normal diesel oil could be used for gas turbines because of the present of impurities which are harmful to the normal operation the unit.

Normally gas turbine units are running on gas which is piped to the power station. In this arrangement there is no inventory stock. TNB has to cater for

emergency situation in case there is problems with the gas supply. Distillate is used for such situation. The emergency stock is for three units running at maximum capacity for 10 hours/day for the next 10 days. The usage per unit of gas turbine at its maximum capacity is 30,000 litres/hour.

The emergency stock is :-

3 x 30,000 litres/day x 10 hours x 10 days = 9,000,000 litres.

On current price of distillate, distillate inventory stock is worth 9,000,000 x 0.53 = RM 4.77 millions.

4.7 Table VII - Stock of Coal for year 1995

Similarly like oil, TNB should make concerted effort to minimize the holding stock of coal. Management of coal delivery is done by Headquarters.

The average coal consumption for 2 units (2 x 300MW) is about 5,000 metric Tonnes (MT) per day. TNB is keeping safety stock of 30 days as coal is imported from Australia, Sumatra and Kalimantan. The current coal price is between RM 90 - RM 100. This result in inventory stock of :

5,000MT / day X 30 days X RM 100 / MT of coal = RM 15 millions.

The reason for holding too much coal is due long lead time in the procurement of coal. Typical lead times as below:

I) Coal from Australia - 30 days for journey of ship from station to coal mines and back to station (one complete journey)

II) Coal from Borneo, Kalimantan - 14 days of complete journey (7 days X 2)

III) Coal from Sumatra - 8 days of complete journey

For safety reason on the station operation, the coal is procured from many sources. Australian's coal was selected as the reference coal in the designing of boiler in 1986 as at that time the were no coal mines in Indonesia. Sarawak

has some coal but the properties of the coal is not suitable to burnt directly in the units at SSAAPP. Sarawak's coal is required to mixed with other coal before it can be fired in the boiler .

4.8 Table VIII - Slow moving items for spare parts in the last 5 years (90 - 95)

This table is to review the spare parts that are considered slow moving in the last 5. Unlike consumable items, spare parts requirement is unpredictable. For equipment that is maintained in good condition, the present of spare parts would give assurance to the owner that the equipment will continue to serve. Such assurance is critical in service industry like TNB. Breakdown can be reduced to the minimum if spare parts are available.

It is not practical to view spare parts as fast moving items in service industry of power generation. The fact that machine is stripped for details inspection every 4 - 5 years give the indication that spare parts are not expected to be used in the early stage of machine life.

For components of machine that do not require spare part replacement in the last 5 years or more should be viewed seriously so that any subsequent failure could have been anticipated or failure could be prevented by early replacement of component. Therefore for spare parts inventory, the review of equipment is more critical as compare to review of fast moving consumable item. Therefore financial implication should not be the focal point. The equipment continuous operation is more important them inventory reduction.

Furthermore as technology advances, equipment that have been in operation for 10 years or more will face the product obsolescence more critically than equipment that are backed with spare parts.

It can be said that spare parts inventory management is not straight forward as traditional inventory management of raw materials, work-in-progress and finished goods.