Effective Utilization and Management of Coal Energy in Indian Thermal Power Plant by Coal Blending and Transport Proximate

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ABSTRACT

Tending towards the Energy need to think beyond the conventional way of power generation and also at the same moment of time different way to analyse the effective management of coal energy for the power generation. The cost effective way of utilization of the coal energy is now essential need for management of coal in thermal power plant. The essential energy need of the country is growing day by day which need the proper management of coal energy in effective way and also at the same moment of time network time reduction in transportation management. Coal power is available in the reliable way and also manages by way of energy indexing. Coal blending is used one of the way to mitigate the solution for the management of coal in the mixing way of combination and composition to analyse utilization of energy in power station. Energy generation with the help of power plant will meet the energy utilization for reducing the transport network length timing and also cost effective way of utilization of energy by the way of coal blending and Dedicated Network development. In this paper we have tried to make the correlation between the coal blending management with the help of unit size of power plant and its approximate efficiency to make effective utilization of coal for making the coal transportation by the dedicated network.

Keywords---- Blending, DFCs, MGR, GCV, Day-Week-Month Mode.

I. INTRODUCTION

Electricity consumption and its utilization by the common manpower is now changing day to day life everywhere and lower electricity tariff to end user[5]. Thus changing world towards the efficient operating cycle characteristics and its management for power plant performance. Efficient utilization [2] of power plant input elements is a major concern for the long life and effective way of resource planning [10]. Development of coal using profiling in the plant will meet the plant to give the use of efficient cycle performance [7] and lesser amount of by product pollution content to atmosphere. As looking for scarcity of coal in some particular plant location, blending of coal [4] is performed. By blending the coal [1] profile change and its management in the smaller capacity and big size of the unit is very important. Energy conversion cycle efficiency [2] is very important for analyzing the plant characteristics and its cost effectiveness during plant operating time [6-8]. Management of coal consumption and its transportation time to power plant will play a vital role for analyzing blending management and Transportation network.

- Higher size plant efficiency will make relative less fuel consumption for per unit electricity generation.
- Higher size plant will more cost effective by the managing the fuel cost.
- Power Plant pollution context is also low in bigger size unit of power plant.
- By Coal blending coal consumption is less and its require efficient management for mixing and plant performance.
- Higher size capital investment cost is higher comparable to sub-critical power plant. Coal blending management will make less heat flux utilization in comparison to subcritical unit.
• Development of Dedicated freight Corridor will reduced coal transportation time to coal.

II. PROXIMATE OF COAL BLENDING

For increasing the availability of the coal in the power plant many power stations is now adopting the way of coal blending in their plant. In the coal blending the low grade high ash coal will be mixed with the higher grade coal in the way proposition for optimum mixing [6] for a particular heat flux value. By the way mixing of the coal in thermal power plant the cost of power generation will be lower down and now this is the adopting method for increasing the availability of coal in power station at the maximum use [8-9]. The management of coal blending [1] is now important for optimum thermal flux. Scarcity of coal in the power plant and unavailability of coal in the large size of power plant will leads to reduce the power plant load factor in such a way that its coal consumption [7] is reduced but at the same moment of time its generation of electricity is also reduced. For the longer period of operation of power plant companies are using the blended coal [4] in such a way that long term plant efficiency is increased [10]. The mixing of coal in such a way that calorific value in increased and management of coal in power station will be for long term operational proximate [6-8]. Blending management and efficiency of plant is the major concern for adopting the efficient coal utilization in power station.

Coal transportation in the thermal power plant is also very important to maintain the daily availability of coal in power station and also fuel security in power plant. Fuel security is also very important for running the power plant for long time in efficient way and increase the efficiency and effectiveness [3-9]. Fuel transportation time is to be minimum so that fuel is to be available within sort span of time to the power station. Most of the coal transportation to the power plant is with the help of railway system and require most attention to avoid any delay of fuel supply to power plant congestion in the railways line will make the path congested and due this coal at the power plant premises is not available within the stipulated time frame span. Thus the development of the in home coal consumption theory as well as development of dedicated railway corridor will make coal movement time to low and increased the availability high. Coal Blending [4] Management for Effective Utilization in thermal power plant is discussed below.

a) Boiler Furnace Flame Condition
b) Heat Volume & Flux degradation due to slogging and fouling
c) Water Spray levels in Super Heater & Re-heaters
d) Emission Levels
e) Acid dew point estimation
f) Resistivity of Ash
g) Process Performance Parameter variation
h) Monitoring of process parameter variation like Super heater spray, steam temp, flue gas exit gas temperature.
i) Trial by low mixture ratio-95%+5%.

j) More than 95% of coal usage on regular basis.

III. COAL BLENDING MANAGEMENT

Coal blending [4] is vital role for the development of fuel need for future prospects of coal energy [7]. In the vital changing context the fuel requirement for managing the coal in the domestic power plant will need the dependence not only on the in-house coal production but at the same moment of time coal availability on the international coal context [10].

The requirement for efficient utilization of coal energy[6] and its management will need the coal mixing and its proper way of utilization in the different size of unit keeping in view of plant load factor and the efficiency of power plant by the way of Unit size selection. Here we are trying to manage the coal utilization in the power by the way of coal blending on the basis of heat value keeping the unit size as element.

The unit size coal blending management is discussed here by keeping the heat value index in the form of Efficiency and GCV[8]. Some case studies of plant capacity as well as plant load factor analyses has been carried out as per given below.

Case-1 (210 & 800 MW Both)

<table>
<thead>
<tr>
<th>Plant</th>
<th>Capacity (MW)</th>
<th>Plant Efficiency</th>
<th>Plant PLF</th>
<th>Blending GCV (Kcal/Kg)</th>
<th>Heat Value basis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>210</td>
<td>30%</td>
<td>88%</td>
<td>3762</td>
<td></td>
</tr>
</tbody>
</table>

1 KWhr 860 Kcal By heat

<table>
<thead>
<tr>
<th>Input Energy</th>
<th>529760000 Kcal</th>
<th>3300</th>
<th>79%</th>
<th>2607 GCV</th>
</tr>
</thead>
<tbody>
<tr>
<td>KG-Coal requirement per hour</td>
<td>140819</td>
<td>KG</td>
<td>5500</td>
<td>21%</td>
</tr>
<tr>
<td>Tons-Coal requirement per hour</td>
<td>141</td>
<td>Tons</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual coal saving by Blending of 1% on heat value basis</td>
<td>6386</td>
<td>Metric</td>
<td>Blended</td>
<td>3762 Kcal/Kg</td>
</tr>
</tbody>
</table>

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**Figure 1:** 210 MW Unit Coal context management

- **Plant Capacity (MW):** 210
- **Plant Efficiency:** 80%
- **Plant PLF:** 90%

**Blending**
- **GCV (Kcal/Kg) by Heat Value basis:**
  - **1 KWhr:** 860 Kcal, 3500 Kcal, 79% 2607 GCV
- **Input Energy (KWhr):** 1629473834 Kcal
- **Energy KG-Coal requirement per hour:** 482140.2669 KG
- **Tonnage-Coal requirement per hour:** 433 Tons
- **Blended GCV (Kcal/Kg):** 3762
- **Annual coal saving by Blending of 1% on heat value basis:** 20087517 Metric Tons
- **Blended GCV (Kcal/Kg):** 3762

**Figure 2:** 800 MW Unit Coal Context Management

**Case-2 (210 & 800 MW Both)**

- **Plant Capacity (MW):** 800
- **Plant Efficiency:** 81%
- **Plant PLF:** 88%

**Blending**
- **GCV (Kcal/Kg) by Heat Value basis:**
  - **1 KWhr:** 860 Kcal, 5500 Kcal, 21% 1135 GCV
- **Input Energy (KWhr):** 312670867.7 Kcal
- **Energy KG-Coal requirement per hour:** 135484 KG
- **Tonnage-Coal requirement per hour:** 135 Tons
- **Annual coal saving by Blending of 1% on heat value basis:** 12237 Metric Tons
- **Blended GCV (Kcal/Kg):** 3784

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Figure 3: 210 MW Unit Coal context management

- Plant Capacity (MW): 210
- Plant Efficiency: 32%
- Plant PLF: 88%
- Blending GCV (Kcal/Kg): 3784
- By heat

Case-3 (210 & 800 MW Both)

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant Capacity (MW)</td>
<td>210</td>
</tr>
<tr>
<td>Efficiency</td>
<td>32%</td>
</tr>
<tr>
<td>PLF</td>
<td>88%</td>
</tr>
<tr>
<td>Blending GCV (Kcal/Kg) by Heat Value basis</td>
<td>3806</td>
</tr>
<tr>
<td>1 KWhr</td>
<td>860 Kcal</td>
</tr>
<tr>
<td>Input Energy</td>
<td>49665000 Kcal</td>
</tr>
<tr>
<td>KG-Coal requirement per hour</td>
<td>130491 KG</td>
</tr>
<tr>
<td>Tonns-Coal requirement per hour</td>
<td>5500 Tonns</td>
</tr>
<tr>
<td>Annual coal saving by Blending of 1% on heat value basis</td>
<td>17752 Metric</td>
</tr>
<tr>
<td>Blended KG-Coal GCV</td>
<td>3806 Kcal/Kg</td>
</tr>
</tbody>
</table>

Figure 4: 800 MW Unit Coal context management

- Plant Capacity (MW): 800
- Plant Efficiency: 35%
- Plant PLF: 88%
- Blending GCV (Kcal/Kg): 3784
- By heat

Effective Energy Management

Figure 5: 210 MW Unit Coal context management
Case-4 (210 & 800 MW Both)

Plant Capacity (MW) 210
Efficiency 33%
PLF 85%
Blending GCV 3828

1 KWhr 860 Kcal By heat
Input Energy 481600000 Kcal 3300 76% 2508 GCV
KG-Coal requirement per hour 125810 KG 5500 24% 1330 GCV
Tonns-Coal requirement per hour 126 Tonns
Annual coal saving by Blending of 1% on heat value basis 22820 Metric Tonns Blended GCV 3828 Kcal/Kg

Blended GCV 3828 Kcal/Kg

Effective Energy Management

Figure 7: 210 MW Unit Coal context management

Figure 8: 800 MW Unit Coal context management
IV. COAL MOVEMENT TO THERMAL POWER PLANT

Coal movement in the thermal power plant is depend on the various location based selection [8-9] and in the most of the cases of site of thermal power station the coal logistics movement is through the Rail Movement. Basic infrastructure of coal movement is with the help of long coal traverse network from one part of the country to the other part of the country.

Thus the coal requirement [7] on the daily basis or the monthly basis will be met with the domestic transportation via mostly with the rail[9]. There are basically two type’s coal movement based on the availability of coal context.

1. PIT-Head/Plant Vicinity Coal Movement: - Coal movement in the states where the plant located and also the coal mine are also located the transportation is made through road network , MGR [9] , Dedicated conveyor belts/ Rope way , yard Gantry rail movement.

2. NON PIT-Head/ Remote Vicinity Coal Movement: - Coal movement in the remote vicinity power plant will generally move from the remote location coal mine and transported to the plant with the help of the available route network [9]. In this type of coal movement cost of coal transportation and material handling is high and plant tariff is also escalated.

V. FUTURE DEDICATED RAILWAY TRANSPORTATION MANAGEMENT

Congestion in transport management will start several years before in the railway system and need appropriate necessary action for the development of the new corridor for taking care of the future need of Indian logistics need.

Indian Railways recognized the problem several years before and in the process of development of dedicated freight corridors (DFCs) of approximate length of 9500 KM in different part of country.

<table>
<thead>
<tr>
<th>Route</th>
<th>DFCs Proposed Length (KM)</th>
<th>Transportation Proximate index (α)</th>
<th>Transportation Congestion reduction index (β)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chennai – Goa</td>
<td>902</td>
<td>2.73</td>
<td>0.37</td>
</tr>
<tr>
<td>Delhi- Chennai</td>
<td>2,190</td>
<td>6.64</td>
<td>0.15</td>
</tr>
</tbody>
</table>

Transportation Proximate index (α) = Estimated approx length travelled by logistics/Approximate speed of Transportation cartage

Transportation Congestion reduction index (β) = 1/
Transportation Proximate index (α)
Coal movement [4] of share of power production is expected to increase by 65% by the 2031-32 and try to maintain the average power production between 55-60%. For the effective need of the coal transportation the coal producing states has to utilize the coal for generating the power and also at the same moment of time the tariff cost should be minimum based on the variable cost components.

Thus with the help of upcoming DFCs most of the old plant location will get coal need fulfillment based on the lower transportation time and also lesser variable fuel cost index. Thus the development of the DFCs will also play a vital role in the reduction of coal transportation time and also availability of coal for the Day-Week-Month Mode.

VI. CONCLUSION

The development of the energy sector in India will generate more opportunity for the economy growth and also the per capita consumption of the electricity will need to revive the development of energy sector in India. Sources of energy generation are available in the way of utilization and it is also the way to make the effective utilization of the coal energy in the country by the way of various techniques inside the power plant as well as in the outer premises of the power plant.

The coal blending is major role changing for the effective management of the coal in the power station keeping the need of the coal in domestic as well as in the international context. The major portion of coal consumption is remaining unutilized in the plant because of the non efficient techniques adoption.

For larger size of the unit of power generation the major contribution of the electricity production is make with the availability of coal and when the availability of the coal is not done with the help of the Indian coal context it will match with the help of international coal with proper blending ratio and the size of the unit which should be ascertain for the management of the coal. Transportation Proximate Index higher side value shows the lower probability of congestion in the longer route network. Coal costing is also play a vital role during the effective management of the coal movement in power plant. Future DFCs will also play a vital role in the coal movement and transportation for the old and upcoming power projects.

REFERENCES