MANJUNG POWER STATION – THE NEW EXPERIENCE

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INTRODUCTION

In order to meet the nation's electricity demand in the new millennium, Tenaga Nasional Berhad has developed a 2,100MW coal fired power plant. TNB Janamanjung Sdn Bhd (TNBJ) was formed by TNB in August 1996 to undertake this project adopting an approach similar to the Independent Power Producers (IPP).

The choice of coal as the fuel is in line with the government five fuel policy and it is also the aim of the Malaysian Government to reduce heavy dependence on natural gas as presently experienced. In this respect, coal is regarded as the best viable alternative fuel because of its abundant reserves distributed throughout the world and relatively stable price.

OVERVIEW OF MANJUNG POWER STATION

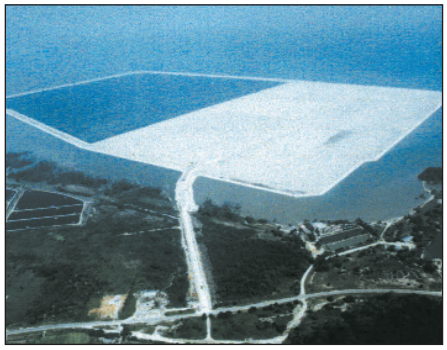
Manjung Power Station is located in the district of Manjung, Perak Darul Ridzuan. The decision to build the power plant on a reclaimed island off the Lekir coastline in Manjung district is in line with the Perak State Government's inspiration to develop the coastal area around Lekir. The attraction of the chosen site is its proximity to deep water (20m), which is a primary requirement for a coal fired power plant, which requires a voluminous seawater supply for cooling. A deep-water jetty terminal to facilitate easy access by large Capemax vessels for coal unloading was also another determining factor. The plant is able to utilise both subbituminous and bituminous coal and the brands chosen are deliberately of the low sulphur grade.

The reclaimed island occupies a total area of 325 hectares of which 291 hectares belongs to TNBJ. The plant facility, coalyard and reserve land occupies 102 hectares and the remaining 189 hectares is for a twenty five years ash pond with surround bunds. Land reclamation works commenced in September 1997 and was successfully completed in May 1999.

The Engineering Procurement and Construction (EPC) contract was awarded in June 1999 to a consortium consisting of Alstom Power Ltd and Paremba Construction Sdn Bhd.

DESCRIPTION OF COAL STOCKYARD

A coal stockyard forms an integral part of the Manjung Coal Fired Power Plant, being the location where the fuel for the generation of the steam turbines is stored. The stockyard was designed to provide a two months' reserve capacity, about 1.5 million tons. Coal is delivered to the coal stockyard from the jetty via the Jetty Delivery System by a series of belt conveyors and two stacker/reclaimer machines. The nominal handling rate for the stacking conveyor is 3,500t/h and for the reclaiming conveyor, 2,500t/h. The interfacing border of operation between the coal stockyard and the LBT is at Transfer Tower 25 (TT2A). The layout of the stockpile is in four linear piles. In addition, a dead stockpile is maintained at the end of the linear piles, which is constructed using mobile equipment.



Aerial View of the Reclaimed Island

The drainage system for the stockyard will allow for the retention and treatment of all site discharge by a waste water treatment plant before it is recycled for use as process water for dust suppression at the stockpiles and for fire fighting. Excess treated discharge will overflow to the sea.

Dust suppression systems are provided at all transfer positions, which is designed to reduce dust nuisance. This is done by the addition of moisture with the aid of a wetting agent, creating smaller droplets. This will cause dust particles to agglomerate and effecting greater spray dispersion and moisture spread.

The Coal Stockpile Dust Suppression system consists of sets of water cannons mounted on each of the live stockpiles and is designed to wet the piles to prevent dust becoming airborne. The system supplies water under pressure via a network of pipes to the stockpile spray points with the sprays positioned to cover the maximum surface in the areas required. Automatic operation of the stockpile spray points is accommodated by virtue of PLC signals that operate the system. Manually-operated ball valves are supplied for each stockpile spray mast to allow adjustment of the moisture addition and maintenance of the sprays.

The boilers in Manjung have been designed according to 'Type B' coal, i.e. Adaro and Suralaya. However, the boiler is capable of developing maximum continuous rating with any coals having analysis and characteristics similar to the the coal samples listed in Table 1.

DESCRIPTION OF COAL AND ASH HANDLING PLANT

The Coal and Ash Handling Plant is another integral part that forms the Coal and Ash Management Services of SJ Manjung. The Coal and Ash Handling Plant is responsible for receiving coal from the coal stockyard with the interface border located at Transfer Tower 30 (TT3) and ending at the Tripper Car on top of the boiler bunkers. All operation is done from the Coal and Ash Control Room. In addition to coaling operations, ash handling is also under the res-ponsibility of this section. The ash handling operation is beyond the scope of this article.

The Coal Handling System is designed to receive coal at a rate of 2,800tph at the Stockyard Transfer tower and transfer it via a dual conveyor route to the boiler bunkers. The maximum consumption of the power station boilers is about 355t/h per boiler unit at BMCR, giving a total coal requirement of 25,560t/day for the 3 × 700MW units. This will require the coaling operations to run for a minimum of 9.5hrs/day in order to maintain the power plant on full capacity for 24 hours. However, the coaling operations will normally be tailored to suit the requirements of any reduction in output over the 24 hour period.

Coal, nominally minus 50mm, is received from the stockyard system at transfer tower TT3, and is fed directly onto the tail end of belt conveyor BC1A or BC1B. These conveyors are rated at 2,800t/h and are inclined up to the top of transfer tower TT4, where they are discharged into coal crushers, one for each conveyor. These crushers reduce the coal size to minus 30mm. Each crusher is also provided with a by-pass facility allowing the coal to be diverted around the crusher if necessary. Whilst the coal is on conveyor BC1A/B, any ferrous tramp metals will be removed by a magnetic separator. Any non-ferrous tramp metal is detected by tramp metal detectors, which can crash stop BC1A/B and the upstream equipment to allow the tramp metal to be manually removed.

Conveyors BC2A/B transport coal at 2,800t/h from the crusher tower TT4 to TT5. The coal is analysed on-line on BC2A/B. Each conveyor can discharge onto either conveyor BC3A/B via diverter chutes. The coal is then sampled by sampling equipment situated at the head end of BC2A/B. Coal is continuously weighed on BC2A/B by belt weighers which provide a totalised flow as well as an instantaneous flow rate.

Conveyor BC3A/B transport coal at 2,800t/h from transfer tower TT5 over the top of the boiler bunkers. Travelling trippers, one on each conveyor

TABLE 1. DESIGN COAL SPECIFICATION

ANALYSIS	COAL B (DESIGN FUEL)	COAL A	COAL F	COAL D	COAL Q	COAL R	COAL S
Total Moisture (%)	27.0	24.0	11.0	19.0	14.0	25.0	18.0
Ash (%)	1.2	1.0	10.1	4.2	5.5	4.0	4.0
Volatile Matter (%)	36.0	34.0	28.8	36.3	39.0	35.0	38.2
Fixed Carbon (%)	35.8	34.0	49.8	40.5	41.5	36.0	39.8
Total Sulfur (%)	0.10	0.10	0.28	0.90	0.50	0.80	0.50
Carbon (%)	54.0	50.0	65.4	58.5	62.8	52.5	59.3
Hydrogen (%)	3.9	5.0	3.8	4.3	4.2	3.8	3.8
Nitrogen (%)	0.6	0.5	1.4	1.2	1.2	1.0	1.1
Chlorine (%)	<0.01	Nil	0.050	<0.01	<0.01	<0.01	-
Oxygen (%)	13.3	8.0	8.0	12.8	11.8	13.0	13.4
Gross Calorific Value (kcal/kg)	5,000	4,900	6,310	5,700	6,200	5,100	5,800
Hardgrove Grindability Index (HGI)	46	53	53	48	46	50	45
Ash – Initial deformation (°C)	1,200	1,200	1,320	1,100	1,120	1,100	1,200
Example of Coal Types	Adaro Suralaya	Roto South	Dartbrook, Bengalla, H. Valley		Satui Prima	Lati	

Transfer Tower and Conveyor Belts

discharge coal as required into each bunker. The system is programmed to ensure that the level of coal in the bunkers is never allowed to fall below the minimum fill level.

Four independent insertable dust extraction filter units are provided and are inserted into fabricated upstands. Each unit is situated at the head end of conveyors BC1A/B and BC2A/B to extract dust-laden air from feed areas. Each unit will be of the continuously cleaning pulse-jet venting design with compressed air cleaning facility including air regulator/pressure gauge. Air is extracted by a 4kW fan set.

Two stand-alone cased filter type units are situated in the vicinity of TT4 with ducting attached to the coal crushers. These filters extract dust created by the crushing action and are fitted with dust hoppers and rotary valves which deposits the collected dust back onto BC2A/B depending on which unit is in operation.

OPERATIONAL ACHIEVEMENTS

To date, some of the operational achievements are as follows:

• First Vessel Received: (Handymax)	24 June 2002
• Capemax Vessel Received:	I) 6 February 2003 – 118,000 MT II) 23 June 2003 – 132,000 MT
• Amount of Coal Received in 2003:	3.5 mil tonnes (48 ships)
• 50th Vessel Received:	21 August 2003
• Takeover of Coal Stockyard:	21 April 2003
• Takeover of Coal and Ash Plant:	25 September 2003