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Connecting India's
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Building Bridges to a Just Transition: Connecting India's challenges and solutions with international experience

June 2021

Written by Sandeep Pai

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Executive Summary

As the energy transition gathers pace globally, there is an increased focus on the need for a “just transition”: that is, ensuring that the shift away from fossil fuels is socially responsible from the perspective of affected workers and communities. Just transition planning is still nascent in India and would benefit from a comprehensive review of the national context and relevant international experience and best practice. This brief provides an initial assessment of priorities and opportunities for further information sharing based on a review of international literature and expert interviews. Specifically, the brief identifies:

- Global just transition elements most relevant for India.
- Research topics needing further investigation to help support just transition in India.
- India's experiences that might be useful for other emerging economies.

Among the key research needs, it highlights:

- Examination of other countries' just transition plans for coal.
- Mapping of stakeholders and their needs, particularly unionized and non-unionized workers and their communities, including to better understand the implications for just transitions of coal in personal and community identity.
- Opportunities to diversify coal state-owned enterprises (SOEs) and coal-dependent regional economies based on international experience and research into local needs and attributes.
- Options to reform coal sector pension funds, based on international experience, to ensure all current and future pensions are fully funded.
- Potential for coal mining and coal power plant sites to become sources of employment and ongoing regional income; how funds could be raised for rehabilitation and development of sites.

Other developing and emerging economies with a coal sector—at the national or subnational level—are likely to face similar challenges and research needs. These countries would benefit from sharing India's knowledge and experiences in just transitions.



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1.0 Introduction

Limiting global warming to 1.5°C, as set out in the Paris Agreement, would mean reducing long-term coal dependence globally and in Asia (United Nations Intergovernmental Panel on Climate Change [IPCC], 2018). Coal will need to fall from around 32% of the global electricity generation mix in 2020 to 0.5% by 2050 (IPCC, 2018). To achieve this, few countries matter more than India, the second largest producer and consumer of coal and whose energy demand is likely to double in the next two decades (International Energy Agency [IEA], 2020).

Today, India remains deeply dependent on coal for its energy needs: around 45% of the country's primary energy and 70% of electricity generation comes from coal (IEA, 2021a). The Government of India also has plans to expand coal mining operations and install more coal-fired power plants to meet its energy security goals.

The rise of renewables, however, particularly solar, has threatened the long-term viability of coal (IEA, 2020a). Recent bids for renewables have been cheaper than the average cost of existing coal power on a levelized cost of electricity basis (Fernandes & Sharma, 2020; Shrimali, 2020). Moreover, the Government of India has set an ambitious target of 450 GW of renewable energy by 2030 (Kovind, 2020). According to modelling by the IEA (2021b), these currently stated policies will see coal decline from 70% to 30% of the electricity mix by 2040. With further efforts to stimulate clean energy investment, solar could overtake coal a full decade earlier, seeing absolute coal demand decline 36% by 2030.

Given the economic and environmental trends indicate that coal could have a limited future in India in the longer term, it is important to plan for a just transition, focusing on coal workers and communities, as well as states that rely on the coal sector for government revenue. Just transition planning is not only about the future: it needs to start now. Some stakeholders advocate shutting down old and inefficient coal-fired power plants that are uncompetitive, as well as being major sources of air pollution (Fernandes & Sharma, 2020; Shrimali, 2020)—and it is important to start early. Evidence of coal declines in other countries shows that creating feasible “just transition” plans requires decades of planning, implementation, and engagement with affected communities.

Just transition planning for the coal sector has tended to focus on developed countries. There is growing interest in just transitions in India and other emerging and developing economies. For example, Ward et al. (2021) identify the drivers of and barriers to an energy transition in India and reflect on what a just transition at the national level could entail. Busby et al. (2020) identify potential financing mechanisms for a just transition away from coal. India's just transition plan would also benefit from sharing of international experience. This brief draws on international literature to identify research needs and opportunities, including how international experience can assist just transition planning for India. The literature review was supplemented by 11 interviews with experts¹ from coal companies, government, and civil society.

¹ Interviews were conducted on the condition of anonymity with representatives of state government of Jharkhand, Coal India, leading coal industry trade unions, and researchers. If relevant, institutions or sectors are cited rather than names or position titles.



2.0 Context

2.1 What Are Just Transitions?

The concept of just transitions first emerged in the United States in the 1970s when Tony Mazzocchi, a leader in the Oil, Chemical and Atomic Workers' Union, sought the support of environmental groups to help fight the Shell Oil company over safety and health issues affecting workers (Morena et al., 2018). Mazzocchi and other unionists advocated addressing workers' livelihoods, health and safety issues, and preserving the natural environment.

The concept was adopted by different unions as well as environmental and social groups across North America and eventually in other parts of the industrialized world (Morena et al., 2018). For example, in the first half of the 2000s, unions such as Comisiones Obreras in Spain, and the Australian Council of Trade Union “regularly used just transition wording in their action” (Morena et al., 2013). Several governments such as Canada's and the UK's, under the umbrella of the Powering Past Coal Alliance, have declared just transition as an important pillar of phasing out fossil fuels such as coal. In 2018, at the 24th Conference of Parties of the United Nations Framework Convention on Climate Change, over 40 heads of state and governments made the Solidarity and Just Transition Silesia Declaration, which again emphasized the need for a just transition of workers by creating good quality jobs.

There is no single definition of a just transition (Ward et al., 2021) but most are based on the core principles of social justice and stakeholder dialogue, and some include issues of climate or environmental justice. Today, most just transition definitions are based on the principles of justice and social dialogue as defined below by Gass et al. (2020):

A just transition is a vision and a process that is negotiated between key partners—workers, employers and governments—who are affected by changes in the economy. These changes are driven by motivators such as the necessary low carbon transition designed to mitigate climate change impacts. It is local in context and must be guided by what can be considered just in the country where the transition is occurring. The overall goal is that social, economic and ecologic opportunities for positive developments are maximized and negative impacts minimized. A just transition also strives to ensure that the costs and benefits of the transition are justly shared. The costs of transition can be economic (e.g., decreased revenues in the fossil fuel sector), social (e.g., unemployment), and environmental (e.g., the level of ambition in climate policy), as can be the benefits (e.g., emergence of new climate-friendly sectors with good and decent jobs).

The concept for just transition is grounded in the International Labour Organization (ILO) publication *Guidelines for a Just Transition Towards Environmentally Sustainable Economies and Societies for All* (ILO, 2015).



2.2 The Socio-Economic Importance of India's Coal Sector

India's coal sector has been dominated by government ownership since the nationalization of coal mining in the 1970s (Chandra, 2018). Since then, Indian federal government and several state governments have expanded the coal sector through SOEs in order to meet growing energy needs and to promote development. Despite some liberalizing reforms, coal mining and electricity generation remain dominated by SOEs (Pai & Zerriffi, 2021; Shukla & Quadri, 2020). Over 90% of coal is produced by government-owned companies: the federal government-owned Coal India Limited (CIL) alone accounts for 80% of the country's production (CIL, n.d.). Close to 50% of India's coal power plants are owned by SOEs, such as NTPC Ltd (Ministry of Power, n.d.). The sector is also largely funded by state-owned banks. While CIL is largely self-funded, power plants are usually two-thirds debt financed, mainly by three government-run entities: the State Bank of India, the Power Finance Corporation, and the Rural Electrification Corporation (Tongia, Sehgal, and Kamboj 2020).

The coal sector is deeply embedded in socio-economic outcomes nationally and has great importance in some states, and this importance is growing, as India is still opening new coal mines and power plants (IEA, 2020b). Although some are led by private investments, the bulk of expansion is happening through SOEs such as CIL and NTPC (Tongia et al., 2020). In addition to energy supply, the coal sector contributes socio-economically in several important areas.

- **Revenue.** According to one estimate, CIL and NTPC alone contribute to around 3% of the federal government's total revenue receipts, while state governments in Jharkhand, Chhattisgarh, and Odisha receive over 5% of their revenue from the coal sector (Athawale et al., 2019). These states are among the poorest in the country, indicating they can little afford unplanned contractions in coal sector revenue and the flow on impact of reduced services to their citizens. Indian Railways, a federal government-owned entity, is also deeply dependent on coal transport, which contributes to nearly 50% of its total freight revenue. Indian Railways' business model is based on overcharging coal mining companies for freight, in order to cross-subsidize passenger fares (Tongia et al., 2020).
- **Employment.** Close to 4 million people are either directly or indirectly employed by the coal mining sector (Pai, 2021).² The number of induced jobs has not been quantified but is likely to be significant in coal-dependent regions. Indeed, depending on how "induced" is defined, almost all jobs in some top coal regions could be considered dependent on earnings from coal. In most coal-dependent states in India there is also an informal or "illegal" sector: locals scavenge coal for personal use as domestic fuel, or to sell at the local market (Chandra, 2018; Lahiri-Dutt, 2014; Pai & Carr-Wilson, 2018). National-level estimates are not available for informal workers, but a recent study found that in one coal-dependent district there were three times more informal workers than formal workers (Bhushan et al., 2020).

² Employment can be direct (employed by the project itself), indirect (supplying ancillary inputs to the project), and induced (providing goods and services to meet consumption demands of direct and indirect employees of the project) (Bacon & Kojima, 2011).



- **Pension funds.** The coal industry supports over half a million coal pensioners, who are mainly the retired workers of coal SOEs (Pai, 2021). The Coal Mines Provident Fund Organization (CMPFO), a federal government organization, collects equal contributions from coal mining companies and workers (CMPFO, 2020). The money is then paid out as pensions after their retirement. However, in practice, the money from existing workers and coal companies is used to pay current pensions. The absence of savings means that any contraction of the coal industry would leave current and future coal pensions underfunded.
- **Corporate Social Responsibility.** In the 2019–2020 financial year, coal mining and power companies spent over INR 1,000 crore (USD 144 million) on corporate social responsibility (CSR) initiatives in over 90 districts (Pai, 2021). India's largest coal power company, NTPC, says it spent two-thirds of its CSR funds “eradicating hunger and poverty, health care and sanitation, education and skill development, and rural development” (NTPC, 2020).
- **Coal-based industries.** Coal-based industries such as steel manufacturing, cement production, and others currently consume over 20% of India's total coal consumption, or 200 million tonnes of domestic and imported coal. There are 977 Indian steel manufacturers across the country, the majority of which rely on metallurgical coal as an input fuel (Lok Sabha, 2020). In districts where they operate, coal-based industries also generate a large number of direct and indirect jobs, contribute to local government revenues, and engage in CSR spending (Chandra 2018; Tongia et al., 2020).

Given the significant footprint of the coal sector's socio-economic contributions at different levels, unplanned contractions in the coal sector could have significant impacts on people and communities in coal-bearing areas. Therefore, any future just transition plans would require planning for each of these aspects.



3.0 Priority Attributes of a Just Transition in India and Identification of Research Needs

To identify themes around international experience that could help enrich policy discussions in India, we examined a framework of 17 key elements of just transition based on a comprehensive review of global scholarly and policy research (Pai et al., 2020). We narrowed this down to seven elements that are relevant to current policy debates and essential for future planning (Table 1). Interviews were used to further investigate the challenges and opportunities for each element and identify priorities for research in the domestic or international context.

Table 1. Priority elements of a just transition strategy for India

Element	Focal point(s)
Long-term planning	National & state
Unions engagement	National, state & local
Community engagement	Local
Local job creation and economic diversification	Local
Recognizing coal in personal and community identity	Local
Fully funded worker pensions	Local
Mine site remediation and redevelopment	Local

Source: Adapted from Pai et al., 2020.

3.1 Long-Term Planning

International experience has shown that a key component of just transitions involves long-term and coordinated planning between governments and relevant stakeholders.

This element emphasizes the need for national, state, and local governments to come together to develop integrated just transition plans. One of the most successful case studies of just transition is the closure of hard coal mines in Germany's Saarland and Ruhr regions. Several years before the government decided to close down the mines, an agreement was signed between the federal government, the state governments of Saarland and NRW, unions, and the energy conglomerate Ruhrekohle AG (Abraham, 2017). The agreement laid out several long-term plans, including guaranteed pensions for older workers and jobs for younger workers.

Given the risks that peak coal in India may arrive sooner than once expected, stakeholders need to develop long-term plans now. Interviewees suggested that since just transition is a new concept in India, civil society groups can play a role in sensitizing top



policy-makers (government ministers and chief ministers of coal-bearing states) about the idea and need for just transition planning. At the same time, it is important to engage with local stakeholders in coal-dependent districts to create roadmaps and mechanisms for long-term just transition policies. Ward et al. (2021) provide a mind map showing stakeholders actively involved in just transitions in India. A similar map could be developed for local coal stakeholders in coal-dependent states like Jharkhand. Indian and international experience on how to carry out civil society engagement on the various dimensions of a just transition (e.g., decisions on investments, development activities, industry diversification) might be useful for the coal sector.

Recent research has shown that there are nearly 284 districts (out of 736) in India that have some form of coal dependency but which vary in both scale and type of dependency (Pai, 2021). For example, some districts are more dependent on coal jobs and others on local revenue. Thus, given these varying degrees of dependence, several tailored local plans would be required.

Interviewees suggested that researchers and policy-makers need to conduct studies to understand the risks and resilience of coal-dependent regions—collectively and as individual communities—before developing plans. Such studies could use models and frameworks from within and outside India that have been used for long-term planning that integrates heterogeneous subnational districts' risks and resilience. Economic modelling of the projected impact of coal asset closures on local socio-economic conditions would be highly valuable (Ward et al., 2021).

Research Priorities

Domestic

- Map socio-economic data on coal stakeholders and their positions on just transition.
- Map coal-dependent districts by extent of coal dependence, risks, and opportunities.
- Undertake economic modelling and qualitative impact assessments of the socio-economic impact of the energy transition on coal-dependent regions.
- Examine “lessons learned” for how to engage civil society in other major structural reforms.

International

- Examine international experience in how to engage civil society in coal structural reforms.



3.2 The Role of Unions

Social dialogue with unions is vital for creating any just transition plan that requires phasing out polluting industries (IndustriALL, 2019; International Trade Union Confederation, 2020). International experience shows that unions are essential to implementing just transition plans and act as partners in specific programs such as retraining (Cha, 2017; Stevis & Felli 2014, 2015). Globally, fossil fuel industries have higher rates of unionization compared to other industries (Cha, 2017), as the majority of fossil fuel production is by SOEs that traditionally encouraged unionization (Natural Resource Governance Institute 2019). Any job losses in the fossil fuel industry may increase tensions between labour unions in these industries and pro-transition stakeholders, as unions attempt to protect their members' jobs. Just transition plans therefore need to be built in consultation with unions.

The coal sector is one of the most unionized sectors in India. Leading coal producers CIL and the Singareni Collieries Company Limited account for nearly 90% of coal production in India and have nearly a 100% unionization rate (Pai & Carr-Wilson, 2018). The five national unions that represent coal workers are affiliated with major political parties including the Bharatiya Janata Party, the current federal ruling party. The five main unions represent different ideologies and are structured differently. For example, the All India Coal Workers Federation, one of India's largest trade unions, has many local branches representing different types of coal workers such as miners, steelworkers, and tradespeople, among others (Pai & Carr-Wilson, 2018). Several local and national trade union members interviewed for the report were not aware of the just transition concept but suggested that any post-coal future would require the government to engage with unions at different levels—nationally and at the state level.

Research Priorities

Domestic

- Map relevant unions' objectives and identify issues that unions consider important for just transition planning, e.g., through in-depth interviews and focus group discussions with union representatives.
- Co-create research and dialogues on just transition with unions.

3.3 Community Engagement

Dialogue with local stakeholders such as civil society and local government representatives of communities in coal-dependent regions is key to a successful just transition (Eisenberg, 2018; Goddard & Farrelly, 2018; Rosemberg, 2010; Snell, 2018; Weller, 2019). This implies that all local stakeholders must get a fair chance to participate in the just transition planning process. International experience shows that there is a tendency among policy-makers to take a top-down approach in making just transition plans and not engage with affected communities. However, failure to engage extensively with communities may result in the politicization of the energy transition in the name of “jobs vs the environment” (Pai, 2021).



Understanding the needs and concerns of non-unionized workers (indirect, induced and informal employees) who benefit from the coal economy is also critical. A recent study on a just transition in the coal-dependent Ramgarh district of Jharkhand showed that worker groups are diverse and heterogeneous, varying in socio-economic background and motivation (Bhushan et al., 2020).

Some interviewees emphasized that a stakeholder mapping exercise must be conducted to understand key stakeholder groups in coal regions. This will help identify local champions who may facilitate meetings and events at the local level for community engagement. Several interviewees said that community engagement must be conducted throughout the transition process. Many international organizations have expertise in carrying out stakeholder mapping exercises in different sectors. Their experience and the frameworks they have built could prove to be useful for stakeholder mapping exercises for the coal sector in India.

Research Priorities

Domestic

- Ensure informal workers are included in efforts to map coal stakeholders.
- Develop mechanisms to engage non-unionized coal workers in transition planning.

International

- Examine international experience in involving non-unionized coal workers in policy planning.

3.4 Coal as an Identity

Researchers focusing on a just transition for coal workers in Global North countries emphasized that coal workers have a strong sense of belonging to the community where they live and work (Carley et al., 2018; Della Bosca & Gillespie, 2018; Haggerty et al., 2018; Lewin, 2019). In many cases, working in the coal industry is also a generational identity issue (Carley et al., 2018). For example, coal miners making formal written submissions in support of coal mine development in New South Wales, Australia, were found to write emotionally about how coal has supported their families for several generations (Della Bosca & Gillespie, 2018). In just transition policies and planning, it is important to recognize this in a meaningful way. However, little research exists even internationally to show how non-tangible losses such as identity can be incorporated into the just transition planning process.

In India, nearly all interviewees said that working in the coal sector is a significant identity issue among workers. An interviewee who worked for CIL for 35 years said, “In the industry, you will find people who are now third-, fourth-, and even fifth-generation coal industry workers. There are families where most of its members are coal industry workers, either directly or indirectly.”

Aside from generational identity, coal workers call themselves “coal warriors” because they are responsible for providing the fuel that runs the economic wheel of the country. In fact,



companies like CIL play coal anthems before events and meetings that recognize the hard work done by workers. When asked about the issue of coal identity, one of the union leaders said, “Our coal warriors have suffered from death and diseases for generations to provide the fuel required to run the economy. We are second only to the Indian army.”

Research Priorities

Domestic and international: Develop case studies from within and outside India to develop ways to acknowledge and address identity as part of the just transition planning process.

3.5 Local Jobs and Diversified Economies

When coal mining industries decline, most workers and community members do not migrate after losing their jobs due to a strong sense of belonging and the fact that most workers are older and less skilled (Beatty & Fothergill, 1996; Danson, 2005; Fothergill, 2001). Therefore, diversifying local economies and creating local jobs is a central element of just transition processes in coal-dependent regions. Lessons from developed countries warrant further investigation but might have limited relevance to India, given the likely high cost of structural adjustment programs delivered by wealthier countries.

In many coal-dependent regions, the entire local economy revolves around the coal industry. For example, a recent study of the impact of coal mine closures in the district of Betul in Madhya Pradesh noted:

Such is the magnitude of influence it [coal industry] holds on the secondary and tertiary sectors of the district, that a fall in the value added by mining showed a simultaneous fall in the secondary sector (manufacturing, electricity and construction) as well as in tertiary sector (in the “trade, repair, hotels and restaurants” and the “financial” components). (Gupta, 2020).

Diversification can assist coal workers, communities, and companies to transition.

Interviewees suggested two main approaches to diversification, which might require skill development and retraining.

First, coal companies like CIL and NTPC should successfully diversify their businesses in order to remain financially stable. If this happens, they may be able to avoid economic downturns at the district levels. One interviewee summarized it as follows: “If CIL remains financially profitable, it can continue to employ people, pay taxes and build roads, and run schools, among others. Therefore, CIL must diversify. In the next 1-2 years, CIL should create a completely new subsidiary company that focuses on renewables or on completely new sectors.” There are some lessons that can be learned from international experience in terms of how some state-owned companies have diversified. For example, in less than a decade, Ørsted, the Danish state-owned fossil fuel producing company restructured itself into a leading global offshore wind company (Morris, 2018).



A large portion of the district mineral foundations (DMFs) funds should be used to promote local industries such as forestry, fishery, and tourism to create jobs. These funds derive their revenue from a levy on coal production (equivalent to a royalty), which they invest in economic and social development in coal-producing districts. This model could be explored as a vehicle for funding investments in economic diversification as part of just transition plans. A policy-maker working with the Jharkhand government provided details of some novel initiatives undertaken in this regard. For example, DMF funds were used to convert a few abandoned coal mines into a lake to promote cage fisheries in the Ranchi district (Jharkhand). Over 100 local people found employment. While this is an important example of diversification, many interviewees warned that each district's diversification plans might look different, as they would depend on local and state resources as well as people's interests and skills. Interviewees suggested that there is a need to research the resource and skill potential of each district in order to assess the district diversification strategies. It must be emphasized, however, that DMFs have had implementation challenges that would need to be overcome. This includes the fact that many DMFs have struggled to disburse their funds, such that large volumes of revenue have been accrued but not allocated (Shalya, 2020). DMFs are also obliged to focus benefits on "mining-affected people"—but, in reality, many projects, including the aforementioned support for fisheries in Jharkhand, do not appear to have attempted to ensure that benefits are being clustered on people who have been affected by mining (Banerjee, 2019).

Research Priorities

Domestic

- Assess local resource and skill levels in coal-dependent regions and use these to develop district-level diversification plans.
- Explore diversification opportunities for India's major coal SOEs.
- Explore expanded use of DMF resources for economic diversification in coal regions.

International

- Review or develop international case studies of how energy SOEs have diversified.
- Review economic diversification strategies employed in coal-dependent regions.
- Share India's experience with DMFs with other countries.

3.6 Worker Pensions

After the coal sector started declining in some countries such as the United States, retired workers' pensions were negatively affected due to the way that the pension model works in these countries. Existing workers and coal companies make equal contributions to the pension fund that is used to pay retired workers. This is the same case in India, as described in Section 2.



Any just transition plans in India must include plans to secure coal workers' pensions.

This is one of the most neglected elements in the current just transition discourse. Currently, equal contributions are made by the worker and the coal company. Each coal company employee pays 7% of their Basic pay and Dearness Allowance³ every month to the pension fund. An equal amount is contributed by the company to the pension fund. Recently, a decision has also been made by coal companies that they will contribute INR 10 (~USD 0.14) per tonne for every tonne of coal it produces to the pension fund. A board member of CMPFO said, “Even today, as the number of pensioners exceeds that of current employees, the fund is barely sustainable. If the coal sector declines, this fund will cease to exist.”

Two board members of CMPFO who were interviewed for this report collectively gave three recommendations as examples of what can be done to make the pension fund sustainable in the short- to medium-term future. First, they recommend that the management contribution should be increased from INR 10 to INR 25 (~USD 0.14 to ~USD 0.34) per tonne of coal produced. Second, there should be an upper limit for the pension amount that any employee can draw, as some senior employees make a lot of money after retirement. Finally, there is a need to revisit how the pension amount is calculated for retirees. Currently, the pension paid to retired employees is calculated as 25% of the average salary of the 10 last months (Sengupta, 2020). This could be increased to the last 30 months, which would result in much smaller pension obligations.

While such ideas could make the pension funds sustainable for some period of time, research is required into how to ensure all pensions are fully funded for current and future retirees, and that the pension payment is fair and sufficient. Internationally, there exist several country-level experiences in reforming pension funds and making them sustainable. For example, in one study, the International Monetary fund has suggested ways to reform pensions, drawing on experiences from 52 advanced and emerging market economies (Clements, 2013). Such experiences and resources might be useful for planning coal sector pension reforms sustainably in India.

Research Priorities

Domestic

- Investigate mechanisms to ensure pensions are fully funded for current and future retirees.

International

- Examine how other countries have reformed pension funds to make them sustainable.

³ Dearness Allowance is a payment to government sector employees and pensioners to compensate for inflation.



3.7 Environmental Remediation

Decommissioning of coal infrastructure and environmental remediation of coal mines and other assets in coal-dependent areas could provide investment and jobs.

Site remediation and redevelopment could also help create access to recreational activities, which will help combat negative economic consequences of legacy contamination (Haggerty et al., 2018).

Interviewees said the federal Ministry of Coal guidelines for proper closure and reclamation of mines are generally not followed. However, interviewees noted that if all coal mines are reclaimed, it has the potential to create a local industry of service providers, equipment manufacturers, and labourers. For example, when mining coal, companies remove layers that lie above coal. These layers are collectively called overburden, which is a mix of stone, mud, and silica. One interviewee said that some components of overburden (sandstone and shale) could be separated out from the rest and used as building materials. The separation process would require machinery and workers.

Even when the mine is reclaimed, these areas can be converted into local tourism sites. For example, in the Khatras area of Dhanbad, after mining operations stopped, the operator of the Bharat Coking Coal Limited mine reclaimed the mine and converted it into a recreational park. This park now attracts thousands of locals every month. While this is good example from within India, the situation is not the same across coal-bearing areas with most coal mining areas left abandoned (Pai & Carr-Wilson, 2018).

Extensive studies are required for understanding the technical requirements for environmental remediation that may vary due to the differences in the types of coal mines (open cast vs. underground) and various other local conditions. Local research institutes in Jharkhand such as the Indian School of Mines have over the years conducted several studies on this topic. Internationally, there are also numerous examples of such environmental remediation programs. The European Commissions toolkit on environmental rehabilitation and repurposing provides guidelines for coal regions in transition on how to go about environmental remediation (Beuermann et al., 2020). The toolkit contains examples of good practices and tools that can be considered during the mine closure phase.

Research Priorities

Domestic

- Technical requirements for mine site rehabilitation, including at the local level.

International: Indian experience relevant to other emerging economies

- Share existing studies of mine site rehabilitation requirements in Indian coal-dependent states.



4.0 Conclusion and Recommendations

Coal has been central to India's development by providing jobs, supporting communities, and supplying the majority of energy for electricity generation. But change is in the air: renewables are already outcompeting coal on a levelized cost basis, and India's central and state governments are under increasing pressure to reduce air pollution and greenhouse gas emissions. A long-term plan is needed to facilitate energy transition and mitigate socio-economic impacts.

Developing a long-term just transition strategy for the coal sector in India will be a major undertaking, involving extensive consultation, research, and innovative financing. This study contributes to the development of such a plan by identifying priorities for research based on a review of international literature supplemented by expert interviews. The key research needs are:

- Examination of other countries' just transition plans for coal.
- Mapping of stakeholders and their needs, particularly unionized and non-unionized workers and their communities, including to better understand the implications for just transitions of coal in personal and community identity.
- Opportunities to diversify coal SOEs and coal-dependent communities based on international experience and research into local needs and attributes.
- Options to reform pension funds to ensure all current and future pensions are fully funded, based on international experience.
- Potential for coal mining sites to become sources of employment and ongoing regional income; how funds could be raised for rehabilitation and development of sites.

Other developing and emerging economies with a coal sector—at the national or subnational level—are likely to face similar challenges and research needs. These countries would benefit from sharing India's knowledge and experiences in just transitions.



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