

Environmentally Benign Coal Mining: Target One Billion Tonne Coal Production by CIL by 2019-20

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ABSTRACT

Coal is the most abundant fuel resource in India. Coal is the major source of energy and is the principal contributor for the industrial growth of the developing nation like India. Coal is a bridge component in a current, balanced energy group. It is connection for the future as a vital low cost energy solution for achieving sustainability challenges for competing with the developed countries. The largest consumer of coal in India is power sector, and the industrial sector is coming next to power sector. The major consumption of coal in India is in steel plant, cement plant and brick-manufacturing units. 52% of primary energy is coal dependent¹. About 66% of India's power generation is based upon coal production¹. While coal is considered the most significant element for the growth of country, it faces major and massive social and environmental issues. Environmental worries are the most important parameter for the coal industry's future. In comparison to the other fossil fuels, coal is more pollution causing and less energy efficient. Coal has an important role in fulfillment of current needs. 212.10 Million Tonnes of coal was imported in the financial year 2014-15². The coal demand will be increasing due to increase in electricity demand of the country. Coal India being the largest producer of coal in India has to plan accordingly to fulfill the coal demand of country. A road map for enhancement of coal production up to 1 Billion of coal by 2019-2020 has been prepared by Coal India³. Due to coal mining the key environmental impacts are on air, water, land, forest, biodiversity, and climate etc. The biggest challenge is to put on the innovative technologies in the most efficient and environmentally friendly manner and to solve social issues by taking care of the implementation of rehabilitation and resettlement (R&R). Thrust is now to promote inclusive growth of mining areas by adequate corporate social responsibilities (CSR) activities^{4,5}. Thus the target 1 Billion of coal production by 2019-2020 may be achieved by proper implementation environmentally benign coal mining for the fulfillment of the growing demand of electricity of India.

Keywords: Coal Production, Coal demand-Supply, Environmental Impacts, Environmental Measures Adopted, Land Acquisition, Corporate Social Responsibility (CSR) and Rehabilitation and Resettlement (R&R).

INTRODUCTION

Coal is the most abundant fuel resource in India. Coal is the major source of energy and is the principal contributor for the industrial growth of the developing nation like India. Coal is a bridge component in a current, balanced energy group. It is connection for the future as a vital low cost energy

solution for achieving sustainability challenges for competing with the developed countries. The largest consumer of coal in India is power sector, and the industrial sector is coming next to power sector. The major consumption of coal in India is in steel plant, cement plant and brick-manufacturing units. 52% of primary energy is coal dependent¹. About 66% of India's power generation is based

upon coal production¹. While coal is considered the most significant element for the growth of country, it faces major and massive social and environmental issues. Environmental worries are the most important parameter for the coal industry's future. In comparison to the other fossil fuels, coal is more pollution causing and less energy efficient. Due to coal mining the key environmental impacts are on air, water, land, forest, biodiversity, and climate etc. Even though there are so many issues coal will remain an imminent foundation and a fundament of India's economy. The Coal resource has an important role in fulfillment of present needs. 212.10 Million Tonnes of coal was imported in the financial year 2014-15². The coal demand will be increasing due to increase in electricity demand of the country. Coal India being the largest producer of coal in India has to plan accordingly to fulfill the coal demand of country. A road map for enhancement of coal production up to 1 Billion of coal by 2019-2020 has been prepared by Coal India.

In terms of coal production, Coal India Limited (CIL) is the biggest company on the Earth. CIL is a state owned coal mining company. It has come into the existence from 1st November 1975 after the organization of private coal mines under



Fig. 1: Map of India Showing Coal and Lignite Resources⁷

one umbrella by the Government of India⁶. In the Starting year of the CIL its initial production was 79 Million Tonnes (MTs). But at present is the single largest coal producer company on the earth. The coal India at present Operating with 82 mining areas, 7 coal producing subsidiary and 1 subsidiary for mine planning and design institute spread in 8 states of India⁶.

Target 1 Billion Coal Production

Coal India Limited alone produces 81% of total coal produced in India. In India about 97-100 Thermal power plant is running on the coal supplied by Coal India Limited¹. Due to increasing demand of electricity and inclusive growth of India there is need of enhancement of coal production. The biggest Challenge for coal India Limited is to meet the increasing demand from the Power sector. It was realized the idea of increasing the production to 1 Billion by 2019-20 to fulfill the demand of the power sectors. The Coal import (Million tonnes) by India is as under:

Major Challenges

The major challenges for achieving the target 1 Billion coal by 2019-20 are: Land acquisition problem, Environmental and Forest Clearance from Ministry of Environment and Forest, improvement of railway lines and transportation system, Introduction of fully mechanized and latest technology, Employees skill up gradation and deployment of sufficient manpower^{3,8, and 9}. Coal mining is a site specific activity. The first basic requirement for initiating coal industry is requirement of Land resource. Land acquisition for coal mining is the biggest problem. To sort out the land acquisition problem is required to implement Rehabilitation and Resettlement (R&R).



Fig. 2: Single tier, Mono culture plantation

The major pollution contribution to air pollution in the coal mining area is due to the dust generated during the coal transportation^{1, 10, and 11}. The pollution from the transportation may be mitigated with the improvement of road quality and by minimizing the road transportation. Introduction of mechanically covered truck will be helpful in subside the major coal dust addition in the environment during the road transportation^{1,11}. The skill development of employees, by technology transfer from other coal producing countries will help in the achievement of the target.

Environmental Issues

During underground and opencast coal mining the main activities are drilling of bore holes, blasting and loosening of coal seams, extraction of coal reserve and transportation of coal from mines to siding or to coal washeries¹¹. The above Mining activities impact the environment and ecology badly, unless impart of planned and controlled ecofriendly methods. Hence it is required for need of equilibrium between mining related activities and environmental benign coal mining. The anticipated impacts of coal mining on surroundings and corresponding mitigation methods for achieving the gigantic target of 1 Billion Coal by 2019-20 is as follows:

Impact on Air Quality

The main air pollution due to coal mines are the fugitive dust emissions of particulate matter (PM) and gaseous emission like CH₄ (Methane), SO₂ (Sulphur dioxide), NO_x (Oxides of nitrogen) and CO (carbon monoxide) etc¹. In major of the mining activities dust particle are produced. The important activities generating dust emissions are drilling, blasting, transportation through hauling road, loading and unloading at sidings, transportation from sidings towards washeries or power plants and crushing of coal in coal washeries. The dust generated in mines can be primary dust sources and secondary

dust sources. The primary source directly generates the dust emission whereas the secondary sources spread the dust emission and carry it from one point to another points also known as fugitive dust^{12,13}. The coal mining operations are mainly of two types opencast mining (OCP) and Underground mining (UGP). In view of air pollution the OCP is more severe than UGP. Suspended particulate matter (SPM) increases respiratory system related diseases such as asthma, bronchitis, skin diseases, allergic reactions, eye irritations etc. Whereas gaseous emissions like CH₄ (Methane), SO₂ (Sulphur dioxide), NO_x (Oxides of nitrogen) and CO (carbon monoxide) contribute towards global warming^{1,14}. The dust emission also contribute in the poor visibility, failure of mining equipments, incremental maintenance cost of equipments and affects ambient air quality nearby the core zone of mining activities. The generated dust can also contribute pollution and suspended particles in neighboring surface waters and may affect agriculture and.

Greenhouse gases (GHG) and acid rain

The main environmental problems faced by the coal and its allied industries like power plants, steel plants are the production of greenhouse gases and acid rain, which impacts at local, regional and global levels¹⁴. In greenhouse effect increases the earth's atmospheric temperature due to the existence of gases like methane, CO etc. The natural phenomenon is being disturbed by the buildup of gases caused by human activity.

Due to the burning of coal and other kind of fossil fuels, Carbon dioxide is produced which is associated to global warming. Due to the burning of coal emissions of nitrous oxides (NO_x) and sulphur dioxide (SO₂) is produced which is accountable for the production of 'acid rain'. Acid rain occurs by the reaction of SO₂ and NO_x, water (H₂O), oxygen (O₂) and other chemicals to form acidic compounds in the atmosphere.

Table 1: The Coal import (Million tonnes) by India²

Coal	2011-12	2012-13	2013-14	2014-15 (Prov.)	2015-16 up to Oct 15
Coking Coal	31.80	35.56	36.87	43.71	26.78
Non-Coking Coal	71.05	110.23	129.99	168.39	84.90
Total Coal Import	102.85	145.79	166.86	212.10	111.68

Coal Mine Fires

The mine fires most probably occurs due to spontaneous heating through two interconnected processes between oxygen coal contact or oxidation process and the thermal process. The fire spreads and reaches in the strata. About 10% of total national coal resources are in the fire-affected areas¹⁵. There are several environmental problems due to mine fires other than safety hazards and loss of precious coal resource. As a result of coal burning, it results gaseous pollution to the surrounding areas, damage to properties and structure, problem of subsidence, unstable surface area, difficulty in underground mining etc.

Impact on Water regime

Mining operations are relatively limited in geographical extent, being wholly predicted to the occurrence of mineral or fossil fuel deposits, which are restricted to specific geological milieus. The mining involves extraction of earth material and creation of voids that alter the water regime and the water balance. Even after reclamation, such mixed out voids are largely filled up by material or waste that have an infra-formational geometry quite different from original rocks. The consequent changes in the natural pattern are largely irreversible.

Due to coal mining the hydrological regime of the mining lease hold area is altered which affects the water quality. Creation of large surface mines and quarries directly alter the ground water gradient and flow, affecting the extraction potential of aquifers for other uses¹⁴. Even if pumped for reuse, the mines water may have harmful particulates and ingredients. In Gondwana terrains, there is considerable lateral groundwater movement through the open industrial



Fig. 3: Three Tier Plantation

spaces of the rocks and their joints, fractures and faults zones. As such, pollution does spread fairly easily. The situation becomes more critical where mining areas are fringed by alluvial basins or valleys that have considerable thickness of porous and permeable sandy horizons, often near surface. These facilitate transmission of polluted waters.

There is huge water loss by evaporation during the spraying of water on haul roads, coal handling points (CHPs) and railway siding.

Acid Mine Drainage

Acid mine drainage (AMD) is one of the major environmental problems in the coal mining areas. Acid mine drainage is a type of wastewater generated from the reaction of sulfide minerals available in coal seams and metallic ferrous ore present. The AMD contamination to surface water precipitates along stream beds of brightly colored orange or yellow secondary iron and sulfur minerals. Due to AMD water pollution fishes and other aquatic life is being disturbed, corrosion of mining equipment and damage to structures occurs.

In India except North Eastern Coalfield (NEC) all coalfields are free of AMD problems¹⁴.

Impact on Land

Mining is site specific the main requirement for coal mining is land. Mining operations despoil the land. In case of underground mining there are mainly subsidence and solid waste disposal problem. In case of opencast mining problems are like (i) Large waste dumps in the vicinity of opencast mines (Overburden and mineral wastes) (ii) Huge void left after excavation (iii) Rapid erosion of land, slope stability problems (iv) Silting and degradation of streams and water bodies caused by erosion of soil (v) Deforestation etc.

Impact of Noise and Vibrations

The activities like blasting, operation of heavy duty machinery and HEMM, crushing, screening, loading and unloading operations in coal handling plants and coal washeries, etc. cause serious noise pollution. The impact of noise pollution does not visible but it is equally contributing like land, water, and air pollution¹⁶.

The noise pollution causes hearing loss. It also effects work performance of the workers. Due to noise pollution communications becomes difficult during the operations. Other than this, the fauna in the core-buffer zone of the mining area is also being effected due to noise pollution. Sensitivity to noise and vibrations of wildlife is much more than the human beings¹⁷.

Environmental Measures Adopted Air Pollution Control Measures

The major source of dust generation in coal mining operation is due to the improper maintenance of haul roads. This can be mitigated by the water sprinkling by mobile and fixed sprinklers. The adequate quantity of dust is generated during the transportation of coal through uncovered truck. By the use of mechanically covered trucks this can be mitigated. The other important activities generating dust emissions are drilling and blasting. By the use of new technology like Surface miner, electrical HEMMs, in pit crushing method, enclosed belt conveyor the dust emission can be controlled.

Water Pollution Control Measures

Water passing through the OB dump carries sediments along with its flow. Construction of the Siltation pond and sedimentation pond may be useful in the capturing the sediments flow. The provision of Effluent Treatment Plant (ETPs) for the workshop effluents and sewage treatment plant (STPs) for the domestic effluent treatment will be helpful in the water pollution control¹⁸. The treated water may be utilized in the sprinklers for dust suppression and for irrigation in gardens. The mine water after primary treatment and disinfection may be utilized for water supply for the nearby villagers of the coal mines.

Noise & Vibration Mitigation Measures

The impacts of Noise pollution can be minimized by providing equipment attached with absorbing device for noise and vibration. It can be mitigated by the use of insulated cabins for operators, by providing ear muffs to the workers working in high noise source zone. Plantation of trees around the plant area will reduce the noise pollution to the surrounding areas. Regular maintenance and replacement of defective parts of

mechanaries and the use of silencer for equipments will be very much helpful in the mitigation of noise pollution caused in the coal mines, which will increase the ability of workers in the achievement of high coal production to reduce import of coal and for the inclusive growth^{16,17}.

Ecological Restoration

The ecological restoration is to establish a three-tier vegetation comprising of native species grasses as lower tier, shrubs and bushes as middle tier and trees as upper tier with an objective to establish biodiversity and food chain; to improve the local climate regime and socio-economic condition¹⁹. Removal of invasive weeds and addition of biomass to the degraded land creates an opportunity for the native species to germinate and establish biodiversity.

Land acquisition and Rehabilitation and Resettlement (R & R)

Land is basic requirement for mining. Mining industry requires large area of land for developing mine and necessary infrastructure. The land acquisition for mining purposes, affects the lives and livelihood of the peoples residing in the area. The development of new mines creates job opportunities for the local villagers, but it also abolishes many traditional sources of income along with the cultural heritage. Land Acquisition and Environmental clearances (EC) are main hindrance in start-up of the mining Projects.

For crossing the hindrance from the Land acquisition the company should design to overcome all the impacts for the land losers by conducting proper socio-economic studies. By the generation of baseline data on socio economic survey the status of project affected peoples (PAP'S) may be assessed in detail. The socio economic study must include the loss of particulars identity, the change in way of life, the dispersion of closeness of communities, the loss of cultural heritage, the loss of emotional affection from the mother land, and so on. With the detailed assessment it may be formulated the proposed action as per the Rehabilitation and Resettlement (R & R) policy of the company.

CONCLUSION

Due to coal mining the key environmental impacts are on air, water, land, forest, biodiversity, and climate etc. Even though there are so many issues coal will continue an imminent foundation and a fundament of India's economy. The coal resource has an important role in fulfillment of existing needs. The biggest challenge is to put on the innovative technologies in the most efficient and environmentally friendly manner. By solving social issues with the care of the implementation of

rehabilitation and resettlement (R&R). Thus the target One Billion of coal production by 2019-2020 may be achieved by proper implementation environmentally benign coal mining for the fulfilment of the growing demand of electricity of India.

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