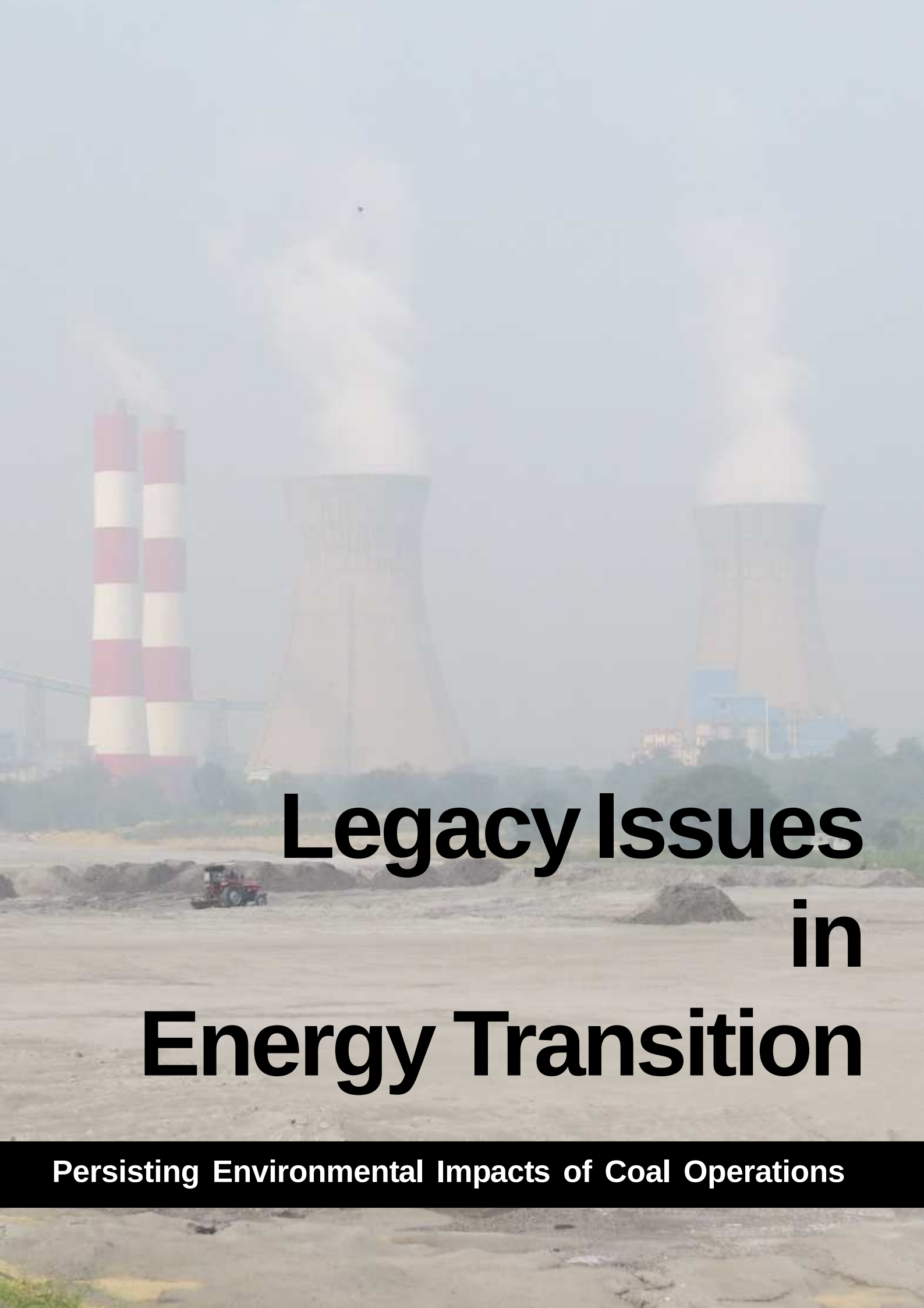




Legacy Issues in Energy Transition

Persisting Environmental Impacts of Coal Operations

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EXECUTIVE SUMMARY

Energy transition is talked about a lot currently. At its core, it is driven by concerns of climate change and high emissions of greenhouse gases, and effectively means decarbonisation of energy sources. One major aspect of the transition seen in India is a shift in the energy sources for power generation from coal to non-carbon sources, like solar, wind and others.

Coal, currently the mainstay of our power system, has many serious environmental and social impacts. Unfortunately, a lot of these have remained unaddressed and continue to threaten local ecologies and livelihoods and health of communities. If these impacts are not handled, they will end up being permanent and unwanted legacies of the transition away from coal.

In any transition, the focus is largely on what lies ahead. That which is left behind as we move to better things is often neglected, or even forgotten. Therefore, this paper highlights such legacies which we may be leaving behind in the energy transition, and the need to address them. Energy transition can have other legacies – like the fate of workers of power plants and coal mines, or the impacts on local economies as coal-operations wind down. In this report, we focus on the legacies of the environmental impacts of coal-operations, and in particular those that pertain to impacts on water and land.

These legacies are of concern for two reasons. First, these legacies continue to have adverse environmental, social and health impacts. Second, given that these legacies are mainly issues that the extant legal framework requires to be addressed, they essentially are physical manifestations of violations of the law. They need to be addressed to mitigate the impacts, as well as to ensure the environmental rule of law, even if belatedly.



Legacy Ash

Ash, in various forms like fly ash and bottom ash, is one of the solid wastes generated in huge quantities from burning coal in power plants. At least since 2009, regulations require power plants to use 100% of the ash they produce. However, this regulation is grossly violated and massive amounts of unused ash have accumulated as a legacy of these violations. As on 31 March 2022, legacy ash was a massive 1734 million tons. This ash continues to pollute air, water and land as it gets blown by wind, and washed into water bodies and soil through run-off, leaching, seepage etc. It continues to impact the health of plants, cattle and humans as it contains toxic metals and other pollutants.

The MoEFCC's Fly Ash Notification 2021 used the term "legacy ash" for the first time and introduced a legally binding provision that such legacy ash should be fully utilised in 10 years. This will be an uphill task as this has to be done along with utilisation of the current ash, whose utilisation is around 96%.

Keeping aside some questions about this 96%, it is important to note that current modes of utilisation like use of ash in manufacture of cement, manufacture of fly ash bricks, use in road constructions etc. have important constraints including how much each mode can absorb, cost of transporting the ash and need for ensuring safety of ecology and health.

Given these constraints, two modes are being seen as major possibilities in handling legacy ash. The first mode is the filling of ash in the voids of end-of-life mines. While the logic is attractive - the coal came from these mines, leaving a void; the fly ash can go back and fill it up – there are concerns of environment and safety in this. This is the reason why for a long time, the Expert Appraisal Committee (EAC) of the MoEFCC had been putting a condition that fly ash would not be used for mine void filling (or for reclamation of low-lying lands)

while granting Environmental Clearances to power plants. In 2019, CPCB issued a set of guidelines for use of ash for filling mine voids, as well as for use of ash for reclamation of low-lying areas. At the same time, MoEFCC issued an Office Memorandum (OM) amending all earlier ECs and allowing use of ash for mine void filling, mandating that the CPCB guidelines be followed. It remains to

be seen how well these guidelines will be followed, whether they will ensure environmental protection and safety, and to what extent will mine-filling help address the legacy ash issue. Early experiences are not encouraging, both, in

terms of guidelines being followed as well as ensuring transparency in the process, particularly with respect to public accessibility of the pre-ash disposal studies and post-disposal monitoring.



Another important issue in the disposal of fly ash in mine voids is the (non) involvement of people in the decision and process of dumping fly ash in mines.

Local communities living near these mines are among those likely to be most affected. Hence, it is important that they are involved in the decision, as well as the process of pre and post studies and monitoring. A closed mine can be put to many different uses, and using it to dispose ash is only one of them. Filling of mines with ash needs to be considered in context of the legally binding guidelines for mine closures and reclamation. An important principle is that the reclamation process should put interests of the local communities at the centre. Some important uses of such closed mines include use of the mine voids as store and source of water for local uses like water supply, irrigation and fishing; or, use of the land recovered after filling and reclaiming the mine for horticulture, grazing or even agriculture purposes. Dumping ash in the mines can render the water and soil unsafe for use. Thus, it is important that the opinion and interests of local communities be at the centre when considering closed mines for disposal of fly ash.

A second approach to address legacy ash is the in-situ stabilisation of ash ponds. The Fly Ash Notification 2021, which mandates use of legacy ash in 10 years, also allows an exemption “where ash pond or dyke has stabilised and the reclamation has taken place”. The effectiveness of this solution in addressing the legacy ash problem depends critically on what constitutes (or what *should* constitute) stabilisation, and reclamation. As required by the Notification, CPCB and CEA brought out guidelines for “stabilised and reclaimed” ash ponds in June 2023. Unfortunately, though incorporating several important provisions, they fall short of what is needed for proper stabilisation and reclamation. The Guidelines call for proper dewatering of the ash in the pond, preparation of site and covering the ash with soil as well as annual certification of reclaimed ash pond in respect of safety, storm water collection and disposal, and environmental pollution. However, the Guidelines assume that every ash pond can be safely stabilised and reclaimed. This can be problematic, for example in cases of the many old ash ponds which do not have an impermeable lining at the bottom. Shutting such ash ponds with the ash left in can continue to seriously threaten groundwater quality in their surroundings for years. These shortcomings need to be rectified. Another issue is the use to which the land reclaimed from the ash pond is put to. The Fly Ash Notification 2021 gives only four options - greenbelt or plantation or solar power plant or wind power plant. There is need to ensure that reuse of land and other resources reclaimed from ash pond prioritise the benefits to local communities.



Two other issues need to be flagged in the case of legacy ash. One of the methods of ash “utilisation” is what is called as “reclamation of low-lying land”. Over the years, ash “utilised” in this mode has steadily increased. Unfortunately, in many cases, this “reclamation” is actually a euphemism for just dumping of ash. Such ash dumps are responsible for significant fugitive emissions of ash and contamination of water bodies. Such ash, though “utilised” still needs to be counted as “legacy ash” and subjected to the provisions of the Fly Ash Notification 2021. Another issue is that of “invisible” legacy ash – invisible in statistics, though it may often be in plain sight! This is ash which has entered the environment thorough leaks, breaches, seepage, deliberate discharge, dumping, blown by wind, contaminating water bodies, soils and other areas. Such cases have also been highlighted by the NGT, among others. These invisible legacy ash deposits need to be identified and addressed.

Coal Washeries

Indian coal is of low grades with ash content of the order of 24 - 63 %. Washing or coal beneficiation is a generic term that covers various methods used to improve the quality of coal by removing denser material and ash. When coal is washed, we get “clean” coal with relatively less ash content, as well as middlings, and rejects. The last one, as the name suggests, are essentially a waste product. Safe handling and disposal of rejects is a major concern for washeries. Rejects can cause fugitive dust emissions and run-off of leachates. Rejects in large quantities have been dumped in areas adjacent to washeries. Rejects are emerging as a major legacy of coal washeries.

There are mainly three ways to use (or dispose) washery rejects - use them as fuel in Fluidised Bed Combustion (FBC) power plants for generating power, use in applications like brick kilns, road construction etc where they may be burnt in an unregulated manner, and filling in mine voids. While use in FBC plants also creates the secondary problem of large quantities of ash, NITI Aayog has also documented that FBC capacity is woefully inadequate in comparison to the quantity of rejects generated. It implies that the filling in mine voids is the best strategy to deal with washery rejects. Unfortunately, scant data is available for generation and utilisation for coal washery rejects.

On 27 May 2021, the Ministry of Coal adopted the *Policy for Handling and Disposal of Washery Rejects* and on 7 Jan 2022 called for its strict implementation by all coal washeries. However, there is little information in the public domain regarding the actual implementation, both, with regards current rejects and legacy rejects.



It is imperative that information and data for generation, utilisation and safe disposal of washery rejects be made publicly available.

End of Life Mines

Mines are massive interventions, with extensive digging up of land, dumping, piling up and disposal of wastes, dewatering of groundwater aquifers, large scale discharge of effluents, dust emissions and so on. These have created significant disturbances in the lands, landscapes, water, soil and ecology of the areas as well as to the lives, livelihoods, culture, economy and health of communities. Mining is eventually closed at all mines, for a variety of reasons. What gets left behind – and how it is addressed, is crucial to the legacy of mining.

The Ministry of Coal acknowledges that before 2009, mine closures were essentially non-scientific closures, leaving the sites abandoned and neglected. A requirement of Mine Closure Plans was brought in in 2003, followed by Mine Closure guidelines in 2009, subsequently revised in 2013, 2020 and most recently in 2025. Guidelines for managing the closure of mines closed prior to 2009 were issued in 2022. In spite of these regulations, the situation on ground of addressing the outstanding issues when mines are closed, has been unsatisfactory and inadequate. As of 2024, a total of 179 pre-2009 and 162 post-2009 mines, considered abandoned/discontinued have been identified out of which 147 have been identified for closure and the rest are to be re-operationalised.

There are three key issues of concern in mine closures. The first is the lack of proper physical and biological recovery of mined land, clean-up of polluted soil and water resources etc. The second is the total lack of any meaningful say for local communities in the entire process of mine closures. The third is the limitations on the uses to which land reclaimed from mining can be put to.

Local communities are impacted when private lands and commons are acquired for mining, as well as due to pollution and other impacts of mining operations. While some of this is offset with jobs from the mines, these are lost when mines are closed. Thus, mine closures need to generate livelihood opportunities to replace the lost ones, and also address pollution and other impacts.

One way to do this is to ensure that resources created in the process of mine closures, including water and reclaimed land are used to address needs of local communities on a priority basis. For this, their involvement in the entire process is critical. Some of the proposed uses of closed mines, like disposal of ash can jeopardise potential local community uses like fishing, water supply, horticulture etc.



There are also severe limitations on the uses to which the land reclaimed from closed mines can be put to. Forest land that had been diverted for mining under the Forest Conservation Act 1980 reverts back to being forest land. It is important to ensure that these lands go back to being “forest lands” in letter and spirit, so that they provide services that these forest lands provided to the ecology and local people as commons. The allowed uses for the non-forest land part of the reclaimed lands are restricted to setting up coal or energy infrastructure development activities. These are likely to have very limited benefits to the local communities.

There appears to be some recognition of these issues and an intent to address them. Three new developments, a proposed Amendment to the Coal Bearing Areas Act 1957, new *Guidelines for preparation of Mining Plan and Mine Closure Plan for Coal and Lignite blocks, 2025* issued by the Ministry of Coal on 31 Jan 2025 and a new community development framework for mine closures called RECLAIM brought out by the Coal Controller Organisation in July 2025 together have important provisions that aim to give central importance to local communities and their interests, and for the use of resources like funds, reclaimed water bodies and lands for their benefit. Though there are gaps in these provisions, including questions whether some of them are legally binding, they represent significant progress. Implementation will be the key.

Retirement of Power Plants

There are no specific regulations or guidelines dealing with decommissioning of retired thermal power plants. In response to an order of the National Green Tribunal, the CPCB has submitted draft *Environmental Guidelines for Decommissioning a Coal/Lignite-Fired Power Plant (Draft)* to the NGT on 22 July 2021. However, they are very sketchy in nature in their current form, and not yet finalised. Till then, decommissioning of power plants will be regulated as per extant laws like Water Act and Air Act. The most critical legacy of retired power plants are the ash ponds, which we have already discussed earlier. The Guidelines issued by CPCB and CEA under the Fly Ash Notification 2021 require regular monitoring and annual certification of reclaimed ash ponds. The case of closed thermal power plants, however, raises the issue of who would bear the continued responsibility and liability of this.

The other issues are related to the safe disposal of all waste, including hazardous wastes, scrap, and clean-up of the pollution that has been caused over the years. The issue of the use to which the land would be put to is a critical one. Like the case of mine closure, here too, the needs and interests of

local communities, (and the interests of the plant workers) including their livelihoods, need to be prioritised and they need to have a meaningful place in the process.

Legacy of Mindset

So far, we have talked about the physical legacy of coal operations. There is another legacy that is as important, though it is not physical –that is the legacy of the mindset and approach. The entire structure of coal operations – mining, washing, transport, power plants, waste disposal – has been driven by a particular approach. This is a top-down approach where the main focus is on the technical, economic, and financial side, and the social, environmental issues are relegated to the sidelines. Needs and interests of local communities and ecology have been ignored, and there is hardly any place for their voices. Bigger is considered better, with attendant centralisation. This approach has been responsible for many of the problems besetting coal operations. Unfortunately, this approach is also a legacy that seems to be retained even as energy systems transition through a technological shift. Renewable energy installations are getting bigger and bigger in scale, are being installed in eco-sensitive areas, on water bodies, and mostly without any involvement of local communities. Though the new renewable energy sources are inherently cleaner in many ways, they are not without impact, especially at scale. Yet, they mostly don't require impact assessments.

It is important that as a part of the energy transition, we also effect a transition in the approaches to managing the entire process. Otherwise, we risk perpetuating the legacy of the same mindset and approach which has led to the current set of serious issues.



X



LEGACIES OF CONCERN

On 31 Dec 2021, the Ministry of Environment, Forests and Climate Change (MoEFCC) issued a notification regarding the utilisation and management of fly ash from coal and lignite thermal power plants (Fly Ash Notification 2021). This was a comprehensively revised version of previous notifications regarding management of fly ash and contained many fundamentally new elements. One such new element was the term “legacy ash” and the provision mandating its full utilisation (MoEFCC, 2021).

Section 5 of the Fly Ash Notification 2021 defines “legacy ash”, saying:

“The unutilised accumulated ash i.e. legacy ash, which is stored before the publication of this notification, shall be utilised progressively by the thermal power plants in such a manner that the utilization of legacy ash shall be completed fully within ten years from the date of publication of this notification and this will be over and above the utilisation targets prescribed for ash generation through current operations of that particular year.”

This provision, and the reference to “legacy” ash is very important, as it is a recognition of waste or pollution that has been accumulating over the years, and which remains to be addressed.

The scale of the problem can be gauged from the fact that the Central Electricity Authority (CEA) noted that the amount of legacy ash in the country as on 31 March 2022 was a massive 1734 million tons (CEA, 2022, p. 64). If we compare this with India’s annual solid waste generation, which was around 60 million metric tons¹ in 2021 as per the Central Pollution Control Board (CPCB, 2021, p. 4), then the legacy ash is equivalent to about 30 years of the total annual solid waste generated in the country!

1. Solid waste is understood here as that covered under Solid Wastes Management Rules, 2016, which is virtually all non-industrial waste. The Rules define it as “solid or semi-solid domestic waste, sanitary waste, commercial waste, institutional waste, catering and market waste and other non-residential wastes, street sweepings, silt removed or collected from the surface drains, horticulture waste, agriculture and dairy waste, treated bio-medical waste excluding industrial waste, bio-medical waste and e-waste, battery waste, radio-active waste generated in the area under the local authorities and other entities mentioned in rule 2”. As per the CPCB, generation of such waste in the year 2020-21 was 160038 tons per day, which is equal to 58 million tons per year.



It is important to note that ash is not the only legacy of concern with regards environmental impacts of coal-based power generation. Official agencies have recognised that such legacies – of wastes, of pollutants and of other impacts - exist in other parts of the coal chain too, for example, in mining and in washeries. We could call them legacy impacts. In this paper, we examine in detail these legacies related to environmental impacts of coal operations, and in particular those that impact water and land resources.

Why are these legacy impacts of such great concern? There are several reasons, which we detail below.

Legacy of Non-Compliance

Legacy impacts often result from, and are a legacy of non-compliance with regulations.

At least since 2009 coal and lignite-based power plants are required to utilise 100% of the ash that they generate (MoEFCC, 2009).² This means that any ash that is left unutilised actually remains as a violation of the regulation. This becomes a concern as this legacy ash represents the persistence of non-compliance with the laws and regulations. Given this, addressing such legacy impacts is an important part of ensuring full compliance with the law. It is an assertion that the law will need to be complied with, even if a little late. It is an assertion for upholding the “environmental rule of law”.³ The Supreme Court of India, in the Mopa Airport case, has also upheld the principle of the “Environmental Rule of Law” and emphasised its application as very important for the quest for environmental governance within a rule of law paradigm, and to address the gap between requirements of environmental law and their implementation and enforcement. (Hanuman Laxman Aroskar Vs. Union of India, 2019)

“Legacy” ash is a recognition of waste or pollution that has been accumulating over the years, and which remains to be addressed.

Legacy of Continuing Impacts

Legacies of the kind we are talking about are those that can adversely, and seriously impact the ecology, and health and livelihoods of local communities. Again, taking the example of fly ash – legacy fly ash sits in slurry form in large fly ash ponds, or as even as

2. The provision for 100% utilisation of ash generated was already there in the Fly Ash Notification of 1999, but it gave upto 15 years to achieve the same in a phased manner, and was unclear about utilisation of the ash that was accumulated during these 15 years. The 2009 Notification required all plants to achieve 100% utilisation in 5 years, and required that the ash accumulated in these 5 years also be fully utilised in the next five years along with 100% utilisation of the current ash generation. This was also in a way a direction to utilise the legacy ash, legacy of the 5 years. But the term legacy ash was not used.
3. The United Nations Environment Program (UNEP) defines ‘environmental rule of law’ as “the principles of rule of law applied in the environmental context”. It further elaborates this as “Rule of law describes a governance system in which all persons, including public and private individuals and institutions, are accountable to laws that are public, equally enforced, independently adjudicated and consistent with human rights. UNEP has identified seven core elements of environmental rule of law.” (UNEP, 2023, p. 15)



dry fly ash dumps. The fly ash from these sites can leach or leak into ground and surface water, flow with rainfall runoff, get blown by wind onto farms, homes and water bodies, and continue to contaminate the environment in many different ways. The National Green Tribunal (NGT) has been looking at the impacts of fly ash as a part of many of the cases before it. In one hearing where it heard eight such major cases together, it noted:⁴

*“The common issue in all the above eight matters is the remedial action against violation of environmental norms by the Thermal Power Plants (TPPs) ... unscientific handling and storage of fly ash beyond capacity of flyash dykes/ponds resulting in devastating accidents due to their breach. Such breaches have resulted in contamination of water sources, damage to crops, loss of human lives and flora and fauna. Accumulated fly ash has been found to be **1670.602 Million Tonnes as on 31.12.2021**. The same is source of continuing damage to public health and environment ... (Page 3)*

“... huge accumulated flyash is not being utilised nor scientifically stored, the ponds/dykes are not properly maintained resulting in polluting water sources, air and land, apart from adverse health effects and damage to the flora and fauna...Bottlenecks in remedying the situation of not utilising accumulated flyash need to be tackled on war footing. (Page 126-127)

“...situation caused by failure of the TPPs to manage fly ash scientifically and to utilize the same within reasonable time is highly detrimental to public health and emergency measures in Mission Mode are required.” (Page 128)

Thus, a legacy of this kind is of concern because it is a situation where adverse impacts continue – even if the plant is no longer polluting or even no longer operating. It is imperative to address these legacies to ensure that the ecology, and health and livelihoods of local communities are not impacted.

Legacy of Energy Transitions

Energy transition is talked about a lot currently. At its core, it is driven by the concerns of climate change and high emissions of greenhouse gases, and effectively means decarbonisation of energy sources. As Patricia Espinosa, Executive Secretary, United Nations Framework Convention on Climate Change (UNFCCC) has said:⁵

“Energy is at the heart of the climate change emergency and it must be at the heart of its solution. A swift and broad transition to renewable energy will

4. Order dated January 18, 2022 in OA 164/2022 (Earlier O.A.No.276/2013) and Other Related Matters. National Green Tribunal (Principal Bench)

5. Statement at Ministerial Meeting on energy planning and implementation, part of the International Renewable Energy Agency's (IRENA's) 11th Assembly on 19 Jan 2021. <https://unfccc.int/news/the-world-needs-a-swift-transition-to-sustainable-energy> Accessed 20 Mar 2025



be essential to achieve the emission reduction goals laid down by the Paris Agreement.”

Thus, one of the major transitions being planned and pursued globally, and in India, is a shift in energy source for power generation from coal to non-carbon sources, like solar, wind and others.

Even though many analysts, activists and our own government (rightfully) argue for a more nuanced approach to energy transitions, where issues like energy security, energy access, affordability, historical responsibility, impacts other than climate, etc. are also to be given due importance, India has an ambitious program in place to transition from a coal-dominated electricity sector to one where renewable and non-carbon based resources play a much bigger role.

India has declared plans to reach carbon neutrality or Net Zero emissions by 2070 and pledged at the UNFCCC, among other things to “achieve about 50 percent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030”. Its performance in adding electricity generation capacity based on renewable energy (RE) has been remarkable. Additionally, there are ambitious plans for the next decade and more to continue this. While coal will continue to play a major role for at least several decades to come, there is little doubt that renewables will be moving to the centre-stage. This shift has numerous benefits, including cleaner and cheaper electricity. However, it carries a big risk of making permanent the legacies of coal.

In any transition, the focus is largely on what lies ahead. There is attention on, and excitement about the new developments. That which is being left behind as we move to



Power plant in Maharashtra and its ash pond in the foreground. Representative image.



better things is often neglected, or even forgotten. In case of the energy transitions, it is precisely the legacy impacts, like huge quantities of legacy ash, or abandoned mines, that can end up being a legacy of the transition. Note that the energy transition can have other legacies – like the fate of workers of power plants and coal mines, or the impacts on local economies as coal-operations wind down or make way for renewable energy sources. However, in this report, we focus on the legacies of the environmental impacts of coal-operations, and in particular those that pertain to impacts on water and land. The other legacies too are very important and any process of “Just Transitions” will need to consider all impacts of the energy transition.

An important reason why this risk is so real pertains to resources. Substantial human and financial resources are needed to address legacy impacts – like legacy fly ash, abandoned mines and several others which we will see in detail later. Rightfully, these resources should have come out of the operational expenses of power plants/ mines etc. But they have been externalised. While the expenses were avoided, the impacts were left unaddressed. These power plants, mines and other entities are now faced with bringing in resources to address the legacy impacts. If the entity is operational and generating good revenue, then these resources can be managed, even if the entity complains of difficulties. But if the plant or mine is being phased out as a part of the transition, if revenues are declining, and in general the sector is seen as a lesser priority (even if not a sunset sector), then finding resources for addressing these legacies will be more difficult.

A thriving sector can generate more resources – human, financial and in terms of attention, than a sector that is seen as going down in importance. Thus, there is a real risk of these impacts being left behind as the legacy of energy transitions.

Given all these reasons – that legacy impacts are a mark of non-compliance, that they continue to pollute, and that they risk being left as permanent legacy features of the energy transition – it is critical that we identify them and address them as a priority . In this report, we take stock of the various legacy issues around coal operations, the possible ways to address them and the challenges involved.

□



LEGACY ASH

Scale and Nature of the Problem

As noted earlier, legacy fly ash as on 31 March 2022 was a massive 1734 million tons. It is not clear whether this figure includes only the ash that is stored in active ash ponds and exhausted ash ponds, or whether it also considers the ash that has been dumped elsewhere. Active ash ponds will have “current ash” as well as “legacy ash”. As pointed out earlier, this ash is causing serious problems of air, water and soil pollution, leading also to the adverse impacts on the health, livelihoods and economies of local communities.

The utilisation of this legacy ash will certainly be an uphill task. According to the CPCB⁶, total ash generation in the country for “independent” thermal power plants in 2022-23 was 292 million tons, and utilisation was 267 million tons. Thus, there is a shortfall even in utilisation of “current” ash. To ensure that current ash is used fully as required by the Fly Ash Notification 2021 and also use the legacy ash will require working in a mission mode.⁷

Let us look at the utilisation in detail.

Table 1 gives various modes of utilisation of ash, and how much ash has been utilised by each method, for the year 2021-22 which is the latest year for which CEA data is available. If legacy ash is to be used, it will need substantial increases in several of the above end-uses. There are several challenges here – cost, potential of the mode to absorb increased quantity of ash, and safety, especially environmental and health safety.

6. Letter dated 20 Feb 2024 from CPCB to The Director (HSM Division), MoEFCC, with the subject “Status of Compliance of Fly Ash Notification dated 31.12.2021” Page 4. Accessed from https://cpcb.nic.in/uploads/flyash/CPCBs_letter_dated_20-02-2024.pdf on 18 Apr 2025
7. Several clarifications are in order here. The “current” utilisation given in CPCB’s letter actually includes some utilisation of legacy ash. Plant wise scrutiny of the figures shows some plants having utilisation more than 100%, which means the legacy ash is being utilised. But this means that utilisation of the “current” ash is less than that implied by the above numbers. The term “Independent” power plants is not explained in the CPCB letter, but we assume this to mean power plants that are not “captive”.



Table 1:
Fly Ash Generation and Its Utilization
Year 2021 - 22 (April - 2021 To March - 2022): End Use-Wise

	Quantity (Million tons)
Fly Ash Generation	271
Fly Ash Utilization	260
Percentage utilization	96%
Utilisation Enduse wise	
In the manufacture of Fly Ash based Bricks / Blocks / Tiles etc.	32
In the manufacture of Portland Pozzolana Cement	69
In the construction of Highways & Roads including Flyovers	46
Part Replacement of Cement in Concrete	2
In Hydro Power Sector in RCC Dams Construction	0
In Ash Dyke Raising	15
In the Reclamation of Low lying Area	36
In Mine Filling	18
In Agriculture / Waste Land Development	0
Others	42
Total Utilization	260

Source - CEA, 2022, p. 87

As **Table 1** shows, one of the biggest uses of fly ash is in the manufacture of cement. Apart from the fact that the use of ash in cement manufacture is limited by the total quantity of cement manufactured, the efficiency of ash for use in cement manufacture and as replacement in concrete is significantly affected once it is converted into a slurry and sent to the ash pond. This is due to various issues like increased moisture content, mixing with bottom ash and so on.

Since fly ash has high bulk, transporting high volumes can be costly, particularly in case of road transport. This often constrains its use at longer distances from the power plants. For example, in an affidavit filed in the Supreme Court by the Association of Power Producers in a matter related to environmental norms for thermal power plants⁸, it has stated that;

“Moreover, in many cases the Power Plant is located in interior regions which does not have any user industry near its vicinity. Hence, in such cases the TPP developer is not in the position to Utilize 100% Fly ash ...”

The NGT had constituted an expert committee vide its orders dated 20.11.2018 and 12.03.2019 in the matter of Sandplast (India) Ltd. & Anr. Vs. MoEF&CC & Ors. in O. A. No.

8. Affidavit on behalf of Association of Power Producers, dated 13 Nov 2018, in Report 81 and 84 in Writ Petition (Civil) 13029 of 1985, M.C. Mehta vs Union of India and Others. Page 35





Ash dumped in open areas since many years. Odisha.

102 of 2014 to review the fly ash utilisation and finalise action plan to achieve 100% utilization of fly ash. In one of its deliberations,⁹ the CPCB had noted that

“...pit head plant has some genuine issues of massive fly ash generation and unavailability of user agencies nearby the Power Plant. The most viable solution for pit head plant is utilisation of ash in abandoned coal mines...”

The Fly Ash Notification 2021 has detailed provisions for the distribution of the cost of transport for utilisation of fly ash, and this is often borne by the power plants. Yet, cost, especially for the transport over longer distances, remains a constraint and this is likely to impact increase in uses for making bricks, blocks and use of fly ash in construction of highways and roads.

Moreover, the utilisation of fly ash has to be “in an eco-friendly manner” as required by the Fly Ash Notification 2021 (Clause 1). Thus, any utilisation - for current or legacy ash needs to be done with strict adherence to various regulations relevant to that use (detailed later on) and in a manner that it will not contaminate at any time the local environment – through run-off, leaching, dust etc. Given this, we strongly urge that the “utilisation” of ash

9. https://www.greentribunal.gov.in/sites/default/files/all_documents/Report%20of%20MoEF&CC.%20CPCB.%20IIT%20Roorkee-O.A.%20No.%20117,102%20&%20499%20of%202014.pdf Page pdf 235



via “reclamation of low-lying areas” should to be avoided as experience has shown that this has a heavy risk of contaminating the environment. As Table 1 shows, out of total utilised ash of 260 million tons, 36 million tons was used in reclamation of low-lying areas in 2021-22.

Lastly, about 42 million tons of ash of out 260 million tons was used in “Other” applications. These “Other” uses raise important questions as to how and where exactly is this ash being utilised. All major uses are accounted for and figures given separately for them, and such massive quantities of ash being used for anything else does raise questions.¹¹ The potential for increased use of ash via “Other” uses can be commented upon only after there is more transparency about what such “utilisation” entails.

Given these constraints, two modes are recently being pushed strongly in a bid to address the use and disposal of huge quantities of fly ash – both current and legacy. These are, filling of mine voids with ash, and in-situ “stabilisation” of old ash ponds, that is, leaving the ash in the old ash ponds themselves.

Filling of Ash in Mine Voids

The first mode being promoted is to put fly ash into voids of mines that are no longer operational. The logic of this is very attractive – the coal came from these mines, leaving a void; the fly ash can go back and fill it up. And in fact, fly ash notifications over the years have been mandating mixing of fly ash with mine overburden for back-filling of mines. However, backfilling of mine voids with ash (on its own or with overburden) has some critical issues of concern.

One set of issues are related to the risks of environmental pollution and health impacts on communities around the mines where ash would be filled, including contamination of ground and surface waters, dust pollution due to the fly ash and so on. It is due such apprehensions that the Expert Appraisal Committee (EAC) of the MoEFCC has, for several years since 2011 or so, put a condition that fly ash would not be used for mine void filling (or for reclamation of low-lying lands) while granting Environmental Clearances (EC) to power plants. This was the case even as the Fly Ash Notifications permitted and even mandated filling of mine voids with ash. CEA has also noted that “There are environmental

The “utilisation” of ash via “reclamation of low-lying areas” should to be avoided as experience has shown that this has a heavy risk of contaminating the environment.

10. One “use” which is not listed in the CEA Report and hence would be included in “Others” is export. Fly ash is exported from India mainly to Bangladesh but also to other countries. Figures are not easily available for total exports of fly ash. One source (<https://deepbeez.com/trade-flow/fly-ash-export-from-india>) indicates total exports of fly ash have averaged around 5.5 million tons per year over last 5 years. It is not clear whether this includes fly ash bricks.



and safety concerns for use of fly ash along with overburden (OB) material for back filling of operating open cast mines. These concerns need to be addressed.” (CEA, 2023, p. 41)

In 2019, CPCB issued a set of guidelines (CPCB, 2019) for use of ash for filling mine voids, as well as for use of ash for reclamation of low lying areas. At the same time, MoEFCC issued an Office Memorandum (OM)¹¹ amending all earlier ECs which had disallowed use of ash for mine void filling and low-lying areas, annulling this condition and allowing these uses. The OM also mandated, among other things, that these uses would be undertaken as per the CPCB guidelines.

The Fly Ash Notification 2021 also has several provisions aimed at facilitating and encouraging filling of mine voids with fly ash. It includes “filling of mine voids” as an “eco-friendly purpose” to be counted towards 100% utilisation by listing it under the allowed uses in Sec A (2). Sec B(3) continues the provision requiring all mines within 300 km of any thermal power plant “to undertake backfilling of ash in mine voids or mixing of ash with external Overburden dumps, under Extended Producer Responsibility (EPR)” and Sec B(4) mandates these mines to get the provision for filling of mine voids with ash included in their mine closure plans. Sec B(5) sets up a committee to identify mines available for backfilling with ash and also “examination of safety, feasibility (not economic feasibility) and aspects of environmental contamination...”

MoEFCC issued an Office Memorandum (OM) amending all earlier ECs which had disallowed use of ash for mine void filling and low-lying areas, annulling this condition and allowing these uses.

However, whether all these provisions will lead to higher utilisation of ash in filling of mine voids, and whether it will ensure that this is done in a manner that does not harm ecological or human health needs to be seen.

A field visit to the Bokaro region by a team including the author of this report found that “pre-2019 disposal of fly ash in mines and in low-lying areas is having significant impact on the environment and on local communities; and that several official agencies have also independently reached similar finding” and that while the ash disposal in mines after 2019 needed to follow the CPCB Guidelines and conditions of the MoEFCC OM of 28 Aug 2019, several violations of these were documented (Raheja & Dharmadhikary, 2022, pp. 26-28).

In another case involving the disposal of fly ash in the Gorbi mines in Singrauli area by NTPC, this author was involved in an attempt to seek information from NTPC in terms of

11. Office Memorandum dated 28 August 2019 issued by Impact Assessment Division, Ministry of Environment, Forests and Climate Change, Government of India. https://parivesh.nic.in/publicdocument/UPLOAD_OM_NOTIFICATION/IA_DOCS/Manual/220_OM_28_08_2019.pdf



copies of various environmental studies carried out as well as copies of the clearances obtained in relation to this filling of fly ash in the mine.¹³ However, these were denied and an appeal process went all the way to the CIC, which heard the matter but has not given any order for several years. We are not getting in to the merits of this specific matter here. The point is that if filling of ash in mines is being done as per the CPCB Guidelines of 2019, which mandate several pre-disposal studies and a post-disposal monitoring, as well as obtaining several clearances, then it is important that these studies and clearances be available in the public domain, to ensure transparency that the process is being done in a safe and sound manner, from environment and health point of view. Only then will public confidence in the process increase.

This also brings us to another very important issue – the (non) involvement of people in the decision and process of dumping fly ash in mines. Local communities living near these mines are among those likely to be most affected. Hence, it is important that they are involved in the decision to dump ash in mines near them. This also includes ensuring that all the studies and post-disposal monitoring records, clearances etc are publicly accessible. Apart from the issue of safety of local communities from possible impacts of fly ash dumping, there is another important reason why their involvement is crucial.

A mine which is no longer to be used for coal extraction can be put to several uses, and using it to fill ash is only one of them. Therefore, it is crucial that filling of ash in voids of mines (whether operational or closed mines) should be considered in the context of mine closure and reclamation, for which there are binding regulations and guidelines. (These are discussed in detail in a subsequent section).

An important principle is that the reclamation process should put the interests of the local communities at the centre, and the use of the mine should be done so that local communities benefit in the process. This principle is explicitly incorporated in both letter and spirit in the latest Mine Closure Guidelines¹³ issued by the Ministry of Coal in January 2025. Dumping fly ash in a mine will almost always mean that its potential benefit for local communities will be jeopardised.

Some such important uses of closed mines include use of the mine voids as store and source of water for local uses like water supply, irrigation and fishing; or, use of the land recovered after filling and reclaiming the mine for horticulture, grazing or even agriculture purposes. Dumping ash in the mines can render the water and soil unsafe for use. We discuss this in more detail in the section on Mine Closures.

12. RTI Application filed in July 2021.

13. These are part of the *Guidelines for preparation of Mining Plan and Mine Closure Plan for Coal and Lignite blocks, 2025*, issued by the Ministry of Coal, Government of India, dated 31 Jan 2025. See section 3.2 “Just Transformation”, and in particular Sec. 3.2.2 (a) on “People and Communities”. Guidelines accessible at <https://coal.gov.in/sites/default/files/2025-01/31-01-2025a-wn.pdf>



The authorities themselves realise this trade-off between using mines for disposing fly ash and using them for uses that will directly benefit local communities. For example, during the 6th Meeting of the Central Level Working Group (CLWG)¹⁴, to allocate coal mines for disposal of ash to thermal power plants, it was decided that:

“...Patch-A , Doikhal Patch and Patch-C of Jamuna Mine (OC) have been identified for development of “Amrit Sarovar” and/or other community purposes. Therefore, these mines cannot be allotted.”

This doesn't mean that closed mines should not be used for disposal of fly ash and washery rejects (subject to appropriate assessments and safeguards, and only if established to be safe); but that local communities must be consulted and their wishes respected when identifying mines for such purposes.

An important principle is that the reclamation process should put the interests of the local communities at the centre, and the use of the mine should be done so that local communities benefit in the process.

In terms of uses of mine voids where no mining is now expected, local communities should be directly and meaningfully involved in the decision-making, their opinions and demands respected, and their interests be given the priority. The use of mine voids to fill ash should be secondary to this, to be undertaken only if local communities do not opt for any other uses of the mine void (or reclaimed and restored land) for their benefit, and subject to all the environmental and health safeguards.

This will be central to a Just Transition and to ensure that in addressing one legacy issue (disposal of ash), we don't end up perpetuating another legacy - a legacy of injustice.

In Situ Stabilisation of Ash Ponds

This is the other major mode being proposed to address the issue of legacy ash. The Fly Ash Notification 2021 was the first such notification to legally mandate and present a time line for the full utilisation of legacy ash. It also provided penalties for defaults. However, the same notification also provided a way out of this requirement, with its proviso that

“Provided further that the legacy ash utilisation shall not be required where ash pond or dyke has stabilised and the reclamation has taken place with greenbelt or plantation or solar power plant or wind power plant as per the guidelines issued by the Central Pollution Control Board (CPCB) as specified in sub-para (6) and the concerned State Pollution Control Board shall certify in this regard. Stabilisation and reclamation of an ash pond or dyke

14. https://cpcb.nic.in/uploads/flyash/MOM_6_CLWG_Meeting.pdf Accessed 24 June 2025



including certification by the State Pollution Control Board (SPCB) or Pollution Control Committee (PCC) shall be carried out within three years from 1 April 2022. The ash remaining in all other ash ponds or dykes shall be utilised in progressive manner as per the above-mentioned timelines.” (Clause A(5), as amended)

The effectiveness of this solution of addressing the legacy ash problem depends critically on what constitutes (or what *should* constitute) stabilisation, and reclamation.

The Fly Ash Notification 2021 requires CPCB to bring out guidelines for specifications of stabilised and reclaimed ash ponds. In more detail, it mandates that:

“Technical specifications of operational as well as stabilised and reclaimed ash ponds or dykes shall be as per the guidelines of the Central Pollution Control Board (CPCB) made in consultation with the Central Electricity Authority (CEA) and these guidelines shall also lay down a procedure for annual certification of the operational as well as stabilised and reclaimed ash pond or dyke on its safety, environment pollution, available volume, mode of disposal, water consumption or conservation in disposal, ash water recycling and green belt, etc.” (Section A(6), amended)

These guidelines for “stabilised and reclaimed” ash ponds were brought out by CPCB in June 2023 (CPCB, CEA, 2023). A look at the guidelines and the provisions in the Fly Ash Notification 2021 show that they fall short of what is needed for proper stabilisation and reclamation.

Broadly speaking, we would argue that stabilisation must include complete physical containment of the ash; strong environmental safeguards to ensure containment of any leaching to water, seepage, control of fugitive and other emissions, and in general ensure no pollution of soil, water or air from the ash pond; structural safety of ash pond; and regular monitoring ensure this in the long term. Reclamation should include cleaning up and restoration of any areas contaminated by the ash pond (and not just the ash pond itself) and putting the land and other facilities to such use as shall prioritise benefits to the local communities, all the while ensuring safety and health. While some of these issues are addressed by the Guidelines and the Notification, there are many important gaps.

We look at the provisions as well as the gaps.

First of all, it is important to note that the Guidelines (CPCB, CEA, 2023) recognise that ash ponds can have serious impacts unless proper safeguards are in place. Some of the issues highlighted by the Guidelines, which have a bearing on what stabilisation should involve, are:

- Ash dumps occupy 40,000 hectares and are “prone to leaking and breaching,



posing serious ecological and public security risks” (unnumbered page, Foreword)

- “Over a period of time, the fly ash disposal can cause problems like large surface setting lagoons for storage, infiltration of transport of water from deposit to soil, dust carryover in wind from dried lagoons and ... ecological and environmental imbalances if proper safeguards are not taken in their design, construction, operation and maintenance.” (Page 3)
- “Bottom Ash Storage lagoon and Over Flow Lagoon are necessarily to be provided with impervious liner using bentonite-blended soil or equivalent to ensure no ground water contamination.” (Page 17)
- “In case of pervious foundation, the seepage from ponds can inundate the neighboring fields, causing damage to the fields”. (Page 66)
- “Ash disposal in setting pond or land fill may influences the aquatic ecosystem through surface runoff and seepage nearby that area and finally result in contamination of ground water by leaching of heavy metals from the CCRs. The water discharged from the ash pond is likely to contaminate the quality of river, channel, nallah water nearby that area eventually thus contaminating the ground water. Some of the heavy metals, released from ash disposal, become detrimental to plant life.” (Page 79,80)
- “Fly ash disposal poses problems in the form of land use, health hazards, and hazard to entire ecosystems. Toxic trace metals present in the ash may leach out of the ash ponds and contaminate the soil, ground water and surface water, limiting the survival and growth of plants and microbial population. Medical studies have proved adverse effect on human health due to presence of respirable particulate matter $<10\text{ }\mu\text{m}$ in size. Finer particles $<2.5\text{ }\mu\text{m}$ have much greater impact as they can penetrate deeper into the respiratory system. Dispersion of particulate matter to the surrounding environment takes place, especially when ash-handling activities on dumping sites are in progress. The air borne fly ash particles deposit on surfaces of materials and plants.” (Page 83)

The actual guidelines for Stabilisation and Reclamation of Ash Ponds are given in the Chapter 10 of the CPCB/CEA Guidelines (CPCB, CEA, 2023, p. 98), but important conditions can also be inferred from other parts of the report.

The Guidelines talk about certain “Preconditions for abandoning the ash ponds” which include ascertaining permissions from regulatory authorities like the SPCBs, and adopting suitable methods for preventing pollution “during the complete exercise”.

During the process of reclamation itself, the Guidelines call for proper dewatering of the ash in the pond, preparation of site and covering the ash with soil. Later, the site is to



be put to use for green belt, solar or wind power plants, as mandated by the Fly Ash Notification 2021. During this process, the Guidelines also require ensuring proper measures to prevent soil erosion and air and water pollution. After reclamation, the Guidelines call for “annual certification of reclaimed ash pond and dykes also in respect of safety, storm water collection and disposal, and environmental pollution and green belt etc.” which is as per the Fly Ash Notification 2021.

These elements constitute important measures to ensure proper stabilisation and reclamation, but there are crucial lacunae in these provisions.

First of all, it seems the Guidelines assume that every ash pond can be safely stabilised and reclaimed. In fact, this is the first question that needs to be asked. Maybe this question is implicit when the Guidelines require that ash ponds obtain permission from regulatory authorities for abandonment. However, even if one assumes this is so, given the importance of this issue, it needs to be explicit and not implicit. Else, there is no compulsion for the regulatory body to examine this question. Second, the document should have presented the criteria to assess whether an ash pond is suitable for abandonment and reclamation. It has not done so, which is a major gap.

Two of the most important criteria to assess whether ash can be left in the pond when it is being reclaimed are structural safety and potential pollution. For the latter, one of the key issues is whether the ash pond has an impervious lining or not. The Guidelines mandate, elsewhere in the document, that

“Ash Pond lining is used to minimize any damage to the groundwater resource due to leaching of metals from fly ash. ...As per the design requirement impervious soil liner or geo-membrane or geotextile liner may be provided.” (Page 44)

And,

“BA [Bottom Ash] Storage lagoon and OFL [Over Flow Lagoon] are necessarily to be provided with impervious liner using bentonite-blended soil or equivalent to ensure no ground water contamination.” (Page 17)

Unfortunately, many of the ash ponds, especially the older ones do not have such a lining. Some of them which had HDPE / LDPE lining had a lining of 150 microns instead of the 1000 microns that the Guidelines recommend. Given this, such ash ponds will continue to seriously threaten groundwater quality in their surroundings if the ash is allowed to be left in the pond when they are reclaimed. We would urge that at least those ash ponds without lining must be mandated to remove and reuse the ash fully before they can be reclaimed.

Some of the other criteria given by the Guidelines for siting of ash ponds are also



important in this context. These include (CPCB, CEA, 2023, p. 16) “that the base can be located no less than 5 ft above the upper limit of the uppermost aquifer” or a demonstrated absence of “hydraulic connection between the base and the uppermost aquifer”, or ash pond be “located at least 500 m away from the HFL/ FRL of the Rivers/ Reservoirs” and “Site should not be located in wetland.” While these are the guidelines for siting of new ash ponds, it stands to reason that if the older ash ponds don’t meet these guidelines, then they should not be allowed for reclamation unless the ash is completely removed and reused.

The other issue of concern is what is to be done with the land reclaimed from the ash pond. The Fly Ash Notification 2021 gives only four options - greenbelt or plantation or solar power plant or wind power plant. (Clause A(5)). While a solar or wind power plant may provide some benefit to the local communities in terms of employment, a green belt may not be of much benefit to them. The Guidelines require that “fruit bearing species shall be avoided” (Page 101), rightfully so as trees grown on soil mixed with ash could have toxic elements which can enter the food chain. Though the report does not mention this, the same logic also means that the reclaimed land should not be used for growing fodder or for grazing. This means that the most obvious benefits that can accrue to local communities with the reclaimed land being returned to the commons, are ruled out. For other benefits, there are no clear guidelines or stipulations – for e.g., though Guidelines say that “tree species for fuel wood and timber” should be grown in the plantations, there is no clear indication of how local people will access these; and regarding solar and wind plants there is no mandate or specification that certain jobs will be reserved for local communities.

We feel it will be very important to address these issues in particular, and in general, amend the Fly Ash Notification 2021 itself, and also the Guidelines, to ensure that reuse of land and other resources reclaimed from ash ponds prioritise the benefits to local communities.

Local communities have the most critical stakes in the structural and environmental safety of a “stabilised” ash pond. In most cases they have been bearing severe impacts of pollution from the ash pond during its lifetime. Further, land for the ash pond had been acquired from the community in the first place and therefore when it has served its purpose, it should rightfully prioritise benefits to them. Given all this, local communities must have an important role to play in the decisions regarding whether to go for *in-situ* stabilisation of ash ponds, whether to go for utilisation of the ash and what end-use the reclamation should entail. Unfortunately, neither the Fly Ash Notification 2021 nor the Guidelines give *any role*, let alone an important one, to local communities. This needs to change. Unless this happens, local communities will continue to be bypassed at best, and continue



to live in shadows of serious environmental and health concerns even as the ash pond is “stabilised” and “reclaimed” on paper. This is a legacy of the energy transition that should be avoided at any costs.

The post reclamation monitoring process also has important gaps. It appears that such a process is considered implicit in the annual certification of the reclaimed ash ponds and dykes. While it is good that an annual certification has been mandated, the Guidelines should have also explicitly highlighted the need for ongoing monitoring of key environmental and safety parameters (like water quality, for example), for which a once-in-a-year assessment is not enough. Also, the Guidelines require the annual certification to be done by “a qualified professional geotechnical engineer” or “a qualified professional engineer for structural stability and safety assessment” (Pages 85-86), implying a focus mainly on the safety aspect. However, it is necessary to explicitly mandate that the certification should also involve an expert on environmental impacts. And last but not the least, both, the annual certification and the ongoing monitoring should meaningfully involve local communities, for which there is no explicit provision in the Guidelines.

Interestingly, the Fly Ash Notification 2021, has said that “Stabilisation and reclamation of an ash pond or dyke including certification...shall be carried out within three years from 1 Apr 2022.” (Clause A(5))

This means that whichever power plants wanted to go for stabilisation and reclamation of their ash ponds should have by now been done with that process. Any remaining ones need to go for fully reusing the legacy ash as per the timelines given in the Notification. The current status is not available in any publicly accessible document, but as per a CPCB letter (CPCB, 2024) in the year 2022-23, totally 22 ash ponds with an area of 622.86 ha were reclaimed while 29 exhausted ash ponds with an area of 2021 ha remained yet to be reclaimed. But these figures for legacy ash remaining are very small and do not match the legacy ash figures given elsewhere by CEA (2022, p. 64).

Local communities have the most critical stakes in the safety of a “stabilised” ash pond. They have been bearing severe impacts of pollution from the ash pond. Land for the ash pond had been acquired from the community in the first place and it should rightfully prioritise benefits to them.

Utilised But Still a Legacy

One of the methods of ash “utilisation” is what is called as “reclamation of low-lying land”. Over the years, ash “utilised” in this mode has steadily increased, from 0.65 million tonnes in 1998-99 to 35.57 Million Tonnes in 2021-22 constituting about 13.13 % of total



fly ash generation during that year. This mode of “usage” of ash can be more accurately described as disposal rather than re-use. Unfortunately, in many cases, this “reclamation” is actually a euphemism for just dumping of ash. Such ash dumps are responsible for significant fugitive emissions of ash, and contamination of water bodies due to run-off of ash and leaching of toxic elements from the dumps. For example, a committee appointed by the NGT in the *Shivpal Bhagat & Ors. Vs. Union of India & Ors.* matter to examine the situation in Raigarh district in Chhattisgarh due to powerplants and coal mines, noted that fly ash was dumped in low-lying agricultural lands in a highly unscientific manner, resulting in leaking of ash into nearby streams and nallas.¹⁵

While such dumping or “low-lying area reclamation” are counted as “utilised” in official records, many such cases need to be treated as legacy ash as they continue to threaten the environment and health of local communities. There is a need for a proper survey and audit of these “reclaimed low lying areas” to identify which need to be addressed as legacy. Note that these are different from the dry ash “mounds” which are a means of storage of ash like the ash ponds, and not modes of usage.

Invisible Legacy

One of the most difficult parts of the legacy ash that needs to be addressed is what can be called as the “invisible” legacy ash – invisible in statistics, though it may often be in plain sight! This is ash which has entered the environment through leaks, breaches, seepage, deliberate discharge, dumping, blown by wind, contaminating water bodies, soils and other areas. This is not counted in any of the reports where ash generation and utilisation is being tallied. In terms of quantities, it may be smaller than the recognised legacy ash, but in terms of impacts it may be substantial, as it can directly come in contact with living beings including humans, animals and plants, and enter the food web and living systems at large.

There are many places where such contamination is found. The NGT has documented several such cases and called for cleaning up such ash and restoring the environment. The NGT may not be calling it “legacy” ash, but it is certainly a legacy in the sense of the commonly understood meaning and hence is of concern when we look at the legacy that the energy transition can leave behind.

For example, in one of its orders¹⁶ dealing with thermal power plants in the Singrauli area, the NGT takes on record the finding of a committee appointed by it, which noted:

“Since long, the industrial effluents have been drained in the Rihand

15. Original Application No. 104 of 2018 (Principal Bench), Joint Committee report dated 16.04.2021 pgs 42-43.

16. Order dated 4 Nov 2020 in Original Application No. 117/2014 (Principal Bench), *Shantanu Sharma vs Union of India and Ors.* Page 12.





Ash "utilised" for filling of low lying area, but still remains a polluting legacy. In Jharkhand.

Reservoir. The Fly the Fly Ash (sic) has also been drained by some of the Thermal Power Plants, Ash travelled to the Rihand Reservoir, polluting the water of the Rihand Reservoir, which is only source of water. The committee has taken a very serious note of this issue and directed the U.P. Pollution Control Board to prepare a DPR for de-silting of sludge in order to purify the water and to increase the capacity of the Rihand Reservoir which has been substantially reduced due to drainage of affluents and fly ash."

In another matter, the NGT noted¹⁷ that the committee appointed by it reported that in the North Chennai area, water was being polluted by thermal power plant through multiple pathways, including leaky ash pipelines, spills from fly ash dykes, and intentional dumping of ash, and that the

"...spread of flyash has altered the topography and hydrology of the area by silting up low lying-areas and water courses. The flyash ponds too have blocked eastward drainage of rainwater leading to changes in land-cover and habitat types in the local region".

Several other such matters whose cognisance the NGT has taken have been detailed in the report *Regulating Coal Operations: Environmental and Social Impacts Through the Lens of the National Green Tribunal* (Tanvani & Dharmadhikary, 2025).

In matters where the NGT has taken cognisance, it has ordered that the ash be removed and the area restored. In the Singrauli area, this is also being followed up by the *Fly*

17. Report of Committee Dated Report 13.12.2017, Original Application No. 08 of 2016 (Southern Zone), R. Ravimaran Vs. Union of India and Ors, Page 8





Field filled with ash from an ash pond breach and ash pond leakage. W. Bengal.

Ash Management and Utilization Mission set up as per an order of the NGT.¹⁸ But in many other cases, especially where the matter has not come before the Tribunal, this “invisible” legacy ash remains mostly unattended. It is critical that this be recognised as a legacy that needs attention, similar to the recognised legacy ash. Proper surveys need to be carried out in proximity of all thermal power plants and ash handling areas to identify such ash and action plans need to be made to address the issue.



18. Order Dated January 18, 2022 in OA 164/2022 (Earlier O.A.No.276/2013) and Other Related Matters. National Green Tribunal (Principal Bench). Direction in Para 21 at Page 140.



LEGACIES OF COAL WASHERIES

Washing –also called coal beneficiation - is a generic term that covers various methods used to improve the quality of coal by removing denser material and ash.

Indian coal is of low grade with ash content of the order of 24 - 63 % in comparison to imported coal which has low ash content of the order of 3-20 %. (CEA, 2023, p. 1) High ash content in the coal used by power plants not only poses environmental problems but also impacts power plant performance and results in higher costs for operation and maintenance of the plant. Using washed – or beneficiated – coal can lead to many advantages like increased power generation efficiency, reduced O&M costs, less air pollution and reduced solid waste, and lower transportation costs if the washing occurs at the pithead (at the mines). It is for this reason that the MOEFCC had mandated limits (at 34%) on the ash content in coal used by power plants at more than a certain distance from mines¹⁹ (ASCI, 2010, pp. 3-4). This requirement has now been removed²⁰ but coal washing remains important.

As explained by MoEFCC's *EIA Guidance Manual on Coal Washeries*, coal washing, or coal beneficiation

“...consists of cleaning of raw coal by separation of mineral matter (ash) from the coal. How extensively the coal is cleaned before use depends on the purpose for which it is mined and on the specifications it must meet for its use. The cleaning of coal is mainly based on separation of the impurities by physicochemical methods...” (ASCI, 2010, p. 5)

When coal is washed, we get “clean” coal – which is coal with relatively less ash content, and we also get two other by-products, middlings and rejects. Clean coal has low density whereas rejects have high density. Middlings have intermediate density. Rejects

19. This was introduced in 1997 in the Environment (Protection) Rules 1986 as Rule 3(8). GSR 560 (E) & GSR 378 (E) dated 19th September 1997 and 30th June 1998.

20. Via the Environment (Protection) Amendment Rules, 2020, notified in gazette notification S.O. 1561(E), dated 21st May 2020 amending the Rule 3, sub-rule 8



contain high ash, mineral impurities, fraction of raw coal feed, etc. (CCO, 2020, p. 1.7) Thus, “clean” coal, middlings and rejects are on a continuum of increasing ash content.

“Clean” coal is the valued product from the washing, while middlings, with higher ash content still can find use. But rejects, as the name suggests, are essentially waste and much more difficult to use or dispose of. They are also a source of serious pollution.

MoEFCC’s *EIA Guidance Manual on Coal Washeries* points out that

“The major potential source of environmental contamination from coal washeries includes: washery rejects (solid waste) ... The disposal of coal washery waste is a potentially serious problem.” (ASCI, 2010, p. 33)

and that

“The most significant issue in operational phase of the coal washery is safe handling and disposal of washery rejects.” (Page 38)

It notes that the rejects are solid wastes that can also cause fugitive emissions of dust and run-off of leachate.

Unfortunately, there are few figures, especially at the aggregate level, for the amount of washery rejects generated every year, their use and disposal and the accumulated rejects. But there are indications that the generation and (lack of) proper disposal of washery rejects is a major problem.

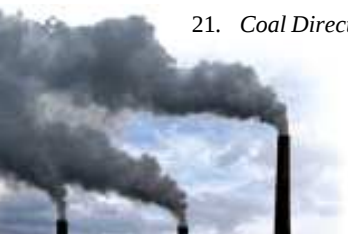
In 2018, Coal India Limited, which produces an overwhelming proportion of coal mined in India (75% in 2024-25²¹), brought out a *Uniform Policy for Disposal and Utilisation of Rejects generated from CIL Washeries (Existing & Future)* (Coal India Ltd., 2018) applicable to all its subsidiaries. This was followed by the Ministry of Coal issuing its *Policy for Handling and Disposal of Washery Rejects* in 2021 (Ministry of Coal, 2021), which is applicable to all coal washeries.

One excerpt from the Minutes of the Meeting dated 17 Apr 2017 of CMDs of all subsidiaries and the Chairman, CIL, quoted in the CIL Policy is very telling:

“Rejects generated from existing coal washeries have been dumped in areas adjacent to washeries over the years as per usual practice. Somewhere if found usable, rejects have been sold through various modes to consumers interested in its utilization. Rest have remained unused / unsold and left to accumulate in reject dumps creating huge space and environmental issues.

“Dump rejects are causing growing environmental concern due to its storage as they degrade the soil and groundwater wherever dumped or stored.

21. *Coal Directory of India 2024-25*, Page 47



This necessitates giving importance to Reject Disposal modalities of the proposed washeries for which application for EC is being submitted. In almost all EAC meetings they always insist for bringing out a policy for disposal of rejects. It was given to understand that MOC is likely to promulgate a policy for Reject Disposal for private washeries. However, after discussion at length, the CMDs suggested that a committee be constituted for framing a uniform policy for reject disposal / utilization by all subsidiaries.” (Coal India Ltd., 2018, p. 2)

There is no reason – and little data – to believe that there has been any change in the situation described above. From field observations as well as official reports it appears that rejects are being generated in large quantities, but the use and safe disposal is happening at a much lesser scale. This is leading to massive accumulation of rejects, leading to serious environmental problems of air, water and land pollution due to dust pollution, leachate, spontaneous combustion with the resultant release of toxic gases etc.

As per a NITI Aayog report, there are mainly three ways to use (or dispose) washery rejects - use them as fuel in Fluidised Bed Combustion (FBC) power plants for generating power, applications like brick kilns, road construction etc where they may be burnt in an unregulated manner, and filling in mine voids. (TERI, 2020, p. 53)

There are few figures, especially at the aggregate level, for the amount of washery rejects generated every year, their use and disposal and the accumulated rejects.

Regarding use in FBC power plants, it may be pointed out that this itself creates the secondary problem of ash disposal as rejects have a very high ash content. Further, the NITI Aayog report notes that

“There is no data available on existing capacity of CFBC using rejects also the current practices consume rejects after blending, however from stakeholder consultation it is learnt that nearly 15-20% of reject can go in existing CFBC and 80-85% of new capacity will needed to be installed in order to consume overall rejects.” (TERI, 2020, p. 55)

Thus, it seems that the FBC capacity is woefully inadequate in comparison to the quantity of rejects generated. The report also notes lack of data about other uses of rejects (in the so-called unregulated sector). The conclusion it draws is not a very encouraging one:

“From the environmental analysis, it can be concluded that the utilization of rejects can have significant environmental impact which has the potential





Massive dump of coal washery rejects, in a coal mining area in Chhattisgarh.

to negate the positive environmental benefit gained through the use of washed coal. However, certain measures can be taken to control the impact of rejects. Globally, filling rejects in mine voids is the most common practice for disposing washery rejects....”

As the figures for washery rejects generated and utilised are not available, we try and estimate these.

Government of India's *Energy Statistics- India 2025* gives the installed capacity of coal washeries in India as on 31 March 2024 at 257.79 Million Tons per Year (MYT), with 208.07 MYT for non-coking coal and 49.72 MYT for coking coal (MOSPI, 2025, pp. 19-21). However, not all of this is operational and details are not available in the public domain. The Coal Directory of India 2023-24 (CCO, 2024, p. 184) gives the actual performance (operation) only for the coking coal washeries, and reports that in year 2023-24, 16.6 million tons raw coal was processed yielding 5.397 MT of washed coal (32.5%). This means that 11.2 million tons was generated in the form of middlings or rejects. The performance details of non-coking coal washeries are not given.

A call for Expression of Interest for procurement of Washery Rejects by the Mahanadi Coalfields Ltd. (MCL)²² dated 13 May 2025 states that the Ib Valley 10 MTPA capacity non-

22. EOI dated 13 May 2025 from MCL https://www.mahanadicoal.in/cmsmns/uploads/MCL_MNS_GN_1747226554.PDF Accessed 10 Aug 2025



coking coal washery of the MCL is expected to produce about 2.55 MT of reject per annum (25.5%), and that the washery which began production in April 2024, has 1.26 MT of rejects available.

A 2019 Report of the Comptroller and Auditor General of India (CAG) *On Assessment of Environmental Impact due to Mining Activities and its Mitigation in Coal India Limited and its Subsidiaries* noting “hazardous wastes ... held in stock by two subsidiaries for a period exceeding 90 days” reports that the Kathara Washery of CCL had been holding 26 lakh tons (2.6 MT) of washery rejects for a period of 13 years! (CAG, 2019, p. 48)

In absence of any aggregate figures, if we estimate that a third of the total capacity of washeries was operational in a year, and produced rejects at 10%, we get a figure of 8.5 million tons of rejects produced in the year 2023-24. We have no figures for the rejects actually utilised for this, but the figures for use in FBC as mentioned in the TERI report quoted above, the quote from the CIL Policy document, the CAG Report quoted above and from field information, one can conclude that most of these would be accumulated rather than used. This author has personally witnessed massive dumps of rejects at several washery locations that have accumulated over the years.

Given that large quantities of washery rejects continue to lie in exposed dumps, resulting in serious ongoing pollution, it is imperative that these be used and/or safely disposed of at the earliest. Else, they are also likely to end up as one of the unwanted and dangerous legacies of the energy transition.

The adoption of the *Policy for Handling and Disposal of Washery Rejects* by the Ministry of Coal on 27 May 2021, and the reiteration for its strict implementation by “all Coal Washeries” through a notice on 7 Jan 2022 shows that the Ministry has recognised the gravity of the problem and has initiated measures to address it. However, there is little information in the public domain regarding the actual implementation, both, with regards current rejects and legacy rejects.

Therefore, it is critical that the Ministry of Coal collect and make public figures and details for the generation, utilisation and safe disposal of washery rejects, giving regular updates on an annual or six-monthly basis for current as well as the legacy or accumulated rejects.

Globally, filling rejects in mine voids is the most common practice for disposing washery rejects



END OF LIFE MINES

Scale of the Problem

One of the largest parts of coal-based power generation is the mining of coal. There are several hundred coal and lignite mines in operation in many parts of the country, producing coal and lignite that feeds the power plants. These mines are massive interventions in the region, with extensive digging up of land, dumping, piling up and disposal of wastes, dewatering of groundwater aquifers, large scale discharge of effluents, dust emissions and so on. All of these have created significant disturbances and disruptions in the lands, landscapes, water, soil and ecology of the areas as well as in the lives, livelihoods, culture, economy and health of the communities. Mining is eventually closed at all mines, for a variety of reasons. What gets left behind – and how it is addressed, is crucial to the legacy of mining.

A press release dated 12 Jan 2024 from the Ministry of Coal²³ highlighting initiatives to address abandoned and closed mines acknowledged that:

“Historically, mine closures have been characterized by uncontrolled processes, leaving equipment and materials abandoned and mine sites neglected. Recognizing the need for a systematic approach the Ministry introduced Mine Closure guidelines in 2009...”

“Mines closed before 2009 often lacked a structured closure framework, leading to non-scientific closures. Acknowledging the physical hazards and environmental consequences associated with these abandoned mines, the Ministry issued guidelines in October 2022 for managing mines closed before 2009...”

This has been the situation even though the issue of a proper scientific closure of mines was recognised in mining regulation several decades back.

23. Coal Ministry Initiates Comprehensive Mine Closure Strategies, Press Release dated 12 Jan 2024, Ministry of Coal, Issued by Press Information Bureau, Government of India, Release ID: 1995607. <https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1995607> Accessed 26 April 2024



The requirement of Mine Closure Plans was brought in in 2003. “The Central Government vide Notification No. GSR 329 (E) dated 10.04.2003 and No. GSR 330 (E) dated 10.04.2003 amended the Mineral Concession Rules, 1960 and Mineral Conservation and Development Rules, 1988, respectively. As per these amendments all the existing mining lessees are required to submit the “Progressive Mine Closure Plan” along with prescribed financial sureties within 180 days from the date of notification.” (Indian Bureau of Mines, 2005, p. 110)

After this, the Ministry of Coal introduced Mine Closure guidelines in 2009, subsequently revised in 2013, 2020²⁴ and most recently in 2025. Guidelines for managing the closure of mines closed prior to 2009 were issued in 2022.

In spite of this history of regulations, the situation on the ground of closed mines remains one of concern, as we describe later in this section. The most recent revisions in the mine closure frameworks and other laws related to mining do signal a genuine interest and intention in changing this situation. Whether these will be effective on ground will depend on not just addressing some key lacunae, but also whether the implementation will be able to break free from decades of top-down, narrowly focused technical approach that has excluded local communities and their interests. Before we discuss these, it would be useful to look at the scale of the issue, status and experiences of mine closure till date.

The scale of the problem is significant. According to the Ministry of Coal’s Year End Review-2024.²⁵

“In terms of statistics, a total of 179 pre-2009 and 162 post-2009 mines, considered abandoned/discontinued have been identified in Coal Companies. Of these, 147 mines are identified for closure and remaining abandoned/discontinued mines are either merged with existing for re-operationalization.”

These 147 mines consist of 88 mines closed pre-2009, and 59 mines closed post-2009.

The Legacy of Mining

Mining has serious impacts during its operations, and several impacts can be of a lasting nature, beyond the mine life, if not addressed. Some such impacts as described by the Indian Bureau of Mines’ *Bulletin on Environmental Aspects of Mining Areas* are:

“Public response to mining is however always negative because it creates a visual impact. It leaves ugly scars on existing landscapes. Mining areas often

24. Coal Ministry Initiates Comprehensive Mine Closure Strategies, Press Release dated 12 Jan 2024, Ministry of Coal, Issued by Press Information Bureau, Government of India, Release ID: 1995607. <https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1995607> Accessed 26 April 2024

25. As summarized in Ministry of Coal Press Release dated 27 Dec 2024, issue by Press Information Bureau, Release ID: 2088467, Available at <https://coal.nic.in/sites/default/files/2025-01/Pib27dec.pdf>



have a monochromatic appearance. Coal mining areas are depressingly black...Fine particles of ore and waste generated spread as layer of dust on every available surface in these areas. Location of crushers and grinders, within the mining areas, aggravates the situation.

“Mining in general affects the existing land, water and air systems...Besides leaving large excavations and huge waste dumps, mining enterprises, means the conversion of land to such purposes, as roads, railways and rope-ways for the mineral transport, townships for housing, infrastructure for administrative purpose, land for stockyards and for preliminary processing of the ore.” (Indian Bureau of Mines, 2005, p. 1)

“The underground mining helps in reducing surface land degradation to certain extent and air pollution, it leads to subsidence, which is equally harmful to the flora and fauna. The water from these mines is pumped out constantly to avoid any accident and flooding in the underground mine. Discharge of mine water into streams leads to contamination of surface water...

“The major problem observed in opencast mines is an improper management of overburden dumps...

“The abandoned old underground mines in the fragile hilly region, especially in the eastern region, are causing great environmental concern, as there is a scope that these may collapse at any time due to subsidence or other natural disasters such as an earthquake.” (Indian Bureau of Mines, 2005, p. 107)

Another important issue in mines that can turn into an unwanted legacy is fires in mines. In several cases, the coal in the mines catches fire spontaneously. Such fires, especially those that go on for long periods have severe impacts like air pollution, safety issues, land subsidence and serious health hazards, on the top of economic losses. The most talked about mine fires are those of the mines in Jharia (Jharkhand) which date back to 1916.²⁶ In fact, such ongoing fires appear to be inadequately recognised and reported, as mostly one sees reports only related to Jharia. However, such uncontrolled fires are there in several other mines – this author has personally visited such mines in Raigarh (Chhattisgarh) and researchers also talk about fires at Singrauli and Singareni coalfields. (Mohalik, Lesterb, Lowndesc, & Singh, 2016) It is critical that such fires and mines be identified and the issue addressed else these will end up being a dangerous legacy.

Indeed, anyone who has studied mining areas, including coal mining areas will attest

26. Press Release, Ministry of Coal dated 25 Sep 2023 *Jharia Master Plan: Coal Ministry Efforts Bring Down Surface Fire identified from 77 to 27 sites*, Release ID 1960543. At <https://www.pib.gov.in/PressReleaseIframePage.aspx?PRID=1960543®=3&lang=2>





Overburden dumps on the bank of a river. Jharkhand.

that all these impacts noted above are common and widespread. Mining areas are littered with massive mining pits, sometimes filled with water, dewatered aquifers and plummeting groundwater levels, huge overburden dumps and polluted land and water bodies. (Oskarsson, Krishnan, & Lahiri-Dutt, 2024, p. 6) (Raheja & Dharmadhikary, 2022) Unless properly addressed (through scientific mine closures) these will create a devastating legacy of mining.

The 2009 Guidelines for Mine Closure did require these issues to be addressed, including “reclamation (both biological and physical) and rehabilitation of mined-out land”, measures for protection of water bodies and for “protection of contamination of ground water from leaching”, management of overburden, rejects and other wastes, “manpower retrenchment, compensation to be given, socio-economic repercussions and remedial measures consequent to the closure of mines” and so on.²⁷ The Guidelines were revised in 2013 and 2020, and another set of Guidelines issued in 2022 for mines closed before 2009, but unfortunately, the situation on the ground regarding addressing the outstanding issues has been unsatisfactory and inadequate.

For example, a November 2021 Report by the National Foundation of India (Dsouza & Singhal, 2021) noted that “Despite 123 mine closures since 2008, there is very little evidence of environment remediation and land rehabilitation in these areas”, though the report does not give any further details.

A report by iForest (Bhushan & Banerjee, 2023, p. 9) says that:

“The existing closure plans, as designed, have allowed/allow significantly high external overburden dumps to exist outside the pits, as well as internal

27. *Guidelines for Preparation of Mine Closure Plan*, Ministry of Coal, Government of India. Letter dated 27 Aug 2009, No. 55011-01-2009-CPAM





Coal mine on fire in Chhattisgarh. These fires have been going on for a long time

overburden dumps of considerable height inside the pits. Besides, a void of significant area and depth is allowed to exist and is filled with water in the quarry area. An assessment of the post closure land use of opencast mines suggests that about 57% of the mine lease area is identified for keeping as backfilled excavated area, external overburden dump and voids. Considering such mine closure plans, the land will not be ready for repurposing once mines are closed.”

A research study of coal mining by the Mahanadi Coalfields in Odisha, sponsored by NITI Aayog and conducted by National Institute of Technology (NIT) Rourkela, Odisha²⁸ found that (Mishra, Undated, pp. 13, 122):

“Though MCL has taken lots of initiation to biologically reclaim the mined areas, but it is not reached with a proper solution due to certain technical problems. Firstly, while extracting coal there is certain short fall of soil quantity and proper reclamation of dump area not being practiced. In the abandoned mines the top soil is not being whether progressively or concurrently utilised for its reclamation which is making the environment degradable as it has become a dumping ground.

28. The Report of the study is undated, but the study notes that the NITI Aayog had sponsored the study in 2015.



“During field study it was observed that abandoned mines which are present near Anantapur Mines and near Jambubahali village has become a challenge for the environment and also a menace for the villagers.”

This author has himself been told by local communities in a field visit to mines near Chandrapur in Maharashtra that nothing was being done for proper land recovery of the closed mines, and that it was observed that several of the closed mines were filled to the brim with water.

These are just some of the instances that show that mine closure on the ground is not happening properly.

Key Concerns in Mine Closure Processes

There are three broad problems with the way mine closures are happening today. The first is that the implementation of the various elements of mine closure, like physical and biological recovery of mined land, clean-up of polluted soil and water resources etc. is not happening in a proper manner, as highlighted earlier. The two other problems are of a more fundamental nature. One is the total lack of any meaningful say for local communities in the entire process of mine closures. The second is the limitations on the uses to which land reclaimed from mining can be put to.

Local communities have very little role to play in the entire process of planning the mine closures, deciding how to repurpose the land, and in the actual implementation. They are neither consulted nor involved in the process. The second issue, which also is strongly related to the first one, is that in many cases, the repurposing and reuse of the reclaimed land does not consider the interests of local communities, and does not benefit them.

Local communities are badly impacted when lands are acquired and used for mining, as they lose agricultural land as well as commons like grazing land and the livelihoods and sustenance these provide. Further, their economy, livelihoods and health are impacted by the air, water and soil pollution, as well as the depletion of groundwater. Some of this is offset due to jobs and livelihoods provided by the mines. When mines are closed, these jobs are mostly lost. Thus, the process of mine closure needs to ensure that livelihood opportunities are generated to replace the lost ones, and also address the pollution and contamination issues. One important way to do this is to ensure that the land that is reclaimed from mining is repurposed in a way that can benefit local economies and generate employment for local communities. Similarly, the water that is being trapped in the mines can be made available for the benefit of local communities (after ensuring that it is not contaminated) for irrigation, fishing, domestic use etc. These have been the demands of local communities too. However, in a large number of cases, the actual process of mine closure and the proposed re-uses completely neglect these.





Closed mine filled with water. Maharashtra.

For example, a Press Release by the Ministry of Coal dated 21 Dec 2022, and titled “Coal Ministry’s Efforts for Just Transition in Coal Mine Closure” outlines the efforts of closing mines based on the principles of Just Transitions.²⁹ It says:

“Just Transition can be explained as a Transition which is just, fair and equitable for all stakeholders where livelihoods of each impacted persons are secured, and no one is left behind.

“In the process of economic transition of the coal region, the reclaimed land and mine asset will be repurposed by engaging public / private firms to create avenues for employment and revenue generation such as solar parks, eco-parks, fish-farming, warehouse, resorts, museum, picnic spot, golf course, pumped hydro using OC/UG voids and other energy related infrastructure.”

Except possibly fish-farming where direct livelihoods will be generated for local communities, most of the other uses put forward by the Ministry appear more in terms of conventional economic options where it is most often the big players, large industries and corporates, big business and commercial players who will benefit, and benefits to local communities are likely to be peripheral in nature.

29. Coal Ministry’s Efforts for Just Transition in Coal Mine Closure: Ministry working on Comprehensive Mine Closure Framework, Thirty new Eco-Parks to be Created in next Five Years Press Release by Ministry of Coal, posted by Press Information Bureau on 21 Dec 2022, Release ID: 1885489. Available at <https://www.pib.gov.in/PressReleasePage.aspx?PRID=1885489>



Another important aspect to be considered is that a number of closed mines are now being looked at for disposal of fly ash and washery rejects as we have discussed in the earlier sections. This will render them practically out of consideration for most community-centred uses as fly ash can lead to severe contamination of the water collected in the mines as well as the reclaimed land.

Fishing is one of the very important uses of the mines for local communities. Central Coalfields Limited (CCL) has itself initiated several such uses and notes that

“Central Coalfields Limited (CCL) has transformed a number abandoned mine pits into thriving fish farms, promoting responsible use of natural resources and boosting local economy and biodiversity... CCL has developed five abandoned mine pits for pisciculture, with impressive results in both community engagement and fish production... CCL’s pisciculture projects have been a game-changer in revitalizing water filled mine pits, transforming them into sources of livelihood for local communities. These projects contribute to the overall economic upliftment of rural areas while promoting ecologically responsible water filled abandoned mine pits.” (Ministry of Coal, 2024)

The Jharkhand Government’s Department of Agriculture, Animal Husbandry and Co-operative (Fisheries Directorate) website, in documenting the Aquaculture Resources of the state, says that a total of 1741 aquaculture resources exist in ‘Coal Pits and Mines’ in Jharkhand.³⁰

But dumping fly ash in mines will seriously jeopardise this resource.

During a field visit to Bokaro region by a team including the author of this report, local community leaders while talking about a coal mine which was partially used for disposing fly ash told the team that:

“...the Jharkhand State Government’s Fisheries Department has been assisting people to carry out fishing (machlipalan) in the water in the void for the last 6-7 years. ... though the mine void is currently being used for fishing (through a cooperative), the fish grown in the void is often sold at cheaper rates in the market than other fresh water fish, with the reason given that it is grown in the mine void.” (Raheja & Dharmadhikary, 2022, p. 11)

This clearly indicates the risks – health wise and also economic – of using mine voids to dispose off fly ash. Thus, using mines to dispose off fly ash would effectively mean that it cannot be used for fishing by local communities (and in fact, neither could the stored water be put to any other use).

30. <https://jharkhandfisheries.org/aquaculture.php> Accessed 24 June 2025



Mine land that is recovered by filling with ash, would be unsafe for growing crops for human uses. For example, the CPCB 2019 Guidelines direct that “fruit bearing species shall be avoided” when creating plantations over land recovered through the ash dumping process. This is a clear indication that fruits grown here would be potentially risky for humans to consume. While the guidelines don’t make any mention of it, the use of these lands for grazing and fodder also would carry similar risks.

Thus, the authorities are aware of these trade-offs, but the concern here is whether the interests of local communities are being sufficiently prioritised when making decisions; and most importantly, these decisions seem to be made by the authorities without any consultation of local communities.

Another key issue is the land which had been taken over for the mine and would be, in theory, reclaimed after the mine closure plan has been implemented. The repurposing of the land and hence the possible employment and other benefits that can be generated for local communities depends critically on to whom and for purpose the land can be allotted.

The land used by a mine often has two components, forest land, diverted for mining under the Forest Conservation Act 1980, and non-forest land. Both are governed differently. As per the Standard Conditions for the diversion of forest lands for (the non-forest purpose of) mining, the legal status of the lands remain the same, that is, they continue to be legally “forest land”. (MoEFCC, 2019) Equally important is the condition that “The period of diversion of the said forest land shall be co-terminus with the period of the mining lease granted under the Mines and Minerals (Development & Regulating) Act, 1957 or Rules framed thereunder.” The 2025 *Guidelines for preparation of Mining Plan and Mine Closure Plan for Coal and Lignite blocks, 2025* also state that “Project Proponent should return the forest land after completion of mining activity as per the land surrender schedule submitted to Central Government during diversion of forest land”. (Sec 4.7) All these in effect mean that after the mine is closed, the land should revert back to forest land. But this should not be just a bureaucratic, on paper reversion. It is important to ensure that these lands go back to being “forest lands” biologically and ecologically, in letter and spirit, with restoration done to ensure that they provide the services that these forest lands provided to the ecology and the local people as commons.

Mines are now being looked at for disposal of fly ash and washery rejects. This will render them practically out of consideration for most community-centred uses as fly ash can lead to severe contamination of the water collected in the mines as well as the reclaimed land.

Regarding the non-forest land that is diverted for mining, the current policy puts se-



vere restrictions on the purposes that it can be re-allotted for.

An Office Memorandum issued by the Ministry of Coal dated 22 April 2022, titled *Policy Guidelines for use of land acquired under the Coal Bearing Areas (Acquisition & Development) Act, 1957*³¹ lists the purposes for which lands which are no longer suitable for or viable for coal mining or lands from which coal has been mined out can be allotted. Subsequently, an Order³² of the Ministry of Coal dated 29 July 2024 extended this policy to any lands acquired or in possession of coal PSUs including lands acquired under the Coking Coal Mines (Nationalisation) Act, 1972, the Coal Mines (Nationalisation) Act, 1973 and the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 (RFCTLARR Act).

These allowed used for the land as detailed in the Sec 4(5) of the Policy are restricted to “coal infrastructure development activities” including for setting up coal washeries, coal handling plants, conveyor systems, coal gasification plants etc. and some other uses like rehabilitation of project affected people due to acquisition of land, or for setting up thermal or renewable power plants and energy related infrastructure.

Thus, it is clear that the lands reclaimed from the mines will not be available for the uses which are likely to directly benefit local communities and which have been among their consistent demands.

Emerging New Paradigm – Intent Seen, Implementation will be Key

There appears to be some recognition of this problem. That may be the reason for the introduction of an Amendment to the Coal Bearing Areas Act 1957 (CBA Act 1957). The Ministry of Coal released a draft bill inviting public and stakeholder comments until December 27, 2024. Important proposed provisions related to the issue of land reuse include powers to the Central Government to issue guidelines for the lease of such lands, allow the Central Government to denotify the land if it is no more required, and

“29. Transfer/Return/vesting of land, for reuse after closure of mine or for use of land which is unviable for mining: Where it appears to Central Government that any land acquired under this Act is no more required, can transfer/return/vest such land for various uses as it may deem fit, in part or full as the case may be, by following the procedure prescribed in the rules made under this Act and publishing notification of such land.”

This indicates the intent to break out from the narrowly allowed reuses of the lands acquired under CBA Act 1957. However, at the time this was being written (March 2026),

31. OM available at <https://coal.nic.in/sites/default/files/2022-04/22-04-2022wn-acts.pdf>

32. Available at <https://coal.nic.in/sites/default/files/2024-07/29-07-24-rules.PDF>



the amendment had not yet been passed. Further, it should be noted that these amendments deal only with lands acquired under the CBA Act 1957 and not with lands acquired under other Acts. Those will need similar amendments.

Two other developments corroborate the intention to break out of the current approach of mine closure and re-purposing.

The first is that on 31 Jan 2025, the Ministry of Coal issued new and revised *Guidelines for preparation of Mining Plan and Mine Closure Plan for Coal and Lignite blocks, 2025*.³³ These have several important provisions that represent, at least in intent, a break with the past. These provisions indicate more focus on just transitions:

“...ensuring that the environment is protected, the land is restored, and affected workers, communities, and regions are supported and empowered throughout the transformation. It involves recognizing and addressing the social, economic, and environmental challenges associated with mine closure activities.” (Sec 3.2)

The also require prioritising the needs of and benefits for the local communities, and creating space for their better participation in the process. (In particular, see Sec 3.1, Sec 3.2, Sec 3.2.1, and Sec 3.2.2)

The Guidelines also make financial provisions for some of these, mandating that

“A minimum of 25% of the five yearly escrow amount deposited shall be utilized for community development and livelihood related activities...” (Sec 3.5.5 (ii)), and

“A corpus from 10 percent of the balance deposited amount from final mine closure cost is to be created towards Just Transformation.” (Sec 3.5.5 (iv))

The Guidelines also provide for the setting up of a “Mine closure advisory committee ... to oversee community development and livelihood plan” (Sec 4.12) which includes the Sarpanch of the local gram panchayat and NGO representative.

All these are welcome steps that can take mine closure processes a step forward in prioritising interests of local communities as well as involving them in the process. However, this will also depend crucially on whether the land and other resources like water can be deployed for the benefits of the community. That will need not just the will, but also amendments of the relevant laws. There is also a need to broaden the representation of local communities and NGOs in the Advisory committee. Lastly, the “Indicative list for community development and livelihood related activities” given in Appendix IX mostly does

33. <https://coal.gov.in/sites/default/files/2025-01/31-01-2025a-wn.pdf>



not involve use of the reclaimed land and/or water sources created, a shortcoming that needs to be addressed, and which is tied to changing the legal regime to allow such use of reclaimed land.

The second important development is the recent launch by the Coal Controller Organisation of RECLAIM. RECLAIM describes itself as a “Community Development Framework with support from the Heartfulness Institute ...It offers a way forward where mining regions can evolve into spaces of resilience, self-reliance, and renewed purpose - shaped by the aspirations of the communities.” (CCO, 2025)

The RECLAIM framework, in the words it uses, certainly represents the “paradigm shift” that it claims for itself, “from a narrow focus on technical compliance to a comprehensive, people-centric approach” (Page 4) It pushes for the full involvement of local communities in mine closure processes right from the planning stage, calling for “Planning with people, not just for them”, and shifting the “role of the community from being passive recipients of a plan to being active designers and decision-makers.” (Page 80-81)

In terms of needs and interests of local communities, RECLAIM “is designed to ensure that the needs, perspectives and insights of people directly and indirectly affected by mining shall be able to shape the decisions that define their future (Page 5) ...” and “RECLAIM encourages planning that keeps the next generation in view. This includes supporting education, investing in skills, and restoring natural resources that provide for future livelihoods.” (Page 7)

In sum, mine closures, apart from the lack of implementation of scientific restoration and clean up, have had a serious shortcoming that they have not prioritised the needs and interests of local communities, that these communities are not involved in any meaningful way in the process, and that the resources created for and from mine closures – including funds, land and water – are rarely if at all deployed for the benefits of local communities. In this context, the three major initiatives - the Mine Closure Guidelines of 2025, the RECLAIM Framework and the proposed amendments to CBA Act 1957 and other Acts to allow other uses of acquired land – taken together do represent a paradigm shift in intent and provisioning, even with some critical shortcomings. Together, they do aim to address the key issues of putting community interests at the centre, giving a meaningful role to communities in the process, and making resources available for that.

The Mine Closure Guidelines of 2025, the RECLAIM Framework, the proposed amendments to CBA Act 1957 and other Acts to allow other uses of acquired land – taken together do represent a paradigm shift in intent and provisioning.



However, the actual implementation is yet to be seen. There are several challenges – one, there are still shortcomings in this new arrangement; second, some of the steps, like passing the proposed Amendment into a law still remain to be taken to the logical conclusion; third, it is not clear if the RECLAIM Framework is legally binding; and fourth, and most important, the mindset and approach enshrined since decades needs to change. Even with all these, it is welcome beginning. The RECLAIM document mentions that the “framework may be piloted in a selected number of mines”. It will be important to see how these pilots are rolled out, and learn from these. Proper implementation of these measures will determine what legacy coal mining will leave behind in the transition.



RETIREMENT AND DECOMMISSIONING OF THERMAL POWER PLANTS

Every thermal power plant has an economic life, after which it is retired. In many cases, units of such retired power plants have been dismantled and newer units have been put up in their place. However, the issue of retirement and decommissioning of power plants is very critical as more and more plants near their end of life.

There are no specific regulations or guidelines dealing with such decommissioning. The CPCB has issued *Environmental Guidelines for Decommissioning a Coal/Lignite-Fired Power Plant (Draft)* in response to an order of the NGT³⁴ which CPCB submitted to the NGT on 22 July 2021. However they are very sketchy in nature in their current form. At the time this was written (March 2026), these Guidelines remained to be finalised.

Till such a time, the decommissioning of power plants is regulated as per extant laws. A question was put to the Minister of Power in the Parliament³⁵ as to

“whether the Government has issued any guidelines for decommissioning of coal-based power plants for safe management, handling and disposal of hazardous substances and dismantling of scrapped thermal power plant sites...”

In reply to this, Minister of Power and New & Renewable Energy stated, on 8 Feb 2024:

“For safe management, handling and disposal of hazardous substances and dismantling of scrapped thermal power plants and disposal, Thermal

34. Order dated 23.03.2021 in the matter O.A. No. 30 of 2021 (SZ), Dharmesh Shah Versus Union of India and Others

35. Unstarred Question No.927 Answered on 08.02.2024 by Shri R. K. Singh, Minister of Power and New & Renewable Energy. Available at <https://sansad.in/getFile/loksabhaquestions/annex/1715/AU927.pdf?source=pqals>



Power Plants (TPPs) are required to follow various rules and regulations, guidelines such as:

- I. Adherence with the environmental norms as applicable under the Water (Prevention and Control of Pollution) Act, 1976 and the Air (Prevention and Control of Pollution) Act, 1981.
- II. Adherence with [the Hazardous Waste Management Rules, 2016](#), [Solid Waste Management Rules, 2016](#) and [E-waste Management Rules, 2022](#)
- III. Adherence to Factory Act-1948”

There was no reference to CPCB’s Draft Guidelines. One of the key issues associated with such decommissioning is the disposal of the legacy fly ash and the closure of the ash pond. We have discussed this in detail in the earlier sections. However, an important question about continuing liability needs to be highlighted here. The Draft Guidelines by CPCB do acknowledge that:

“Closure of ash ponds (surface impoundments) probably will be the most challenging tasks to undertaken during a decommissioning process.” (Page 6)

However, they seem to assume that this essentially only means capping and stabilisation of the ash pond. They do not seem to consider or advocate the method of *utilisation* of all the legacy ash lying in the pond. The Guidelines say:

“Closure of most surface impoundments of the power plant will require drainage, placement of an impermeable cap, and topping with soil and a vegetative cover until full compliance with ash utilization notification is achieved. Proper placement of the cover and specified slopes will be required. The type and depth of cover required may vary based on the waste disposed in the impoundment.

“The caps for the impoundments will require continued maintenance to maintain the site contours, vegetative cover, and drainage. Such impoundments will require the installation and monitoring of groundwater wells.” (Page 6)

A key point here is that such a capping of ash ponds will require continuing attention, as indicated by the words like “require continued maintenance” and “monitoring of groundwater wells”. Who will do this continued maintenance or monitoring is not mentioned. It will be a critical question as the power plant itself will be decommissioned. It may be recollected that the CPCB and CEA *Guidelines on Design, Construction, O&M and Annual Certification of Coal Ash Ponds* (CPCB, CEA, 2023, p. 102) require that:

“Power plants shall ensure annual certification of reclaimed ash pond and dykes also in respect of safety...environmental pollution...” (Emphasis added)



But what happens when the power plant itself is decommissioned? Who will ensure annual certification and the continued maintenance? Who will be liable in case of any problems? There needs to be some legal provision which will ensure that the owners and operators of the plant would remain liable and be held accountable in case of any safety and health issues related to disposal of ash and other hazardous waste, stabilisation of ash pond etc.

The other issues are related to the safe disposal of all waste, including hazardous wastes, scrap, and clean-up of the pollution that have been caused over the years. The issue of the use to which the land would be put to is a critical one. Like the case of mine closure, here too, the needs and interests of local communities, (and the interests of the plant workers) including their livelihoods, need to be prioritised and they need to have a meaningful place in the process.

The case of Bathinda thermal power plant highlights some of these issues. The 460 MW Guru Nanak Dev thermal power plant in Bathinda, Punjab, owned and operated by the Punjab State Power Corporation Ltd (PSPCL) is one of the few power plants in the country to be fully shut-down and its land taken up for re-purposing. Thus, its experience will be valuable in guiding the closures of power plants in the coming year. The Government of Punjab decided on 20 Dec 2017 to permanently close the operations of the Bathinda power plant with effect from 1 Jan 2018.³⁶ Subsequently, a Cabinet sub-committee was set up on May 18, 2020, to work out the modalities of the redevelopment of the Bathinda plant land.³⁷ The redevelopment plans included connecting the 164 acres of water bodies established for the power plant to the city water supply system, using 280 acres of the project colony land and buildings for civil and policy administration, and converting the plant area of 1320 acres to an industrial hub.³⁸ We have not been able to ascertain the recent status of the land redevelopment.

Some of the issues are important there. One, the press releases clearly state the intention of the Government to “redevelop the site to bring prosperity to the area by maximizing direct and indirect employment generation opportunities” and that “after closing down the thermal plant, not a single employee – be it regular or contractual – was re-trenched; and all employees were accommodated.” This is critical and it should be the core of any such closure process.

Second, it is not clear whether the local community members as well as representatives of the power plant employees were consulted and involved in the process of planning

36. https://cea.nic.in/old/reports/others/planning/pdm/closure_ropar.pdf

37. <https://pspcl.in/Otherlinks/capt-amarinder-led-punjab-govt-gives.aspx> Press Release of PSPCL, dated 22 June 2020, No. I/38771/2020

38. Statement of then Finance Minister, Shri Manpreet Singh Badal, quoted in a press release of PSPCL dated 23 June 2020, No. I/39514/2020. Available at <https://www.pspcl.in/Otherlinks/bathinda-thermal-plant-to-provide.aspx>



the closure, including the decision-making process for how to redevelop the land. There should be a structured mechanism to allow for such participation.

Lastly, while the concerns of power plant employees seem to have been taken care of, and the land re-purposing is also being planned to cater to multiple objectives, it appears that the clean-up of the environmental waste has not been given the same attention. In particular, the massive amount of (legacy) ash that has been left behind by the plant operations remains to be utilised or disposed. Unfortunately, even proper information regarding this is not available in the public domain. The latest figures available on the PSPCL website are for the June 2020.³⁹ As per these figures 20.98 million tons of ash was lying in the ash pond as of 31 May 2020. Ash utilised in June 2020 was just 35,357 tons, leading to 20.95 million tons still remaining. A later report by the CEA, which gives figures for ash generation and utilisation for the year 2021-22 is the last from CEA to give figures for the ash remaining and utilised at the Bathinda plant. It gives the ash remaining at the (closed) Bathinda plant on 31 Mar 2022 as 20.365 million tons (CEA, 2022, p. 60). The rate of utilisation of ash as per that report indicates that it would take 60 years for the ash to be utilised fully. This is a very serious issue as the ash will pose severe risks of pollution to the ecology and health of local communities. We have not been able to ascertain the current status of ash disposal and clean-up of other polluted areas. This again highlights the issue that environmental impacts keep being neglected and risk being left behind as a polluting legacy of the energy transition.

Detailed case studies of plants closed till date will help in developing better guidelines and protocols to tackle the legacy issues.

However, the issue of closures of thermal power plants may not come up in the immediate next few years as of now. The Parliament reply quoted above also notes that:

“The Central Electricity Authority has issued an advisory to all the Thermal Power Utilities not to retire or repurpose their coal-based power stations (units having capacity of more than 200 MW) before 2030... considering the expected energy demand scenario and availability of capacity in future.”

Given this, there is little chance of any decommissioning of coal power plants happening in the near future. However, the question remains of critical importance as the situation will definitely arise in the coming years. It would be good to use the time available to develop proper guidelines for decommissioning of power plants.

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39. <https://docs.pspcl.in/vieworders.html?ofc=gndtpflyash#custom-href-vieworders> Accessed 18 Feb



LEGACY OF MINDSET AND APPROACH

So far, we have talked about the physical legacy that coal operations are likely to leave behind even as the energy transition takes place. However, there is another legacy that is as important, though it is not physical – and that is the legacy of the mindset and approach.

This entire set of coal operations – mining, washing, transport, power plants, waste disposal – have been driven and carried out by a particular mindset or approach. This is a top-down approach where the main focus is on technical, economic and financial side, and social, environmental issues are relegated to the sidelines. Needs and interests of local communities and ecology have been ignored. The approach has been to create bigger and bigger entities and enlarge the scale of the players and the units, with attendant centralisation of the system. Assessment of social and environmental impacts are often highly inadequate or flawed. Addressing them, even in terms of just proper implementation of existing laws and regulations is done casually, and failures and lapses in this are taken lightly or disregarded, and easily tolerated. These factors have been responsible for many of the issues we have discussed earlier in this note.

If the same mindset is retained even as the energy system transitions through a technological shift, we are likely to see the emergence of many problems on lines similar to the ones faced by coal operations, even though the new renewable energy sources are inherently cleaner in many ways. Unfortunately, it seems that this is the case, and the same approach that characterised coal operations continues.

For example, solar PV based electricity generation installations are growing bigger and bigger in scale, and we are seeing emergence of many contestations around the land that they need. Solar installations are being planned and implemented on water bodies and reservoirs, creating a set of serious implications for the ecosystems these are a part of. These solar PV installations do not require an Environmental Clearance and hence don't require any Environmental Impact Assessments. Given their increasing scales, they are likely to have significant impacts, which can be mitigated or addressed only if they are assessed.



Pumped storage projects (being pushed as a part of the “renewable” energy systems as they are necessary for the absorption of solar and wind generation into the grid) are coming up in ecologically sensitive areas like the Western Ghats. While these do need Environmental Clearances, they are also being planned and pushed with the same mindset of treating EIAs and ECs as mere formalities, ignoring cumulative impacts and so on. Consultations with local communities are rare in all these cases. Involvement of local people and better benefit sharing arrangements are necessary.

It is important that as a part of the energy transition, we effect not just a transition in the technologies of energy generation and supply, but also in the approaches to managing the entire process. Otherwise, we risk perpetuating the legacy of the same mindset and approach which has led to the current set of serious issues.



CONCLUSIONS AND RECOMMENDATIONS

There is a transition underway in India's energy, especially electricity sector. There is both intent and action to push for a shift to renewable energy sources for powering electricity generation. As a corollary, the role of coal in electricity generation is diminishing, even though it is likely to remain a significant source for several decades. The entire chain of coal operations necessary for coal-based electricity generation – mining, processing, washing, burning, waste disposal, transport – has severe impacts on the environment as well as the health and livelihoods of communities. Unfortunately, large parts of these impacts have remained, and continue to remain unaddressed, creating a persistence of such impacts.

The transition to cleaner energy sources is definitely a welcome step. However, in the process unless the ongoing and accumulated impacts are addressed, the country will remain saddled with serious legacy issues of coal-based generation. This paper has identified some of the key legacy issues, focussing mainly on the environmental legacy issues, and within that, mainly those impacting land and water. It is clear that the scale of such legacy issues is huge- including more than a billion tons of accumulated fly ash, millions of tons of overburden and washery rejects, end of life mines that remain without proper and scientific closures, polluted water bodies and lands, and communities saddled with loss of livelihoods and health problems.

These need to be addressed in a mission mode even while ensuring that “current” issues (environmental impacts emerging from ongoing operations) are also taken care of, otherwise they will keep adding to the legacy impacts.

Addressing legacy issues needs both, the intent and will to do so, and sustained actions. Resources also need to be made available for this, and would primarily need to come from the sector operations themselves as these legacy issues are nothing but issues on which action was needed even as these issues emerged, but such action was “deferred”. The urgency of action on legacy issues also partly comes from the fact that the energy transi-



tion is likely to leave a diminished coal sector, and a diminished sector will find it more difficult to provide resources for taking care of these “deferred” responsibilities.

At least in some areas, there is evidence of the intent to tackle these legacy issues, demonstrated most clearly by new regulations and guidelines like the Fly Ash Notification 2021 and the *Guidelines for preparation of Mining Plan and Mine Closure Plan for Coal and Lignite blocks, 2025*. At the same time, significant gaps and issues remain even in these new regulations, and there is need to bring better legislation, regulation and guidelines across the spectrum of coal operations to address the gaps. This paper has highlighted some key gaps and issues in relevant sections. Implementation remains a permanent bottleneck and this has to be addressed.

There is also a need to make available up to date information and data on all these impacts. Unfortunately, we have seen that even some of the data that was earlier available in the public domain is no longer available. This needs to change and detailed information and data on all the legacy impacts – at project and aggregated levels - needs to be collected, collated and made easily accessible.

Last but not the least, it is critical that local communities, especially those directly impacted by these legacy issues, be meaningfully involved in the planning and implementation of the processes to address these issues.



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Legacy Issues in Energy Transition

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