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PAPER TITAL : QUALITY MANAGEMENT APPROACH TO COAL BASES THERMAL POWER PLANT

Er,Ashwani Sharma *

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1.1 Introduction

The purpose of that introductory chapter is providing an overview of the research that presented through the body of this work. The chapter has been divided into three sections. The first section aims providing the background and basic need for study. The second section presents the researcher objectives, and the overall organization of the thesis is presented in section three.

1.2 Background and Uses for this Study

To survive and compete in the rapidly changing business environment many organizations around the world have been forced to employ new philosophies to improve their organizational performance. Many of these philosophies have total quality management (TQM) at their core. TQM emerged in 1980 in the U.S.A, providing a structure for a competitive response to growing dominance of Japanese manufacturers. Although there is much evidence in the literature of research being carried out in established economies, it is evident that there is a limited amount of research being undertaken concerning TQM in developing countries. Goshen [1] stated that: A number of gaps are identified in the literature on quality management in developing countries like India, Japan etc along with significant challenges including differing theory of quality‖.

* **Mechanical Engg.**

** **HOD Mechanical Engg.**

Reviewing the literature published by C. D. Go swami [2], it was found that presently India is facing serious challenges of energy security threat due to short fall of peak power supply by 18.4%. Under the above scenario, coal based thermal power plant is being focused as major source of commercial energy. But India has historically failed to meet its power sector targets by a significant margin and with tremendous opportunities ahead; the power sector continues to be affected by the shortfall both on generation as well as transmission side. For example, for the current installed capacity of around 160 GW, the inter-regional transmission capacity is only about 15 GW (13 percent of the installed capacity).

By reviewing the literature and various articles has seen that there are many thermal power plants in India not working smoothly or suffering from shortages.

1.2 Research Aim and Objectives

The main objective of this dissertation is to carry out a case study in order to have useful insight in TQM in a Coal based Power Plant. Case study deals with the maintenance practices carried out in TPP along with TQM techniques. During the case study data has been collected from different source and these data has been interpreted in order to make it more useful and understandable.

Literature Review

Crosby [3] gave definition of quality as conformance to requirement. Crosby‘s essential points in his definition of quality were (1) it is necessary to define quality, (2) one must know what the requirements are and be able to translate these requirements into measurable products or service to characteristics, and (3) it is necessary to measure the characteristics of a product or service to determine whether it is of high quality.

Ishikawa [4] stated that ―To practice quality control is to develop, design, produce and service a quality product that is always economical, most useful and always satisfactory to the customer.‖ He stated that all employees should clearly understand the objectives and business reasons behind the introduction and promotion of companywide quality control. The features of the quality system should be clarified at all levels of the organization and communicated in such a way that the people have confidence in these features. The continuous improvement cycle should be continuously applied throughout the whole company for at least three to five years to develop standardized work. Both statistical quality control and process analysis should be used, and upstream control for suppliers should be developed and effectively applied. The company should define a long-term quality plan and carry it out systematically. The walls between departments or functions should be broken down, and cross functional management should be applied.

Deming [5] pointed out that only 15 percent of quality problems are actually due to worker error. The remaining 85 percent are caused by processes and systems, including poor management. Deming said that it is up to management to correct system problems and create an environment that promotes quality and enables workers to achieve their full potential. He

Believed that managers should drive out any fear employees have of identifying quality problems and that numerical quotas should be eliminated. Proper methods should be taught, to detect and eliminate poor quality and it should be everyone‘s responsibility.

Berry [6] has defined the importance of TQM philosophy in a single and a very comprehensive sentence as, ―Because it‘s a matter of survival.‖

Ross [7] further elaborated, that Total quality management is based on a number of ideas. It means thinking about quality in terms of all functions of the enterprise and is a start-to-finish process that integrates interrelated functions at all levels. It is a systematic approach that considers every interaction between the various elements of the organization. Moreover, total quality management is integration of all functions and processes within organization in order to achieve continuous improvement.

Bester field [8] has stated that Total quality management is the application of quantitative methods and human resource to improve all the processes within an organization and exceed customer needs now and in the future. It integrates fundamental management techniques, existing improvement efforts, and technical tools under a disciplined approach.

Hells ten and Klefsjo [9] supported the view that TQM is an evolving system. They defined TQM as a continuously evolving management system consisting of values, methodologies and tools, the aim of which is to increase external and internal customer satisfaction with a reduced amount of resources. In their paper they argued that methodologies are ways to work within the organization to reach the values‖. A methodology, according to Hellsten and Klefsjo it consists of a number of activities performed in a certain way‖. According to them tools have been defined as facilitator of data and provides a support in decision making. TQM also has elements of accomplishing no defects and eliminate waste and has considered customer satisfaction as the main objective of TQM.

Slacked. al. [10] mentioned that TQM should be thought of as a philosophy and a way of thinking and working which particularly stresses the following:

a) covering all parts of the organization;

b) including every person in the organization;

c) examining all Expenditure which are related to quality, especially failure;

d) costs; like Direct and indirect uses in production

1 Energy Scenario in India

Energy is one of the most important building blocks in human development, and, as such, acts as a key factor in determining the economic development of all countries. In an effort to meet the demands of a developing nation, the Indian energy sector has witnessed a rapid growth. Areas like the resource exploration and exploitation, capacity additions, and energy sector reforms have been revolutionized.

India has the fifth largest generation capacity in the world with an installed capacity of 152 GW as on 30 September 2009, which is about 4 percent of global power generation. The average per capita consumption of electricity in India is estimated to be 704 kWh during 2008-09. However, this is fairly low when compared to that of some of the developed and emerging nations such US (~15,000 kWh) and China (~1,800 kWh). The world average stands at 2,300 kWh.

Energy is vital for development and this means that if India is to move to a higher growth trajectory than it must ensure the reliable availability of energy. It faces a formidable challenge in providing adequate energy supplies to users at a reasonable cost. India‘s nominal

GDP crossed the US $ 1 trillion mark in 2007-2008 which means that the annual growth rate of nominal GDP during the period was stupendous 18 percent. Thus the energy challenge is of fundamental importance. In the last six decades, India‘s energy use has increased 16 times and the installed electricity capacity by 84 times. In 2008, India‘s energy use was the fifth highest in the world. However, resource augmentation and growth in energy supply have failed to meet the ever increasing demands exerted by the multiplying population, rapid urbanization and progressing economy. Hence, serious energy shortages continue to plague India, forcing it to rely heavily on imports.

3.2 Current Scenario of Coal based Thermal Power Plants in India

Thermal power plants convert energy rich fuel into electricity and heat. There are various types of thermal power plants based on the types of fuel they use for power generation. Possible fuels include coal, natural gas, petroleum products, agricultural waste and domestic trash / waste. Other sources of fuel include landfill gas and biogases. In some plants, renewal fuels such as biogas are co-fired with coal. We know that power is the most important input for development and progress of any country, Government of India has been endeavoring to increase installed Power Generating Capacity continuously to maintain an annual growth rate of 9%. The installed generating capacity of our country as on 31st December, 2011 is 1,86,655 MW and at the end of the 11th Five Year Plan it was expected to be 2,00,000 MW. To achieve this target, a large number of Thermal Power Plants including large capacity ultra Mega projects were installed [21]. But India has historically failed to meet its power sector targets by a significant margin and with tremendous opportunities ahead; the power sector continues to be affected by the shortfall both on generation as well as transmission side.

By reviewing the literature and various articles it can be seen that there are many thermal power plants in India not working properly or suffering from shortages. Such as

On 28 February 2011, 32 power stations [were down to] had critical stock [levels] including 18 stations with super critical stock, i.e. stock for less than 4 days. [22]

1.The loss of generation due to non-availability of thermal units due to forced outages during 2011—12 increased to 11.46 per cent, Central Electricity Authority (CEA) said. ―The increased forced outages were due to increased forced shutdown of units due to coal supply problem and transmission constraints and equipment problems of some new units,‖ the CEA report added. The report said 59.87 per cent of the total forced shut downs were of duration of up to 24 hours. Around 39 per cent outages were of duration varying from 1 to 25 days and only 1.45 per cent of shut downs were for more than 25 days. [23]

Presently India is facing serious challenges of energy security threat due to short fall of peak power supply due to underperformance of power plants. These power plants are part of infrastructure society and it is essential that these power plant facilities are constructed so as achieve a higher level of reliability. Moreover, it is for the companies involved in this industry to contribute to society by realizing higher performance at lower cost and good technology. Enhancing the efficiency of power plants is the demand of current scenario.

COAL BASED THERMAL POWER PLANT: A CASE STUDY

5.1 Introduction

Power is an essential requirement for all facets of life and has been recognized as a basic human need. The availability of reliable and quality power at competitive rates is very crucial to sustain growth of all sectors of the economy.

Since Independence in 1947 Indian power sector progress has been rapid. From mere 1713 MW of installed power generating capacity in 1950 the capacity at the end of March, 2011 raised to173625 MW excluding capacity of renewable energy. As we know the development in power sector has led our country to the path of development and Thermal power plants are seen as the backbone of power sector so it is essential that these plants need to work properly. Any firm depends on its technologies as well on its staff to maintain high quality and to meet the customers‘requirement efficiently. Here a case study has been discussed, conducted at coal based thermal power plants to examine the maintenance procedures and management methods of the plant.

5.2 Case Study

Haryana Power Generation Corporation limited was incorporated as a company on 17th March, 1997 and was given the responsibility of operating and maintaining State's own generation projects. HPGCL came into existence on August 14, 1998 for bringing in excellence in power generation in its States own generating stations. In addition, it has been entrusted with the responsibility of setting up of new generating stations in order to keep pace with the ever increasing demand of power.HPGCL has embarked on a mission to establish itself as a modern, growth oriented organization and to make its presence felt in the country's dynamic power sector.

Management and OHSAS: 18001 Certification for Health and Safety Management, for its power stations during the month of December 2009. The certification has been awarded by a world class certifying agency, M/s British Standards Institution (BSI) after carrying out exhaustive audits of the Power Stations and Corporate Office of HPGCL.

The quality systems as per ISO-9001 have taken deep roots in HPGCL. The company has made significant achievement in Total Quality Management (TQM). The power stations situated in the Haryana are giving excellent performance and have broken all previous records of efficient generation. HPGCL has an ambitious plan to add sufficient generating capacity in the State in order to bridge the gap between demand and supply.

Landmarks & Achievements

1. Generation capacity of 2617.2 MW added since creation of HPGCL – an increase of more than 300 %.
2. HPGCL was awarded Gold Shield by Ministry of Power in January 2010 for meritorious performance relating to early completion of 2x300 MW DCRTPP, Yamunanegar.

3. Central Electricity Authority, New Delhi selected 250 MW Unit-8 of PTPS, Panipat for the award of ―Best Executed 250 MW Thermal Power Project‖ of year 2004-05.

4. The Ministry of Power, Govt. of India awarded Meritorious Productivity award to PTPS for good performance during the year 2003-04 as the power station achieved highest ever PLF of 78.75% during the year.

5. The 210/250 MW Units (2x210MW+2x250MW) of PTPS, Panipat have performed very well during 2007-08 and achieved a Plant Load Factor of 93.61% which is comparable to the best performing Power Plants in the Country.

6. The Overall Oil Consumption of 1.66 ml/unit achieved in 2007-08 is the lowest since formation of HPGCL.

7. An overall PLF of 78.94% achieved by HPGCL plants in 2007-08 is the highest since formation of HPGCL.

8. HPGC has achieved highest ever Plant Load Factor (PLF) of 78.94% during 2007-08 which is the highest PLF since formation of HPGCL.

5.5 Coal Pulverizing Plant

5.5.1 Introduction

Of the commercial fuels – coal, heavy furnace oil and light diesel oil, coal is the basic fuel used in the boiler, where the study has been conducted, for power generation due to its distribution and availability.

Indian bituminous coal specifications:

Moisture – 5 - 30%

Ash – 1 - 60%

Volatile – 12 - 40%

Abrasion Index – 60 - 125Mg/Kg

HGI – 45 - 110

Most efficient way of utilizing coal for steam generation is to burn it in pulverized form. Pulverized coal fire firing is a method whereby the crushed coal generally reduced to fineness such that 70 – 80% passes through a 200 Mesh sieve is carried forward by air through pipes directly to burners or storage bins from where it is passed to burners and discharged into combustion chamber. The mixture of coal and air ignites and burns in suspension condition. For pulverizing the coal equipments and systems would be required with high availability.

Factors affecting the Milling Plant Performance

The major factors that affect the milling capacity observed during study are as follow:

1. Grindabilty of Coal

It is the measure of the ease with which coal can be pulverized. The coal available at plant has HGI varying between 45 HGI – 60 HGI (Hard Grove Grindability Index). Higher the HGI easier is the coal pulverization.

2. Moisture Content

The total moisture content of the raw coal is made of inherent and free or surface moisture. The drying of moisture is carried out by PA fans. The mill capacity decreases with the increase in moisture. The hot air temperature should lie between 75 ^{0}C – 85 ^{0}C

3. Fineness of Milled Product

The mills are designed for bituminous coals and normally for this type of coal to give optimum efficiency a fineness of 70% through 200 mesh is desired. This mill and classifier is designed to produce this fineness. The mill fineness and output both are interdependent.

4. Size of Coal Input

Larger the size of coal input to the mill more is the amount of work per unit is increased to get the same fineness. The desired size of coal lies between 25 mm – 50 mm.

5. Mill Wear

Mill wear is caused due to grinding action and abrasive nature of coal. It depends mainly on the gap between bowl surface and grinding rollers and quality of coal. The gap between bowl surface and grinding rollers is maintained 3mm.

6. Calorific Value and Reject able Material Content of the Coal

The plant is designed for coal having calorific value of 4800 KCal/Kg. But in India coals have calorific value range between 3200 – 3600 Kcal/Kg. So this is the major factor which affects the performance of the coal mill. The rejectable materials consist of stones, iron bars, broken hammers etc. these materials causes damage of mill parts, vibrations, coal spillage and mill outages.

Dirty Pitot Survey – Summary Data Mill A

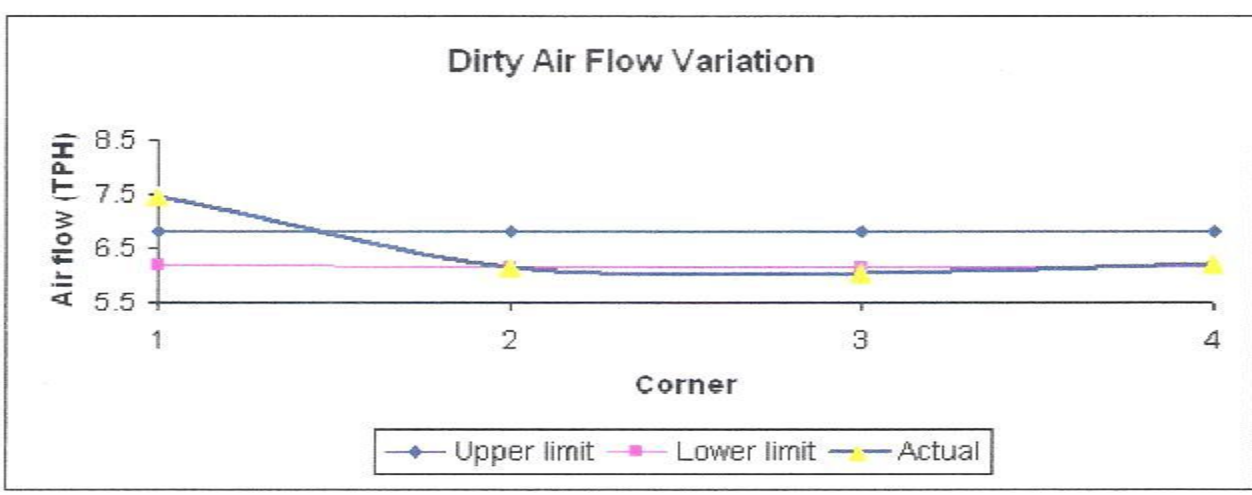
	Unit	UCB	Measured
Unit Load	**MW**	**103**	
PA Flow	**TPH**	**33.00**	**32.03**
Mill Outlet Temp.	**0_C**	**83.25**	**72.29**
Mill Amps	**Amp**	**18.12**	
PA Header Pressure	**mmWc**	**700**	
Inlet PA Temp.	**^{0}C**	**242.25**	

Description	Corner					
	1	2	3	4	Mean	Desired value
Velocity m/s	**27.6**	**26.1**	**24.0**	**26.7**	**26.1**	**> 18**
Air Flow T/hr	**8.4**	**8.0**	**7.5**	**8.2**	**8.0**	
Dev. From Mean % (Velocity)	**5.9**	**-0.1**	**-8.2**	**2.4**		**+/- 5%**
Mill Outlet Temp. ^{0}C	**76.6**	**74.1**	**66.0**	**72.5**	**72.3**	
% Retention on 50 mesh	**1.5**	**2.0**	**2.4**	**1.9**	**2.0**	**< 1%**
% Through 200 mesh	**82.8**	**74.8**	**68.3**	**63.8**	**72.4**	**~ 70%**

Dirty Pitot Survey – Summary Data Mill B

	Unit	UCB	Measured
Unit Load	MW	103	
PA Flow	TPH	32.00	25.91
Mill Outlet Temp.	0_C	101.00	102.96
Mill Amps	Amp	20.85	
PA Header Pressure	mmWc	756	
Inlet PA Temp.	0_C	238	

Description	Corner					
	1	2	3	4	Mean	Desired value
Velocity m/s	26.8	22.1	21.4	21.6	23.0	> 18
Air Flow T/hr	7.5	6.2	6.1	6.2	6.5	
Dev. From Mean % (Velocity)	16.5	-3.7	-6.9	-5.9		+/- 5%
Mill Outlet Temp. ^{0}C	106.0	108.4	101.5	96.0	103.0	
% Retention on 50 mesh	0.9	0.5	0.8	0.8	0.8	< 1%
% Through 200 mesh	73.4	73.2	72.8	78.2	74.4	~ 70%



Dirty Pitot Survey – Summary Data Mill C

	Unit	UCB	Measured
Unit Load	MW	105	
PA Flow	TPH	29.64	29.43
Mill Outlet Temp.	0_C	59.70	61.58
Mill Amps	Amp	15.86	
PA Header Pressure	mmWc	700	
Inlet PA Temp.	0_C	244.00	

Description	Corner					
	1	2	3	4	Mean	Desired value
Velocity m/s	25.7	22.8	22.4	22.0	23.2	> 18
Air Flow T/hr	8.2	7.2	7.1	6.9	7.4	
Dev. From Mean % (Velocity)	10.8	-1.9	-3.7	-5.1		+/- 5%
Mill Outlet Temp. ^0C	10.8	-1.9	-3.7	-5.1		
% Retention on 50 mesh	60.6	60.5	6.5	64.7	61.6	< 1%
% Through 200 mesh	84.0	56.7	69.8	71.1	70.4	~ 70%

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