Sustainability of Coal Mining
Challenges and Way Forward

Report of the Proceedings of NIAS Workshop

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Contents

1. Introduction and rationale for the workshop

2. Agenda

3. Inaugural Session

3.1 Address by Guest of Honor

3.2 Keynote address

3.3 Book Release: Sustaining natural resources in a changing environment

4. Technical Session

4.1 Statutory clearances for coal mines in India

4.2 Sustainability in coal mining: Initiatives in India

4.3 Health and environmental impacts of coal mining on communities

4.4 Environmental governance of the coal industry

5. Conclusions and Policy Recommendations
1. Introduction and rationale for the Workshop

Coal forms the bulwark of India’s energy sector today, and its share is approximately three-fourths of the country’s electricity generation. India has enough coal reserves to last several decades even at double the current rate of production, and coal-based power is likely to remain as one of the cheap options among different energy alternatives for electricity generation in India in the near future. Therefore, the predominance of coal-fired power generation will continue in the coming decades (even with the recent focus on renewables) in order to provide energy security and affordable power to all Indians.

One of the key features of India’s coal sector is that most of the coal (more than 90%) is obtained through surface mining. More and more underground mines are being converted to surface mines because of compared to underground mining, surface mines are characterized with higher extraction rate, lower cost of production, and better safety record.

While mining operations have a major impact on the environment during their operation period, they also have positive economic impacts on the local area in terms of infrastructure development.
and provision of employment and business opportunities for local people. The coal industry is one of India’s largest employers. However, the impacts of coal mining on the ecology of the local area are also well established, particularly in the case of surface coal mines.

A crucial step in the direction of protecting the environment from multiple factors was the Environment Protection Act of 1986. It enabled the Central Government to take all measures deemed necessary for protecting the environment, and preventing, controlling, and abating pollution. The Ministry of Coal (MOC) published India’s first Mine Closure Guidelines for coal mines in 2009 and subsequently revised them in 2013. These Guidelines primarily govern the preparation of the statutory Mining Plan and/or Final Mine Closure Plan that are also incorporated by reference in the Environmental Clearance granted to coal mines by the Ministry of Environment, Forest, and Climate Change (MOEF&CC). These Guidelines direct the coal mine Owners to ensure that the mining area is restored to create a ‘self-sustaining system’ post mine closure.

Additionally, in 2015, the Central Government introduced a new Section 20A in the Mines and Mineral Development & Regulation Act (MMDR Act 2015), which empowers the Central Government to direct the State governments in relation to scientific and sustainable development and exploitation of mineral reserves as well as the promotion of restoration and reclamation activities so as to make optimal use of mined-out land for the benefit of the local
communities. This has put conservation of the coal mining areas and the surrounding ecosystem, as well as the needs of the local communities at the forefront of the Governments’ priorities.

Given that India will continue to depend on coal for a significant portion of its electricity generation for the next 30-40 years, and the aforesaid changes in Laws and Guidelines governing coal mining, there is a necessity for a detailed understanding of the current scenario of surface coal mining in India. This includes a study of coal mining technology and practices, post-closure care and maintenance of the mine, and the institutional and policy gaps. Additionally, in the light of sustainable development goals, it is important to make the process of mining and mine closure aligned to the SDGs. A holistic view of mining ecosystem would ensure the coal mining system is designed to be an economically, socially, and ecologically sustainable system in the long run.

In order to explore the interface of coal mining and sustainable development, a workshop titled, “Sustainability of Coal Mining” was organized at NIAS. This workshop forms a part of study supported by Science and Engineering Research Board (SERB), Department of Science and Technology, Govt. of India. Two of the objectives of the study are (i) conceptualization ‘self-sustaining ecosystem’ in case of open cast coal mine closure, and (ii) assessment challenges in the current regulatory regime of the opencast coal mine. This workshop was an initiative to bring academics, industry personnel, policymakers, and civil society to a common forum. The Energy and Environment Program, National Institute of Advanced Studies (NIAS) organized this workshop on 05 July 2018 at NIAS, Bengaluru.

2. Agenda

The workshop comprised of two sessions: an inaugural session and a technical session (Annexure). The inaugural session was designed to bring out the broad issues of climate change, sustainable development, and coal mining, while the technical session was designed to explore the government, legal, environmental, civil society, and industry perspectives. Apart from the eminent speakers listed in the Annexure, the Workshop saw diverse participation from research institutions, government, mining companies, civil society, and students. In addition to the relevant faculty and students from NIAS, faculty and/or stakeholders from diverse organizations,
Ashoka Trust for Research in Ecology and the Environment (ATREE, Bangalore), Chongqing Jiaotong University (Chongqing Shi, China), Indian Institute of Science (IISc, Bangalore), Institute of Social and Economic Change (ISEC, Bangalore), KJ Somaiya Institute of Management Studies and Research (SIMSR, Mumbai), London School of Economics and Political Science (LSE, London, UK), National Law School of India University (NLSIU, Bangalore), Odisha Mining Corporation (OMC, Bhubaneswar), Singareni Collieries Company Limited (SCCL, Hyderabad), The Other Media (Chennai), and Western Coalfields Limited (WCL, Nagpur) participated in this Workshop. Dr. Hippu Salk Kristle Nathan, the coordinator of the workshop from NIAS welcomed all participants and presented the agenda for the Workshop.

3. **Inaugural session**

Dr. Shailesh Nayak, Director, NIAS delivered the welcome address and emphasized the need for India to develop and implement policies and strategies to enhance the sustainability of coal since coal will fuel approximately 58 percent of India’s electricity generation (down from the current FY 19 level of 75 percent) even in 2040 (BP, 2019). This is despite the fact that India is projected to generate 27% of its total power generation through Renewable Energy (RE) sources by the year 2040 (up from the level of 6% in the year 2017).

Dr. Nayak stressed on the need to design a system capable of minimizing the environmental hazards associated with coal in the interest of India’s energy security since coal is the only energy source that India has in abundance. He welcomed the speakers and participants and insisted upon an interdisciplinary approach to understand the issues related to coal sustainability so that suitable policy recommendations can be submitted to the Government after appropriate stakeholder consultations as is being done through this Workshop.

3.1. **Guest of Honour address**

The Guest of Honor, Dr. Ruth Kattumuri, Co-Director India Observatory, LSE, UK, delivered a talk on the topic “Sustaining natural resources in a changing environment”. She cited the work being done globally in the context of Sustainable Development Goals
Research with Relevance

(SDGs). She explained the inclusivity and relevance of the SDGs by explaining how they are relevant for the developed as well as developing countries while the earlier Millennium Development Goals (replaced by the SDGs from November 2015) were mostly meant for developing economies. In this sense SDGs are more inclusive in terms of shared responsibility and commitment. Dr. Ruth’s talk covered two distinct streams of work – the first being the impact of climate change, and the second being the British Government policies related to coal and the energy sectors.

In the first component, Dr. Ruth explained how climate change is a threat to sustainable development and the unprecedented impact of climate change on human and natural systems since the mid-20th century. She juxtaposed climate change impacts and the SDGs to demonstrate several opportunities to link mitigation, adaptation, and the pursuit of other societal objectives through and integrated response. She further suggested that successful implementation of mitigation measures against climate change rely on the deployment of appropriate tools, suitable governance structures, and enhanced capacity to respond. Dr. Ruth highlighted that the population rise and urbanization in India together with climate change have not only increased pressure on the ecosystem but may have also contributed to extreme weather events like, floods, droughts, dust
storms, and lightning strikes.

In the second part of her address, Dr. Ruth talked about the phasing out coal mines in a sustainable manner, keeping in mind the social repercussions. She discussed measures taken by the British Government to phase out coal based Thermal Power Plants (TPP), and India’s plans to reduce dependence on coal by increasing the installed power generation capacity of Renewable Energy Sources (RES) to 175 GW. She concluded her presentation by highlighting the importance of sustainability by adopting socially and environmentally responsible practices while ensuring that people’s lives and livelihoods are well protected before phasing out any surface coal mine, coal-fired power plants or any other industry.

3.2. Keynote Address

The inaugural session concluded with a keynote address by the Chief Guest, Sri D. N. Prasad, Ex-Advisor, Ministry of Coal with a special focus on the necessity of coal for meeting the demand for affordable energy which is crucial for India’s development. He started his talk by giving a global and historical perspective on energy. He explained the carbon imperialism imposed by Western and European countries, while the same Western and European countries have degraded the environment in the name of development during the past 200 years. Hence, Sri Prasad expressed his dismay at the present demand of developed countries that the developing countries need to drastically reduce their use of fossil fuels in order
Sri Prasad’s dismay was based on his reasoning that feasibility and freedom of energy choice must be of paramount importance for any country. He pointed out that other than coal, India is bereft of any other form of conventional energy. Nevertheless, Government of India (GOI) has committed that 40% of generation capacity will be non-fossil fuel-based by the year 2030 under the Paris Agreement. India has been putting all efforts to increase share of renewable in its energy portfolio. Yet, commercial viability of storing the variable and intermittent nature of energy from renewable sources is one of the biggest hindrances for growth of renewable energy in India. Therefore, a country like India needs to be pragmatic in developing its resource base in such a scenario.

While India has a coal-based TPP capacity of 197 GW which generates approximately 75% of the electricity produced in the country, the country may require an additional 150 to 200 GW of coal-based TPP capacity to meet its base load electricity requirements. Since coal is the most affordable source to meet India’s electricity demand, the dependency on coal could not be avoided given the country’s commitment to provide electricity to all households, provide water (through pumped-irrigation schemes) for agriculture and domestic use, and provide traction to achieve all other SDGs. Since energy is a critical input to most SDGs, India needs to foster its energy interests to meet its development goals.

Sri Prasad did mention that coal reserves in India are partly located in ecologically sensitive areas which are covered with forests. Therefore, it is mandatory to restore coal mining areas through a pre-planned progressive mine closure process even before the final closure of the mine. After the publication of the Mine Closure Guidelines by the MOC in 2009, all coal mining companies in India are providing Rs. 600,000- per acre of area used for opencast mining as a financial assurance in an Escrow Account operated by the Coal Controller in the MOC. The money accumulated in this Escrow Account acts a contingency fund for the Government of India to restore the mined-out area if the project proponent is unable to restore the same as per the approved final mine closure plan for any reason.

Sri Prasad explained that India has adequate coal reserves to meet the domestic coal demand, but domestic coal production is hampered by the multiplicity of regulators who enforce (albeit, in an
uncoordinated manner) a plethora of statutes governing various aspects like, environment, forests, resource conservation, and health & safety. There should be one single authority to deal with all regulatory matters impacting coal mines in India, other than health & safety of the mine and the people employed therein. He concluded the inaugural session by suggesting NIAS should develop their own recommendations regarding the regulatory approach to coal mining based on world’s best sustainable practices and submit the same for GOI’s consideration.

### 3.3. Book release

At the end of the inaugural session, a themed volume of Contemporary Social Science: “Sustaining natural resources in a changing environment” co-edited by Linda Hantrais, Ruth Kattumuri and Ashley Thomas Lenihan was released by the Chief Guest Dr. Ruth Kattumuri. The volume (which has now been published as a book by Taylor & Francis) includes an article by Prof. R. Srikanth and Dr. Hippu Salk Kristle Nathan entitled “Towards sustainable development: planning surface coal mine closures in India.”. The work related to this paper was partly supported by the project awarded to NIAS by the Science and Engineering Research Board, Department of Science and Technology, Government of India.

### 4. Technical session

The technical session was chaired by Dr. Sharachchandra Lele, Member of the MOEF&CC’s Expert Appraisal Committee for coal mining and Distinguished Fellow in Environmental Policy and Governance at the Ashoka Trust for Research in Ecology and the Environment, Bengaluru. In his initial remarks, Dr. Lele opined that coal is one of the most challenging sectors in terms of governance and regulation. He stated that India is one of the unique regions in the World where every ecological niche has been occupied by communities for thousands of years. Therefore, any resource appropriation that happens in terms of conversion of forests to various non-forest uses like mines, dams, or roads result in a situation where resources are taken away from someone and given to another for carrying out some non-forest activity. The key question to be answered is whether transfer of these resources leads to more or less development. He concluded by stating that sustainability of coal mining must address the questions such as where, how much, and in what form to mine coal.
4.1. Statutory clearances for coal mines in India

Dr. Sandhya Mishra, Deputy General Manager (Forest & Environment) in the Orissa Mining Corporation, Bhubaneswar made the first presentation in the technical session. She began her talk by explaining the important role played by coal in India’s economy and how the government has been sensitive to some of the aspects of sustainable development. Therefore, the Government of India (GOI) has enacted several legislations for forest conservation and environment protection which are applicable to all mining operations and has also included various provisions related to forest and environment in the laws governing coal mining in India. Dr. Sandhya then explained in detail the steps that are carried out to secure various kinds of clearances in the pre-mining stage as well as the mining company’s obligations for post-mining compliance.

4.2. Sustainability in coal mining: Initiatives in India

Mr. Kaushik Chakraborty, General Manager, Environment, Western Coalfields Limited (WCL), Nagpur, then delivered a talk on “Sustainable Coal Mining with Focus on Returning Land to Pre-mining Land Use and Impact on Water”. Mr. Chakraborty presented the work carried by Western Coalfields Ltd. (WCL) with respect to land reclamation. So far WCL has planted 185 lakhs of saplings covering an area of approximately 6721 ha.

Mr. Chakraborty emphasized that WCL, instead of filling up the
mined-out final void with overburden, is developing the final void for water storage through rain water harvesting, particularly in the water-scarce areas surrounding Pench and Kanhan coal mines. In fact, the Gram Panchayat and District Forest officer (DFO) of these areas have requested WCL not to fill the final voids after final closure of the opencast coal mines since these voids are often the only source of water in these areas. Therefore, WCL monitors the quality of mine water before and after treatment to ensure that the water is fit for supply to the community at large. In addition, WCL has started supplying bottled drinking water branded as “Coal Neer” from a water treatment & bottling plant at Patansaongi.

On 25th March 2018, WCL also entered into a Memorandum of Understanding (MoU) with a State Power Utility, MAHAGENCO to supply 10.76 million cubic meters of water per year to their Thermal Power Plants (TPPs). Similarly, WCL is planning to sign a Memorandum of Understanding (MOU) with the Vidarbha Irrigation Development Corporation for providing 28.16 million cubic meters of water per year for irrigation purposes. WCL has already implemented 29 schemes related to drinking water, irrigation, and well-recharge, and is planning to implement another 24 schemes related to drinking water and irrigation in 2018-19.

WCL has also developed two closed mines in the State of Maharashtra (Gondegaon and Saoner) as India’s first eco-tourism sites containing closed underground mines and surface coal mines. In these two mines, WCL has showcased the reclamation of these coal mines for tourism purpose after their final closure.

4.3. Health and environmental impacts of coal mining on communities

Ms. Shweta Narayan, Coordinator at Community Environmental Monitoring, the Other Media, Chennai delivered a talk on “Health and Environmental Impacts of Coal Mining in Communities and Mitigation Strategies.” At the outset, Ms. Shweta acknowledged the fact that coal is important for the economic development of the country and reiterated that environmentalism and development can co-exist as a good environment will contribute towards economic development. Ms. Shweta then presented a case study conducted by a team of doctors from Kolkata in the Tamnar and Ghargoda blocks of Raigarh District of Chhattisgarh, which contained an opencast coal mine as well as a thermal power plant. She mentioned
that in this case, standard dust suppression practices were not followed despite the fact that certain villages were located within 500 m from the mining area.

As a result of these major gaps in the implementation of statutory provisions related to health and safety in this mine and pithead Thermal Power Plant (TPP), the research team found that joint pain, musculoskeletal problems, and dry cough were common in almost every household of the area. Further, a large number of mental health cases were also found in the surrounding communities. Water and soil samples collected from the ash pond and the surrounding areas also indicated high levels of Aluminum, Arsenic, Antimony, Boron, Cadmium, Chromium, Lead, Manganese, Nickel, Selenium, Vanadium, and Zinc.

This study also attracted a number of questions in terms of the methodology adopted and the inferences drawn since this case study cannot be generalized to include all coal mines or all coal mining companies in India. During the discussions that followed, it was agreed that more systematic studies are required before drawing general conclusions on the impacts of coal mining on public health since a number of statutory provisions have been imposed on coal mines in India specifically to avoid such impacts. However, it was also agreed that the enforcement of these legal provisions for environment protection is not uniform across India.
Shweta Narayan concluded by stating that several key recommendations of this study such as the need for in-depth studies to identify the nature of pollutants and their impact over communities residing around coal mines and TPPs, provision of free health care for residents living around coal mines and TPPs, supply of safe drinking water, continuous monitoring of emissions, and remediation measures to limit levels of air and water pollution within the statutory limits have been accepted by MOC and MOEF&CC, and are being implemented by them. The coal sector (mines and TPPs) must adopt these practices in and around all operations.

4.4. Environmental governance of the coal industry

Prof. M.K. Ramesh, National Law School University of India (NLSUI), Bangalore delivered a talk on “Environmental Governance of the Coal Industry”. He discussed the evolution of policies and Laws related to environment protection in India and explained the key judgments of the Supreme Court of India related to environment protection in areas containing coal mines and TPPs.

Prof. Ramesh shared his observations on the evolution of environmental judiciary in India post-1972 when environmental concerns and governance in India was triggered by International obligations committed by India which were later internalized at the Central level in the formulation of legislation and at the State and local levels through implementation of such legislation. However, Prof Ramesh remarked that in India, people with the responsibility of managing environment are still unskilled, untrained, and ill-equipped to discharge their functions as per various legal provisions. Therefore, judiciary had to play a very
active role in protecting our environment during the last two decades as a monitor, super administrator, and micro-manager to instruct the Government through various judgements. The Judiciary in India stepped in to fill the vacuum between legislative prescription and administrative action, and through its decisions evolved the environmental jurisprudence in India. The Judicial directives, which led to some discomfort for the Government and the project developers, did not evolve naturally either by regulators or through industry practice. In this regard, Prof. Ramesh highlighted the Godavarman case through which Supreme Court introduced various measures for forest and environment protection.

In India, governance and management of mineral resources are shared between the Central Government and the State Government(s) where the Central Government has the upper hand and can easily overcome any difference of opinion, opposition, and inconvenience posed by any State Government. Prof Ramesh also pointed out the failure of forest department to utilize Compensatory Afforestation Fund Management & Planning Authority (CAMPA) funds for afforestation as originally envisaged, and the inability of several State Pollution Control Board(s) to enforce the emission norms as prescribed under Water Act 1974 and Air Act 1981.

Finally, Prof. Ramesh explained the overarching nature of environmental laws which need to be internalized for all mining and development activities. Specifically, it is essential for environmental policy with respect to mining to be comprehensive by allocating due emphasis on the need of coal for India while acknowledging its adverse impacts on the environment. Prof. Ramesh highlighted the Supreme Court’s judgement on August 2, 2017 where the Court had declared that illegal mining includes not only mining outside the lease area as prescribed under the MMDR Act but also any violation of environmental laws within the lease area, since mining can be lawfully carried out only in compliance with all applicable Laws of the Land, including all relevant provisions of Forest and Environment Laws. This Judgment showcases the importance attached to forest and environment Protection by the Supreme Court of India.
Conclusions & Policy Recommendations

After thorough discussions on the various issues and concluding remarks from Dr. Sharadchandra Lele who chaired the technical session, the following conclusions and policy recommendations were finalized during the Workshop:

- In the light of the Sustainable Development Goals adopted by India in 2015, the focus must be to include sustainability at the mine planning stage and to develop innovative coal mining and land reclamation technologies & practices so that the mined-out land can be made useful for the local communities, post-closure. This requires a robust, integrated coal mining and reclamation policy with clear objectives and a capable monitoring mechanism to ensure sound implementation.

- In view of the critical role of coal in India's energy sector in the next couple of decades, the coal sector must develop its own enlightened policies incorporating sustainability considerations (social aspects, economic dependencies, and ecological sensitivities) into the mining process right from the planning stage so that a coal mine which cannot be closed in a safe and sustainable manner is not opened in the first place.
• The coal sector in India also needs to benchmark sustainable practices across various companies in terms of environment protection and public health.

• There is an urgent need for Thermal Power Plants (TPPs) to enhance utilisation of washed coal to reduce ash generation and also to develop technologies and innovative business policies to enhance ash utilization in various sectors of the economy.

• TPPs must develop and implement technologies to address the chronic issue of ash disposal which is sterilising vast amounts of land and also leading to water and air pollution. There is a dire need to conduct comprehensive, site-specific scientific studies on a long-term basis before and after ash dumping into coal mine voids is approved.

• All coal mining companies and TPPs in India must extend free health services to the local communities also so that the impact of coal mining and/or power generation on public health can be assessed regularly to enable timely implementation of control measures.

• The Compensatory Afforestation Fund (CAF) Rules to be enacted under the CAF Act must also facilitate the reinforcement of the administrative mechanisms to enable efficient utilization of the financial resources released from the CAMPA funds.

• There is a need to enhance the capacity (in terms of numbers, technology, and knowledge) of the enforcement authorities not only to enable effective monitoring and enforce compliance with Law, but also to incorporate learnings from best practices and failures.

• There is an urgent need for MOEF&CC to constitute a full-time Expert Appraisal Committee (EAC) for the coal sector which will be able to devote more time and attention to monitoring of past approvals as well as to the appraisal of new
Workshop Programme

Inaugural Session (Chair: Dr. Shailesh Nayak, Director, NIAS, Bengaluru)

Welcome Address by Dr. Shailesh Nayak, Director, NIAS, Bangalore

Address by the Guest of Honor, Dr. Ruth Kattumuri, Co-Director, India Observatory, London School of Economics & Political Science, United Kingdom

Release of Special Volume of Contemporary Social Science

Keynote Address by the Chief Guest, Mr. D.N. Prasad, Ex-Advisor, Ministry of Coal, Government of India.

Technical Session (Chair: Dr. Sharachchandra Lele, ATREE, Bengaluru)

Environmental Pollution of Coal Mining by Dr. Sandhya Mishra, Dy. GM, Forest & Environment, Odisha Mining Corporation, Bhubaneswar, India.

Sustainable Coal Mining with Focus on Returning Land to Pre-mining Land Use and Impact on Water by Mr. Kaushik Chakraborty, General Manager, Environment, Western Coalfields Ltd., Nagpur, India.

Health and Environmental Impacts of Coal Mining in Communities and Mitigation Strategies by Ms. Shweta Narayan, The Other Media, Chennai, India.

Environmental Governance of the Coal Industry by Prof. M.K. Ramesh, NLSIU, Bengaluru

Discussions

Vote of Thanks
About the NIAS Energy and Environment

The Energy and Environment Program (EEP) at NIAS was established in 1999. EEP’s research encompasses all forms of commercial energy: coal, hydro, nuclear, gas, and renewables as well as their environmental and societal implications. During the last three years EEP has reoriented its research focus on the major challenges faced by India in the fields of Energy, Natural Resources, and the Environment. All ongoing research projects are interlinked through the Sustainable Development Goals.

In addition to their research, teaching, institutional responsibilities, and outreach activities, EEP faculty are also engaged in working groups constituted by GOI on key aspects of National mineral and coal policies. They have also provided vital inputs to GOI on the National Steel Policy and Power Sector reforms. Some of EEP’s key recommendations in relation to the mineral sector have been incorporated in NITI Aayog’s report on “Strategy for New India@75” submitted to the GOI in November 2018, while NIAS recommendations related to the power sector have been incorporated in GOI’s proposed amendments to the Electricity Act.

In order to advance EEP’s goal of “research with relevance,” our faculty are not only collaborating with Government departments and agencies but are also working closely with other like-minded organizations in areas like environmental health. In order to advance NIAS initiatives in policy advocacy, EEP also organizes policy-focused workshops to bring together key stakeholders to discuss key subjects like, energy sustainability, environmental health, and power sector reforms.
This workshop was conducted with the financial assistance received from the Science and Engineering Research Board (SERB) in the Department of Science and Technology of the Government of India, through a SERB-funded project titled “Interdisciplinary forays into human-environment interactions: an integrative research initiative in energy, ecology and nonlinear modelling”. The success of the workshop is also due to the wholehearted participation of the domain experts, academicians, policy experts, civil society and industry participants.