Coal Assessment and Extraction in India: Issues and Prospects

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Outline

1. Importance of Coal in India
2. Challenges in the Coal Sector
3. Seminar Series on Key Coal Issues
4. Key Issues
   a. Resource/Reserve Assessments
   b. Technologies for coal extraction
   c. Social and Environmental Issues
   d. Human Resource and Capacity Building
   e. Institutional and Pricing Reforms
5. Conclusions
1.0 Electricity and Coal

- Electricity is a key modern energy source
- Electricity is unevenly distributed
  - 490 million people w/o electricity (mostly in rural areas)
- Coal dominates Indian electricity sector
  - Accounts for 53% of commercial energy; 71% of electricity generation
- 80% of domestic coal produced is used for electricity generation in India
- India has significant domestic coal resources – key for energy security

**Sources of Electricity**

**Coal Consumption by Sector**
1.1 Growing demand for electricity

• Electricity generation expected to increase six-fold by 2030
  – 600 TWh in 2004-05 → 3600-4500 TWh by 2030
    (China: 3250 TWh in 2007)

• Future growth of electricity in India is projected to rely heavily on coal
  – 10 GW of coal-power installed 2002-2007
    (China: 90 GW in 2006)
  – 45 GW of coal-power planned for 2007-2012

• Domestic coal production might be unable to cope with demand → Rising imports
1.2 Future Coal Demand

- Indian projections higher than IEA/EIA

More coal mining and coal use in India
1.3 Lifetime coal consumption (power plants)

BAU: Same plant-type distribution as 11th Plan (all using Indian coal)

<table>
<thead>
<tr>
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<th>Existing Plants</th>
<th>11th Plan BAU</th>
<th>6% GDP</th>
<th>8% GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity Growth</td>
<td>11%</td>
<td>4.8%</td>
<td>6.4%</td>
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<tr>
<td>Lifetime Coal consumption (BT)</td>
<td>12.2</td>
<td>24.7</td>
<td>68</td>
<td>91</td>
</tr>
<tr>
<td>Peak coal consumption (MT)</td>
<td>327.3</td>
<td>573.6</td>
<td>1353</td>
<td>1805</td>
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Challenges in Coal Sector
2.0 Challenges in Coal Sector

• Need to meet the rising demand
  – Increasing pace of exploration
  – Upgrade technologies to access deeper coal reserves

• Reduce and manage social issues
  – Resettlement and rehabilitation

• Limit and manage environmental impacts
  – Balance between forests and mining

• Introduction of institutional and pricing reforms

• Human resources and capacity building
3.0 Joint Seminar Series

• Initial interactions with the Indian Planning Commission and ASCI on CCT roadmapping
  – Encouraging discussions with Kirit Parikh, Surya Sethi, & T.L. Sankar

• Initiated a stakeholder-based workshop series to jointly assess problems, policy gaps, and policy solutions in both the coal and the coal power sectors
  – Series to build on Integrated Energy Policy exercise and Sankar Committee work on coal-sector reforms
  – Direct engagement with policymakers and stakeholders
  – Facilitating open “off-the-record” discussions among a wide range of stakeholders
  – Two workshops on the coal sector already held in India
  – Two more planned: a) coal power; b) pricing, regulations, institutions
3.1 Goals of Seminar Series

• Assess the current state of knowledge and gaps
• Determine a plan of action for filling knowledge gaps
• Assess key processes and technologies for more efficient and cleaner coal extraction and power generation
• Set in a motion a process for discussions and resolution of conflicts among different stakeholders
• Help develop a coherent roadmap for the coal and coal-power sector for the coming two to three decades
3.2 Workshop Process

• ETIP team (Ananth Chikkatur & Ambuj Sagar)
  – Research and interviews with various stakeholders
  – Preparation of a “Background Paper,” highlighting key issues, to be
    handed out to participants before each workshop
  – Facilitate discussions during the workshops
  – Convert each Background Paper to a Final Paper (including
    discussions during the workshop) – to be published by Planning
    Commission

• Planning Commission/ASCI (Surya Sethi, Satyamurty, T.L.
  Sankar)
  – Organization and logistics of workshops
  – Review Background and Final Papers
  – Arrange for funding from local sources

• Funding from NTPC, CIL, and SCCL
  – Support for workshops and participants’ travel (if necessary)
  – Support for ETIP team’s travel and research activities (but not
    salaries)
3.3 Policy/Technology Roadmapping

- **Need for a Common Vision**
  - Common vision is necessary for development of better and consensus-based policies
  - Different visions can lead to different approaches and policies
  - Vision must address the challenges and constraints facing the sector
  - Perspectives of different stakeholders (PSUs, private industry, NGOs, citizen groups...) must be taken into account
3.4 Visioning Exercise

- Facilitated a process (w/ gov’t, industry and NGOs) to develop a common vision for the Indian coal sector:
  - **Vision in practice:** “*Produce the desired/requested quantum of production using the most economical means possible.*”
  - **Starting point:** “*Coal is a national asset that needs to be preserved, conserved, extracted, and utilized efficiently in a socially and environmentally sustainable manner to meet the nation’s energy needs.*”

- Lots of discussion – involving a whole range of stakeholders (Coal industry, NGOs, Ministries)
- New issues were raised
- Terms were defined
- Final Vision was accepted by all present
3.5 Common vision (coal sector)

Coal, a national asset, must be assessed, extracted and utilized in a scientific and viable manner with due responsibility for working conditions as well as ecological and social sustainability to meet the human and economic development needs in the country.

- “assess” = explore, quantify, and categorize
- “scientific” = systematic, efficient, economic (conservation and preservation is implicit in “scientific”)
- “Viable” includes economic, social, and environmental costs
- ‘working conditions” includes safety, occupational hazards, living environment, health
- “sustainability” = maintain (or improve) performance of existing system for current and future generations
Key Issues
4.0a Reserve/Resource Assessment

- Confusion among experts regarding “reserve” vs. “resources”
- Currently, only geological resources are assessed in India (not reserves)
  - Total: 253 billion tons (96 BT in “Proved” Category)
- Only tentative reserve estimation available
  - Basis for estimation is not reliable (nor publicly available)
  - IEP: 56-71 BT of extractable reserves
  - MoC/CMPDI: 52 BT
- Better estimates of reserves is critical for development of long-term electricity/energy policies
- Coal reserve estimates are poor in almost all countries (EWG report)
4.0b Coal exploration in India

• Key exploration agencies:
  – Geological Survey of India (GSI)
  – Coal Mine Planning and Design Institute (CMPDI)
  – Mineral Exploration Corporation (MECL)
  – Singareni Collieries Company Limited (SCCL)

• Funding: Ministry of Mines and Ministry of Coal

• Borehole Drilling is main technology in use for coal exploration
  – Limited number of drills; vintage and breakdowns
  – Need to use alternative technologies (seismic, geophysical techniques)
  – Insufficient investment in exploration technologies
  – Limited knowledge of international state-of-the-art technologies and practices
4.0c Exploration Constraints

- Knowledge gaps in various aspects of coal resources (magnitude and distribution of resources by area and by depth)
- Exploration overly guided by production considerations
  - There has been less emphasis on quality, and more on quantity, of geological reports
  - Overemphasis on exploration within 300 m depth
- Exploration pace limited by forest conservation laws and social issues
  - Problems getting forest clearances on time
  - People resisting exploration in their lands (worried about forced eviction)
- Domestic technological capacity is weak in the exploration sector, with little indigenous technological R&D inputs, and severe problems with human resources
4.0d Converting resource to reserves

- Lack of reconciliation and integration of data—data systems and databases: common repository; reconciliation; coordination; integration
- Significant uncertainty about confidence level of various data (quantity and quality)
  - Error assessment and statistical analysis is not being done regularly
- Significant confusion about extractable coal
  - Accuracy of reserve and resource assessments
  - Methodology for projecting extractability from resources
- Depleted reserves
  - No data exists on depleted reserves (only cumulative production)
  - Possible linkages with illegal mining
  - Crucial to assess mining efficiency and needs to be done regularly
- Need for better institutional coordination
  - Incorporation of feedback from past/field experiences
- Need for a joint exercise among exploration agencies to address these issues
4.1a Technologies for extraction

• Limited and evolving knowledge of technologies
  – Incomplete data and information on technology assessments in Indian context
  – Technology forecasts – cost and performance uncertainty
  – Evolving technological capacity in the country

• Need to look not just at extraction technologies, but overall technology systems (blasting, conveying, processing, etc.)

• Coal India Limited (CIL) is the dominant player in coal production
  – CIL effectively sets technology standards

• Contractors (with short-term contracts) are now engaged in coal extraction
  – Issue about legality; can be technology leaders

• Increasing role of the private sector (captive mining)
4.1b Opencast Technology

- Current dominance of opencast mining (OCM)
  - Low cost, ease of implementation, greater mechanization, faster production
  - Shovel-dumper, loader-dumper, and shovel-draglines

- Problems with OCM
  - High operating costs
  - Low capacity utilization
  - Large operation and maintenance workforce
  - Need to plan and build extensive road system for overburden removal and dumping
  - Extensive land degradation (social/env’t concerns)

- OCM prices do not reflect many environmental and social costs (lack of level playing field for underground mining)
  - Methods for assessment of environmental and social costs

- Other options: surface miners, crushing and conveying, bucket-wheel excavators, selective mining, highwall mining
4.1c Underground Mining (UGM)

- Underground mining is declining
  - Opencast-able resources are limited

- UGM will be needed to meet the sharply rising future demand
  - Long-term perspective needed to put appropriate policies in place

- Main UGM technologies currently in use are:
  - Conventional Bord & Pillar system
  - Semi-mechanised Bord & Pillar system with Side Discharge Loaders (SDLs)/Load Haul Dumpers (LHDs)/Universal Drilling Machines (UDMs)
  - Continuous Miners (CMs), Mechanised Longwall, and other special methods

- Problems with UGM
  - High cost of production (twice as expensive as OCM)
  - Low productivity
  - Challenges in increased mechanization

- Initial deployment of mechanized longwall had many problems
  - Inadequate exploration of the areas earmarked for longwall mining
  - Non-availability of long panels; sequencing of extraction from different seams
  - Lack of proper, trained manpower, and poor planning
4.1d Issues for technology deployment

• Need to carry out a mine-level study on man and machine productivity, and analyze reasons for variations
  – Will allow for benchmarking
  – Necessary for designing better incentive schemes for workers and management
  – Appropriate technology choices can only flow from such an exercise

• Long-term markets (with less uncertainty) are necessary to attract manufacturers
  – Long-term contracts are necessary for contractors to adopt advanced technologies
  – Legitimize contract mining

• Need to rationalize the pricing of coal grades to promote new technologies
  – Higher prices for higher grades
  – Coal is currently priced lower than other fossil fuels on energy basis

• Impact of greater private sector involvement?

• Procurement is an important issue
  – Can delay new technology acquisition/deployment
4.2a Displacement—Key Social Issue

• Displacement of people due to coal mining is inevitable and is of enormous magnitude
  – PAPs and secondary displacees (due to loss of agricultural land, environmental degradation, etc.)
  – Coal Vision 2025: 170,000 families or 850,000 displaced persons would have to be rehabilitated by 2025 when the requirement for land would double from current 147,000 ha to 292 500 ha

• Some data and socio-economic information on PAPs exist, and need to be publicly disseminated
  – Fernandes: about 5 million (DP and PAP) for all mining (mostly coal) *disputed*
  – 75% of displaced people’s lives worsened due to displacement

• Detailed socio-economic data needs to be monitored, collected, and authenticated on a routine basis for all projects

• Different firms have different R&R policies, but they can always do better
  – Key is in implementation—poor record
  – Initial focus was employment, and now more cash-based
  – Company management need to have a long term social vision (change of mindset)
4.2b Better R&R

• Rehabilitation and Resettlement (R&R) should make sure that people are better off than before
  – People can become more positive towards coal mining projects, if they see it as being in their benefit
  – Those who are paying the price should be the beneficiaries

• PAPs must be part of the decision-making process
  – Different groups will have different needs (especially tribals)
  – R&R benefits impact different groups differently

• R&R should include creation of social assets (health, education, etc.) and benefit sharing
  – People need assets to enter the new economy and be aware of their options and opportunities
  – Both employment and lump-sum cash creates lots of social problems
  – Allow PAPs access to opportunities emerging from projects (e.g. township)

• Start development/training activities in areas well-before projects & operations commence
  – Need to create a baseline of socio-enviro-economic conditions (20-25 year timeframe)

• Need for a national “displacement roadmap/planning” to eliminate multiple displacement
4.2c Reclamation/Illegal Mining

- No proper data on number and area of non-working mines (abandoned, orphaned, closed, temporarily continued, etc.)
- “Closed” mines need to be reclaimed/rehabilitated and land be returned and reused
  - Post-mined land can be gifted to others—need for policies to make this happen
  - Legal issues regarding post-mining land use needs to be addressed
  - Leasing is not feasible in Indian legal conditions
- Progressive reclamation is being done, but final closure has issues
  - External overburden dumps, final height/contouring, etc.
  - Closure plans need to fully followed and certified by DGMS (liability issues)
- Money that is collected for closure/reclamation needs to be in a separate account and used only for this purpose
  - Reclamation bonds/bank guarantees need to be considered
- Illegal mining and illegal marketing (pilferage)
  - Small shallow-dug “village mines” on private land
  - Mining on re-opened abandoned or orphaned government mines
  - Scavenging on the leasehold land of official operating mines
- No proper data on extent of illegal mining and illegal marketing
  - 70-80 MT?
- Illegal mining is linked to the question of ownership of mineral resources
4.2d Environmental Issues

- There is now some convergence of views between coal companies and MoEF
- Need to have longer perspective plans and avoid ex-post facto clearance
- MoEF to provide better guidelines on preparation of Environmental Impact Assessment (EIA)
  - water/air modeling, quantifying damage costs, etc.
  - Regional conditions/impacts/other projects
  - New technologies, washeries
- Mitigation is often addressed in EIA, but cost of damage to environment is not assessed
  - Methods for quantification of damages needs to be developed
- Implementing options that protect environment without corresponding production/profit benefits are contentious issues
- Need to separate environment and R&R costs in DPRs
- EIA-EMP should not be administered or directly funded by project proponent
  - EIA should be prepared by independent accredited agencies (blacklist bad agencies)
  - EIA agencies should report to MoEF, rather than project proponent directly
- Need to involve local people in preparation of EIAs, as they have intimate knowledge of flora and fauna
4.2e Go-NoGo Zones

- Key concern is reduction of time taken for clearances
- Creation of Go-NoGo zones for forest areas
  - Accepted in principle
  - Need for demarcating and mapping areas
  - Enforcement
- Create Go-NoGo areas for infrastructure development (demarcate and exclude coal bearing areas)
  - There are tradeoffs between forests and habitation – need for balance
  - Need to make a master plan for all coal bearing areas (CIL, captive, etc.)
  - Certification needs to be provided
- Green credits for afforestation can also be considered
4.3 Human Resource/Tech. Capacity

- Lack of appropriately trained manpower is becoming a critical problem
  - Geologists in exploration and mining
  - Graying workforce as hiring has been restricted
  - Experienced people are retiring with loss of expertise and institutional memory
  - Loss of experts through migration to private sector and captive mining

- Retraining of workers is critical to promote increasing mechanization

- Working conditions in mines
  - More data and information is needed to ascertain state of affairs in mines

- Retention of young people and experienced people
  - Salaries, benefits, and attractive career paths

- Strengthening technological capacity
  - CMPDI and SCCL should learn about international practices and take up training programs with international experts
  - JV and acquisitions can increase indigenous capacity
4.4a Institutional Reforms

• Government dominates the coal industry – Ministry of Coal, CIL, SCCL

• Better coordination and cooperation among different ministries (coal, railways, env’t/forests, mining, power) is needed
  – Need to exchange information on practices, management methods, etc.

• Need clarity on institutional functions
  – Conflict of interest in agencies doing multiple tasks
  – Funding problems

• Need for greater competition
  – Captive coal mining and private sector entrants are being encouraged with allotment of coal blocks
  – Can help improve technologies and management practices

• Important to assess how increasing private sector involvement in coal will affect current institutions and practices

• Need for an independent coal regulator to regulate aspects of the extraction and transport of coal, and set appropriate prices for large consumers
4.4b Pricing Reforms

• Coal prices deregulated since 2000, but prices are still “guided” by Ministry of Coal, which controls the main coal producer (CIL)

• Current grading scheme has poor incentives for quality
  – Coal should be priced according to its heat value
  – Number of grades can be increased
  – Already in process

• Need for FSTAs between large consumers and suppliers
  – Can reduce illegal mining
  – Already in process

• Need to include social and environmental costs in coal price
  – Need for assess methodologies in Indian context
5.1 Conclusions/Outlook

• Need for better data and analysis all around
  – Lots of data gaps
    • resources, reserves, technology suitability, abandoned mines, displacement, socio-economic data, environmental impacts, reforms, etc.

• Need for better planning process
  – Lack of coordination among different agencies
  – Lack of common vision
  – Retrospective analysis (critical examination of the past)
  – Long term perspectives and planning

• Need to involve a wider range of stakeholders
  – Critical in ensuring successful implementation of policies

• Seminar series is helping on all of these fronts
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