Chapter 02

General Systems in the Boiler Side

2.1 Coal Pulverizing System

The main task of the coal pulverizing system is to pulverize coal into a fine powder stems in order to make sure better and efficient burning.

There are five coal bunkers installed in LVPS out of which the fifth one is on standby. The effective volume of raw coal bunkers per boiler without the standby bunker is enough for the coal consumption of 10 hours at Boiler Maximum Continuous Rating (BMCR) for the designed coal.

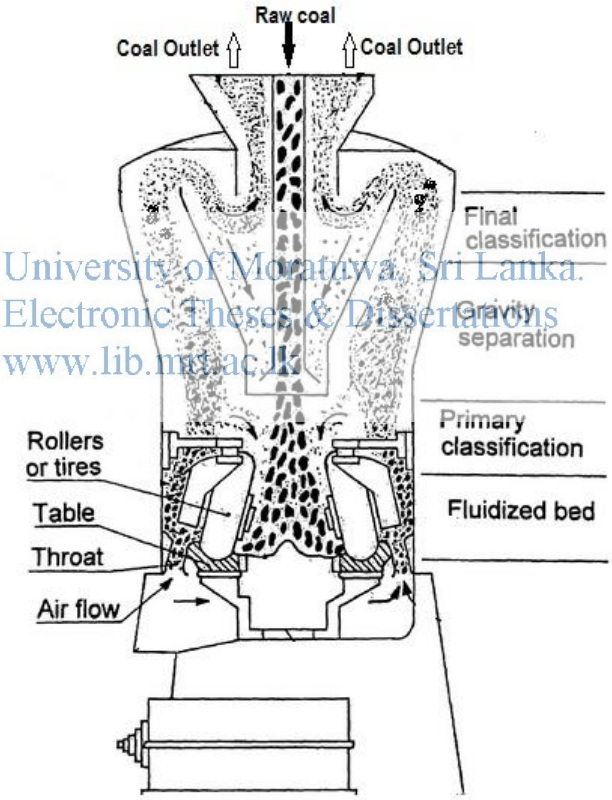

Figure 2.1: Cross section of a coal pulverizer

Source: Inferential pulverized fuel flow sensing and manipulation within a coal mill

Coal feeder delivers coal in the bunker to pulverizer where pulverized coal with certified fitness is produced by grinding and drying. There are five roller pulverizers with 400kW motors. According to the design, four pulverizers out of five should be

capable to produce 100% BMCR with guaranteed coal. The fifth one is been in standby.

After grinding, the pulverized coal is sent to the separator which is located on the top of the pulverizer. In the separator fine pulverized coal (fineness of 200mesh) is separated and sent into four coal pipes, and the rest coarse coal will go back to the pulverizer to be ground again. The mixture of pulverized coal and air is sent through coal pipes directly to burners.

2.2 Primary Air (PA) System

The main task of the PA system is to supply heated air to the pulverizers to dry the coal during the pulverizing process and to transport pulverized coal into the furnace. Cold air which is come with the atmospheric temperature from the outlet of PA fans is divided into two parts. One part through Air Pre-Heater (APH) comes to common header pipe and heated to about 330^{o}C. The rest of cold air also comes into another common duct pipe. Those hot and cold air are used to adjust the PA temperature by mixing together just before coming in to the pulverizer. It helps to keep the coal dry during the pulverizing process and to convey to the burners without stacking in the conveying pipes.

There are two 1250kW PA fans (both are necessary to run to generate 300MW) used to produce hot and cold primary air in LVPS. The primary air system is designed to operate with single PA fan under boiler low load conditions.

2.3 Air Pre-Heater (APH)

The APH is a heat exchanger where the heat from the boiler flue gas is transferred to cold air to make hot air increasing the thermal efficiency of the boiler by reducing the heat loss due to flue gas. The heat in flue gas is transferred to hot primary and secondary air before being released through the chimney. It also allows control over the temperature of gases released from the stack to meet emission regulations.

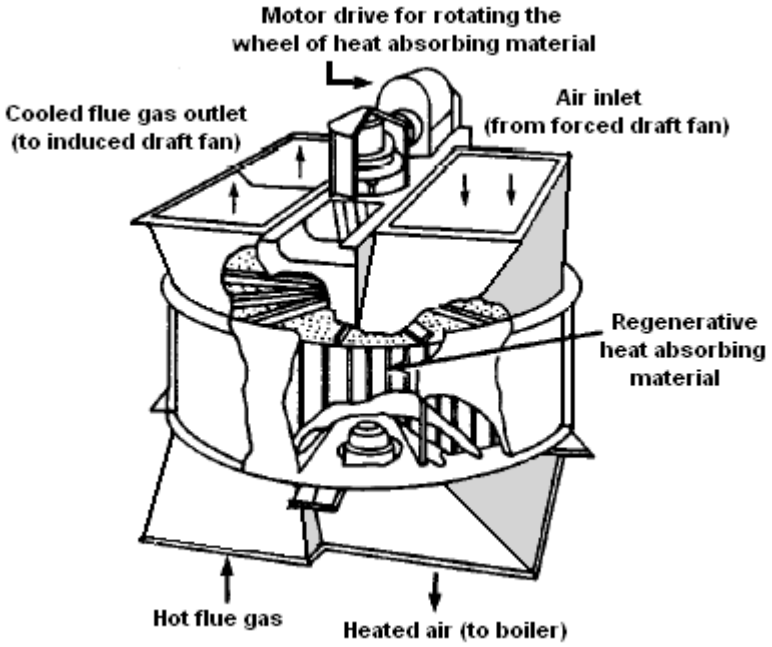

Figure 2.2: A typical rotating-plate air preheater

Source: U.S. Environmental Protection Agency

There are two tri-sector type APHs each of 7.5kW and 0.9 rpm installed and operated in LVPS. The large sector is connected to the boiler hot flue gas outlet. The hot exhaust gas flows over the rotating blades, transferring some of its heat to the blades. The second, smaller sector is fed with ambient air from Forced Draft (FD) fans, which passes over the already heated element as it rotates into the sector, and is heated before being carried to the boiler furnace for combustion. The third sector is fed with one portion of air provided from PA fans passing air over the already heated element as it rotates into the sector, to produce hot primary air used in the pulverizers to carry the coal-air mixture to coal boiler burners.

2.4 Secondary Air System

Purpose of the secondary air system is to provide the air required for combustion in the furnace. This system includes two 50% capacity of BMCR axial FD fans with 710 kW motors and variable moving blade pitch controllers. The design and the arrangement of secondary air system are done to operate with single FD fan under boiler low load conditions.

The cold air through air preheater, after being heated to about 346^{o}C goes into wind box of boiler burners located in both sides of the furnace. The wind box is designed to distribute air evenly to all burners.

2.5 Flue Gas System

The flue gas system is designed to draw out the flue gas from furnace to help the burning process and push out through the boiler chimney. It also helps to maintain negative pressure inside the furnace, which traps the flame inside the furnace without letting it come out through manholes.

This system includes two Electro Static Precipitators (ESP) and two 50% capacity of BMCR axial flow type Induced Draft (ID) fans with variable moving blade pitch flow controllers and 1800 kW motors.

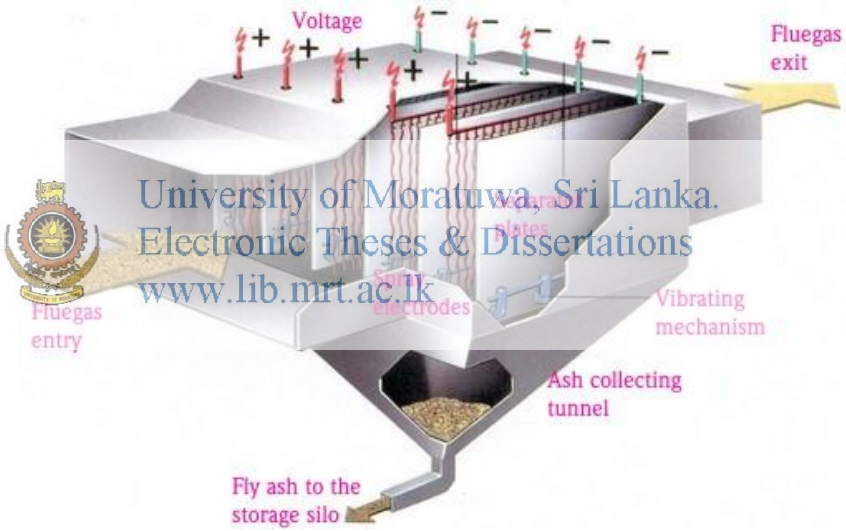

Figure 2.3: A typical electrostatic precipitator

Source: Endress + Hauser corporate website

ESP is designed to trap and remove fly ash particles from the flue gas. It charges the fly ash particles electro statically and then attracts and deposits on plates. When enough dust has accumulated, the collectors are shaken to dislodge the dust, causing it to fall with the force of gravity to hoppers below. Cleaned gas then passes out of the precipitator and through a stack to the atmosphere. ESP in LVPS collects about 99.5% of the dust from the flue gas.