AN ANALYTICAL STUDY ON NEW MANAGEMENT TECHNIQUE IN IMPORTED THERMAL COAL FOR COAL BASED THERMAL POWER PLANTS IN INDIA.

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ABSTRACT

India is a developing economy. Energy requirement is an essential need for its growth and development. With the increasing economic growth of the country as well as with the need of energy requirement, the imports of oil and coal have become a vital part of our economy. 60% of our requirement of electricity is fulfilled by coal based Thermal power Plant. Coal India limited supply is 90% of domestic Coal requirement, rest of the demand is fulfill by import. In order to fulfill our thermal coal requirement, and to reduce demand supply gap import of Thermal coal is done from Indonesia, South Africa etc. Coal meets 24% of today’s global energy requirements more than two-thirds of it is used for power generation and coal-fired power plants account for almost 40% of global electricity production. Coal is thus globally traded commodity and the dynamics of price are influenced by a complex variety of factors. In India coal is known as black gold because around more than half of energy requirement India is meeting by coal. Coal India Limited is a regulatory body that regulates production of Coal, around 90% of Thermal coal is produced by CIL, rest of the requirement, India meet through domestic production and import. In 2011 requirement of coal was 600MMT approximately but supply was only 500MMT. This paper aims to find out the requirement of thermal coal for power plants in India. This paper would also highlight the present available source and the potential for Import Substitution. This paper would highlight the requirement of coal based on Installed capacity of thermal power plants in India.

Key Words:

Installed Capacity, Thermal Coal, MW, Load Factor, Calorific Value, Joule.
INTRODUCTION

India’s energy-mix comprises both non-renewable (coal, lignite, petroleum and natural gas) and renewable energy sources (wind, solar, small hydro, biomass, cogeneration biogases etc.). Forecasting of non-renewable sources of energy like coal, lignite, petroleum, natural gas and the potential for generation of renewable energy sources is a pre-requisite for assessing the country’s potential for meeting its future energy needs. Two main steam coal regional markets can be identified: the Atlantic and the Pacific. Main suppliers of the first market are South Africa, Colombia, Russia, Poland, Indonesia, Australia and the US, while on the Pacific side the main suppliers are Australia, Indonesia, China and Russia. Import demand comes mainly from EU 25 on one side and from Japan, South Korea and Chinese Taipei, these countries altogether requiring almost 70% of internationally traded coal.

COAL AND LIGNITE RESERVE

India has a good reserve of coal and lignite. As on 31 March 2011 the estimated reserves of coal was around 286 billion tones. Coal deposits are mainly confined to eastern and south central parts of the country. The states of Jharkhand, Orissa, Chhattisgarh, West Bengal, Andhra Pradesh, Maharashtra and Madhya Pradesh account for more than 99% of the total coal reserves in the country. The estimated reserve of lignite as on 31 March 2011 was 41 billion tonnes, of which 80% was in the southern State of Tamil Nadu. The total installed electricity generation capacity in India has increased from 16,271 MW as on 31 March 1971 to 206,526 MW as on 31 March 2011, registering a compound annual growth rate (CAGR) of 6.4%. There has been an increase in generating capacity of 18654 MW over the last one year, which is 10% more than the capacity of last year. The highest rate of annual growth (11.3%) from 2009-10 to 2010-11 in installed capacity was for Thermal power followed by Nuclear Power (4.8%).

The total Installed capacity of power utilities in the country increased from 14,709 MW in 1970-71 to 173,626 MW as on 31 March 2011, with a CAGR of 6.2% over the period. The highest CAGR (7.1%) was in case of Thermal utilities followed by Nuclear (6.1%) and Hydro (4.4%). At the end of March 2011, thermal power plants accounted for an overwhelming 64% of the total installed capacity in the country, with an installed capacity of 131,200 MW. Hydro power plants come next with an installed capacity of 37.6 thousand MW, accounting for 18.2% of the total installed Capacity. Besides, non-utilities accounted for 15.9% (32.9 Thousand MW) of the total installed generation capacity. The share of Nuclear energy was only 2.31% (4.78 MW). The geographical distribution of Installed generating capacity of electricity as on 31.03.11 indicates that Western Region (both central and state sector) accounted for the highest share (30.98%) followed by Southern Region (27.35%), Northern Region (26.88%), Eastern Region (13.45%) and North Eastern Region (13.5%).
EXHIBIT NO. 1 - COMPOUND ANNUAL GROWTH RATE OF INSTALLED GENERATING CAPACITY IN INDIA

Compound Annual Growth Rate of Installed Generating Capacity in India
from 1970-71 to 2010-11

Source: CEA - Source: Central Electricity Authority (Energy Static pdf)

DEMAND OF THERMAL COAL IN INDIA

Coal is an essential part of Indian energy requirement at present 54.09% or 93918.38 MW (Data Source CEA, as on 31 March 2011) of total electricity production in India is from Coal Based Thermal Power Station. A coal based thermal power plant converts the chemical energy of the coal into electrical energy. This is achieved by raising the steam in the boilers, expanding it through the turbine and coupling the turbines to the generators which converts mechanical energy into electrical energy.

Total installed capacity of thermal power plant in India is 1,05,931 MW that requires non coking thermal coal of thermal power.

Exhibit: Compound Annual Growth Rate of Production Of Energy In India

Compound Annual Growth Rate of Production of Energy in India by Primary Sources from 1970-71 to 2010-11
An Analytical Study On New Management Technique In Imported Thermal Coal For Coal Based Thermal Power Plants In India.
-Dr. Sumeet Gupta, Dr. M. S. Pahwa and Mr. Ankur Gupta


REVIEW OF EXISTING LITERATURE

India is looking to these long term arrangement because it wants to tie up supply agreements to manage the risk associated with the supply shortfall it is currently experiencing. Indeed, India is facing a shortfall of around 83 million mt of coal in the current fiscal year, which is set to increase to 142 million mt in FY2011-12, according to Indian coal minister Sriprakash Jaiswal February 3. Speaking at a coal conference organized by the Associated Chambers of Jaiswal said there was a need to permit mining in these areas to meet India's coal requirement. "Nearly 600 million people in the country do not have access to electricity, and the government is facing tough challenges in meeting energy requirements. While our energy supply is met from various sources such as coal, hydro-power, oil and gas, nuclear and other non conventional energy resources, coal plays a predominant role in supporting our needs," he said.

203 coal blocks have been declared by the environment ministry as "no-go" areas, with environment and forest clearance refused to these blocks, which collectively hold around 660 million mt/year of coal resources. India is planning to add 78,000 MW generation capacities by March 31 2012, of which 50,000 MW is coal-based. However, the country has been facing coal shortages over the years and has resorted to imports to fill the supply gap.

(MALINI MENON; JO WINTERBOTTOM)

(Reuters) - India's thermal and coking coal imports rose 18 percent to 63.98 million tonnes in April to September from a year ago, coal ministry figures provided by an official showed, as local supplies continued to lag galloping demand.

Asia's third-largest economy imported 102.853 million tonnes of thermal and coking coal in the 2011/12 fiscal year, jumping nearly 50 percent from a year earlier, the figures given to Reuters on Tuesday showed. The ministry expects India to produce 574.40 million tonnes of coal in 2012/13, 6.4 percent more than in the previous fiscal year. But the shortfall between India's domestic coal supply and coal demand will be around 192 million tonnes in the fiscal year to March 2013, according to the coal ministry. India is seen importing 100 million tonnes of thermal coal alone in this fiscal year, despite a sluggish revival of post-monsoon spot buying and a slowing economy, suppliers and end-users have said. Indian thermal coal imports were 71.052 million tonnes in the last fiscal year, while its coking coal imports stood at 31.801 million tonnes.

"The environmental challenges are going to be more stringent in the years to come and the coal producers and consumers would need to address the issues for sustaining the projected growth in our energy planning through adoption of state-of-the-art technologies and human resource. Due to the international coal price volatility the economics of power generation in India is getting hampered and it is creating a cost pressure on the consumers, therefore the government is trying to boost coal production and is also looking at PPP in coal sector to meet the rising demand."

"The country is heading towards becoming a global player in non ferrous metal industry with most of production plants tapping potentials in the foreign
markets. However, the Indian iron ore mining industry, in 2011-12, has been severely affected by events related to regulation, policy and other environmental concerns."

India's non-ferrous metal industry, mainly consisting of aluminum, copper, lead and zinc has traveled a long way from where it was a decade ago. In the next decade, the industry is expected to see a dramatic turnaround with lots of expansion plans running at full capacity, pointed out the press statement.

India's coal imports are likely to touch a whopping 185 million tonnes (MT) by 2017, almost 20% of the international dry-fuel trade amid widening demand-supply deficit, according to Planning Commission. Projecting the imports to increase to 185 million tonnes by 2017 against 137 MT by the end of the 11th Five Year Plan (2007-12), a draft paper by the Plan Panel on Energy for the 12th Plan (2012-17) has cautioned that "there is an urgent need to take effective measures to step up coal production."

"If domestic supply does not match the target growth rate of 7.5% per year, the import demand will be higher. The projected level of imports of around 185 MT is large keeping in mind that international trading in coal is only around 900-1,000 MT of the total consumption of over 6,000 MT world over," The international availability of coal is going to be restricted due to concerns on climate change. "International prices of coal are also likely to remain high because of taxes which are being imposed by several coal producing countries, including Australia and Indonesia,". The total demand of coal grew by about 8% during the Eleventh Plan against the domestic production growth of only 4.61%.

The gap was filled by higher imports. State-run Coal India, which meets over 80% of the domestic requirement, is battling with problems including delays in regulatory clearances, law and order etc. to augment the production.

**Objectives of the Study**

- To analyze the paucity in demand & supply of indigenous coal.
- To analyze the thermal coal requirement based on Installed capacity of thermal coal based power plants.
- To analyze the imported coal demand in near future based upon Indian energy scenario.

**Research Methodology**

**Research Design**

Exploratory research method has been used for this project. This is a type of research conducted for a problem that has not been clearly defined. Exploratory research helps determine the best research design, data collection method and selection of subjects. It draws definitive conclusions only with extreme caution. This research relies on secondary source of data such as different published report, literature and data qualitative approaches such as informal discussions with employees, consumers, management or competitors and more formal approaches through in depth interviews, focus groups, projective methods, case studies or pilot studies. Research based on internet search engine is also one of the reliable sources for exploratory research. This research is considered as an exploratory due to the following reasons:
The research aims to provide a comprehensive insight into a newly developed situation.

The research primarily relies on secondary sources of data.

Source of Data

For this research several source of secondary data such as Annual Report of companies such as CIL, CEA etc., Internet Search, Research paper published on world coal/energy market, and Report published on Future trade of coal have been used.

Data Analysis

As per total electricity generation capacity: The requirement of thermal coal in future as per the installed electricity generation in India.

a) Electricity Generation Capacity in India includes all source power plant, wind power, solar power, Hydro Power plant, nuclear power. Growth in Electricity generation sector we generally take 8%.

b) Coal fired Electricity Generation capacity is around 55% of total capacity generation.

<table>
<thead>
<tr>
<th>Year</th>
<th>Coal Gross Imports</th>
<th>Coal Net</th>
<th>Crude Oil Gross Imports</th>
<th>Crude Oil Net</th>
<th>Petroleum Products Gross Imports</th>
<th>Petroleum Products Net Imports</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Imports</td>
<td>Exports</td>
<td>Net Imports</td>
<td>Imports</td>
<td>Exports</td>
<td>Net Imports</td>
</tr>
<tr>
<td>1970-71</td>
<td>0.00</td>
<td>0.04</td>
<td>-0.04</td>
<td>11.08</td>
<td>0.00</td>
<td>11.08</td>
</tr>
<tr>
<td>1975-76</td>
<td>0.00</td>
<td>0.44</td>
<td>-0.44</td>
<td>13.62</td>
<td>0.00</td>
<td>13.62</td>
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<tr>
<td>1980-81</td>
<td>0.05</td>
<td>0.11</td>
<td>0.44</td>
<td>16.25</td>
<td>0.00</td>
<td>16.25</td>
</tr>
<tr>
<td>1985-86</td>
<td>2.03</td>
<td>0.21</td>
<td>1.82</td>
<td>15.14</td>
<td>0.53</td>
<td>14.62</td>
</tr>
<tr>
<td>1990-91</td>
<td>4.50</td>
<td>0.10</td>
<td>4.40</td>
<td>20.70</td>
<td>0.00</td>
<td>20.70</td>
</tr>
<tr>
<td>1995-96</td>
<td>8.87</td>
<td>0.09</td>
<td>8.78</td>
<td>27.34</td>
<td>0.00</td>
<td>27.34</td>
</tr>
<tr>
<td>2000-01</td>
<td>20.93</td>
<td>1.29</td>
<td>19.64</td>
<td>74.10</td>
<td>0.00</td>
<td>74.10</td>
</tr>
<tr>
<td>2005-06</td>
<td>38.59</td>
<td>1.59</td>
<td>36.60</td>
<td>99.41</td>
<td>0.00</td>
<td>99.41</td>
</tr>
<tr>
<td>2006-07</td>
<td>43.08</td>
<td>1.55</td>
<td>41.53</td>
<td>111.50</td>
<td>0.00</td>
<td>111.50</td>
</tr>
<tr>
<td>2007-08</td>
<td>49.79</td>
<td>1.63</td>
<td>48.17</td>
<td>121.67</td>
<td>0.00</td>
<td>121.67</td>
</tr>
<tr>
<td>2008-09</td>
<td>59.00</td>
<td>2.17</td>
<td>56.83</td>
<td>132.78</td>
<td>0.00</td>
<td>132.78</td>
</tr>
<tr>
<td>2009-10</td>
<td>73.26</td>
<td>2.45</td>
<td>70.80</td>
<td>159.26</td>
<td>0.00</td>
<td>159.26</td>
</tr>
<tr>
<td>2010-11(e)</td>
<td>68.92</td>
<td>4.41</td>
<td>64.51</td>
<td>163.59</td>
<td>0.00</td>
<td>163.59</td>
</tr>
</tbody>
</table>

Growth rate of
2010-11 over 2009-10(%) -5.92 79.67 -8.89 2.72 - 2.72 18.24 16.01 15.10

Source: www.mospi.gov.in

Thermal coal Requirement as per the Installed capacity of power plant:

Installed capacity of power plant in India = 105931MW
Installed capacity in watt = 1.05931E+11
Power plant load factor is 75% = 85336783000
Here plant load factor 75% which is given in CEA website.
An Analytical Study On New Management Technique In Imported Thermal Coal For Coal Based Thermal Power Plants I India.

Dr. Sameet Gupta, Dr. M. S. Pahwa and Mr. Ankur Gupta

Source: Central Electricity Authority, General Review 2010-11 & Annual Report 2011-12

Coal requirement:

Coal calorific value generally we take 5500.

**Gross calorific value of India coal is 5500 to 6000 (source CIL)**

Cal per kg = 5500000

In joule per kg = 22990000

Thermal Coal Requirement = installed capacity/calorific value

Kg/sec = 3455.77425

Kg/day = 298578895.2

Kg/year = 1.08981E+11

In MT = 108981296.7

In MMT = 108.9812

Let Efficiency of thermal Power plant in India is 30% (coal conversion efficiency of power plant)

(Source CIL, CEA)

**EFFIENCY:** This means conversion of coal into heat generation of Indian thermal power plant is 30%. This factor depends upon the technology advancement.

Such that net coal Requirement = 108.9812*100/30 = 363.270

**CONSUMING SECTOR CONSUMPTION % SHARE IN CONSUMPTION OF THERMAL COAL:**

<table>
<thead>
<tr>
<th>SECTOR</th>
<th>PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Utility</td>
<td>68</td>
</tr>
<tr>
<td>Power Captive</td>
<td>7</td>
</tr>
<tr>
<td>Steel</td>
<td>3</td>
</tr>
<tr>
<td>Sponge Iron</td>
<td>5</td>
</tr>
<tr>
<td>Cement</td>
<td>3</td>
</tr>
<tr>
<td>Others</td>
<td>14</td>
</tr>
</tbody>
</table>

Source: CIL, MoC
An Analytical Study On New Management Technique In Imported Thermal Coal For Coal Based Thermal Power Plants In India.

-Dr. Sumeet Gupta, Dr. M. S. Pahwa and Mr. Ankur Gupta

Such that total Requirement of Thermal Coal Taking all sectors:

\[ = 363.27 \times 100/75 \]

\[ = 484.3613 \text{ MMT} \]

In 2011 Domestic supply of coal was

From CIL = 389.97 MMT

Other = 24.89

NET IMPORT = consumption--domestic supply

Such that we have imported thermal coal in 2011-2012 was 70 MMT.

So from the above calculation we can find requirement of coal in future:

- If installed capacity increase in future.
- If production of domestic supply decrease.
- If GCV value of coal increase.
- Plant load factor increase.

Compound annual Growth rate of Coal Production in Indian is 4.36%.

Compound annual Growth rate of Thermal power plant is 7.09%.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>INSTALLED CAPACITY IN (MW)</th>
<th>REQUIREMENT OF THERMAL COAL(MMT)</th>
<th>DOMESTIC PRODUCTION OF THERMAL COAL(MMT)</th>
<th>IMPORT REQUIREMENT OF THERMAL COAL(MMT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>105931</td>
<td>484.36</td>
<td>418.42</td>
<td>65.94</td>
</tr>
<tr>
<td>2012</td>
<td>113441</td>
<td>518.700</td>
<td>434.7</td>
<td>84</td>
</tr>
<tr>
<td>2013</td>
<td>121384</td>
<td>555</td>
<td>446.59</td>
<td>108.4</td>
</tr>
<tr>
<td>2014</td>
<td>130097</td>
<td>594.85</td>
<td>462.288</td>
<td>132.5</td>
</tr>
<tr>
<td>2015</td>
<td>139321</td>
<td>637.0345</td>
<td>476.909</td>
<td>160</td>
</tr>
</tbody>
</table>
FINDING

The finding of the research can be interpreted as:

Requirement of coal import in future depends upon the installed capacity of thermal power plant.

Gap between demand and supply can be reduced by domestic production as well as import.

Gap can also be reduced by technological upgradation of thermal power plant to increase efficiency which is now 30%.

Increment in plant load factor also reduce gap.

Less dependent on coal power plant and installed solar. Wind power plant.

Use better quality of coal can be used to reduce our import.

CONCLUSION

India’s primary source of energy is coal based thermal power plant. Fulfillment of demand of coal is essential part of economy such that need of import of coal become essential, but the price of imported coal is much higher than domestic coal. So to minimize the import of coal domestic production as well as technical advancement plays a major role.

RECOMMENDATION

Due to the international coal price volatility the economics of power generation in India is getting hampered and it is creating a cost pressure on the consumers. It has also pointed out that the international availability of coal is going to be restricted due to concerns on climate change.

"International prices of coal are also likely to remain high because of taxes which are being imposed by several coal producing countries, including Australia and Indonesia. In order to minimize import and also to reduce risk in supply deficit following measure can be taken up by Indian economy:

1) Improve coal plant efficiency which is now 30% with the help of technical advancement.
2) Increase production of CIL by maximum utilization of resource. Such that increase domestic supply of coal so that less depends on import.
3) Generally coal calorific value is less compared to other energy resources so choose other alternative of resource we can minimize our import.

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