UPDATE

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A special issue on Coal released on the eve of Delhi Forum - mm&P - Cellano Group *Workshop on Social and Environmental Costs of Coal Mining*

This document provides a brief overview of the energy scenario, importance of coal in India's Commercial Energy needs, the impacts of coal mining and use and the options. An elaborate compilation on Coal Mining in India will be released shortly.

ENERGY SCENARIO IN INDIA

India is a country of about a billion people. It is vast in dimensions and the diversity of situations. Despite its huge dependence on non-commercial fuel sources, Commercial Energy generation and use are of enormous magnitude. In order to develop its commercial sources, India opted for a planned economy after independence. Energy Planning in India is still largely restricted to the conventional large-scale energy generation systems and was narrowly conceived as the Power Sector. The focus has been to increase total power capacity with very little effort to look into the operational aspects of these projects. The Power sector continues to be a major sector in the Planned economy and an area of major concern in the new liberalised economic regime. It is no doubt that the State's policies towards commercialisation raised host of issues associated with the exploration, extraction and use of fuel resources.

India's per capita commercial energy consumption at the time of independence was a mere 15.6 kWh and by 1991 had shot up to 315 KwH. The energy requirement which was estimated at 376 kWh in 1995 is now estimated at 502 kWh (MEA, 98). Further more, the demand for power is relentlessly raising. In order to keep the existing overall growth rates sustained it is estimated that an additional 83,000 MW capacity should be added in the next ten years. Since Independence the emphasis has been on 'supply', even though in the recent periods there has been some shift towards 'demand' management. The growth of a large segment of urban and industrial consumers has meant that the demand is outstripping the demand and the reliability of power in the rural areas, wherever it has reached, will continue to remain as they are with `brown-outs' extending to several months in a year.

Large-scale power development is also going through major crises. The prime issue in the mind of current developers is in terms of the investments needed. Currently, estimates for the additional capacity installation are put at 83 billion US dollars. The larger the scale there is a severe lack of institutions that can efficiently manage them. The social and environmental costs associated with them are still not adequately understood, leave alone any significant positive efforts. In the last two decades there has been a growing realisation of the global warming implications of fossil fuel use that might eventually force us to abandon some of the fossil fuels. In fact, none of the major power projects, some of which were given the privilege of being `fast-track' projects have been stuck for want of financial closures or the projects being intrinsically unviable. Almost all have to also face litigations from various quarters, given that the entire life cycle of the power project there are violations of law.

Coal is the most significant fuel, accounting for more than half of the primary commercial energy available in India. The ratio of power generated through large-scale conventional Hydro-, Thermal and nuclear systems have over the last three decades seen a distinct shift towards Coal. These plants run into severe problems of installation and expansion. Poor plant-load factors, poor transmission and distribution infrastructure, increased awareness of environmental and social costs, the financial losses due to uneconomic pricing and poor collection continue to mar its effective development and utilisation. This increases the demand for mining greater quantum of material and in larger area, causing impact to larger number of people and vast tracts of the

land. Coal production has already increased almost eight times in the last three decades.

Indeed, there has been a view that Governments and their decision-makers have been more keen on capital-intensive generation programmes and populist measures rather than improving the effective use of the already existing capacity (E.A.S Sarma, 2001). The power sector has been one of the major areas of State investments. Despite this, there has been a considerable shortfall in power generation. The total installed capacity in the country at the beginning of the IX Plan is 86,000 MW (Planning Commission, 98). Energy deficit is currently estimated at 12 percent and the peaking shortage is up to eighteen percent.

COAL IN INDIA

Geographical Distribution of Coal

The major coal deposits occur along the present day river valleys of Damodar, Koel, Sone-Mahanadi, Pench-Kanhan, Pranhita-Godavari. These deposits have been formed during the Upper Paleozoic Permo-Carboniferous period, roughly 300 million ago. The contiguous landmass of Antartica, Africa, Australia and the Indian Sub-continent, called the Gondwanaland existed during this period and even coal deposits are found in correlatable horizons. But for some small lenticular deposits in the Himalayan foothills, all of the Gondwana coals in India occur in the South-West quadrant of the country. There are nearly 50 coalfields each varying in size from a few square kilometers to mega-size of 1500 square kilometers. The thickness of the mineable deposits also vary significantly from the minimum being half a meter to very thick coal seams of over 150 meters. The coals are largely bituminous or sub-bituminous with very high ash content and low sulphur and phosporus.

There are over 20 small coalfields formed in the Tertiary eocene-Oligocene period, roughly 25-60 million years ago constituting about one percent of the coal deposits. These deposits occue in the Northeast along the Naga, Mikir, Khasi-Jaintia hills and also in Jammu. Workable lignite deposits are found in widely separated areas such as Jammu, Rajasthan, Gujarat and Tamil Nadu. Neyveli in Tamilnadu has the largest lignite mine and associated power generation projects.

Coal Mining in India

Coal has been in use in India from time immemorial. The use of mined coal is also known from various coal mining regions. The commercial mining began during the British regime under Warren Hastings when a private company was allowed to mine from the Raniganj Coal Fields in West Bengal. The British also soon had the Geological Survey of India to systematically map the Coal occurrences. Ever since the organisation continues to map in greater and greater detail coal occurrences in the country and establishes the reserves.

Mining of Coal in India has been largely undertaken by Coal India Limited and its subsidiaries following the nationalisation of all coal companies in the early seventies. There are a few private collieries captive to large Steel and Cement Companies. The Singareni Collieries in Andhra Pradesh is a joint venture of the State Government and the Central Government.

The current reserves in various categories are estimated at 208 Billion Tonnes. The reserves comprise of only 15 per cent coking coal. The rest are non-coking coals with only 13 percent of relatively superior quality with an ash content of less than 24 per cent.

The estimated demand for Coal in the key sectors is as follows (Ministry of Coal, GOI, 99):

Sector	**Demand (MT) 2001-2002**	**Demand (MT) 2004-2005**
Coking Coal Iron and Steel Industry	51.6	54.9
Non-Coking Coal		
Power	265.8	370.7
Cement	21.4	30.0
Others	71.1	75.5
Total	**409.9**	**531.1**

The Impacts of Coal Mining

The impacts of Mining has been descriptively captured as `Mining is a devastating operation that not only destroys the natural ecosystems, particularly if it is surface mining, but also introduces tremendous distortions into the social fabric. The associated problems of deforestation, waste disposal, water pollution, air pollution, dereliction, vibrations from blasting, land collapse and drop in water table are of course marked and perhaps to be expected in every mining operations. But little attention has been paid to the fact that most mining is in remote tribal areas and the impact on health, hygiene, sanitation, accidents, increased intensity of work, market prices, prostitution and anti-social activities are a necessary corollary of mining as it is practiced today' (Roy, 85).

The fact that the shift in coal mining to larger open-cast mines necessarily means a dramatic increase in the magnitude of all these impacts with the indigenous communities at the receiving end. The first and the foremost are the acquisition of personal and community land, which robs people of their basic livelihood opportunities. A huge quantum of land has already been leased to mining companies; the nearly doubling in the short-run would mean what was cumulated over a century of mining will be replayed in a short span of time, allowing no possibility of people to adjust. The Coal industry and its financiers have virtually given up on their abilities to rehabilitate people, despite huge and well-orchestrated propaganda about social responsibilities. The World Bank, reflecting this, had diluted its effort to `Income Restoration' and that too after a considerable `transition time' and pompously held a workshop to highlight such efforts. The Coal Industry, which is largely in the tribal regions (Schedule V States), comes under the purview of a Supreme Court Judgement which seeks to set aside 20 per cent of the profits annually for local development. The same Judgement has instructed the Governments to explore the possibility of setting up cooperatives wholly composed of tribals to undertake mining. The State and the Coal Companies have been morbidly silent on this account. There are numerous examples generated through detailed case studies in region after region of the brutalities and deprivations attached with displacement. The effort of the Government, on the other hand, seems to be to make land acquisition easier and cheaper for the industry.

Once the mining activity begins in an area, the visual impacts, caused by scarring the landscape with rapid deforestation and digging, is prominent. The noise and dust pollution particularly during the development and construction phase, general nuisance due to transport, and the air and water pollution associated with the operations have to be faced by the local communities. Local communities in these areas and in newer areas have continued to struggle for their rights getting more and more determined to voice their opposition to a system of development that deprives them rather than enriches them. In some of the coal bearing areas the multiple displacements and conditions in relocated sites that people have suffered are appalling. The valuation of assets lost by local communities is biased to the mining industry with laws favouring the State to take unilateral decision on land acquisition.

There are several other impacts of Coal mining, some very exclusive to it, considering the quality and nature of the material. Geochemically, Indian coal deposits are a repository of a variety of toxic heavy metals in trace quantities. Even with as low as one gram/tonne of such metal in coal, the projected demand of 531 million tonnes that coal industry throws into the environment over 5000 tonnes of heavy metal, the cumulative effect of which is devastating. It is also known that some of these trace elements are radiogenic whose impacts are little known in the context of coal mines.

The high proportion of ash in Indian Coals means nearly a third of the material mined has to be disposed back as burnt solid waste. This means enormous efficiency losses as well as problems associated with disposal of such huge quantities. While there have been attempts to convert them into fly-ash bricks and other building materials, the downstream problems associated with the use of such potentially radiogenic wastes on human health would be enormous.

Generation of GHGs and Implications to Global Warming

Coal burning alone is estimated to consume 7 Billion Tonnes of Oxygen and adds 10 Billion tonnes of Carbon-di-oxide into the atmosphere. Since the industrial revolution about 100 Billion Tonnes of carbon-di-oxide would have been added to the atmosphere. The carbon-di-oxide emissions in India are currently estimated to be of the order of 1191 teragrams. The contribution of coal-fired power generation accounts for roughly a sixth of the fossil energy consumption and contributes a quarter of the carbon-di-oxide released from fossil fuels.

In the light of the debates surrounding the Framework Convention on Climate Change, several insidious mechanisms are being introduced to continue the use of coal in the richer nations such as the idea of imposing a Carbon tax in relation to the carbon-di-oxide emitted. This will bring in additional cost burden to the manufacturers in the developing countries, who are already reeling under price pressure, and eventually would need larger quantums to be mined for being economically viable. The second such move is the idea of Carbon trading where a country can trade its quota of emissions with other countries on a financial consideration. This will bring serious distortions in the use of fuel resources in different parts of the world and obviously the poorer nations will be forced to bear most, if not all, the costs. While the problems associated with coal and other fossil fuels themselves are of a gigantic magnitude, the global rich are trying to claim in the midst of the din that nuclear energy is a `clean technology', meriting admittance into negotiations on Clean Development Mechanisms.

The Options

The dependence on Coal is going to be getting larger. In the coal mining areas itself there has been the potential of Coal-Bed Methane, which has been the cause for several accidents in coalmines as a source of fuel. It is estimated that nearly 1.5 TMC of gas could be extracted from coal semas in India. More stringent measures from exploration to final disposal could bring in some marginal improvements considering the massive expansion it is slated for. The most obvious and perhaps inevitable option is a massive shift towards renewables. The importance of increasing use of renewable energy sources in the transition to a sustainable energy base was recognised in India even before Independence; people like Mahatma Gandhi emphasised the importance of use the of cow-dung and other fuels efficiently. However it was only in the seventies, particularly after the first oil-crises, that the state made an active effort to promote renewable energy systems. During the past quarter century, some effort has gone into the development, trial and induction of a variety of renewable energy technologies for use in different sectors of economy and sections of society in India.

Despite its current status, India has a tremendous potential for power generation and has several unique advantages in renewable energy and latest estimates place them at over 50,000 MW. `India has today among the world's largest programmes for renewable energy. Our activities cover all major renewable energy sources of interest to us, such as, Biogas, biomass, solar energy, wind energy, small hydropower and the other emerging technologies. In each of these areas, we have programmes of resource assessment, R&D, technology development and demonstration. Several renewable energy systems and products are now not only commercially available, but are also economically viable in comparison to fossil fuels, particularly when the environmental costs of fossil fuels are taken into account' (MNES `99). Currently renewable energy power generation capacity forms about 1.5% of total installed power generation capacity in India, and therefore needs vigorous promotion and establishing institutional systems to develop additional capacity and manage the systems at decentralised level. There are also several options for direct thermal applications using solar technologies and more efficient use of bio-fuels.

RENEWABLE ENERGY SOURCES POTENTIAL IN INDIA

A. Power Generation

Sl. No.	Sources/Technologies	Units *	Approximate Potential

1.	Wind Power	MW	20,000
2.	Small Hydro Power(upto 15 MW)	MW	10,000
3.	Biomass Power	MW	17,000
4.	Biomass based Cogeneration	MW	3,500
5.	Solar Photovoltaic Power	MW/Sq. Km.	20
6.	Urban & Industrial Waste based power	MW	1700
SOURCE: MNES, 1999			

- In addition, there is a large potential for Ocean Thermal Energy Conversion, Sea Wave and Tidal Power, which are being estimated at 79000 MW (MEA, 98).

B. Thermal Applications

Sl No.	Sources/Technologies	Units *	Approximate Potential
1.	Solar Thermal System Solar Water Heating Systems	MW/Sq.Km (Million Square Meter Collector Area)	35 30
3.	Improved Biomass Chulha (Cookstoves)	Million	120
SOURCE: MNES, 1999			

India prides itself as being a front-runner in the area of alternate energy and has a very encouraging policy framework. The key elements, as enunciated by the Ninth Plan, are:

1) Creating necessary institutional mechanism for R&D, demand development through market mechanism, mandatory use of established technologies, amendments of Electricity Acts for absorption of Non-Conventional power into the grid, creation of infrastructure for repair, maintenance etc.
2) taking necessary steps to remove administrative bottlenecks, if any, and reverse the slow down in critical areas of promoting non-conventional energy sources, and
3) Giving thrust to co-generation programme in industries to meet their power needs and sell surplus to the utilities.

Indeed, the spread of various renewable energy technologies has been aided by a variety of policy and support measures by Government. The policy is clearly directed towards a greater thrust on over all development and promotion of renewable energy technologies and applications. The recent policy measures provide excellent opportunities for increased investment in this sector, technology up-gradation, induction of new technologies, market-development and export promotion.

Major policy initiatives taken to encourage private/foreign direct investment to tap energy from renewable energy sources include provision of fiscal and financial incentives under a wide range of programmes being implemented by the Ministry and simplification of procedures for private investment, including foreign direct investment in renewable energy projects. A host of fiscal incentives and facilities are available to both manufacturers and users of renewable energy systems, which include:

1. 100% accelerated depreciation for tax purposes in the first year of the installation of projects/systems.
2. No excise duty on manufacture of most of the finished products.
3. Low import tariffs for capital equipment and most of the materials and components.
4. Soft loans to manufacturers and users for commercial and near commecial technologies.
5. Five-year tax holiday for power generation projects.
6. Remunerative price under alternate power purchase policy by State Government for the power generated through renewable energy systems, fed to the grid by private sector.
7. Facility for Banking and wheeling of power.
8. Facility for Third party sale of renewable energy power.

9. Financial Incentives/Subsidies for devices with high initial cost.
10. Involvement of women not only as beneficiaries but also for their active contribution in implementation of renewable energy programmes.
11. Encouragement to NGOs and small entrepreneurs.
12. Special thrust for renewable energy in northeastern region of the country. 10% of Plan funds earmarked for North-East towards enhanced and special subsidies.
13. Allotment of land on long term basis at token lease rent and supply of garbage free of cost at project site by State Governments, in respect of projects on energy recovery from municipal waste.

Despite the abundant potential and the relatively better conditions as compared to several developing countries, the actual capacity generated is still very meagre.

RENEWABLE ENERGY POWER GENERATION CAPACITY (31.03.99)

Source/Technologies	Units	Cumulative Physical Achievements	India's Position in the world
Wind Power	MW	1024	IV
Small Hydro Power (UPTO 15 MW)	MW	183.45	X
Biomass based Power	MW	161.40	IV
Biomass Gasifiers	MW	33.90	I
Solar Photovoltaics	MW	47	III
Energy Recovery from Urban & Industrial Wastes	MW	7.75	
Source: MNES, 1999			

The government has also encouraged several end-use technologies and has and claims an impressive record in terms of the cumulative achievements. However the sustenance of these efforts and expanding upon the base will need several new initiatives, including dramatically changing our existing unsustainable trends in mining, energy generation and management.

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