JUST TRANSITION OF COAL-BASED POWER PLANTS IN INDIA

A policy and regulatory review

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List of Abbreviations

AOC	Administrative Order of Consent
ARO	Asset retirement obligation
BTPS	Badarpur Thermal Power Station
C&D	Construction and demolition
CCME	Canadian Council of Ministers of the Environment
CCR	Coal combustion residual
CEA	Central Electricity Authority
CERC	Central Electricity Regulatory Commission
COP	Conference of the Parties
CPCB	Central Pollution Control Board
CTE	Consent to Establish
CTO	Consent to Operate
DEQ	Department of Environmental Quality
EC	Environmental clearance
EIA	Environment Impact Assessment
EMP	Environment Management Plan
EPA	Environmental Protection Agency
EU	European Union
GENCO	Generation company
GNDTP	Guru Nanak Dev Thermal Plant
GW	Gigawatt
Ha	Hectares
HWM	Hazardous waste management
ID Act	Industrial Disputes Act
MoEFCC	Ministry of Environment, Forest & Climate Change
MoP	Ministry of Power
MW	Megawatt
NGT	National Green Tribunal
NPPF	National Planning Policy Framework
PCBs	Polychlorinated biphenyls
PPA	Power purchase agreement
PSPCL	Punjab State Power Corporation Limited
PSU	public sector undertaking
PUDA	Punjab Urban Development Authority
R&M	Renovation and modernization
RGGI	Regional Greenhouse Gas Initiative
RMP	Risk Management Plan
RPO	Renewable purchase obligation
SERC	State Electricity Regulatory Commission
SPCB	State Pollution Control Board
TPP	Thermal power plant
UK	United Kingdom
US	United States

Summary for stakeholders

India's coal fleet is fast ageing. About one-fifth of the current capacity is primed for decommissioning as their average age is more than 35 years. If the Ministry of Power's advisory to retire coal-based generation units of more than 25 years old is implemented, then as much as 50-60 GW capacity will retire in the coming ten years. But is India prepared to decommission such large capacities under a just transition framework, ensuring fair and inclusive outcomes for the environment, labour and community?

This report maps existing legal and regulatory requirements in India arising at the time of plant closure in the context of environment, land, labour and finance, and assesses their adequacy from the perspective of ensuring a just transition. It then examines some of the key challenges in ensuring an efficient closure. Suggestions are then presented on how the existing legal and regulatory system can be better designed for ensuring a 'just decommissioning' of coal-based power plants.

Decommissioning a coal-based thermal power plant (TPP) in a just transition context entails a complex set of technical, environmental, social and economic interventions. The objective is to ensure that the plant site is fully remediated, the economic loss of dependent workforce and communities compensated, and new economic opportunities and environmental outcomes are created for communities to benefit from.

But presently, in India, there are no laws that mandate decommissioning and repurposing of a coal TPP. Unlike the coal mining sector, decommissioning plans are not required to be developed for TPPs before plant construction or during operations. The existing laws and regulations related to the environment, labour, land and finance are either ambiguous or are silent on decommissioning, leaving enough space for non-standard approaches.

Central and state laws and regulations on environment, labour, land and finance are silent or ambiguous on TPP decommissioning

Environmental laws

1. **No legal mandate:** There are no laws that mandate the clean-up and remediation works for TPP decommission or even an industrial decommission.

- The Environmental Impact Assessment (EIA) notification, 2006, under which Environmental Clearance (EC) is given to set up TPPs, is silent on the decommissioning aspect.
- The Forest Conservation Act, 1980, under which forest land is diverted for setting-up TPPs, doesn't specify decommissioning. Instead, it just mentions that the land has to be reverted to the forest department.
- Decommissioning is not mentioned in Air or Water Act.

2. **Multiplicity of permits:** As dismantling, clean-up, remediation and repurposing qualify as a new activity under various environmental statutes, multiple consents and clearances are required for decommissioning.

- New consent under Water and Air Act would be required to start dismantling and clean-up. New permits are also required under Hazardous waste and C&D waste rules.
- For repurposing, new consent to establish and consent to operate would be required under Air and Water Act.
- Depending on the sector of repurposing, a new EC will be required.
- Change in land use/ activity will require a new forest clearance.

Overall, meeting the requirements of the existing environmental statutes is too cumbersome for decommissioning and repurposing.

Land laws

The land ownership structure in India's thermal power generation sector creates an additional layer of peculiar complexity. Power plants have been installed on a mix of freehold and leasehold land, using land acquisition acts. In the case of leasehold land, the landowner (mostly state governments) and plant owners (GENCOs) are separate entities, creating a high possibility of delayed and inefficient decommissioning. In the case of freehold land, without a clear legal mandate to decommission and remediate, the site is likely to remain in an 'as-it-is' state.

1. **No policy for repurposing land:** There is no policy framed by the states or the centre on how the brown field land would be repurposed.
2. **Lack of clarity on the return of leasehold land:** A GENCO has to return the land to the state/central government after the lease period. But the condition in which the land has to be returned is not elaborated in the terms and conditions of the lease document.
3. **Lack of mechanism for quick decision-making:** About two-thirds of the land of TPPs are with the state and the central government. In addition, the leasehold land of the private sector would also revert to the government. So, the state and central government have the most significant role in deciding the fate of the TPP sites. However, there is no mechanism at the central or state level that can take quick and efficient decisions on repurposing and transferring land.

Labour laws

Decommissioning a TPP entails retrenching a large labour force, including both formal and informal workers. The existing labour laws in India require some compensation to be paid to formal employees at the time of retrenchment. However, none of the current laws addresses the transition requirements of a large number of informal workers employed at a power plant, who are typically three to four times the number of formal employees.

1. **No policy or law for a just transition:** The Indian labour laws are not designed for large-scale closure of industrial facilities. The closure of plants is viewed mainly in terms of a potential dispute between the owner and the workers. But for large-scale decommissioning of fossil-fuel assets, peaceful and systematic closure is essential. But there is no policy or law to enable a just transition of all types of workers to allow peaceful and systematic closure.
2. **Weak provisions for informal and contract workers:** There are no provisions in the Contract Labour (Regulation and Abolition) Act, 1970, to provide social security or reskill unemployed labour. The Social security Code, 2020 is also not designed to deal with large-scale industrial closure.
3. **Need to amend the labour acts:** There is a need to amend the labour acts to enable a just decommissioning of power plants. The acts must be revised to incentivize repurposing of power plants so that the least number of workers are retrenched.

In addition to little guidance, there is limited precedence in India on managing various aspects of TPP decommissioning

Financial regulations

Decommissioning cost is not explicitly considered in financial calculations or disclosure. Presently, there is little guidance available and limited precedence regarding the financial aspects of decommissioning.

1. **Decommissioning costs not factored in:** Decommissioning costs are not factored into the financial calculations while setting up the TPP. So, no funds are kept aside

by the power plant owners for end-of-life activities. Presently, the salvage value is assumed to be sufficient to enable a just decommissioning. However, as seen from the international and Indian experience, the salvage value might not be adequate. In the absence of clearly earmarked funds and clearly established liabilities, there is a strong possibility of both public and private companies resorting to inaction.

2. **Decommissioning cost not part of liability:** Under current financial accounting principles, decommissioning cost is not part of liability and hence is not reported.
3. **Higher chances of leaving the plant 'as-it-is':** If decommissioning and repurposing are financially unviable, GENCOs are likely to leave the plant 'as-it-is'. This has been the experience in the developed world. Hence, there is a need to create a financial security mechanism to enable decommissioning and repurposing.

From the review of the existing laws and regulations surrounding decommissioning of coal TPPs, it is clear that the policymakers have so far not envisaged large-scale decommissioning scenarios. But the closure of TPPs is an inevitability; the only variable factor is time. Overall, the present policy and regulatory frameworks need to be redesigned to ensure a just decommissioning of coal TPPs.

Comprehensive redesigning of the existing legal, policy and regulatory frameworks needed to enable a just decommissioning of TPPs

India can learn a lot from other countries in handling large-scale decommissioning. From the global experience, the following action points emerge:

- **Prepare in advance:** Countries with massive dependence on coal and typically weak financial position of utilities should prepare in advance to manage all aspects of coal power plant closures.
- **Clean-up and remediation through a legal mandate:** Clean-up and remediation of the power plant site must be addressed by a dedicated law. It is necessary to create a mechanism for retiring power plants to develop and submit retirement plans in advance and act upon the approved plan after retirement. Establishing a clear liability and a timeline for action is crucially important.
- **Adequate financing for clean-up and remediation:** Financing for power plant closure, especially remediation works, should be made available within the power market mechanism. In regulated power markets, regulators must clearly identify and define costs that can be recovered by rates through the consumers. This is important for protecting the rights of consumers as well as to avoid the lapse of liability by the utility. In addition, it is important to initiate this early, to spread the costs over a longer time period and minimize the impact on consumer tariffs.
- **Just transition action:** Governments need to take a proactive role in ensuring just transition planning and oversight in light of the long-term impact of coal plant closures on communities and workers and the relatively passive approach adopted by power plant owners. In countries like India, with weak social security structures, dedicated laws must be created to support the transition of affected communities.
- **Prioritize redevelopment:** Central, state, and local guidance and programmes need to incentivize and prioritize the redevelopment of coal power plant sites. This is important for both local area redevelopment as well as for utilization of brownfield lands. This requires creation of planning structures as well as investment support.

So far, the focus of energy sector policies, legislations, and regulations in India has been on planning, designing, construction, operations and renovation of generation capacity. However, now is the time to start addressing issues related to end-of-life management.

Chapter 1

INTRODUCTION

A substantial number of coal-based power units in India have aged and are gradually becoming uncompetitive. As a result, these units are routinely retired, often decommissioned and at times repurposed for reuse. According to the Central Electricity Authority (CEA), 126 coal-based power generating units aggregating a capacity of 11,995-Megawatt (MW) have been retired from operations between March 2016 and June 2021 due to techno-economic and commercial considerations.[1] Typically, thermal power plants (TPPs) in India operate under a tariff structure that allows for the asset to be depreciated up to 90 per cent during a 25-year power purchase agreement (PPA) period. However, these units continue to operate for longer durations of 35 to 45 years and even more following substantial investments in renovation and modernization (R&M).

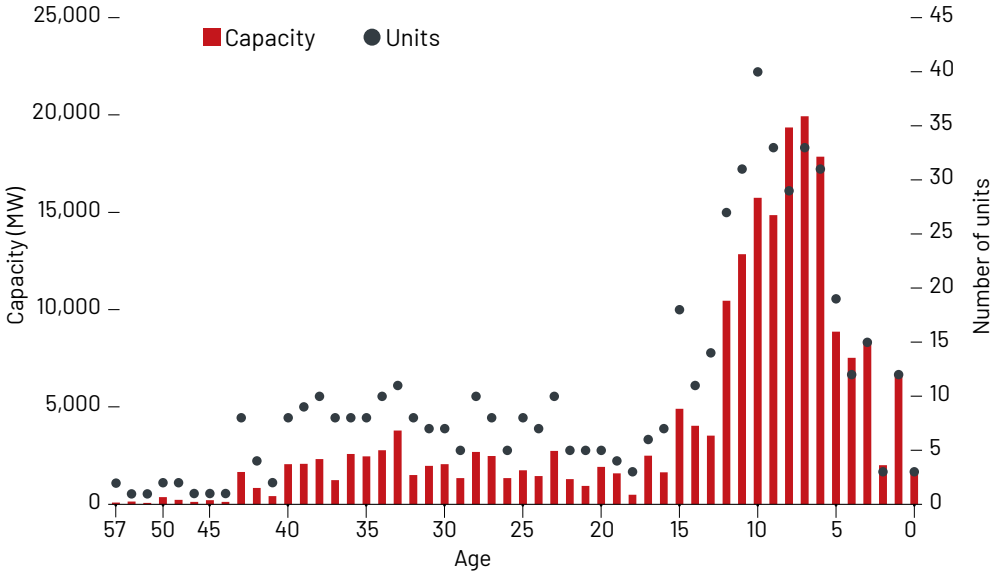
The scenario of these units running for four to five decades is likely to change in the coming years as the pressure on coal-based power generation mounts due to environmental, climate change and economic reasons. At the United Nations Framework Convention on Climate Change's COP26 meeting in Glasgow, India has made a bold pledge to gradually and substantially cut greenhouse gas emissions to achieve a net zero status by 2070. This provides a strong fundamental demand for coal phase-down, not just in power generation but in most coal-consuming sectors. India's coal fleet is fast ageing, and the demand for coal-based power is also shrinking. The new renewable purchase obligation (RPO) trajectory calls for India to meet 43.33 per cent of its power requirement from clean energy sources by 2030.

At a micro-level, several techno-economic factors contribute to the decommissioning decision of a coal-based power generation unit. These include unit availability, reliability, capacity factor, efficiency, generation cost, etc. However, the age of a generation unit can be considered a good proxy for an elementary assessment as, typically, the performance deteriorates with age. About 210-Gigawatt (GW) of coal-based capacity is operational in India. Of this, about 58 per cent of the operational capacity across 230 units is new and under a decade old, and another 21 per cent of capacity across 126 units is 11 to 20 years old. So, about 78 per cent of the installed capacity is less than 20 years old, which is aligned with the fact that the investment boom in India's coal-based power sector occurred after delicensing of the generation sector by the Electricity Act, 2003.

Of the remaining, 9 per cent capacity across 70 units is 21 to 30 years old, 11 per cent across 87 units is 31 to 40 years old, and the remaining 2 per cent across 25 units is 41 to 57 years old. So, one-fifth of the current capacity is primed for decommissioning.

One-fifth of India's installed coal-based capacity of 210 GW has primed for decommissioning, representing units aged between 30 to 57 years

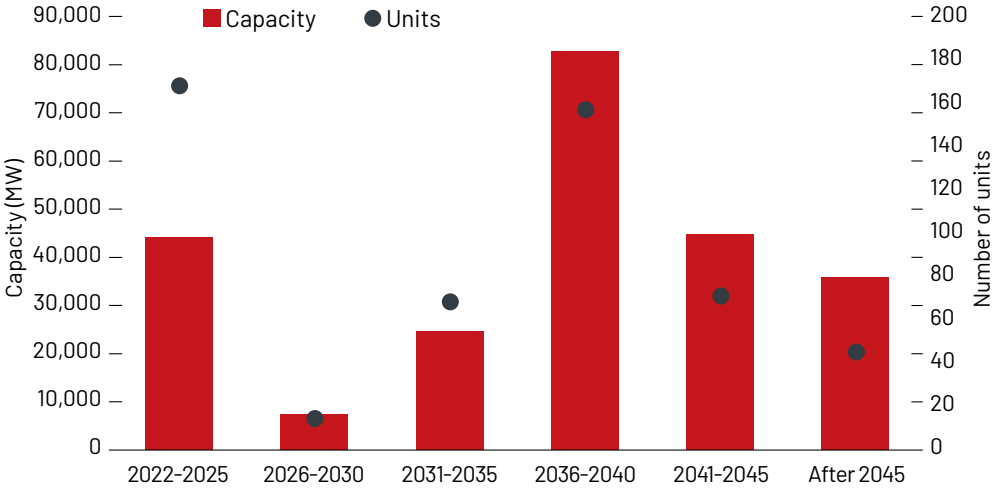
Graph 1.1: Vintage of India's coal-based power generation fleet



Source: Global Energy Monitor, July 2022

So far, 169 thermal power units have been retired in India,[2] including 126 units that have been retired since 2016. In case the Ministry of Power (MoP) advisory to retire coal-based generation units over 25 years old is implemented, 44 GW of capacity across 177 units will have to be retired in India by 2025. This category includes 27 GW of capacity across 112 units which are over 30 years old. In the next decade, between 2026 and 2035, 32 GW across 100 units will need to be retired from operations. Maximum retirements will be witnessed between 2036 and 2040 when 83 GW of capacity across 166 units will need to be retired. Post-2041, 45 GW of capacity across 80 units will be retired by 2045, and another 36 GW across 54 units will be retired after 2045.

Graph 1.2: Retirement schedule of India's coal-based power generation capacity



Note: Assuming an aggressive coal-phase down scenario, where units are retired after 25 years of operations
Source: CEA; Global Energy Monitor

In a nutshell, India is staring at a large-scale decommissioning of coal-based power plants in the coming years, as much as 50-60 GW in the coming ten years. But is India prepared to decommission such large capacities under a just transition framework, ensuring fair and inclusive outcomes for the environment, labour and community?

The focus of energy sector legislations, policies and regulations in India, like in most countries, has been on planning, designing, construction, operations and renovation of generation capacity. Meanwhile, the issues related to end-of-life management have not been addressed adequately.[3] There are no clear laws to guide TPP closure. While some guidance on environmental aspects of the closure is available, issues of labour, land and reuse remain largely unaddressed. Further, the current tariff determination structure does not ensure adequate availability of funds to enable 'a just decommissioning'.

50-60 GW of coal-capacity is expected to retire in the coming decade, but there is little guidance available on TPP end-of-life management

1.1 A just decommissioning

Decommissioning a coal-based TPP in a just transition context entails complex set of technical, environmental, social and economic interventions. The objective is to ensure that the plant site is fully remediated, the economic loss of dependent workforce and communities compensated, and new economic opportunities and environmental outcomes are created for communities to benefit from. This is a complex, laborious and expensive endeavour for a plant owner.

There are several challenges in operationalizing this transition. First, a detailed set of actions are required to address and remedy the environmental degradation caused to the plant

site due to decades of TPP operations. Then, ecological remediation becomes paramount to ensure that the plant site is free of pollutants and contaminants after closure and that the site is restored to its best possible state for the subsequent planned use. The most extensive remediation effort is required at the ash pond/deck site, which is already a highly mismanaged segment in India.[4] Environmental concerns also become necessary during the plant demolition process as large power plant components, construction and demolition (C&D) waste, as well as toxic and hazardous materials are handled and transported for recycling or disposal.

The existing environmental laws and regulations concerning decommissioning are ambiguous, leaving enough space for non-standard approaches. Unlike the coal mining sector, decommissioning plans are not required to be developed for coal-based TPPs in India before plant construction or during operations.

The land ownership structure in India's thermal power generation sector creates an additional layer of peculiar complexity for several plant sites. Power plants have been installed on a mix of freehold and leasehold land. In the case of leasehold land, the landowner and plant owners are separate entities, creating a high possibility of delayed and inefficient decommissioning. In the case of freehold land, without a clear legal mandate to decommission and remediate, the site is likely to remain in an 'as-it-is' state for a long period of time.

On the social front, decommissioning TPP entails retrenching a large labour force employed at the power station, including both formal and informal workers. The existing labour laws in India require some compensation to be paid to formal employees at the time of retrenchment. However, none of the existing laws addresses the transition requirements of the large number of informal workers employed at a power plant, typically four times the number of formal employees. This labour vulnerability often results in public outcry and agitation against the planned decommissioning, adding to closure management complexities.

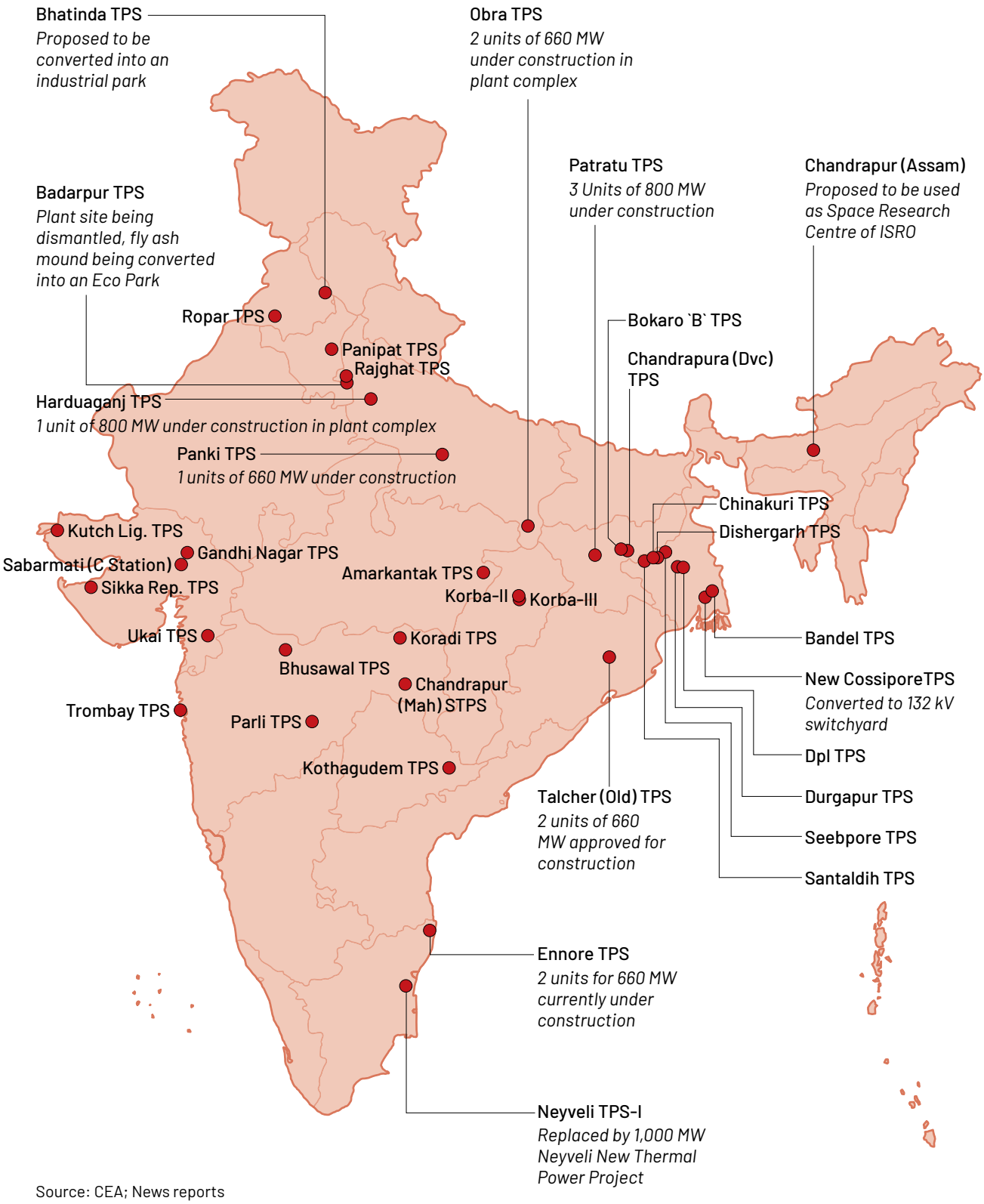
Finally, there are massive economic barriers as end-of-life management of TPPs has remained unaddressed under regulated tariffs. There are many direct and indirect expenses to be incurred during power plant decommissioning and an even larger set of expenses to be met to ensure a just decommissioning. These costs substantially exceed the funds that can be recovered through the sale of used equipment and scraps and are currently not being accounted for in tariff determination. Moreover, the power plant owners often do not set aside funds for end-of-life action. In the absence of clearly earmarked funds and established liabilities, public and private companies will likely resort to inaction.

At present, there is little guidance available and limited precedence in this regard. Most of the decommissioned units in India are proposed to be replaced with more efficient super-critical units. However, given the existing excess supply scenario and the increased focus on renewable energy, only a handful of these proposals have been green-lighted for implementation. Out of the 12 GW thermal capacity retired since 2016, only 2.7 GW is being replaced by new super critical units. This includes plants under construction as well as plants approved for construction. Most retired units await future action, and only four retired plants aggregating 1.4 GW of capacity have been or are being repurposed.

NTPC Limited's Badarpur Thermal Power Station (BTPS) and Punjab State Power Corporation Limited's Guru Nanak Dev Thermal Plant (GNDTP) are the only examples of power plants being fully dismantled and sites being remediated for alternate reuse. The BTPS site is being returned by NTPC to the Union Ministry of Housing and Urban Affairs, given that land was leased from the Government of India. The land is to be returned after remediation and conversion of the ash pond area into an Eco Park.[5] In the case of GNDTP, the state government, as the land owner, has decided to hand over the plant site to Punjab Urban Development Authority (PUDA) after site remediation for development of a mega industrial park.[6] The experiences of these two plants provide several learnings concerning above mentioned environmental, labour, land and economic challenges.

Of the 12 GW of coal-based capacity decommissioned since 2016, most retired units await further decision and action

Map 1.1: Decommissioned coal-based power units in India during 2016-2021



Source: CEA; News reports

Note: Refer to Annexure for details of the units decommissioned at each of the identified power plants

1.2 Study objective

As India witnesses rapid coal capacity retirements in the coming decades due to age, economics, environment and climate change, it is vital to provide clear guidance to power plant owners on closure-related aspects to avoid scenarios of inaction, inadequate action or ad-hoc action. The existing legal and policy void can result in sub-optimal environmental outcomes and negatively affect the workforce, communities and even the power generation companies. Such scenarios can be avoided if a clear framework of action for protecting the environment, labour and redevelopment can be discussed and framed in advance. Therefore, a detailed review of the existing legal, policy and regulatory landscape is essential to plan and prepare for the imminent future of coal-phase down in India.

This report maps existing legal and regulatory requirements in India arising at the time of plant closure in the context of environment, land, labour and finance. It assesses their adequacy from the perspective of ensuring a just transition. It then examines some of the critical challenges in ensuring an efficient closure. Finally, suggestions are presented on how legal and regulatory tools can be better designed to ensure a 'just decommissioning' of coal-based power plants.

Detailed review of existing legal requirements for decommissioning is vital to avoid inaction, inadequate action or ad-hoc action

1.3 Study approach

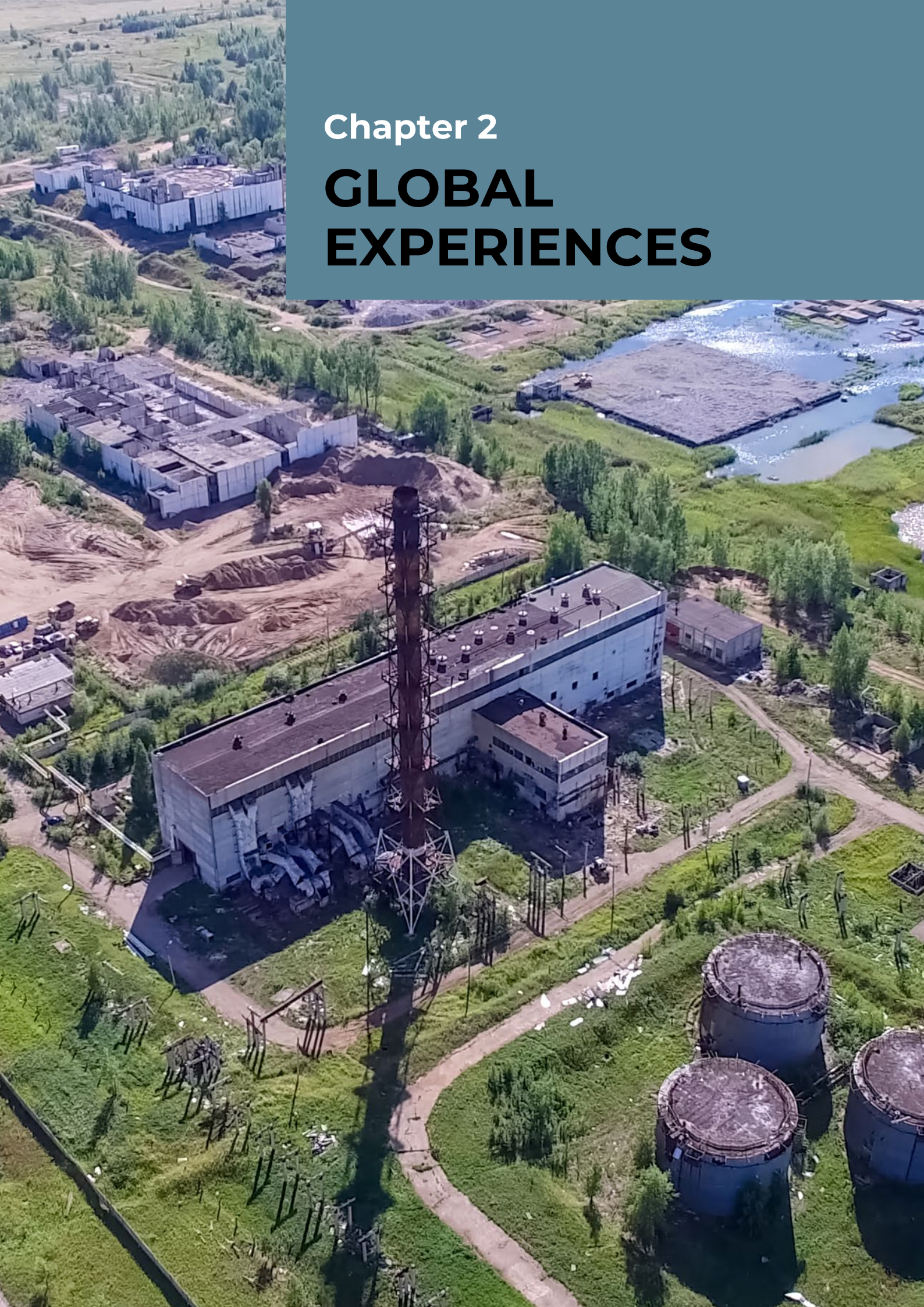
The report has relied on the following approach to assess the procedures and gaps in the legal landscape during the decommissioning of a TPP:

- Literature review to evaluate regulations and practices regarding TPP closure globally
- Review of laws and regulations of India, including:
  - » Review and analysis of salient central government laws and regulations related to environmental permits, management and remediation, labour issues, land and assets, finances, and other relevant matters.
  - » Review of state-specific laws and regulations on these matters (if any) focusing on Jharkhand, Odisha and Chhattisgarh.
  - » Review of associated regulatory processes.
- Case studies to evaluate the challenges of power plant decommissioning under the current mechanism and for achieving a just transition.
- Consultations with various constituencies through interviews:
  - » NTPC Limited and Punjab State Power Corporation Limited
  - » CEA
  - » Central Electricity Regulatory Commission (CERC)
  - » Central Pollution Control Board
  - » Ministry of Environment, Forest & Climate Change
  - » Labour union representatives at the centre and state levels
  - » Labour, corporate and environmental lawyers
  - » Independent consultants, including ex-CERC and ex-CEA officials and academicians

The report's observations and recommendations are intended to enable policy discourse to support a just decommissioning of TPPs.

Chapter 2

GLOBAL EXPERIENCES

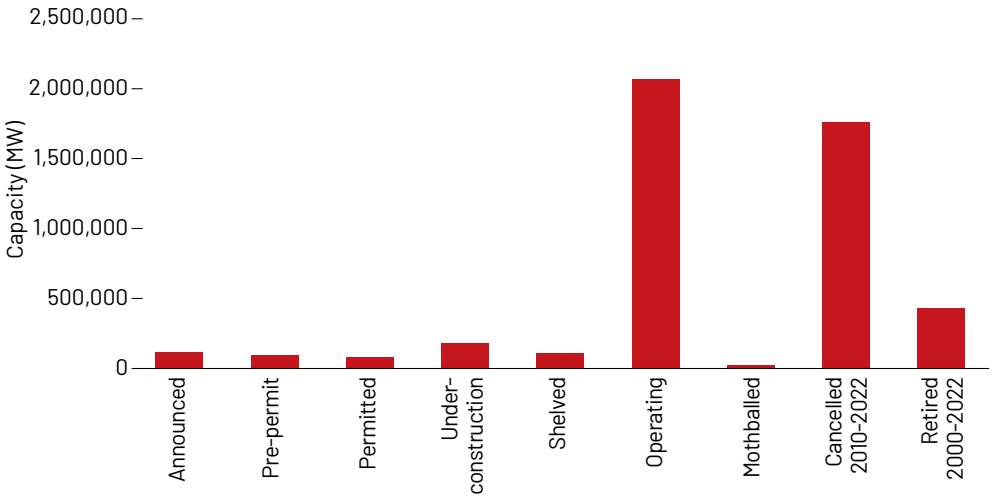


Substantial coal-based power generation capacities have been retired globally in the past two decades. According to the Global Energy Monitor platform, 432.5 GW of coal capacity has been retired since the year 2000, which amounts to one-fifth of the capacity currently operating. Notably, a substantial number of new projects have been cancelled due to overcapacity and air pollution concerns, and the cancelled capacities amount to 85 per cent of the currently operating capacity. The retired capacities have been gradually increasing, from 20.5 GW during 2000-05 to 64.2 GW during 2006-10, 139.2 GW during 2011-15, and 218.1 GW during 2016-20.

Sixty per cent of the retired capacity is located in the United States (US) and China, followed by 7 per cent in the United Kingdom (UK), 6 per cent in Germany, 4 per cent in India and 2 per cent in Canada. While closures in the US, China and India have been driven by techno-economic concerns, European countries have been pushing voluntary retirements of coal power plants as climate mitigation action.

432.5 GW of coal capacity has been retired globally since 2000, 60 per cent of which is accounted by the US and China

Graph 2.1: Status-wise coal-based power capacity in the world

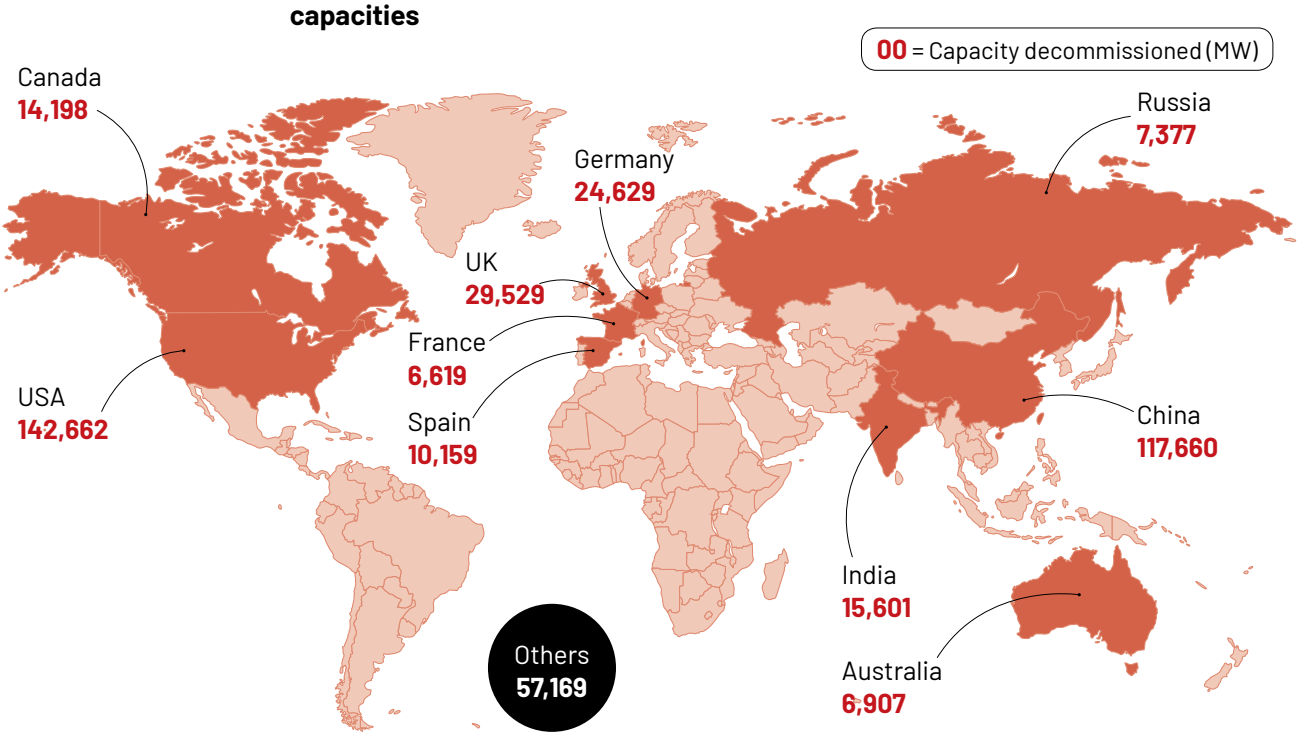


Source: Global Energy Monitor, July 2022

Graph 2.2: Year-wise decommissioned coal-based generation capacity in the world

Source: Global Energy Monitor, July 2022

Map 2.1: Leading countries with decommissioned coal-based generation capacities



Source: Global Energy Monitor, July 2022

Following the retirement from operations, a coal-based thermal power plant (TPP) may be decommissioned or abandoned. As decommissioning is a complex, tedious and expensive activity, retired units are often left standing with little follow-up action due to the absence of strong legal requirements or lack of funds with the plant owners. As a result, abandoned power plant sites have become quite common in the US, which has witnessed maximum coal closure in the past two decades.

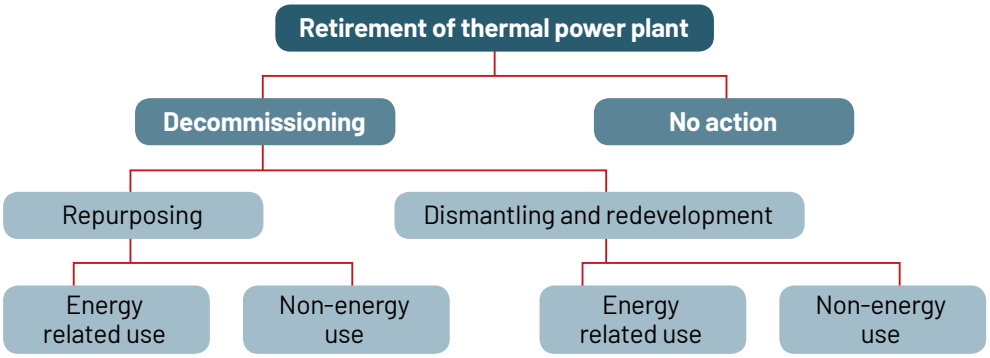
Some decommissioned plants have been repurposed with small retrofits or significant replacements to operate as energy generation assets on alternate fuels such as natural gas or biomass. For example, several coal power plants in European countries are planned to be repurposed with biomass, natural gas or waste pellets. In China and India, most decommissioned small sub-critical units have been replaced by larger super-critical efficient units.

Retired TPPs have either been repurposed for energy or non-energy use or abandoned, depending on the business decision of plant/land owners

In some cases, the civil structures of the power plant have also been utilized for non-energy use without significant dismantling, such as in shopping complexes, offices and data centres. Remediations works remain crucial in this case, as large parts of the site are affected by ash and coal handling.

Finally, there are scenarios where power plants have been fully dismantled and land area remediated for redevelopment, either for energy-related or non-energy use, depending on the business decision taken by the landowner. Due to the pre-existing transmission and other support infrastructure, there is a strong case for utilizing these sites for energy-related end-use such as for solar power generation and battery or other storage technologies.

Figure 2.1: Post closure treatment of thermal power plants



Source: iFOREST Assessment

142,663 MW of coal-based capacity has retired in the US since 2000, and another 111,185 MW is planned for retirement by 2040

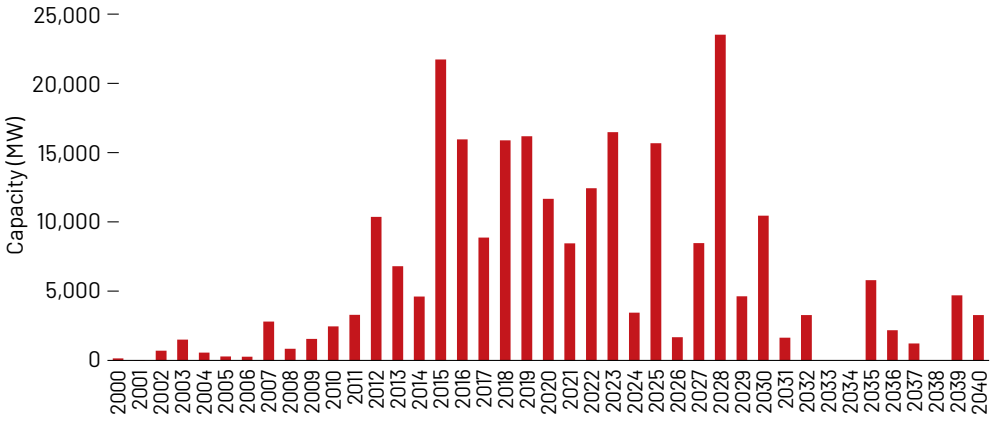
The experience of the countries currently leading in coal TPP closures provides essential lessons in the context of a 'just decommissioning' discussion. Most of these countries, especially the US, were caught unprepared by the coal TPP closure wave. These countries have gradually been developing guidance frameworks at national or sub-national levels for handling environmental and labour-related challenges. The experiences also highlight the importance of identifying clear funding sources for enabling a just decommissioning, as these costs were often not accounted for in generation tariffs.

2.1 United States of America

As of July 2022, 217,894 MW of coal-based capacity is operational in the US, and 142,663 MW has retired since 2000, as per the Global Energy Monitor. While the average annual decommissioned capacity between 2000 and 2010 was 1,016 MW, it increased to 11,537 MW in the last decade. By 2040, another 111,185 MW is planned for retirement in the country, at an annual average of 10,522 MW in the next decade and at 2,208 MW in the following decade.

The massive coal phase-out in the US has been driven by the ageing of the coal fleet, as well as stiff competition from cheap natural gas and renewable energy sources.[7] Strengthening of environmental protection regulations, especially the Mercury and Air Toxics Standards, Clean Water Act, and Coal Combustion Residuals Rules has also been a strong trigger. Power plant owners have opted to close loss-making older plants rather than invest in compliance-related upgrades. Some power plants have also been shut in response to long-term voluntary goals of companies on carbon emissions.

Graph 2.3: Actual and planned retired coal capacity in the US



Source: Global Energy Monitor, July 2022

2,250 MW Navajo Generating Station in Page, Arizona was decommissioned in November 2019 and is currently being demolished

A centralized data set on the follow-up action on retired power plants in the US is not available; however, news reports indicate that a vast number of these plants are still standing with no decommissioning or repurposing done. According to a September 2016 article published in the *Power Magazine*, of the 200 power plant sites comprising 600 units retired between 2000 and 2016, only 35 had been demolished, and 15 were sold for redevelopment. At the remaining 150 sites, the retired units were still standing and awaiting further action.[8]

Lack of experience in decontaminating and dismantling emerged as the initial hurdle in the decommissioning process, as power plant owners had little understanding of the requirement and process. Eventualy, specialized engineering management firms emerged offering decommissioning as a specialized package factoring in financial, environmental and community costs. Some plant owners are getting the plant site decommissioned through specialized vendors and then either redeveloping it or selling it off. Others are selling the power plant 'as-is-it' for the next owner to undertake the decommissioning for future redevelopment or sale.

A key reason for inaction on decommissioning in the US is the lack of mandate for and high costs for decommissioning and remediation. Decommissioning process of a coal-based power plant is not firmly regulated in terms of specific procedures.[9] The US Environmental Protection Agency (EPA) has prepared 'factsheets' to guide and support companies and affected communities in efficient closure of coal-fired power plants. There are three specific factsheets on coal plant decommissioning prepared by EPA:

1. Plant Decommissioning, Remediation and Redevelopment;
2. Financing Clean-up and Redevelopment; and,
3. Stakeholder Identification and Facilitation.

Though not mandatory for TPP owners, these serve as important baseline documents for reference for efficient decommissioning. More recently, more robust guidance on TPP closure is emerging at the state level, primarily focused on addressing labour issues, but a strong national mandate is lacking.

Lack of mandates and high costs of remediation led to wide-spread inaction on TPP decommissioning in the US

2.1.1 Environmental Guidance

The US EPA's factsheet for Plant Decommissioning, Remediation and Redevelopment identifies the general process to be followed for addressing environmental concerns during decommissioning of a power plant.[10] The key prescriptions set forth are:

- Power plant owners are required to act per the power plant's environmental permits, which typically specify actions to take before, during and after closure.
- The site owner is responsible for ensuring that all regulatory requirements are met and is required to coordinate with relevant public utility and environmental regulators to ensure compliance.
- Planning for reuse in advance is recommended, though it is acknowledged to be difficult, as it determines the extent of assessment and clean-up works required.
- The first phase of site clean-up is during the decommissioning phase, which includes the removal of asbestos, process chemicals, polychlorinated biphenyls (PCBs), lead and other hazardous materials; capping of ash disposal area with a protective cover of soil; removal of fuel tanks and contaminated soil etc.
- The second phase of site clean-up is during the remediation phase, which starts with detailed testing of soil and groundwater samples to investigate and document any contamination and then act per relevant state law.
- The guidance also calls for clear identification and documentation of leftover areas with high contamination levels for future land use restrictions.

Remediation works in the US are being guided by largely the state laws and permits, and fall under the jurisdiction of state EPAs

Figure 2.2: US EPA guidance on pre- and post-decommissioning procedures

Step 1	Step 2	Step 3	Step 4
Shut-down	**Decommissioning**	**Remediation**	**Redevelopment**
• Approval of roadmap for decommissioning, remediation and redevelopment from the board of owners • Developing a decommissiong plan and deployment of dismantling personnel • Announcement of ceasing power production	• Termination of permits such as air pollution control, water withdral and water discharge • Removal of hazardous materials and reusable equipment • Dismantling structures • Closure of on-site ash landfils in line with the federal and state permit requiremetns	• Testing and documenting soil and water samples for contamination • Developing a plan for clean-up in line with federal and state laws and the planned site reuse • Approval of clean-up plan by the state environmental agency, follwing public consulation • Land-use restrictions informed before redevelopment to manage leftover contamination	• Developing plan for redevelopment considering the following factors - controlling agency, avaialbility of resources/ ammenities, economic development opportunities, zoning issues, existing land-use restriction, property value, and vehicular traffic

Source: US EPA

Overall, the remediation activities at closed power plants in the US are guided by the relevant laws for air pollution control, water withdrawal for cooling, water discharge, hazardous waste storage, fuel storage tanks and flue gas stack etc., and as per the requirements mentioned in the environmental permits of the operation power plants. The remediation works are thus under the jurisdiction of the state EPAs, the permitting authorities.

In Montana, the legislature has passed a dedicated law for guiding remediation action at closed power plants, expanding the scope of state intervention beyond the scope of the Administrative Order of Consent (AOC) or the environmental permit. The Coal Fired Generating Unit Remediation Act of 2017 (Senate Bill 339) requires power plants to submit the remediation plan to the Montana Department of Environmental Quality (DEQ) for review and approval. The plan must include information about the planned property reuse, findings of investigations and studies, and planned remediation works to meet or exceed applicable legal obligations.

The law provides for a clear timeline of action and engaging the community. As per Section 5 of the Act, the plan submission has to be made within 90 days of actual plant retirement or five years before planned plant retirement. The DEQ must provide public notice of the plan within 120 days of receiving a proposed remediation plan and allow for a 45-day comment period. If the DEQ modifies the plan, the proposed modifications must again be put up for comments. The plant owner is also given a specific timeframe to appeal against DEQ's decision. The approved plan is then enforced through an administrative order first, followed by judicial action if the plan is not implemented. DEQ can set a penalty for each day of violation based on penalty factors listed in the law.

2.1.2 Financing Options

Large sums of money are required at every stage following a coal power plant shut down, including decommissioning, remediation and redevelopment. Under the Resource Conservation and Recovery Act, which provides the framework for managing hazardous and non-hazardous, plant owners are responsible for implementing and paying for corrective actions to address environmental contamination during the plant operations and at the time of decommissioning. Power plant owners often find these costs prohibitively high, though financing options are available.

For the TPP decommissioning, financing options vary from state to state depending on the power market type:

- **In regulated energy markets**, TPP owners can recover the decommissioning costs from ratepayers subject to the approval of the relevant public service commission. The estimated decommissioning cost is added to the base rate, and funds are generated over time. This helps accrue funds in advance and protects the state from a company's liability default.[11]

In regulated energy markets of US, decommissioning costs can be recovered from ratepayers, and most states have defined specific conditions and criteria for cost recovery

Most states with regulated energy markets have taken additional action to minimize the risk of unfair payments being recovered from ratepayers. For instance, Tennessee Valley Authority, a federally owned power utility, had spent over $1 billion in 2008 on clean-up of a large spill from a coal combustion residual (CCR) impoundment, which was recovered through tariffs. The case highlighted the need for regulations to specify costs that can be recouped through rates. Since then, states have been enacting laws defining specific conditions and criteria for cost recovery.

For instance, in 2015, North Carolina limited the ability of utilities to recover costs associated with the clean-up.[12] In the same year, Nevada enacted a similar law, which requires utilities to develop detailed plans that adhere to a 'timely clean-up'; otherwise, the state can withhold the utility's right to recoup decommissioning costs through rates. In 2016, Washington passed a law allowing decommissioning costs to be recovered from Washington ratepayers for power plants that will remain open for another five years.[13] The law provides a procedure through which the power companies can place amounts equal to one or more regulatory liabilities into a dedicated account, to be used solely to cover decommissioning and remediation costs.

Under Florida's law passed in 2016, TPP owners are required to update the cost estimates every four years to ensure that undue costs are not transferred onto ratepayers.[14] Virginia also passed a detailed law in 2019 to provide a clear methodology for managing and closing CCR unit, and provided for its cost recovery through rate adjustment under some specified conditions.[15] Meanwhile, Wyoming passed a specific law in 2019 stating that power utilities cannot include the cost of redevelopment in the rates being charged for a coal power plant planned to be retired, unless approved otherwise by the regulator.[16] In Georgia, the law requires that total cost estimates for proposed projects to include construction and non-construction related costs incurred through commercial operation, including decommissioning/dismantling costs.[17]

- **In open markets**, TPP owners are to incorporate the decommissioning costs into their business costs and set the sale price of power accordingly. Publicly listed companies are required to report these costs as asset retirement obligation (ARO), an obligation associated with the retirement of a tangible long-lived asset, to the US Securities and Exchange Commission. There have been multiple instances of old power plants in deregulated markets abandoned 'as-it-is', as plant owners did not take adequate measures to accumulate funds for closure during the years of operations.[18]

Decommissioning costs are required to be clearly identified as a financial obligation by publicly listed companies in the US

For later stages of remediation and redevelopment of power plant sites, several funding options and incentives have been made available for thermal plant owners in the US in recent years.[19] These include federal, state, local and private funding sources:

- **Federal funding and incentives:** The EPA's Brownfields and Land Revitalization Programme provides funding and technical assistance to state, municipal and tribal organizations to support remediation and redevelopment of brownfields properties, including former power plant sites. Funding assistance is available as grants and revolving loans for the assessment and clean-up of brownfields, research and planning for redevelopment, and environmental job training of communities. The fund is available on a cost-share requirement, where the recipients must provide a 20 per cent matching fund. The programme is not available for private companies.

  In addition, other federal programmes are being rolled out by the Department of Housing and Urban Development, Department of Commerce, Economic Development Administration, Department of Agriculture, Department of the Interior, National Park Service etc., that can be accessed to support brownfield project redevelopment. The Internal Revenue Service's New Markets Tax Credit is also available for economic development projects in low-income communities, including redeveloping coal-fired plants.

- **State and local level funding and incentives:** Similar to the federal level, several funds and incentives have been made available at the state level through departments of economic development, housing, environmental and energy, as well as regional development agencies, brownfield redevelopment authorities etc. to support components of plant site remediation and redevelopment planning and implementation. Municipal level financing options and incentives are available in some cases, mainly as property or income tax incentives or cost-sharing mechanisms.

- **Private funding sources:** Traditional debt and equity mechanisms are the most common funding sources for redevelopment planning and implementation. Corporate sponsorships, grants and contributions, and crowdfunding are emerging as potential sources, given the growing support for the coal phase-out. Bonds present another potential source, which has not yet been tapped. Georgia is discussing a Bill introduced in February 2022 that would allow CCR remediation to be funded by utility tariff bonds.[20] Meanwhile, programme-related investments are also available from philanthropic foundations foundations in the form of loans, loan guarantees or equity investments to fund the redevelopment of power plants.

- **Carbon markets:** Pennsylvania, which has the second highest coal power capacity in the US, plans to utilize carbon markets such as Regional Greenhouse Gas Initiative (RGGI) to fund economic redevelopment. The state has proposed placing a significant portion of RGGI proceeds, estimated to be around $300 million annually, into a new Energy Communities Trust Fund to support such investments.

2.1.3 Just transition for workforce and community

The issues of remediation and redevelopment of closed plant sites are closely linked with the just transition of workers and communities dependent on power plants. In recent years, the Federal Administration has been making some efforts towards this, guided by the government's Interagency Working Group on Coal and Power Plant Communities and Economic Revitalization.[21] The government passed Infrastructure Investment and Jobs Act in 2021 to create jobs for workers to accelerate economic recovery, including those affected by the energy transition. This initially included a $725 million federal-aid package[22], which also covered clean-up of hazardous materials and land restoration. The aid package was later expanded to $1.2 trillion through an amendment.

More recently, a Justice in Power Plant Permitting Act has been introduced in 2022, which proposes setting up of a Just Energy Transition Fund of $10 billion to support income, health insurance, pension fund protection, job training, and job placement for workers affected due to closure of power plants.[23]

Some states in the US have been taking proactive measures towards just transition since before. For example, the Massachusetts legislature set up a Plant Revitalization Task Force in 2012 to address the needs and concerns of communities facing power plant closures. As a result, the task force developed plans for redevelopment and closure.

Pennsylvania in 2014 passed a comprehensive Coal-Fired Electric Generation Facilities Deactivation Act, which called for setting up a Pennsylvania Displaced Coal-fired Electric Generation Facilities Employee Assistance and Environmental Remediation Fund in the state treasury to provide unemployment, counselling, housing and job training assistance for displaced facility employees. The fund also provides grants to municipalities for immediate clean-up of a facility and utilization of leftover waste coal.

Dedicated laws are being framed in the US, at federal and state levels, for supporting workers and communities affected by power plant closures

In 2019, Colorado enacted Act Concerning a Just Transition from Coal-based Electrical Energy Economy to develop policies for supporting affected workers and communities. Under this legislation, a Just Transition Office and Just Transition Advisory Committee were established to undertake comprehensive just transition planning. Colorado's Just Transition Action Plan was finalized in December 2020, which called for supporting laid-off coal workers by connecting them with job and training opportunities. The law calls for power plant owners to submit a workforce transition plan to the Just Transition Office and the affected community within specific timelines.

Illinois, which has the third highest coal capacity in the country, has passed several legislations in 2021 to support just energy transition. These include Energy Transition Act, Energy Community Reinvestment Act, Community, Energy, Climate, and Jobs Planning Act, and Clean Energy Jobs and Justice Fund Act.

2.2 Canada

Unlike the US, where techno-commercial reasons have driven the coal phase-out, Canada is planning to shut down its coal capacity primarily due to climate concerns. The government formulated the Reduction of Carbon Dioxide Emissions from Coal-fired Generation of Electricity Regulations in 2012, which was later amended in 2018 to accelerate the phase-out of coal-based electricity generation by 2030.[24] As a result of this regulation, most coal-based power plants in the country are to retire before end-of-life. As per Canada's Energy Future 2021 report, published by the Canada Energy Regulator, the country is on its way to reducing its dependence on coal-based power generation to less than 1 per cent of the energy mix by 2035, compared to 5 per cent in 2019.[25]

Most coal units in Canada are planned to be converted to natural gas, supported by government funding support raised through carbon taxes

Currently, coal-based power generators are located in only four states in the country – Alberta, Saskatchewan, New Brunswick, and Nova Scotia. The current focus of coal closure in each of these states seems to be on replacing existing units with alternate energy sources.[26] So far, no dedicated laws, regulations, or guidance has been introduced at the central or state level to deal with dismantling and remediation. However, there is a detailed federal-level approach identified for dealing with contaminated sites that would also apply to power plants (*See Box 2.1*).

Alberta, which accounts for 60 per cent of the country's coal-based capacity, plans to convert most coal units into natural gas-based power plants by 2029. To ensure this, the state government has entered into 'Off-Coal Agreements' with owner companies. The agreed compensation to TransAlta, ATCO, and Capital Power for converting six units aggregating about 3,500 MW capacity to natural gas amounts to C$1.36 billion ($0.99 billion) to be paid out between 2017 and 2030.[27] These payments are planned to be financed through a carbon tax on large industrial emitters.

Meanwhile, the focus of government's efforts in the country has been on the just transition of the workforce and communities. Canada launched a Task Force on Just Transition for Canadian Coal Power Workers and Communities in 2018.[28] The government later made a budgetary allocation of C$35 million ($25.72 million) over a five-year period to aid skills development and economic diversification activities, based on the recommendation of the task force.[29]

Alberta has been most proactive in operationalizing just transition through several funds and programmes for the workforce and communities engaged in coal mining and coal-based power production. The state announced a C$40 million ($29.4 million) Coal Workforce Transition Fund in 2017 to assist laid-off workers with income support, relocation assistance and transition advice, retraining and other resources to help find new jobs.[30] This included programmes like Bridge to Re-employment programme, Bridge to Retirement programme, Relocation Assistance programme, Coal and Electricity Transition Tuition Vouchers, Canada-Alberta Job Grant etc. Later in 2018, the state announced a Coal Community Transition Fund of C$5 million ($3.67 million) in March 2018 to support 12 projects in 17 affected communities in the state to plan economic diversification.

BOX 2.1: CANADA'S FEDERAL APPROACH TO DEALING WITH CONTAMINATED SITES

The Canadian Council of Ministers of the Environment (CCME), Environment Canada and Health Canada have developed numerous guidance documents and tools to manage contaminated sites. These include several regulations and guidance tools[31]:

- Environmental Quality Guidelines, CCME, 1999
- Procedures for Conducting Human Health Risk Assessments at Contaminated Sites in Canada, Health Canada, 1998

- A Framework for Ecological Risk Assessment: Technical Appendices, CCME, 1997
- Guidance Document on the Management of Contaminated Sites in Canada, CCME, 1997
- A Risk Management Framework for Contaminated Sites, A Discussion Paper, First Draft, Environment Canada, 1997
- Recommended Canadian Soil Quality Guidelines, CCME, 1997
- A Framework for Ecological Risk Assessment: General Guidance, CCME, 1996
- Protocol for the Derivation of Environmental and Human Health Soil Quality Guidelines, CCME, 1996
- Guidance Manual for Developing Site-Specific Soil Quality Remediation Objectives for Contaminated Sites in Canada, CCME, 1996
- Protocol for the Derivation of Canadian Sediment Quality Guidelines for the Protection of Aquatic Life, CCME, 1995
- Phase-1 Environmental Site Assessment, CSA Z768, Canadian Standards Association, 1994
- Subsurface Assessment Handbook for Contaminated Sites, CCME, 1994
- Guidance Manual on Sampling, Analysis, and Data Management for Contaminated Sites - Volume I: Main Report, CCME, 1993
- Guidance Manual on Sampling, Analysis, and Data Management for Contaminated Sites - Volume II: Analytical Method Summaries, CCME, 1993
- Remediation Technologies Screening Matrix, U.S. EPA, 1993
- National Classification System for Contaminated Sites, CCME, 1992
- National Guidelines for Decommissioning Industrial Sites, CCME, 1991
- Interim Canadian Environmental Quality Criteria for Contaminated Sites, CCME EPC-CS34, 1991

Based on these, a clear and detailed Federal Contaminated Sites Action Plan has been developed to guide site owners in undertaking remediation works.[32] Broadly, the action plan entails five approaches and ten activities.

Figure 2.3: Best management practices for implementing sustainable approaches in Canada

Approach	Activities
Preliminary Project Planning	**Step 1:** Identify suspect site
	Step 2: Historical review
Initial and Detailed Testing Program and Site Assessment	**Step 3:** Initial testing programme
	Step 4: Classify site (optional)
	Step 5: Detailed testing programme
	Step 6: Re-classify site
Remediation/Risk Management Strategy Development	**Step 7:** Develop remediation/ risk management strategy
Remediation/Risk Management Strategy Implementation	**Step 8:** Implement remediation/ risk management strategy
Confirmatory Sampling and Final Reporting / Long-term Monitoring	**Step 9:** Confirmatory sampling and final reporting
	Step 10: Long-term monitoring (if required)

Detailed federal-level approach is identified in Canada for dealing with contaminated sites, including decommissioned power plant sites

2.3 United Kingdom

UK coal phase-out, the highest in Europe so far, is a result of a convergence of market drivers and gradually introduced regulatory interventions for pollution and climate control. The government passed Climate Change Act in 2008, committing to 80 per cent greenhouse gas emission by 2050, and later introduced regulations such as mandatory use of carbon capture and storage for all new coal plants, increase in carbon prices, stricter pollution controls and more robust support for renewable energy. These contributed to the gradually dwindling economics of the ageing coal fleet in the country. Finally, in 2015, the government decided that coal capacities would be fully phased out by 2025.[33]

The government has created an enabling environment for individual plant operators to decide on retirement decisions. While a few retired coal plants in the UK have been converted to biomass, waste pellets and natural gas, the majority have been closed and dismantled for redevelopment.[34]

Redevelopment works at decommissioned plant sites in the UK have been guided by the National Planning Policy Framework (NPPF) and its accompanying Planning Practice Guidance.[35] The recent NPPF 2021 calls for making as much use as possible of suitable brownfield sites[36] after ensuring that adequate measures are taken to ensure site suitability for redevelopment as per the scope of Environmental Assessment of Plans and Programmes Regulations 2004. All brown field sites are required to be assessed by an experienced environmental consultant, including analysis of soil, groundwater and surface water, and remediation of identified risks and liabilities.[37] The phased approach includes desk-based assessment, ground investigation, quantitative risk assessment, remediation options appraisal and remedial design implementation verification. As per the Environmental Protection Act 1990, after remediation, as a minimum, land should not be capable of being determined as contaminated as per Part 2A of the law.[38]

Local authorities have also been provided rights under UK laws to support remediation and redevelopment works. As per the Right to Reclaim Land under Section 215 of the Town & Country Planning Act 1990, communities have the legal authority to improve local area by freeing disused publicly-owned land for new development, where abandoned sites are degrading the environment.[39] Local planning authorities can pass local development orders to grant planning permission for specific types of development.

National Planning Policy Framework in the UK guides redevelopment of decommissioned plant sites in the UK, provides for detailed site remediation

Rugeley power station at Staffordshire, England is being converted into a sustainable village of 2,000 homes powered by solar panels

2.4 Germany

Germany enacted the Act to Reduce and End Coal-Fired Power Generation in July 2020, which set a roadmap for shutting down the country's remaining coal power capacity. The Coal Exit Law calls for the phased closure of coal capacity – to 15 GW of hard coal and 15 GW of lignite power generation capacity by 2022; 8 GW of hard coal and 9 GW of lignite power generation capacity by 2030, and a complete phase-out by 2038.[40]

BOX 2.2: COAL PHASE-OUT LAWS IN EUROPE

Several countries in Europe have set targets to accelerate the coal phase-out. While coal phase-out in countries like Denmark, Hungary, Ireland, Italy, Portugal, and Greece has been announced as strategic decisions or energy policies; countries like Finland, France, Germany and Netherland have enacted dedicated laws to provide strong legal backing to their commitment.[41]

- **Finland**, in 2019, adopted a legislative proposal to ban the use of coal in power generation from May 2029. The law makes €90 million ($87.22 million) available for compensating energy companies, support for wind power, repurposing power plants for biomass and gas etc.
- **France**, in 2019, enacted the Energy and Climate Law which introduced from January 2022 an emission cap of 0.7 kt eqCO_2 per MW annually for power plants emitting more than 0.55 t eqCO_2 per MWh, making coal power plants unprofitable.
- **Germany** enacted the Coal Power Exit Law in 2020 to stipulate coal exit by 2038, with an option to accelerate it to 2035. It also provides mechanisms for making compensations to coal companies to ensure early closures.
- **Netherlands** introduced National Coal Prohibition Law in 2019, which provides for a ceiling of €328,000 ($317,870) per closed MW or an amount equivalent to the assessed revenue loss plus the plant dismantling cost. Furthermore, it calls for a phased shutdown in the following manner:
  - » Inefficient coal plants with an electrical efficiency of less than 44 per cent, not utilizing biomass or producing renewable heat, prohibited from January 2020.
  - » Inefficient coal plants with an electrical efficiency of less than 44 per cent that can utilize biomass or produce renewable heat prohibited from January 2025.
  - » All coal plants prohibited from January 2030.

Dedicated laws are enacted by several European countries to provide legal backing to coal-phaseout commitment, with compensation for coal companies

The German law allowed for compensation payments to be made to power plant owners for early closure of plants to offset the loss of potential profits as well as to dissuade legal action against the shutdown and to prevent the dismissal of workers for operational reasons.[42]

To phase out 16.8 GW of lignite-operated coal plants, the government negotiated an agreement with plant operators and affected states, wherein the operators will receive a payment of €4.35 billion ($4.2 billion) by 2030, and affected workers will receive a maximum of €5 billion ($4.8 billion) by 2048. For hard coal, the government introduced a reverse auction mechanism, wherein plant operators can offer specific prices for capacities to be taken offline within a pre-decided ceiling, which can range from €165,000 ($159,904) per MW to reward early closures (2021) to €89,000 ($86,251) per MW to plants that close later (2024-27).[43] The first auction held in December 2020 for shutting down

4.8 GW of coal capacity was concluded at a weighted average of €66,259 ($64,213) per MW.[44] The second tender round in April 2021 compensated 1.5 GW at an average of €59,000 ($57,178) per MW. Such payments are subject to state-aid investigations approved by the European Commission.

Liability for remediation is strongly defined by German laws, with no provision of relief or funding support for clean-up works

BOX 2.3: DISPUTES OVER COMPENSATIONS FOR CLOSURE – ARBITRATIONS IN THE NETHERLANDS

The Dutch coal prohibition law provides a ceiling of €328,000 ($317,870) per closed MW or an amount equivalent to the assessed revenue loss plus the plant dismantling cost. However, only one coal plant owner Vattenfall asked for compensation aligned to it, while the owners of the remaining four coal plants – RWE AG, Uniper and Onyx sought a higher compensation. The government agreed to pay Vattenfall €52.5 million ($50.87 million) in compensation to close the oldest plant by 2020 and initiated negotiations with Onyx. However, it refused to compensate RWE and Uniper for the remaining three plants. RWE had sought €1.4 billion ($1.35 billion) in compensation to shift its 1,600 MW plant to biomass by 2025, which it considers economically unviable without subsidies.

This resulted in a series of legal proceedings by RWE and Uniper under the Energy Charter Treaty, which grants substantial protection to foreign investors, claiming that the compensation offer does not match the depreciated value of plants.[45] Both RWE and Uniper initiated arbitrations at the International Centre for Settlement of Investment Disputes, while RWE also commenced court proceedings. In response, the Dutch government initiated two anti-arbitration injunctions before German courts stating that the arbitration agreement in the Energy Charter Treaty cannot be given effect due to the incompatibility of the Energy Charter Treaty with European Union (EU) law in intra-EU investment protection matters.

RWE and Uniper argue that the law does not appropriately take into account the interests of power plant owners as the compensation is not adequate, while the government seems to invoke the right to regulate as a reason to acquit itself. Meanwhile, research indicates that these compensations are justified as the concerned power plants are already becoming uncompetitive with rising carbon prices and cheaper renewable energy.

2.4.1 Land remediation and reuse

Closed power plants in Germany, including Europe, have been mainly repurposed for energy and non-energy uses. As per the toolkit developed by the European Commission for repurposing infrastructure related to coal fired power plants, energy-related uses include conversions to natural gas or biomass or redevelopment into a renewable energy or energy storage site. Non-energy uses include conversions to data centres, logistical ports, industrial parks and commercial sites.[46]

Remediation of plant sites has not been reported as a major concern in Germany, as the government's focus has been on minimizing contaminations and pollution during the operations phase itself. As such, there is no legally binding definition of a brownfield site in Germany, and there is no standard approach defined for it.[47] This is also true for the EU. While brownfield remediation is prioritized under the 2030 Sustainable Development Goals and Agenda, there are no EU standards to define contaminated sites, and no single methodology defines site-specific remediation standards.[48]

In Germany, at the national level, Federal Soil Protection Act defines remediation as the elimination/reduction of pollutants, undertaking containment measures, and eliminating

harmful changes in the soil's physical, chemical or biological characteristics. The regulations on the assessment and remediation of contaminated sites are fixed under the German Federal Soil Protection Ordinance of 1998. Federal law and ordinance are complemented by different subordinated statutes and regulations notified by state governments.

A key feature of the legal requirement in Germany is that the liability for remediation is very strongly defined. The Federal Soil Protection Ordinance provides threshold values for undertaking sanitation works for various polluting substances. If remediation of a site is required, liability is not limited to the polluter entity, but it can also be extended to the current and past site owner/possessor even when the polluter is still present/ solvent.[49] There is no provision of liability relief even for small businesses or individual polluters and; there is no funding provided for clean-up or investigation other than for public authorities.

2.4.2 Worker and community support

Germany's pre-existing social securing net provides a strong foundation for implementing a just transition of affected coal power plant workers. The German Code for Social Security provides strong unemployment protection, pension system, health insurance, social care etc.

For instance, laid-off power plant workers under the age of 58 are covered under the national social security code that ensures the continuation of health and retirement benefits during phases of unemployment and ensures payments under the public job retraining programme to support new vocational degrees and entry into new fields.[50] For older workers of over 58 years of age, an adaptation payment fund has been introduced under the Coal Exit Law with a budget of €5 billion ($ 4.84 billion) through 2048 to provide salaries until their pension payments start.

The existing employment and labour laws and regulations in Germany also build a strong foundation for just transition. For instance, German laws provide for 'co-determination' where workers can also participate in the management of private companies. In addition, in the coal sector, for companies with over 1,000 workers, parity representation between workers and shareholders is provided in the supervisory board.

From the perspective of coal communities, the concerns of revenue loss are also addressed by Germany's regional equalization system, wherein states share tax revenues. This improves the capacity of coal-affected regions to finance social services and public infrastructure maintenance.

In addition to these pre-existing structures that support just transition, Germany has also adopted an overarching regional structural policy approach for the economic rebuilding of coal-dependent regions. These include several initiatives to attract new businesses and support existing local enterprises.

Existing labour laws and the social securing net in Germany provides a strong foundation for ensuring just transition of coal workforce

2.5 Conclusion

All aspects of a coal plant's end-of-life, from retirement to decommissioning to remediation and redevelopment, need legal and regulatory guidance to ensure efficient action. The experiences of the global north point to the following:

- **Preparing in advance:** Countries with massive dependence on coal and typically weak financial position of utilities should prepare in advance to manage all aspects of coal power plant closures. While the US in recent years has undertaken a wide range of actions to deal with issues pertaining to coal plant closure, these have not been adequate against the pace and scale at which closures took place.

- **Clean-up and remediation through mandates and not guidance:** Clean-up and remediation of power plant sites need to be addressed by dedicated laws, as reliance on overarching laws for guidance tends to be inadequate in the face of plant abandonment. It is necessary to create a mechanism for retiring power plants to develop and submit retirement plans at least five years in advance and act upon the approved plan after retirement. Establishing a clear liability and a timeline for action is crucially important.
- **Adequate financing for clean-up and remediation:** Financing for power plant closure, especially remediation works, should be made available within the power market mechanism. In regulated power markets, regulators must clearly identify and define costs that consumer rates can recover. This is important for protecting the rights of consumers as well as avoiding the lapse of liability by the utility. It is also important to initiate this early to spread the costs over a more extended period and minimize the impact on consumer tariffs.
- **Just transition action:** Governments need to take a proactive role in ensuring just transition planning and oversight in light of the long-term impact of coal plant closures on communities and workers and the relatively passive approach adopted by power plant owners. In countries with weak social security structures, dedicated laws must be created to support the transition of affected communities.
- **Prioritizing redevelopment:** Central, state, and local guidance and programmes need to incentivize and prioritize the redevelopment of coal power plant sites. This is important for both local area redevelopment as well as for utilization of brownfield lands. This requires creation of planning structures and provisions of investment support.
- **Laws for accelerating climate action:** Creating legal frameworks is vital for ensuring and guiding early closure of power plants to support climate action. This is not just important to strengthen the commitment towards climate action but also to avoid litigations with coal companies and provide a clear assurance of help to affected workers and communities.

Important for countries to prepare in advance for managing all aspects of coal plant closure, in order to avoid sub-optimal actions by power plant owners

Chapter 3

LAWS, REGULATIONS AND GUIDELINES

The retirement of coal power generating units is not a new phenomenon for India. The Global Energy Monitor dataset indicates that India has retired coal capacity of 15,601 MW since 2000, the fifth highest closed capacity in the world, following the US, China, UK and Germany. Moreover, the pace of coal plant closures is expected to increase in the coming decades as the country's coal fleet ages and reaches its end of life.

However, the nature of upcoming coal plant closures is likely to be fundamentally different from the past experience, which focused on replacing old retired units with new, more efficient ones. As the competition from clean energy sources builds and the responsibility toward climate change mitigation increases, the retired coal-based units will not likely be replaced with new coal-based units.

So far, there have only been a few instances where power plants for been retired, dismantled and remediated for reuse, including the Badarpur Thermal Power Station (BTPS) in Delhi and Guru Nanak Dev Thermal Power Plant (GNDTP) in Bathinda. The existing legal and regulatory mechanisms in India dealing with critical environmental, land, labour and finance issues are not adequately equipped to address the issues of a just coal power plant decommissioning – a framework that supports the interests of coal power plant owners, workers, communities, and the environment. This chapter discusses the existing rules, regulations and guidelines related to the environment, land, labour and finance.

Environmental remediation of a decommissioned power plant site in India depends largely on the land owner, which may or may not be the plant owner

3.1 Environmental laws, rules and regulations

In India, no laws mandate the clean-up and remediation works for thermal power plant (TPP) decommissioning or even for industrial decommissioning.

Presently, power plant owners have the right to decide the fate of their retired power plants unless it is leased land, in which case the land owner (mainly the government) decides on the reuse of the power plant site. If a power plant is left abandoned, the owner is only required to maintain the site conditions as per the requirements set under the existing clearance and consent issued under various environmental laws. No rules mandate remediation works to be initiated within a given timeline.

However, if a power plant has to be decommissioned, then multiple existing regulations kick in to address different aspects of decommissioning. To guide decommissioning, the Central Pollution Control Board (CPCB) has published a draft Environmental Guidelines for Decommissioning a Coal/Lignite-Fired Power Plant.[51]

BOX 3.1: DRAFT ENVIRONMENTAL GUIDELINES FOR DECOMMISSIONING COAL/LIGNITE-FIRED POWER PLANTS

The draft guidelines were formulated in July 2021 based on directions of the Southern Bench of the National Green Tribunal (NGT) as part of proceedings in the case of Dharmesh Shah vs Union of India & Others. The individual applicant had sought the framing of proper guidelines concerning decommissioning Neyveli Thermal Power Station-I in Tamil Nadu. The NGT noted that *"there is no general guideline or monitoring system to supervise the decommissioning process of TPPs"* and directed the Ministry of Environment, Forests & Climate Change (MoEF&CC), the Central Electricity Authority (CEA) and CPCB to evolve the same.[52]

It provides a broad framework under which decommissioning and remediation works should be taken up. It calls for early decisions on land use to guide closure

activities and lists all applicable environmental regulations and permissions applicable at the time of power plant decommissioning. The draft also suggests that power plant owners undertake a detailed Environment Impact Assessment (EIA), develop an Environment Management Plan (EMP), and accordingly initiate decommissioning works.

Overall, the draft guidelines have put together all the environmental rules and regulations and added a few more procedures, such as a detailed EIA for decommissioning. However, in its current form, it prescribes a highly complicated process which will delay the decommissioning process.

Key features of the draft guidelines are as follows:

- Future land use of the site should be determined before decontamination planning to align the efforts and investments with the requirement.
- Plant owners should carry out an EIA and prepare an EMP to guide the decommissioning process. The relevant regulatory body should approve the post-closure EMP.
- Compliance with environmental statutes must be maintained throughout demolition and remediation works. These include provisions under:
  - » Water (Prevention and Control of Pollution) Act, 1974
  - » Air (Prevention and Control of Pollution) Act, 1981
  - » Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016
  - » Construction and Demolition Waste Management Rules, 2016
  - » Rules regarding management and utilisation of combustion residue or ash
  - » Regulation of Polychlorinated Biphenyls Order 2016
  - » E-Waste (Management) Rules, 2016
  - » Other local regulations
- Compliance with occupational safety laws must be maintained throughout demolition and remediation works. These include provisions under:

CPCB draft guidelines prescribe a complicated procedure for clean-up of decommissioned plant sites, likely to cause implementation delays

» Building & Other Construction Workers (Regulations of Employment and Conditions of Service) Act, 1996

» Factory Act, 1948

- Existing permits/consents must be modified, revised, or new permits obtained for the demolition and remediation process, as required. These would vary depending on plant location and other factors but broadly entail:

  » Revising Consent to Operate (CTO) under the Water (Prevention and Control of Pollution) Act, 1974, to account for any changes in wastewater or stormwater discharges. For instance, a new stormwater permit would be needed for the coal storage yard remediation.

  » Changing permissions and obtaining new permissions under the Air (Prevention and Control of Pollution) Act, 1981, to account for any expected visible emissions.

  » Updating and resubmitting Risk Management Plans (RMPs) under the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

- Waste management is identified as a crucial component of decommissioning phase, for which the following aspects are highlighted:

  » Waste treatment and disposal should be aligned with the CTO issued under the Water and Air Acts.

  » Disposal of waste oil and oil sludge should be as per HWM Rules 2016.

  » Construction and demolition waste should be disposed of as per the Construction and Demolition Waste (Management) Rules, 2016.

  » Management of ash and closure of ash ponds should be as per Fly Ash Utilization Notification, 1999 and later amendments.

  » Closure of permitted solid waste landfills or surface impoundments should be as per the approved post-closure plans. If plants do not have a post-closure plan, separate permission for closure would be required.

  » Revised or new CTO under solid waste regulations would be required for surface impoundments for a specified number of days.

- A dedicated team should be set up by the power plant owner to undertake the decommissioning activity. Concerned SPCB should monitor the activities through periodic inspections.

Power plant owners require several permits and consents at the dismantling, clean-up and remediation stages

3.1.1 Key laws and rules during dismantling, clean-up and remediation

Under the current environmental laws, if any new activity leads to wastewater discharge or air pollutants emission, then consent/authorisation is required under the respective laws. As power plant dismantling, clean-up and remediation is a new activity; it will require new permits under various statutes. For instance, either the existing CTO needs to be revised, or a new CTO will be necessary under the Water (Prevention and Control of Pollution) Act, 1974 and Air (Prevention and Control of Pollution) Act, 1981 to manage pollution during the demolition and clean-up phase. In addition, other local regulations at the municipal level may also require compliance, such as transportation and disposal permits to take out and dispose of thousands of tonnes of construction and demolition (C&D) waste from the plant site.

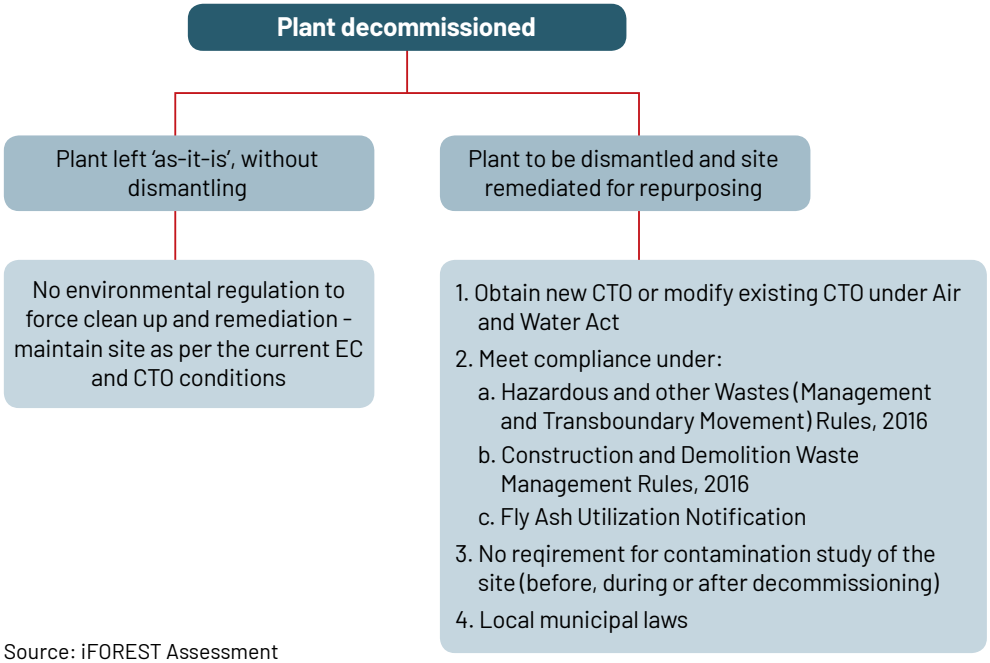
Apart from the Air and Water Act, rules and regulations on managing various types of wastes will also apply during coal plant demolition and remediation. These include:

- Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.
- Construction and Demolition Waste Management Rules, 2016.
- Fly Ash Utilization Notification.

The compliance requirements under these three regulations are discussed below.

However, in none of the existing laws, a contamination study of the site must be conducted at any stage – before, during or after decommissioning. Though the MoEF&CC issued a Guidance for Assessment and Remediation of Contaminated Sites in 2015, it only applies to a site declared as a 'contaminated site'.

Figure 3.1: Existing environmental regulation during dismantling and remediation



Source: iFOREST Assessment

a. Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016

Several hazardous materials are utilised in power plant equipment and operations, including waste oil, oil sludge, asbestos-containing sheets, polychlorinated biphenyls (PCBs), toxic metals and mercury etc. Power plants also typically have surface impoundments for metal-cleaning wastes, boiler blow down or makeup water treatment sludge.

Existing environmental laws do not require contamination study of the decommissioned plant site, at any stage of clean-up or remediation

All such hazardous waste and storage areas are to be treated and disposed of as per the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 (HWM Rules 2016) issued under the Environment (Protection) Act, 1986. These broad-based rules define the responsibilities of 'an occupier' or site owner for hazardous and other waste management, including prevention, minimisation, reuse, recycling, recovery, utilisation/co-processing, and safe disposal. This is to be monitored by State Pollution Control Boards (SPCBs). The disposal liability is vested in the 'operator', who can be made to pay financial penalties in case of violations.

Transporting these hazardous and other wastes are governed by rules under the Motor Vehicles Act, 1988 and relevant guidance issued by CPCB. This also requires a No Objection Certificate from the concerned SPCB.

CPCB's draft guidelines for power plant decommissioning refer to the HWM Rules 2016 for managing and disposing all hazardous waste materials at power plant sites. In addition, the guidelines call for an inventory of hazardous wastes and waste-containing materials to be prepared in advance.

Figure 3.2 Hazardous waste management during power plant closure

Asbestos-Containing Materials	• Survey to identify ACM • Autorisation required under HWM Rules 2016 • Since all ACM is difficult to identify in survey, careful acccounting and review during the delmolition process important
Polychlorinated Biphenyls & toxic metals	• As per Regulation of Polychlorinated Biphenyls Order, 2016, PCBs cannot be drained onto land or the effluent treatment plant • Removal and disposal of PCBs or equipment/wires containing PCBs or toxic metals is to be done as per HWM rules 2016
Mercury containing lights	• To be removed and disposed through an authorised hazardous waste recycling facility under HWM Rules 2016 and under intimation of the concerned SPCB.
E-Waste	• To be disposed/recycled as per the E-Waste (Management) Rules, 2016 • Autorisation for management of e-waste required as per the rules
Chemicals and Materials Removal and Disposal	• Re-useable chemicals and other equipment (like freon, batteries, residual oil, used lubricants, fuel, metal-cleaning chemcals etc.) to be sent/sold for reuse/recycling • Disposal to be with authorisation from SPCB under HWM Rules 2016

Source: Based on Draft Environmental Guidelines for Decommissioning a Coal/Lignite-Fired Power Plant, 2021

Several directions and approvals from local authorities required for construction and demolition waste management

b. Construction and Demolition Waste Management Rules, 2016

Demolition of a power plant generates large amounts of debris as power plant buildings, chimneys, cooling towers, storage tanks, effluent treatment plants, and other civil structures are taken down. The waste generated in the power plant dismantling process is to be managed and disposed of in line with the Construction and Demolition Waste Management Rules, 2016.[53] These rules apply to all waste categories resulting from construction, re-modelling, repair and demolition of civil structures including building materials, debris and rubble.

The rules distinguish between deconstruction and demolition, wherein the former refers to planned selective demolition, which maximises salvage, reuse and recycling. In contrast, demolition refers to the complete breakdown of structures. Both scenarios are applicable post-power plant decommissioning, depending on management decisions.

For plant owners or service providers/contractors involved in power plant dismantling works, the following requirements are listed in the C&D Waste Management Rules, 2016:

- Preparing a comprehensive waste management plan to be submitted with the local authority, seeking appropriate approvals.
- Collecting and segregating concrete, soil, steel, wood, plastics, bricks and mortar; and storage as per the notification of the concerned local authority.
  - » Regular clean-up of the area, with the frequency to be decided in consultation with the concerned local authority.

  - » Tie-up with authorised agencies for removal of the C&D waste.
  - » Disposal or handover of C&D waste at a collection centre/processing facility authorised by local body/SPCB.
  - » Payment of relevant charges for collection, transportation, processing and disposal of C&D waste as per notifications by the local authority.
- Informing concerned authorities regarding relevant activities from the planning stage to the implementation stage.

Local authorities play an important role in C&D waste management as several directions and approvals are tied to them, while SPCB is responsible for overall monitoring.

c. Fly Ash Utilization Notification, 1999 as amended

Decommissioning power plants and land remediation requires managing accumulated fly ash and closure of ash ponds. This is the most challenging and expensive stage of power plant decommissioning, as ash management practices at Indian power plants have been sub-par. This has led to vast amounts of 'legacy ash' accumulated across the operational power plants, estimated to be 1,670 million tonnes at 191 TPPs as of December 2021.[54] This ash is typically stocked in huge ponds, with cases of accidents/spill often reported leading to massive contamination. According to reports, 76 such incidents took place between 2010 and 2020.[55]

Managing accumulated fly ash and closure of ash ponds is the most challenging and expensive stage of power plant decommissioning

Ash ponds are essentially solid waste landfills or surface impoundments that need to be drained, placed with an impermeable cap, and topped with soil and a vegetative cover. As per the existing environmental rules, at the time of power plant closure, the ash pond area has to be closed as per the power plant's CTO under the Solid Waste Management Rules, 2016 and as per the provisions of the latest fly ash utilisation notification. The CTO typically includes the post-closure plans for ash ponds approved by the concerned SPCB. In case the CTO of a power plant does not specify a post-closure plan, separate permission for ash pond closure is required under the Solid Waste Management Rules, 2016. In the case of older power plants, where the challenge is most profound as many old plants do not have proper containments with clay or synthetic liners, close coordination with SPCB is recommended by the draft guidelines for decommissioning.

Legacy ash management

The MoEF&CC is trying to address the issue of old ash ponds through stronger regulations for legacy fly ash management, which would also reduce the effort required at the end of plant life for closing ash ponds.

Fly ash is managed as per the MoEF&CC's Fly Ash Utilization Notification, 1999, as amended from time to time. In the latest version of the notification issued in December 2021, the ministry recognised the burden of legacy ash for the first time. It specified progressive usage of accumulated ash, over and above the utilisation targets, within ten years. In the first year of this new amendment, the utilisation of legacy ash has to be at least 20 per cent of the annual ash generation, which increases to at least 35 per cent for the second year and at least 50 per cent from the third year onwards. This is to be treated as a statutory obligation and 'change in law'. The notification identifies several eco-friendly ways of utilising fly ash.

Failure to comply with this will result in an environmental compensation of ₹1,000 per tonne of unutilised legacy ash during that financial year. If legacy ash utilisation is not completed in a decade, an environmental compensation of ₹1,000 per tonne will be imposed on the remaining unutilised quantity. Legacy ash utilisation is not required in the case of power plants where the ash pond/dyke has stabilised and plantations have been completed.

If the latest amendments on the utilisation of legacy fly ash are implemented in its entirety, then at least 1.2 billion tonnes of legacy ash will have to be utilised in the next ten years. This is equal to 75 per cent of the legacy ash currently accumulating in the fly ash pond.

Implementation of new fly ash notification would significantly reduce clean-up and remediation efforts at the time of power plant closure

Table 3.1: Legacy ash utilisation as per the latest Fly Ash Utilization Notification

Year	Capacity (GW)	Ash generation (million tonnes)	Legacy ash utilisation target (million tonnes)
2023	215	232	46
2024	224	242	85
2025	233	251	126
2026	242	261	131
2027	250	270	135
2028	260	281	140
2029	266	287	144
2030	266	287	144
2031	266	287	144
2032	266	287	144
Total		**2,685**	**1,237**

Note: Assuming 1) Constant PLF of 60 per cent; 2) Ash content of 34 per cent; 3) coal capacity in 2029-30 is 266 GW as per CEA Optimal Mix report 2029-30[56]
Source: iFOREST Assessment

Implementation of the new notification would significantly impact the closure cost of coal power plants, as clean-up and remediation efforts would be substantially reduced. As of now, dealing with fly ash ponds remains challenging for plant owners and crucial to prevent contamination. But it would also require significant additional resources that power plants would not have accounted for in their tariff calculations. Assuming the cost of handling legacy ash is about ₹1,000 per tonne (similar to the environmental

compensation), the additional burden on power plants would be about ₹0.20 per kWh of gross generation. Considering the average transmission and distribution losses, the tariff will have to be increased by about ₹0.25-0.30 per kWh. As this new regulation is a 'change in law', the power plants can recover this cost from the consumers if approved by the Central Electricity Regulatory Commission (CERC) or relevant State Electricity Regulatory Commissions (SERCs).

BOX 3.2: FLY ASH UTILISATION ISSUES AT BADARPUR AND GURU NANAK DEV TPPS

At the 705 MW Badarpur Thermal Power Station (BTPS) of NTPC Limited, which was fully decommissioned from operations in October 2018, massive amounts of fly ash had accumulated during the four decades of its operations. According to news reports, the legacy ash at BTPS amounted to 25 million metric tonnes in 2016.[57] Given that there was a persistent demand to close BTPS to reduce air pollution in Delhi, NTPC started prioritising fly ash utilisation before the plant closure. The plant started disposing of the fly ash at an increasing rate, often more than 100 per cent vis-à-vis the annual generated amount. For example, in 2016, BTPS generated 66,300 tonnes of bottom ash and 265,200 tonnes of fly ash, while the utilisation was 124,026 tonnes of fly ash and 549,469 tonnes of pond ash. This aggregated to 331,500 tonnes of ash generation and 673,495 tonnes of utilisation, or a utilisation rate of about 200 per cent.[58]

According to NTPC officials, a large amount of fly ash utilisation in 2016 was in building the Delhi-Agra highway and ash-brick manufacturing. In addition, BTPS had also started developing a green belt on the ash pond. As of May 2016, NTPC managed to convert about 90 per cent of the fly-ash pond area into a green belt with Ipomoea and other shrubs.

In 2017, an Eco Park was conceptualised at the ash pond area of the power plant. Spread across 885 acres (358 Ha) of land, it is claimed to be India's and perhaps Asia's largest eco-park. It is planned to include a periphery jungle, jungle safari, a zoo, golf course, water bodies, flora and fauna, boating facilities etc. NTPC is developing the project with the permission of the Delhi Development Authority. Works were initiated in 2019 and are scheduled to be completed in 2022.

According to reports, NTPC had submitted an on-site remediation plan before permanent closure for the restoration of the fly ash pond.[59] However, this had received criticism from environmentalists who argue that a proper contamination study should have been conducted before redevelopment works were initiated. This is because leachates from the ash dump site may have contaminated the sub-surface aquifers and groundwater.[60]

Unlike BTPS, the fly ash pond closure at the Guru Nanak Dev Thermal Power Plant (GNDTP) at Bhatinda has been at a slower pace. The 460 MW power plant owned and operated by Punjab State Power Corporation Limited (PSPCL) was retired from operations in September 2017. As per estimates, the plant was previously generating over 1,200 tonnes of ash daily.[61] As of June 2021, there was approximately 22 million tonnes of fly ash waste spread over 853 acres (345 Ha) of land within the plant premises. According to PSPCL, 56 private agencies from the cement manufacturing or brick kiln sector have been authorised to lift ash without any charges. As a result, about 30,000 tonnes of fly ash is being taken monthly from the dykes. Of this, nearly 90 per cent is being lifted by a leading private cement manufacturer.[62] However, at this rate, it will take about 60 years to remove all the ash.

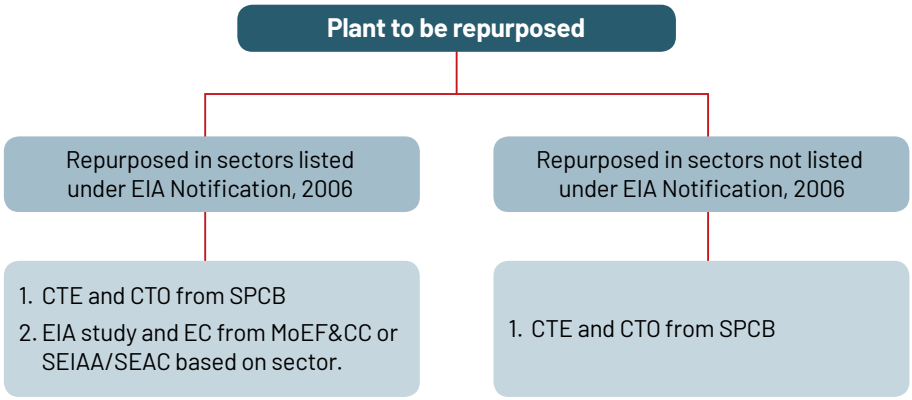
Contamination studies were not undertaken at BTPS before permanent closure for the restoration of the fly ash pond

3.1.2 Key laws and rules during repurposing

The compliance requirements during repurposing depend on the specific end-use planned for a retired power plant. Generally, if the power plant is being repurposed for alternate use, new environmental clearance (EC), Consent to Establish (CTE) and CTO need to be obtained, depending on the nature of the new activity. If the repurposed sector falls within the EIA Notification, 2006, new EC, CTE and CTOs are required. If the reuse sector is not within the purview of the notification, then EC is not required, but CTE and CTO will be needed unless exempted by the SPCB.

Compliance requirements during repurposing depend on the specific end-use planned for a retired power plant

Figure 3.3: Environmental laws and rules for repurposing thermal power plants



Source: iFOREST Analysis

Overall, the current environmental statutes are not designed to handle an efficient dismantling, clean-up, remediation and repurposing of a TPP. There are gaps in the existing rules, such as the lack of a law that mandates time-bound decommissioning. But some procedures need to be relooked at, such as taking a new CTE or a new EIA study for repurposing. There is an opportunity to give a solid legal basis for decommissioning power plants by modifying existing laws and enacting a new law to guide decommissioning.

3.2 Health and safety-related laws

In addition to environmental laws, health and safety regulations are crucial for industrial dismantling and demolition. The health and safety aspect during decommissioning is covered under laws like the Factories Act, 1948 and The Building and other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996.

The Factories Act, 1948 aims to secure the provision of adequate welfare measures for the workers, including health, safety, proper working hours, overtime wages etc. The Act applies to all factories using power and employing ten or more workers and not using power but employing 20 or more workers on any day of the preceding 12 months. Many states have specific rules attached to the Factories Act that deal with dismantling activities. For instance, in Punjab, the Punjab Factory Rules, 1952, dismantling activities are categorised as risk-prone. Therefore, the Act provides that labour in the site vicinity must be provided with effective screens or suitable goggles, PPEs, gas-cutters etc. To ensure labour safety, such rules must be elaborated and replicated in other states.

The Building and other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 regulates construction workers' employment and conditions of service. The Act provides for their safety, health and welfare measures. It includes 'demolition works' and 'generation of power, cooling towers etc.' and provides for several broad outlines, including:

- Setting up a welfare fund to assist workers in case of an accident, provide pension support, sanction housing loans, pay for group insurance, provide financial assistance for the education of children or major ailment, make payment of maternity benefits etc.
- Providing clean drinking water, creche facility, accommodation, bathroom facilities, first-aid and canteen.
- Appointing a safety committee and safety officers where more than 500 people are employed.

It calls for extensive rules to be drawn by the relevant government relating to safety, including using explosives, scaffolding practices, safeguarding of machinery, fire precautions, provision of medical facilities for building workers etc.

In 2020, the central government introduced the consolidated Code on Occupational Safety, Health and Working Conditions, 2020, which replaced 13 central laws regulating the health, safety and working conditions of workers, including the Factories Act, 1948 and the Building and other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996.[63] Among other things, the Code apply to "building or other construction work" which includes demolition works and includes several economic sectors including power generation. Relevant provisions of the Code in the context of power plant demolition are as follows:

- All establishments covered by the Code must register with relevant offices.
- Such establishments' employers must ensure that the workplace is free from hazards and compliant with all occupational safety and health standards. The employers are required to provide and maintain a safe and risk-free working environment; ensure proper disposal of hazardous and toxic waste; provide all relevant information, training and supervision to workers; and provide adequate welfare facilities as per prescribed standards, including ambulance and medical facilities.
- In the case of construction works (including demolition), employers are to consider all safety and health aspects of workers at the planning stage.
- Factories dealing in hazardous processes must disclose all information about the health hazards and the measures to overcome such hazards for safe handling of such materials to the workers and relevant authorities.
- The employer is to appoint qualified safety officers in case of factories employing 500 workers or more; factories carrying on the hazardous process and employing 250 workers or more; construction works engaging 250 workers or more; or mines employing 100 workers or more.
- Some establishments may also be required to set up safety committees comprising representatives of employers and workers.
- Inspection of establishments covered under the Code may be conducted from time to time by inspector-cum-facilitators appointed by the government.
- Under the Code, an offence that leads to the death of an employee is punishable with imprisonment of up to two years or a fine up to ₹500,0000, or both. In addition, the employer can be penalised for any other violation with a fine between ₹200,000 and ₹300,000.

Employers are responsible for ensuring workplace is free from hazards and compliant with all occupational safety and health standards

Overall, the Code contains general provisions which apply to all establishments. Special provisions on the health and safety of workers engaged in demolition and dismantling activities of hazard-prone establishments are not explicitly provided.

Central and state governments must set up Occupational Safety and Health Advisory Boards at the national and state levels to advise on standards, rules, and regulations to be framed under the Code. The Codes are part of extensive labour reforms introduced in India by the central government, which are planned to be implemented in a staggered manner in the coming months.

3.3 Land-related laws

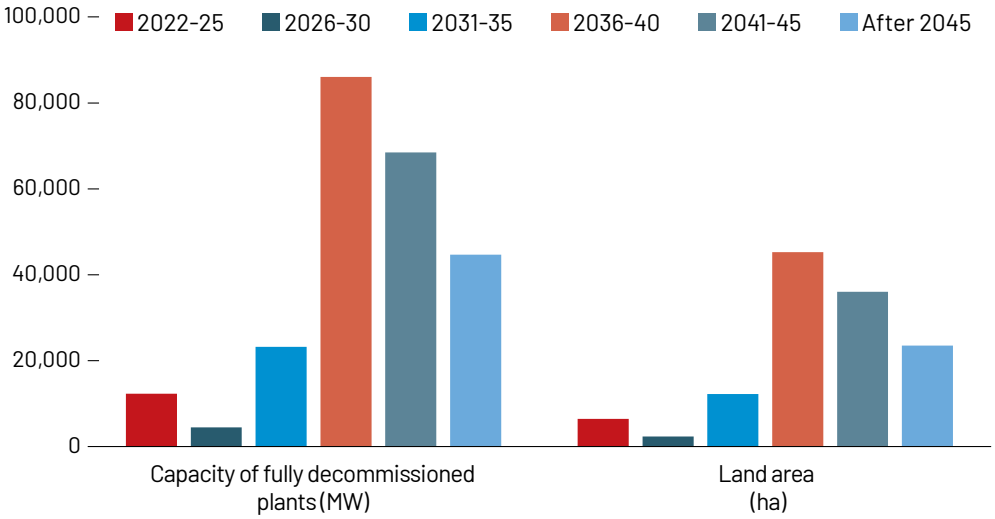
The land is a crucial consideration in TPP decommissioning, with implications on redevelopment decisions and remediation. While there is no centralised data set available, India's operational and upcoming power plants are estimated to occupy an aggregate land area of 125,891 hectares (ha). This is almost equivalent to the size of the National Capital Territory of Delhi. This massive land area, which is to become available gradually over the coming decades, presents both a huge opportunity and an enormous challenge for remediation and redevelopment.

Under the 25-year scenario, where power generation units are retired at the end of 25 years of operation, complete power plants aggregating 16.8 GW capacity will be decommissioned by 2030, making an area of 8,850 ha available. In the following five years, another 12,230 ha of land will become available. This will increase substantially to 45,273 ha becoming available in 2036-40, 36,039 ha in 2041-45 and 23,498 ha after 2045.

Given the existing and upcoming coal-based capacity, the power plant land area is estimated to be equally split between central, state and private sector power generation companies (GENCOs), at 33 per cent share each.

125,891 ha aggregate land area will become available for remediation and redevelopment as power plants are closed in next 50 years

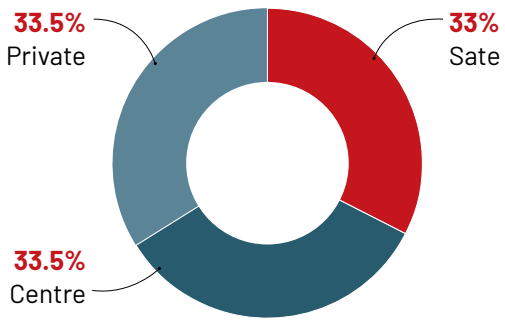
Graph 3.1: Estimated land area to become available with power plant closures



Notes: Capacity of fully decommissioned TPPs is considered as plant area becomes available for redevelopment after the last unit retires at 25 years of age; Land intensity is taken to be 1.3 acres per MW (0.53 Ha per MW), based on actual land area data of 30 power plants of NTPC Limited

Source: iFOREST Estimates

Graph 3.2: Share of the land area held by central, state and private sector GENCOs



Source: iFOREST Estimates

3.3.1 Land ownership pattern

For TPP installation, land is typically acquired from the various land categories under the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act (LARR), 2013 or the Land Acquisition Act, 1984 in case the acquisition was made before 2013. This is because power generation is an economic activity with a "public purpose". Land patches acquired under the Act have then been transferred to GENCOs through either a lease deed or a sale deed.

Therefore, the land with power plants is either freehold land wholly owned by the GENCOs or leased from the central or state governments. A portion of land with TPPs is also forest land.

According to financial declarations of GENCOs, the thermal power sector land, across the centre, state or private sector categories, appears to be a mix of freehold and leasehold land.

- NTPC, the biggest thermal power company in the country, reports to own freehold land worth ₹65.12 billion and has leased land worth ₹29.35 billion. Assuming that the land values are similar for freehold and leasehold, NTPC has full ownership rights over about 70 per cent of its land assets; for the rest, it has the right to use.
- In the case of the state public sector undertakings (PSUs) like Mahagenco, 95 per cent of land is reported to be freehold in annual reports.
- Similarly, in the private sector, 60 per cent to 100 per cent of the land assets owned by major GENCOs are reported to be freehold land. This includes private GENCOs like Reliance Power, Tata Power, Adani Power, Torrent Power, JSW Energy etc. While these companies typically also have generation assets other than coal-based TPPs or some have distribution sector assets, TPP land dominates land ownership.

Table 3.2: Value of land assets of major power GENCOs in India

Sector	Company	Freehold land (₹ billion)	Leasehold land (₹ billion)
Central	NTPC Limited	65.11	29.34
State	Mahagenco	16.56	0.79
	UPRVUNL	1.24	0.26
	RRVUNL	1.42	0.13
Private	Reliance Power	40.01	15.45
	Tata Power	12.53	8.29
	Adani Power	10.17	7.53
	NLC Limited	7.58	-
	Torrent Power	5.14	1.52
	JSW Energy	4.68	0
	JP Power	1.14	0.10

Source: Annual reports of respective companies

Note: Data for NTPC excludes ₹36.66 billion worth of leased coal mining land and ₹7.51 billion of land under submergence; Data for Mahagenco as of March 2021.

GENCOs hold to be a mix of freehold and leasehold land, leading to a peculiar complexity to land redevelopment

3.3.2 Implications of landownership on decommissioning

Post-closure land remediation and utilisation of TPP sites are linked intimately to land ownership. In the case of plants built on freehold land, the shareholders of respective GENCOs have absolute rights to decide the future of the land. In the case of PSUs, this is likely to be controlled by central or state governments. Finally, in the case of leased land, it is to be reverted to the appropriate government or department per the lease terms. Each of these scenarios has district implications on just decommissioning coal power plants.

Figure 3.4: Implications of land ownership on thermal plant decommissioning

Freehold land	Leased non-forest land	Leased forest land
• Land remains with the GENCO • Shareholders decide on remediation and repusrposing	• Land reverted to landowner (mostly state government) after lease period • Dismantling/remediation to be done by GENCOs as per lease contract	• Land use classification remains forest • Ownership of land remains with state government/Forest Department • Land can only be used for the purpose it has been diverted
• For PSUs, decision by state/central government; currently no formal mechanism to take decisions • No law to mandate decommissioning • Site can remain 'As-it-is' if decommissioning financially unviable	• Redevelopment subject to government decision, typically a long drawn process • Remediation being linked to redevelopment decision may also be delayed	• Land returned to Forest Department after lease period • No specific conditions related to dismantling/ remediation mentioned in approval letter • Land can be re-leased after fresh forest clearance by central government

Source: iFOREST Analysis

Decision on site utilisation is entirely up to the company management and shareholders, leading to the risk of site abandonment

a. Freehold land acquired under the Land Acquisition Act or privately

Many TPPs are operational on land parcels owned by respective GENCOs. In case of the closure of such power plants, GENCO remains in complete control of the land, and the decision on site utilisation is entirely up to the company management and shareholders.

As laws and regulations in India do not firmly establish the clean-up and remediation requirements, there is a risk of plant sites being left abandoned. This is especially true if GENCOs are financially stressed and do not have adequate resources to remediate or repurpose/redevelop. This is prevalent in the US, where power companies left retired power plants as-it-is, even though the land is a valuable resource since funds for dismantling and remediation of sites were unavailable and the regulations did not mandate decommissioning.

In the case of PSUs, especially state sector GENCOs, land utilisation decisions are likely to be delayed due to the long-drawn bureaucratic procedures. This would further impact efficient planning and execution of reclamation works as these are linked to planned land reuse.

b. Non-forest land leased from the government

In the case of a power plant constructed on leased land, the land will be reverted to the landowner in a condition defined in the lease contract. However, fixing explicit liabilities for site remediation and repurposing is very important in these cases, as the GENCO owns the plant, but the government owns the land. Therefore, dismantling and remediation are the power plant owner's responsibility, but the decision on repurposing has to be taken by the landowner (government). As the level and cost of remediation depend on repurposing, a clear legal contract is required between the GENCO and the government for decommissioning and repurposing.

If such contracts don't exist, the chances of the GENCO abandoning the site and leaving it to the government to remediate it are very high. Also, if GENCO is a private company, it can declare bankruptcy and abandon the site. In all such cases, the taxpayers will have to foot the bill for dismantling and remediation.

The critical factor in case of the leased land is the preparedness of the government department to take a decision. Typically, when land is returned or is being returned to the state or the central government, it is assigned to a particular department/ministry. The department then decides on the reuse, which is subject to Cabinet approval.

There is a risk of delayed decisions on the reuse plan being made by government departments as land owners, which can delay decontamination works. At present, no committee at the central or state level is entrusted with taking quick, effective and well-thought-out decisions in case of plant decommissioning.

c. Forest land leased from the forest department

Forest land is often diverted for TPP development. An especially significant area of pit-head TPPs is often constructed on diverted forest land. According to the MoEF&CC database, about 11,435 ha of forestland has been diverted for TPPs since the enactment of the Forest (Conservation) Act, 1980.[64] All such land will be reverted to the forest department after decommissioning of the plant.

According to the 'Handbook of Guidelines for Effective and Transplant Implementation of the Provisions of Forest (Conservation) Act, 1980', any forest land diverted for non-forest use requires prior approval of the central government and can be used only for the purpose for which it has been diverted. In the case of TPP, the following are the key conditions for diversion:

- The forest land shall not be used for any purpose other than that specified in the project proposal.
- The forest land proposed to be diverted shall under no circumstances be transferred to any other agencies, department or person without prior approval of the government of India.
- The period of diversion (lease period) shall be co-terminus with the period of lease to be granted in favour of the user agency or the project life, whichever is less. The period of diversion is generally 30 years, after which the land has to be given back to the forest department.[65]

In case of leased land, clear legal contract needed between GENCOs and land owners (government) for decommissioning and repurposing

There are no specific conditions related to dismantling and remediation mentioned in the approval letter.

Repurposing of the power plant site is possible, but new permission has to be taken for the same from the central government. In cases where the change in land use becomes necessary by the same 'user agency', i.e., the original lessee, the state government can request the central government for prior approval, providing details of primary approval

granted and the new intended propose.[66] However, if the re-diversion becomes necessary for another purpose by another user agency, a fresh proposal for prior approval needs to be submitted to the central government. While permitting re-diversion, the central government may modify original conditions or impose additional requirements.

Only two TPPs in India, Badarpur and Bhatinda, have been fully decommissioned for redevelopment in India in recent years

BOX 3.3: LAND ISSUES IN CASE OF DECOMMISSIONING BADARPUR AND GURU NANAK DEV TPPS

There have been two cases of TPPs fully decommissioned for redevelopment in India in recent years, with one being a central PSU plant constructed on leased land and the other being a state sector plant built on PSU-owned freehold land.

In the case of Badarpur Thermal Power Station (BTPS), the land had been leased to NTPC Limited by the central government for fifty years at an annual lease rent of ₹52 million.[67] This was a purpose-linked lease wherein the central government had reserved the right to review the lease of the land if the power generation activity was stopped or if the land was used or proposed to be used for an activity other than power generation.

The central government decided to redevelop the ash pond area into an Eco Park and return the remaining land to the Ministry of Housing and Urban Affairs. As per NTPC officials, the company was required to return the land fully levelled, remediated and 're-grassed'.

Meanwhile, in the case of the Guru Nanak Dev Thermal Power Plant (GNDTP) in Bathinda, the land belonged to the power plant owner, Punjab State Power Corporation Limited (PSPCL), a state government-owned company. An initial proposal was to convert two of the retired coal-fired units into biomass-based units. The company board had cleared the proposal regarding converting one of the units to a paddy straw-fired plant. However, it wasn't cleared by the state government since it required extensive infrastructural arrangements for collection and supply of paddy year-long along with adherence to pollution laws.[68] Later, a proposal to convert the existing plant to a solar-based plant was also mooted.[69]

In the end, the PSPCL board passed a resolution, as per the state government's instructions, to hand over the 1,320 acres (534 Ha) of plant land (except the area of the residential colony spread over 280 acres (117 Ha)) to Punjab Urban Development Authority (PUDA). The transferred land is to be redeveloped as a pharma industrial park and sold under a 80:20 profit sharing scheme. Under this, 80 per cent of profit from the sale of the developed land exceeding the notional value of the land would go to the land owner PSPCL, and PUDA would retain 20 per cent for developing and branding the area. For this purpose, the Government of Punjab has allowed PUDA to raise a loan of up to ₹1 billion for the development and sale of the site with a state guarantee.[70]

Overall, issues related to the closure and repurposing of land have not been adequately addressed in the current policy and regulatory framework. As a result, land-related matters can become complicated and should be prioritised through a new policy and amendments to the existing laws and regulations.

3.4 Labour laws

India's thermal power sector employs a large number of formal and informal workers, who are likely to be rendered unemployed due to the closure of power plants. While there is no consolidated data on the number of employees in the thermal power sector, the Central Electricity Authority (CEA) uses a thumb rule to estimate the workforce. For the upcoming plants, CEA uses a thumb rule of 0.486 workers per MW for technical staff and 0.144 workers per MW for non-technical staff, considering both contractual and non-contractual formal workers. For existing power plants, CEA considers the formal workforce to be 1.24 workers per MW.[71] However, the employee assessment of operational power plants by iFOREST shows that the employment in older power plants is significantly higher than CEA's thumb rule.

In 2021-22, iFOREST undertook a detailed study of two of India's biggest coal districts – Korba, Chhattisgarh and Angul, Odisha – to assess jobs and livelihood dependence on coal mines and TPPs. In Korba, which has 11 operational TPPs with 26 units and a total installed capacity of 6,428 MW, the formal workers per MW were found to be about 2.0, while the informal workers were 2.3 per MW. This amounted to 4.3 workers per MW being employed in Korba.[72] In Angul district, which has Odisha's highest power capacity, the formal workers per MW were again found to be 2.0, while the informal workers were about 2.6 per MW.[73] Overall, from Korba and Angul, the average number of formal and informal workers per MW is ascertained to be 2.0 and 2.5 respectively.

Table 3.3: Formal and informal workers in power plants in Korba and Angul

District		Korba	Angul	Total
Capacity (MW)		6,428	6,210	12,638
Formal Employment	Departmental	9,106	3,236	12,342
	Contractual	3,587	9,072	12,659
	Total	12,693	12,308	25,001
	Employment factor (persons/ MW)	2.0	2.0	2.0
Informal Employment	Total	14,901	16,310	31,211
	Employment factor (persons/ MW)	2.3	2.6	2.5
Total Employment		**27,594**	**28,618**	**56,212**

Source: iFOREST Research

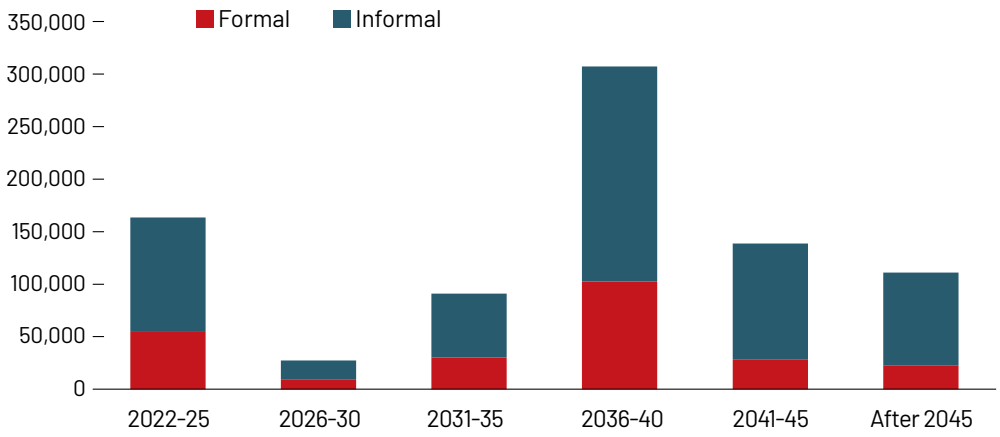
850,000 to 970,000 formal and informal workers are estimated to be employed in the India's thermal power sector

From Korba and Angul studies, it is clear that the CEA thumb rules are not accounting the number of informal workers engaged by power plants. In addition, the number of formal employees, especially contractual employees, is also underestimated.

Using CEA thumb rules for older and newer power plants, the coal-based power sector is estimated to employ nearly 250,000 formal workers in existing and upcoming power plants. However, using employment factors for formal employees derived from Korba and Angul districts, the total number of formal employees working in TPPs could be about 370,000. In addition, the sector employs an estimated 600,000 informal workers, assuming an average of 2.5 informal workers per MW, as indicated by the Talcher and Korba power plants. In totality, anywhere between 850,000 to 970,000 workers are employed in the thermal power sector.

In a 25-year scenario, where power plant capacity is gradually closed as units reach the age of 25 years, an estimated 192,028 formal and informal workers would lose employment as 51.4 GW is closed by 2030. Loss of employment would be highest in the next decade of the 2030s, as 3,98,215 formal and informal workers would lose employment due to the closure of 107.3 GW coal-based capacity. Beyond 2040, another 247,892 workers are likely to become unemployed due to the closure of 80.5 GW capacity.

Graph 3.3: Estimated number of workers to be laid off due to power plant closures



Notes: The estimates consider units to be retired at 25 years of age; For formal workers, the employment factor used by CEA in the National Electricity Plan 2017-22 has been considered; for the informal workforce the employment factor from Angul and Korba power plants has been considered.

Source: iFOREST Estimates

No liability/ responsibility on the industry owner or contractor to provide alternate means of employment or reskill contract labour

3.4.1. Just transition of the workforce

The challenge of a just transition is primarily a factor of the terms of employment, and it depends on whether the worker is informal and formal, contractual or permanent.

a. Informal workers

The key challenge of 'a just labour transition' facing India with respect to coal power plant decommissioning is to manage and support the informal workforce, as two-thirds of the affected workforce is informal. These employees will be rendered unemployed, with little re-employment prospects and minimal social security cover. The existing laws that deal with working conditions and other benefits for contract labourers do not provide for any liability/responsibility on the industry owner or contractor to provide alternate means of employment or reskill them.

b. Formal departmental workers

Formal departmental employees of PSUs are likely to face lesser challenges as they can be either retired with a pension and social security benefits or transferred to another power plant or other establishments. Moreover, they can also be easily reskilled and employed in some other sector as they are qualified.

The study of Angul and Korba shows that the departmental workers of PSUs like NTPC are in the older age bracket. For example, about 73 per cent of the departmental employees at NTPC's Korba plant and 70 per cent of the departmental employees at NTPC's Talcher Kaniha STPS are above the age of 40 years. There is also a declining trend of hiring departmental employees by companies over recent years, indicating that the average age of departmental employees will further increase. Considering this scenario, the retirement of a large majority of departmental employees can be synchronised with the closure of power plants in the next 10-20 years.

Those who will not retire will likely be transferred to other operational plants, either coal-based plants, other generation plants, or other industrial assets. Due to the continuous government push for increasing the share of renewables in the energy mix, many thermal power generation PSUs, especially in the central sector, have already been diversifying their businesses into solar, storage etc.

c. Formal contractual workers

Contractual/fixed-term formal workers are also likely to face serious unemployment challenges, as the liability and responsibility of the companies towards their job and social security are much smaller. The share of such workers now stands substantial, enabled by the 2018 amendment of the Industrial Employment (Standing Orders) Act, 1946.[74] However, the number may vary from plant to plant. For instance, there are 3,236 departmental employees and 9,072 fixed-term employees at the Angul power plants, while there are 9,106 departmental workers and 3,587 formal contractual workers at Korba power plants.

Under the Industrial Employment Act, establishments can hire employees/workers for a specific time which may or may not be renewed at the end of the contract period. While these rules provide a lot of flexibility to the employer, fixed-term employees typically receive lower statutory benefits. However, the Code on Social Security, 2020 has strengthened some benefits like gratuity, which has been made available even to fixed-term employees who serve for one year.

BOX 3.4: POST-CLOSURE LABOUR MANAGEMENT AT THERMAL PLANTS

I. Badarpur Thermal Power Station

At the Badarpur Thermal Power Station (BTPS), the executive and non-executive departmental employees were transferred to alternate locations at the time of plant closure. Since NTPC Limited was the significant stakeholder in BTPS, employees were given the option to choose three preferred destinations for relocation from a list of 24 project locations. According to company sources, while some employees were transferred due to promotions in line with the company's administrative policy, some were transferred in line with the requested locations.

Meanwhile, despite protests, around 450 contract workers engaged at BTPS were laid off and had to find work elsewhere.[75] Compensations aligned with the Industrial Disputes

Photo courtesy: thewire.in

Liability/ responsibility of the companies towards job and social security of contractual/ fixed-term formal workers is much smaller

Act, 1947 were provided. In the case of BTPS, such employees were already aware of the gradual closure of the plant. They could find work in the national capital region, which has a strong availability of diverse economic opportunities. NTPC had no legal obligations or responsibility toward resettling them or finding alternate employment.

II. Guru Nanak Dev Thermal Plant

Photo courtesy: punjabikhurki.com

Similar to the BTPS experience, the departmental employees of the Guru Nanak Dev Thermal Plant were transferred to alternate power plants and offices of PSPCL post-closure. This had to be aligned with the company's transfer policy. In one instance, an employee scheduled to retire within a year approached the High Court of Punjab and Haryana against his transfer, as the PSPCL transfer policy stated that any employee due to retire within one year may be allowed to continue at the same station. The plea was upheld by the court, deeming the transfer legally invalid under the PSPCL rule.[76]

Meanwhile, the Guru Nanak Dev TPP closure decision was met with agitations by various interest groups like unions of farmers, labourers, employees, and students, as the company was not liable to provide much transition support.

III. Talcher Thermal Power Plant

The 460 MW Talcher TPP operated by the NTPC was closed in 2021 after being in operation since 1967 (with the last unit set up in 1984). At its retirement, the TPP employed 1,400 contractual and about 570 departmental workers. After the closure, some departmental employees were shifted to the Talcher Kaniha TPP operated by NTPC in Angul. However, the transfer of others is on hold until the new TPP — Talcher Phase III ultra-supercritical plant — comes up, which NTPC is now constructing on the same premises.

However, the contracts of 875 contractual workers were terminated with the plant's closure. The remaining contractual workers were retained to maintain the premises. Interactions with the retrenched workers suggest that most of them are the sole earning members in their families, who are now struggling to find work.

Considering the terms of the contract, the company has no obligation to provide alternative employment in the event of a closure. However, due to the stability of income and long-term dependence on the TPP, the workers are demanding alternate jobs and compensation, considering it to be a 'moral obligation' of the company. The labour unions – workers' union and NTPC men's Congress – who usually confine themselves to the causes of the departmental employees filed a petition in the Odisha High Court against the loss of employment. The case is sub-judice.

In absence of adequate transition support, power plant closures have been met with agitations by various interest groups

3.4.2 Current labour laws

There are no dedicated guidelines under the labour Codes or ensuing central or state policies and regulations for planning a "just labour transition" required when the coal-power plant is decommissioned. Therefore, at the moment, they are being decided on a case-to-case basis.

The terms of employment between any employee and an employer are covered by their signed engagement contract and the employer's service rules and regulations. These contracts and rules are, in turn, governed by the relevant central and state labour laws and statutory rules. In the context of decommissioning of TPPs, the essential laws that come into play are the Industrial Disputes Act, 1947 (ID Act), the Contract Labour (Regulation and Abolition Act) of 1970 and various laws pertaining to social security. At present, there are over 100 state and 40 central labour laws in India that govern various aspects of wages, working conditions, social security and industrial dispute resolution.

However, in 2020, the Government introduced Labour Codes to simplify this existing system to ensure uniformity and facilitate compliance. These Codes regulate wages, industrial relations, social security, and occupational safety. In the context of decommissioning of TPPs, there of three codes that will come into play:

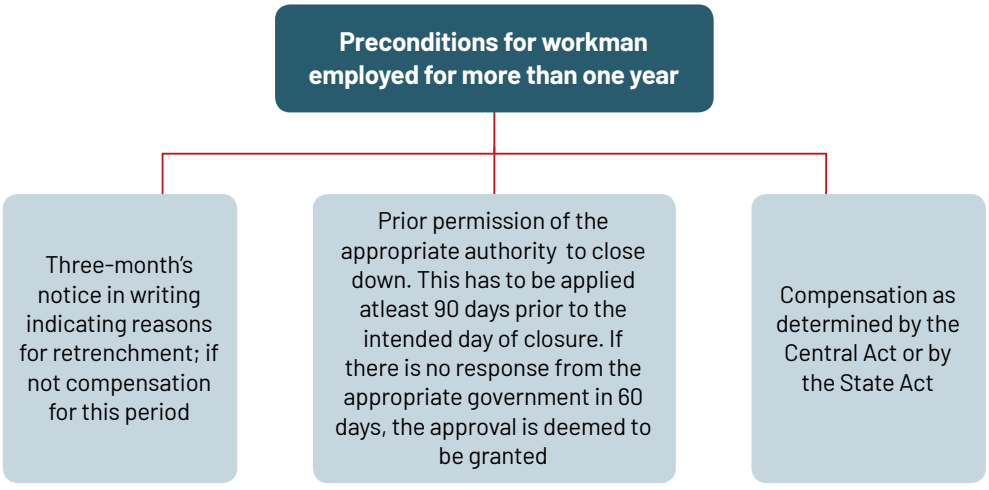
1. The Industrial Relations Code, 2020.
2. The Code on Occupational Safety, Health and Working Conditions, 2020.
3. The Code on Social Security, 2020.

The Codes have been enacted and are still to be implemented; until then, the existing Acts (proposed to be repealed) remain in force.

A. Industrial Disputes Act, 1947

The ID Act deals extensively with retrenchment-related provisions when an industry is closed. The Act applies to all establishments falling within the term 'industry' and employing 'workmen'. 'Retrenchment' implies termination of the service of a workman by the employer for any reason other than due to disciplinary action, voluntary retirement, retirement on superannuating, or non-renewal of contract. The ID Act lays down preconditions for retrenchment for industrial establishments employing at least 100 workmen on an average working day for the preceding year.

Figure 3.5: Conditions for retrenchment under the ID Act



Source: iFOREST Assessment

No dedicated guidelines provided under the labour Codes or ensuing central or state policies and regulations for just labour transition planning

As per the law, workmen employed in any industrial establishment who have been in continuous service for at least one year under an employer can be retrenched by following certain preconditions:

- **Notice for retrenchment:** A written notice is served three months in advance to the workmen indicating the reasons for retrenchment, or the workmen should be paid in lieu of such notice wages for the notice period.
- **Permission of appropriate Government:** Prior permission is obtained from the appropriate Government or authority for the shutdown. This has to be applied for at least 90 days before the intended day of closure. After making necessary enquiries, the appropriate Government may grant or refuse the permission. If there is no response to the application in 60 days, the approval is deemed to be granted.
- **Compensation to workmen:** Where permission for retrenchment has been granted, every worker employed in that establishment is entitled to receive compensations at the time of retrenchment as per the ID Act or relevant state Act. As per the ID Act, the compensation is equivalent to fifteen days' average pay for every completed year of continuous service or any part over six months. However, the compensation cannot exceed average pay for three months when the undertaking is closed down on unavoidable circumstances beyond the employer's control. Unavoidable circumstances exclude financial difficulties, accumulation of undisposed stocks, expiration of the lease or license period or exhaustion of minerals in case of a mine.

The compensation amount varies from state to state. For instance, Odisha and Maharashtra have adopted the same compensation as the central ID Act. In Jharkhand, however, every worker employed in that establishment immediately before the application for retrenchment permission is entitled to receive compensation equivalent to three months' average pay for every completed year of continuous service or any other year over six months.

Compensation to workers under the ID Act is reasonable, but reduces substantially in case of closure under 'unavoidable circumstances'

Figure 3.6: Compensation under central and state-level ID Act

Central Act	Jharkhand Act	Maharashtra Act	Odisha Act
Where permission for retrenchment has been granted, every workman who is employed in that establishment immediately before the date of application for permission is entitled to receive compensation which is equivalent to fifteen days' average pay for every completed year of continuous service or any part thereof in excess of six months	Where permission for retrenchment has been granted, every workman employed in that establishment immediately before the date of application for permission is entitled to receive compensation equivalent to three months' average pay for every completed year of continuous service or any other year part thereof in excess of six months.	*Same as Central*	*Same as Central*

Source: iFOREST Assessment

- **Penalty for non-compliance:** In case of non-compliance with the ID Act, an employer may face a maximum penalty of one-year imprisonment and a fine of ₹5,000. Where the non-compliance is continuous, a further fine of ₹2,000 for each day of violation may be imposed.

In 2020, the Government enacted the Code on Industrial Relations as part of labour reforms which would replace the Industrial Disputes Act, 1947; the Trade Unions Act, 1926; and the Industrial Employment (Standing Orders) Act, 1946. Chapters IX and X of the Code deal with lay-off, retrenchment, and closure.

Overall, the present compensation mechanism indicated in the ID Act is reasonable. However, it is excessive in states like Jharkhand. It can be financially burdensome and perhaps unviable to retrench the workforce working at the power plant for 20-25 years in Jharkhand. However, in case of unavoidable circumstances, which are likely to be applied in case of power plant closure, the compensation is expected to be much smaller.

A viable and fair compensation framework will become necessary for the Indian coal power sector, where the rights of both the power plant owner and formal and informal workers are protected.

In 2020, the Government passed the Industrial Relations Code to amend and consolidate laws relating to trade unions, employment conditions in industrial establishments and undertakings, investigation and settlement of industrial matters, and related issues. The Code replaces The Trade Unions Act, 1926; The Industrial Employment (Standing Orders) Act, 1946; and The Industrial Disputes Act, 1947. The Code provide a broader framework for protecting the rights of workers, minimise frictions between the employers and workers, redress and settle the differences:

- Mandates employer to take prior approval from the appropriate Government in the event of lay-offs, retrenchment or closure, any mines, factories, or plantations that are: (i) non-seasonal, (ii) having three hundred or more workers.
- As lay-off compensation, employers are required to give to every worker who has completed at least one year of continuous service:
  - » 50 per cent of basic wages and dearness allowance if he is laid off, and
  - » One month's notice (or equivalent wages) and 15 days' wages for every year of continuous service for such a period to a worker who has been retrenched.
- Provides for the constitution of a negotiating union in an industrial establishment having registered trade unions for negotiating with the employer.
- Introduces the concept of Reskilling Fund to provide training to the retrenched workers. The fund will be made up of employer contribution (equivalent to 15 days of salary as the last retirement of the worker immediately before being fired) and contributions from other sources as prescribed. The fund must be used to pay the last 15 days of salary extracted by the worker, to his account, within 45 days after the worker's dismissal.
- Provides for Fixed Term Employment, enabling such employees to receive statutory benefits such as ESI, PF, bonus, and wages, including gratuity like that of a permanent worker other than the notice period after the conclusion of a fixed period, and retrenchment compensation.

When implemented, the Code will introduce several reform measures that can improve outcomes for all employee categories in the event of power plant closures; however, it calls for a much smaller compensation relative to the ID Act.

A viable and fair compensation framework necessary for the Indian coal power sector, where rights of power plant owners and workers adequately protected

B. The Contract Labour (Regulation and Abolition) Act, 1970

The Contract Labour (Regulation and Abolition) Act, 1970 deals with working conditions and other benefits of contract labourers. It is a welfare legislation meant to ensure that contract labour is treated with dignity and respect.

- It applies to every establishment where 20 or more workmen are employed anytime during the last 12 months.

- The Act covers working conditions of workers, adequate facilities like drinking water, canteen etc., and proper facilities for women workers, etc.
- There are three significant stakeholders under this Act- "the Establishment", "the Contractor", and "the Workman". Establishment refers to any place where any industry, trade, manufacturing or occupation is carried out and includes Government and private areas. Workman may be skilled, semi-skilled, or unskilled in carrying out manual, supervisory, technical or clerical work. The terms of employment may be expressed or implied. It excludes a managerial or administrative person who draws wages exceeding ₹500 monthly for the supervisory role; and an outworker. A Contractor is a person who supplies contract labour for any work of the establishment and includes a sub-contractor.
- Every establishment and contractor under the Act must register or obtain a license to execute the contract work.

Existing laws and upcoming Code do not provide adequate social security for workers in the event of the closure of an industrial establishment

Going forward, the Contract Labour (Regulation and Abolition) Act, 1970 is to be subsumed under the Code on Occupational Safety, Health and Working Conditions, 2020 (OSH Code) once it is implemented. The new Code increases the threshold limit for applicability of law on organisation employing 50 or more contract labour. It expands the definition of contract labour to include inter-state migrant workers to ensure that the benefits provided to the contract labour are also provided to the inter-state migrant workers. The OSH Code also provides for a single registration of every establishment. The new Code also provides clarity on the types of jobs for which contract labour can be engaged, by restricting employment of contract labour in the core activities of an establishment. Core activities are defined as any activity for which the establishment is set up and includes any activity which is essential or necessary to such activity.

Meanwhile, the existing Act and the upcoming Code do not have any provision for social security in the event of the closure of an industrial establishment. In addition, there is no liability for the principal employer or the contractor to provide any compensation, transition support, alternate means of employment, or skilling assistance to the workers. The Act/Code need to be revised in light of the large-scale closure expected over the coming decades.

C. The Code on Social Security, 2020

The Social Security Code, 2020 amends and consolidates the laws relating to social security to extend social security to all employees and workers in the organised or unorganised or any other sectors. The Code has consolidated nine labour statutes – The Employees Compensation Act, 1923, The Employees State Insurance Act, 1948, The Employees Provident Fund Act, 1952, The Employees Exchange Act, 1959, The maternity Benefit Act, 1961, The Payment of Gratuity Act, 1972, The Cine Workers Welfare Fund Act, 1981, The Building and Other Construction Workers Cess Act, 1996 and The Unorganised Workers' Social Security Act, 2008.

As per Section 2(26) of the Code, "employee" means any person employed on wages by an establishment, either directly or through a contractor, to do any skilled, semi-skilled or unskilled, manual, operational, supervisory, managerial, administrative, technical, clerical or any other work, whether the terms of employment be express or implied. The Code contains various provisions for contractual, inter-state migrant, self-employed and unorganised labour, including building and construction labour. It aims to provide social security for each category of workers.

Table 3.5: Provision of social security for different worker categories

Chapter	Regarding	Applicability
III	Employees' Provident Fund	Every establishment in which twenty or more employees are employed.
IV	Employees State Insurance Corporation	Every establishment in which ten or more persons are employed other than a seasonal factory.
V	Gratuity	(a) every factory, mine, oilfield, plantation, port and railway company; and (b) every shop or establishment in which ten or more employees are employed, or were employed, on any day of the preceding twelve months; and such shops or establishments as may be notified by the appropriate government from time to time.
VIII	Social Security and Cess in respect of Building and Other Construction Workers	Every establishment which falls under the building and other construction work.
IX	Social Security for Unorganised Workers'	Unorganised sector, unorganised workers', gig worker, platform worker.

Source: Based on Code on Social Security, 2020

A social security system is envisaged for the unorganised workers in Chapter IX of the Code. To access social security, it aims to register all the workers by self-certification on an online portal or as required by the Government (Section 113). Welfare schemes under this Chapter have been demarcated for the Central (Section 109(1)) and State Government (Section109(2)) as below.

Table 3.6: Provision of social security for unorganised workers

Central Government	State Government
• Life and disability cover • Health and maternity benefits • Old age protection • Education • Any other benefit as may be determined by the central government	• Provident fund • Employment injury benefit • Housing • Educational schemes for children • Skill upgradation of workers • Funeral assistance • Old age homes

Source: Based on Code on Social Security, 2020

New Social Security Code streamlines the process of obtaining social security benefits, which can assist in a just workforce transition

One of the key highlights of the new Code is the establishment of Career Centers, which will not only collect and furnish information relating to employers and persons seeking employment but also provide vocational guidance, career counselling and guidance for self-employment (Section 2(9)). Under the Code, most establishments would have to notify job vacancies in career centres (Section 139). In addition, the Aadhaar Card will be required to use the facilities offered by the Career Centre (Section 141).

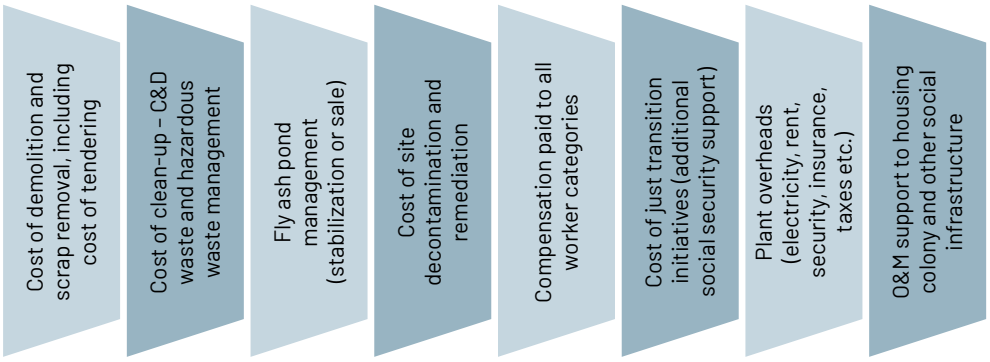
Overall, the Social Security Code 2020 has streamlined the process of obtaining social security benefits, which can assist in a just workforce transition. But the Code is not designed to address the large-scale closure of industrial establishments. It needs to be amended to address the just transition issues of contractual and informal workers. The Code is currently being implemented on a pilot basis.

3.5 Financial regulations

Decommissioning a TPP is an expensive proposition. There are several direct and indirect costs, such as the cost of dismantling civil structures, clean-up and waste management, statutory compensation to workers, land remediation costs and continued plant overheads, including taxes or the cost of operating social infrastructure. While some of these costs may be universally applicable, others depend on the planned reuse of the power plant infrastructure and site, the degree of remediation and the extent of damage to the site. In that sense, it is challenging to ascertain a generalised cost of decommissioning and remediation.

More than Rs 1,100 billion is estimated to be required (at current prices) for decommissioning India's coal power capacity

Figure 3.7: Direct and indirect cost of decommissioning thermal plants

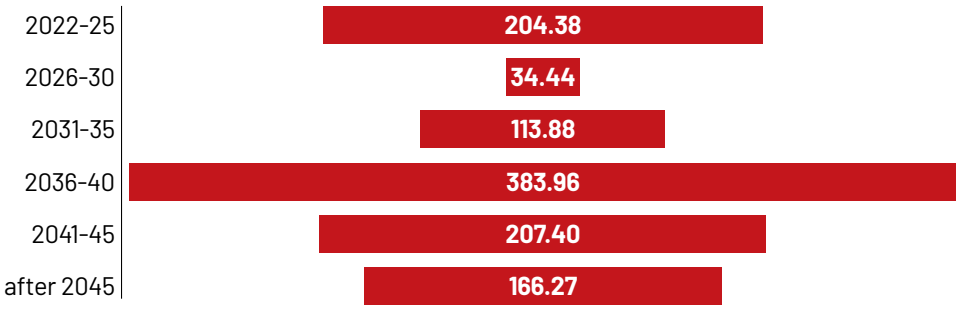


Source: iFOREST Assessment

Relative to the Global North, the power plant decommissioning costs in case of India are likely to be lower due to low labour costs and lower environmental remediation costs. A recent study ascertained the cost of decommissioning a 1,000 MW coal-based power plant in India to be around $58,000 per MW or ₹4.6 million per MW.[77] The cost of decommissioning of the Badarpur thermal power station is estimated to be in a similar range. (The cost of decommissioning BTPS is estimated to be ₹3.80 billion. This includes ₹3.43 billion spent on developing an Eco-park on fly ash pond and ₹300-350 million on clean-up and other overheads. The cost per MW is about ₹5.4 million.) However, these costs do not include just transition costs for all kinds of workers and the local community.

Given India's existing and upcoming coal-based capacity of about 240 GW, the estimated funds required for decommissioning would be more than ₹1,100 billion ($16 billion) at current prices. In the 25 years retirement scenario, about ₹250 billion ($3.3 billion) would be needed during 2022-2030 to decommission plants.

Graph 3.4: Estimated funding requirement for decommissioning of power plants in India (₹ billion; at current prices)



Notes: Assuming an average decommissioning cost of ₹4.6 million per MW, which excluded costs of labour and community just transition; Cost estimated at current prices; Scenario analysis based on units being decommissioned after 25 years of age.

Source: iFOREST Estimates

3.5.1 Current legal provisions on financing decommissioning

Power generation is a delicensed economic activity; hence, there are no regulatory requirements governing the commencement and decommissioning of a TPP. A generation company's Board of Directors has to decide on decommissioning the power plant, and the Central Electricity Authority (CEA) needs to be intimated. Unless there are grid-security concerns, the power plant closure proceeds, and CEA deletes the plant from its All India Installed Capacity Database.

Currently, there are only two ways in which a power plant can recover the cost of decommissioning:

(a). By selling the land, plant and machinery after decommissioning

(b). From tariff through 'change in law' provision, if a new legal provision mandates decommissioning.

a. Salvage value

CERC regulations allow for 10 per cent of the capital cost to be recovered as salvage value, which may not be adequate for remediation works

Coal-based power plants in India sell power to distribution companies under long-term power purchase agreements signed for 25 years. The tariffs for such plants are fixed by central or state electricity regulatory commissions depending on whether the power plant sells in the inter-state or intra-state power market. The Central Electricity Regulatory Commission (Terms and Conditions of Tariff) Regulations, 2014 provides the framework through which inter-state power plants can recover variable and fixed costs. This framework has been replicated in the states through state-level regulations for intra-state power plants.

Currently, the decommissioning cost is not explicitly mentioned in the tariff regulation. But, CERC regulations state that *'the salvage value of the asset shall be considered as 10 per cent and depreciation shall be allowed up to a maximum of 90 per cent of the capital cost of the asset'*. In other words, an end-of-the-life value of a power plant — the salvage value — can be used for the decommissioning cost. However, the case of Badarpur and Guru Nanak Dev Thermal Plant indicates that salvage value may not meet the total cost of decommissioning.

Overall, there are many uncertainties in the decommissioning costs and salvage value. These values will be site-specific and would depend on the intended repurposing. At some sites, the sales of scrap and repurposing of land would be sufficient to meet the entire decommissioning and just transition costs; at the other sites, they may not be. So, ensuring adequate finance for decommissioning the site and for the just transition of workers and communities is essential.

If dismantling, clean-up and remediation of TPPs are enforced through a new law, the costs can be recovered through tariffs under 'change in law'

BOX 3.5: DECOMMISSIONING COSTS VS SALVAGE VALUE

The auction for dismantling all four units of Guru Nanak Dev Thermal Plant (GNDTP) was done with a reserve price of ₹1.32 billion. The contract was eventually awarded to Mumbai-based HR Commercial Private Limited, which won the bid at ₹1.64 billion for carrying out the dismantling process and selling the scarp.[78] Hence, Punjab State Power Corporation Limited (PSPCL) received ₹0.32 billion above the reserve price. The scrap sales, therefore, got PSPCL ₹3.6 million/MW. If we assume the decommissioning cost as ₹4.6 million/MW, then there is a shortfall of ₹1.0 million/MW for decommissioning GNDTP. However, it is to be considered that GNTDP had invested over ₹6 billion on renovations in the early 2010s, which could be the likely reason for the higher scrap value.

In the case of Badarpur Thermal Power Station (BTPS), the reserve price for the sale of decommissioned plant and machinery was ₹1.89 billion.[79] However, the amount paid by the winning company is not available. If we assume that BTPS also got a 20 per cent higher bid, similar to GNDTP, then the salvage value would be about ₹2.25 billion or ₹3.2 million per MW. The cost of decommissioning BTPS is estimated to be ₹3.8 billion or ₹5.4 million per MW. So, there is a gap of ₹2.2 million per cent MW between the decommissioning cost and salvage value.

The gap in cost can be recovered or narrowed by selling the land. But this will depend on the ownership of land and the value of the land. If the land is freehold, it can be sold and money used for decommissioning. In case the land is leasehold, it cannot be sold.

b. Change in law provision

A new law enforced within the period of PPA is considered a 'change in law', and the power plants are allowed to recover the cost of meeting the new law from the tariff.[80] Recently, the power plants were allowed to recover the cost of installing air pollution control equipment's to meet the new air pollution norms.[81]

If dismantling, clean-up and remediation of TPPs are enforced through a new law, then this can be regarded as a 'change in law', and the extra cost can be recovered through tariff. But this is a tricky proposition as the decommissioning expenses will have to be recovered while the plant is in operation, but the expenditure would happen after the plant is closed. In this situation, an entire regulatory framework would have to be developed to ensure that the money collected from the consumers is used for proper decommissioning. Regulatory clarity would also need to be provided on what costs can be recovered through the tariffs.

In totality, the legal provision regarding the financial aspect of decommissioning requires significant reforms to ensure that adequate resources are available for a just decommissioning, and GENCOs are made liable for achieving the objectives of the decommissioning.

3.6 Gaps in existing laws and regulations

Just decommissioning a TPP that includes dismantling, clean-up, remediation, repurposing and support to workers and local communities is a new concept for the country. At present, there is no example in India of a fully dismantled TPP with land wholly remediated. But as more and more TPPs are decommissioned due to techno-economic and environmental reasons, India will need a regulatory framework that enables efficient and just decommissioning. For this, the existing regulatory lacunae must be filled. Some of the major legal and regulatory gaps are listed below.

3.6.1 Overarching gap

a. **No legal mandate:** There is no legal mandate to decommission a TPP. A TPP can be retired and remain 'as-it-is' without legal repercussions. This is especially true if the GENCO owns the land (freehold land). However, if the plant site is leasehold land, the GENCO has to return the land based on the lease contract terms to the owner, the state or the central Government.

b. **Lack of comprehensive guidelines:** There are no comprehensive guidelines for just decommissioning that identifies process and procedures to handle environmental, labour, land and local economy-related issues.

3.6.2 Gaps in environmental regulation

a. **Environmental statutes are silent on decommissioning:** There are no laws that govern the clean-up and remediation works for TPP decommissioning or even industrial decommissioning.
   - The EIA notification, 2006, under which Environmental Clearance (EC) is given to set up TPPs, is silent on the decommissioning aspect.
   - The Forest Conservation Act, 1980, under which forest land is diverted for setting-up TPPs, doesn't specify decommissioning. It just mentions that the land must be reverted to the forest department.
   - Decommissioning is not mentioned in Air or Water Act.

b. **Lack of guidelines:** A Draft Environmental Guidelines for Decommissioning a Coal/ Lignite-Fired Power Plant was released by the Central Pollution Control Board (CPCB) in 2021. But these have been drafted with limited stakeholder consultation and, as such, have much scope for improvement. In 2015, MoEF&CC also published a 'Guidance for Assessment and Remediation of Contaminated Sites', but these have to be adapted for TPPs.

c. **Multiplicity of permits for decommissioning:** As dismantling, clean-up, remediation and repurposing qualify as a new activity under various environmental statutes, multiple consent and clearances are required for decommissioning.
   - New consent under Water and Air Act would be required to start dismantling and clean-up. New permits are also required under hazardous waste and C&D waste rules.
   - For repurposing, new consent to establish (CTE) and consent to operate (CTO) would be required under Air and Water Act.
   - Depending on the sector of repurposing, EC will be required.
   - Change in land use/ activity will require new forest clearance.

Overall, meeting the requirements of the existing environmental statutes would be too cumbersome for decommissioning.

Environmental statues are currently silent on TPP decommissioning, and there is a lack of clarity in guidelines

3.6.3 Gaps in land laws

a. **No policy for repurposing land:** Despite the massive amount of land that will become available after the decommissioning of the TPPs, there is no policy framed by either the States or the Centre on how the land would be repurposed. The factors that would determine the repurposing are not spelt out.

b. **Lack of clarity on leasehold land:** The GENCO has to return the land to the state/central government after the lease period. But the condition in which the land has to be returned is often not elaborated in the contract. For instance, issues like the level of remediation, the fate of the fly ash pond etc., are not clearly specified. This ambiguity leaves ample room for disputes between GENCOs and the Government. If the GENCO is a PSU, then the Government has the flexibility to decide on the fate of the land. But if GENCO is a private company, the chances of dispute are high. A detailed specification on the condition and quality of land post-decommissioning must be part of every contract. This will enable the GENCO to plan for decommissioning.

c. **Lack of mechanism for quick decision-making:** About two-thirds of the land of TPPs are with the state and the central Government. In addition, the leasehold land of the private sector would also revert to the Government. So, state and central Governments have the most prominent role in deciding the fate of the TPP sites. However, the experience of BTPS and GNDTP shows that the decision-making is somewhat ad hoc. This is because there is an absence of a central or state mechanism that can take quick and efficient decisions on repurposing and transfer of land. To ensure that decommissioning adheres to strict timelines, it becomes imperative to have an empowered committee of the state or union Cabinet to take decisions.

Indian labour laws and Codes are not designed for managing large-scale closure of industrial facilities

3.6.4 Gaps in labour laws

a. **No policy or law for a just transition:** The Indian labour laws are not designed for large-scale closure of industrial facilities. The closure of plants is viewed mainly in terms of the potential dispute between the owner and the workers. That is why the primary law dealing with the closure of plants is called Industrial Dispute Act. But for large-scale decommissioning of fossil-fuel assets, peaceful and systematic closure is essential. But there is no policy or law to enable a just transition of all types of workers to allow peaceful and systematic closure.

b. **Weak provisions for informal and contract workers:** There are no provisions in the Contract Labour (Regulation and Abolition) Act, 1970 to provide social security or reskill unemployed labour. Presently, informal and contractual labour constitute the majority workforce and would be left without any job or social security when the TPPs are decommissioned. The Social Security Code, 2020 is also not designed to deal with large-scale industrial closure.

c. **Need to amend the labour acts:** There is a need to amend the labour Acts to enable a just decommissioning of power plants. The Acts must be revised to incentivise plant repurposing so that the least number of workers are retrenched.

d. **No policy for transfer, retirement, re-skilling or re-employment:** There is no consistent policy relating to the transfer, retirement, reskilling or re-employment of the TPP employees. These terms will vary for the public and private sector enterprises. Hence, the Government should lay down broad guidelines, especially for PSUs, to enable a just transition and reduce conflict.

3.6.5 Gaps in financial regulations

a. **Decommissioning costs not factored:** Decommissioning costs are not factored into the financial calculations while setting up the TPP. So, no funds are kept aside by the power plant owners for end-of-life activities. Instead, the salvage value is assumed to be sufficient to enable a just decommissioning. However, as seen from the international and Indian experience, the salvage value might not be sufficient. In the absence of clearly earmarked funds and clearly established liabilities, public and private companies are likely to resort to inaction.

b. **Decommissioning cost is not part of liability:** Under current financial accounting principles, the decommissioning cost is not part of liability of GENCOs and is not reported.

c. **Higher chances of leaving the plant 'as-it-is':** If decommissioning and repurposing are financially unviable, GENCOs are likely to leave the plant 'as-it-is'. This has been the experience in the developed world. Hence, there is a need to create a financial security mechanism for GENCOs to enable decommissioning and repurposing.

Chapter 4

FRAMEWORK FOR A JUST DECOMMISSIONING

From the review of the existing laws and regulations surrounding decommissioning of a thermal power plant (TPP), it is clear that policymakers have not envisaged large-scale decommissioning scenarios so far. But the closure of TPPs is inevitable; the only variable factor is time. This section elaborates on the legal and regulatory reforms required for a just decommissioning of TPPs in India.

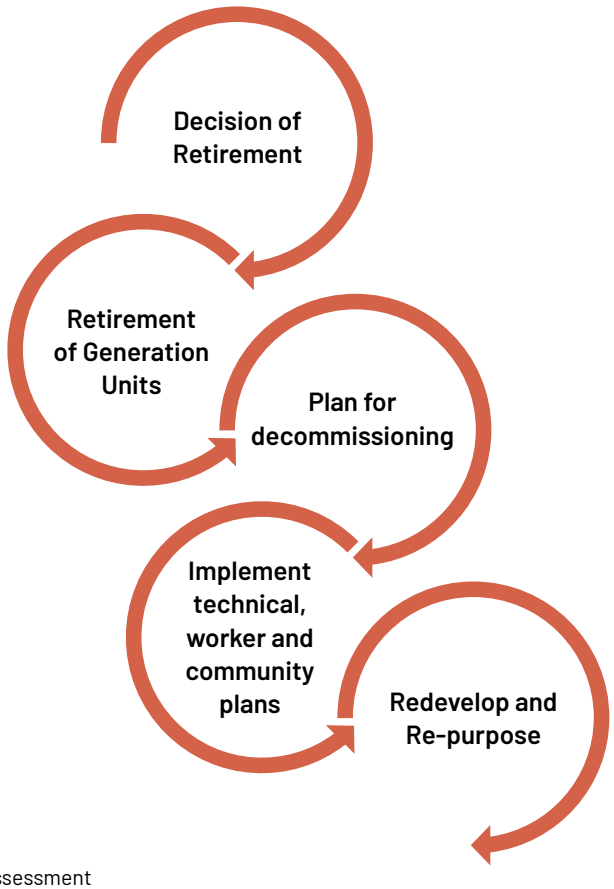
4.1 A 'just decommissioning' process

A shared understanding of the process and outcome of a 'just decommissioning' process is essential to make necessary policy and regulatory reforms.

The decommissioning process refers to a comprehensive set of actions for retiring a power generation plant, dismantling facilities, removing components, and cleaning and remediation the land area. Just decommissioning ensures that the land is thoroughly decontaminated and remediated as per the next identified land use requirements. It also necessitates a just workforce transition through adequate compensation, transfer, skilling/reskilling and the creation of alternate job opportunities. There is an additional requirement of repurposing plant/land to address the socio-economic requirements of the dependent communities. This becomes particularly important for pit-head power plants in far-off locations with limited pre-existing, alternate economic opportunities.

Overall, a 'just decommissioning' is when the plant and site are repurposed, environmental quality is enhanced, workers are compensated or provided alternate job opportunities, and the local economy is sustained and enhanced. To achieve these outcomes, the entire process, from the decision to retire to the redevelopment of the plant site, entails the following key steps:

Figure 4.1: Process of decommissioning a thermal power plant



Source: iFOREST Assessment

Developing an understanding of a just decommissioning process for TPPs crucial to identify required legal and regulatory reforms

Step 1: Decision of retirement

The retirement decision is typically driven by technical (plant efficiency), environmental and economic parameters. Generation units have a life span of about 25 years, which can be extended through investments in renovation and modernisation. However, there comes the point when such units are to be retired as they cannot compete with cheaper alternatives. Furthermore, new stringent environmental requirements are also pushing plants towards retirement, as investments in expensive pollution abatement technologies may not make economic sense for very old units. Further, retirement decisions in the Global North are now being driven by climate change concerns and associated laws, as well. In India, as power generation is a delicensed activity, the retirement decision is taken by the board of directors of the power generation company and intimated to the Central Electricity Authority (CEA).

Comprehensive guidance on TPP decommissioning required, as it is a multi-year project with complex considerations of land, environment, labour and community

Step 2: Retirement of generation units

The retirement decision is followed by the facility's withdrawal from power generation. The decision is shared with the concerned grid manager/operator to ensure no grid security-related concerns. All generating equipment, i.e. boilers, turbines, and generators (BTG), are shut down, and operating permits are terminated.

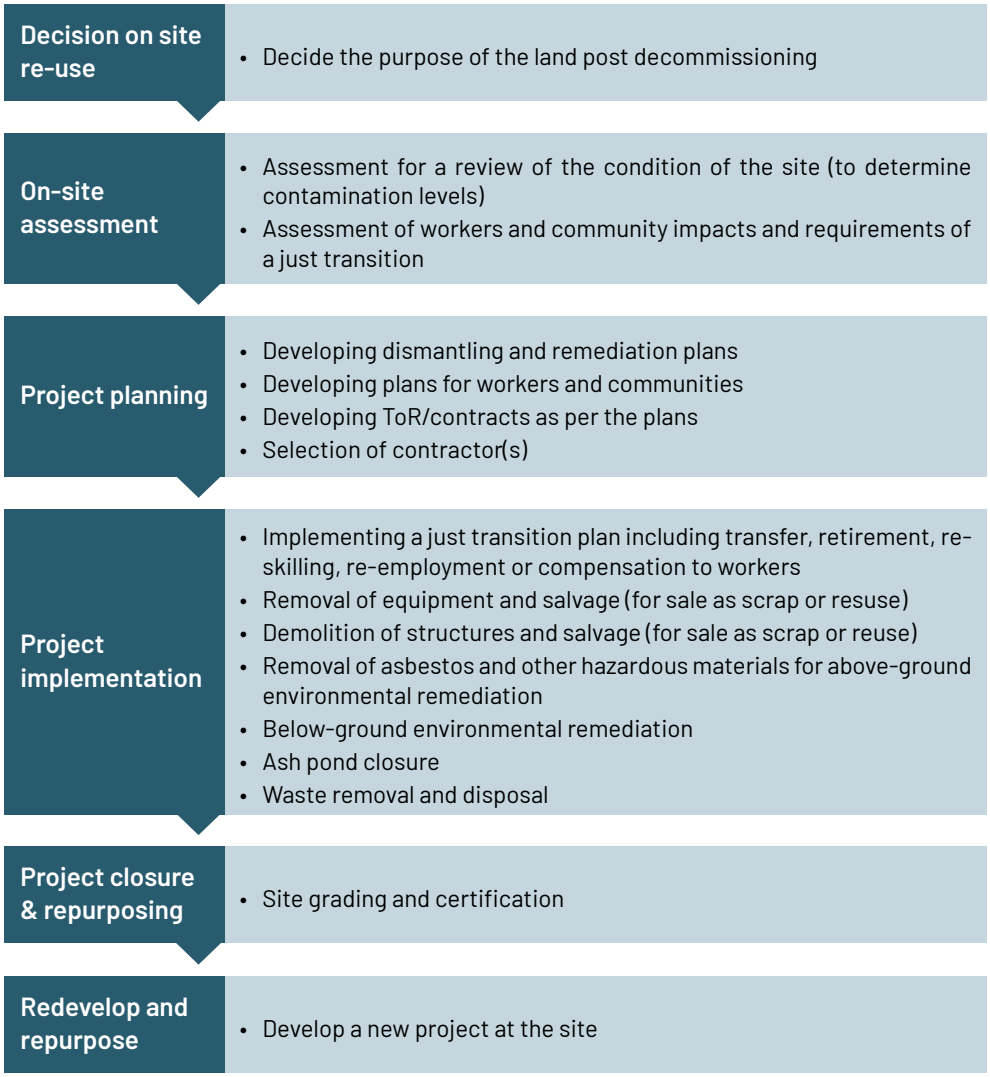
Step 3: Planning for decommissioning

The decommissioning process entails several systematic steps and activities, and the extent of effort varies across projects depending on site-specific situations and the repurposing plan. Thus, decommissioning is a two to three-year-long 'project' that needs to be meticulously planned before execution begins. Therefore, a comprehensive guideline is required to enable proper planning and execution.

It is crucial to decide on site repurposing at the earliest possible stage, as the extent of effort (time and funds) required in dismantling and clean-up entirely depends on the planned repurposing. For instance, if the site is intended to be reused to install an energy plant like solar, natural gas, or biomass, then the extent of remediation would be limited, and the electrical systems can be reused without significant modifications. On the other hand, if the site is planned for residential or recreational purposes, then the remediation and restoration standards would be very high.

The planning stage typically comprises (1). Technical planning, and (2). Workers and community planning. Technical planning entails onsite assessment, including soil and groundwater testing to determine the extent of decontamination required; evaluating safety issues; developing a detailed strategy for dismantling, clean-up and site remediation; and selecting contractor agencies or agencies for undertaking these activities. In worker and community planning, a thorough assessment is made of the impact of the closure and the plan to remediate it. This includes plans for transfer, retirement, reskilling, and re-employment of workers. A community plan is also developed to reduce the impact of the closure on the local community and businesses.

Figure 4.2: Thermal power plant decommissioning planning and implementation



Source: Modified from EPRI 2010

Step 4: Implementation

a. Dismantle, clean up and remediate

Deconstruction of plant requires removal of all equipment, inventory and materials from plant site for reuse or recycling or disposal; demolition of plant facilities, including the cooling towers and all civil infrastructure; followed by clean-up and waste abatement. Typically, power plants have large amounts of high-value scrap metal, particularly steel, that can be sold to recover a portion of decommissioning costs. This stage requires strict adherence to safety standards as several hazardous materials associated with the generation process and structures (such as process chemicals, asbestos, polychlorinated biphenyls, lead, etc.) must be removed.

Decision on site reuse should be made at earliest possible stage, as decommissioning planning and execution is dependent on it

Power plant operators have a clear liability for ensuring site remediation to meet environmental regulations. The extent of clean-up requirements varies from plant to plant, depending on the environmental damage caused during operations and the planned site reuse. Major concerns to be addressed are contamination from leaked hazardous/chemical materials used, ash pond and coal handling plant. Typical steps would include:

- Cleaning up hazardous materials such as asbestos-containing material.

- Cleaning of coal handling plants and removal of coal residue from the soil.
- Remediation of the onsite ash pond/deck (the largest waste stream of TPPs).
- Removal of scrubber slurry generated by the plant's environmental control equipment.
- Cleaning up any contamination of adjacent water bodies or land due to power plant operations.

b. Implement a workforce and community just transition plan

The plans developed for workers and communities should be implemented. Due to the varied nature of skill levels, education, wages and gender split, the decommissioning process requires a planned and systematic system that can deal with workers in a just manner. For instance, many workers can be employed in the decommissioning and repurposing activities, and many more can be reskilled to take up different jobs. These should be planned in advance and implemented.

Step 5: Redevelop and repurpose

A just closure needs to create opportunities to revitalise the power plant site to improve economic and environmental outcomes for the local community. The remediated plant site can be used for several applications that stimulate green economic growth. Coal power plants typically have access to railways, roadways, water, and other infrastructure. This makes such sites quite apt for industrial use. The availability of electrical infrastructure makes these sites suitable for energy-related repurposing – including conversion to solar power plants, natural gas-based plants, biomass plants, battery storage etc. Plant sites near cities have more robust demand for commercial use due to valued real estate.

Decommissioning of TPPs should be mandated by a new law, or amendment to an existing law

4.2 Recommendations for policy and regulatory reforms

4.2.1 Overarching policy and regulatory reforms

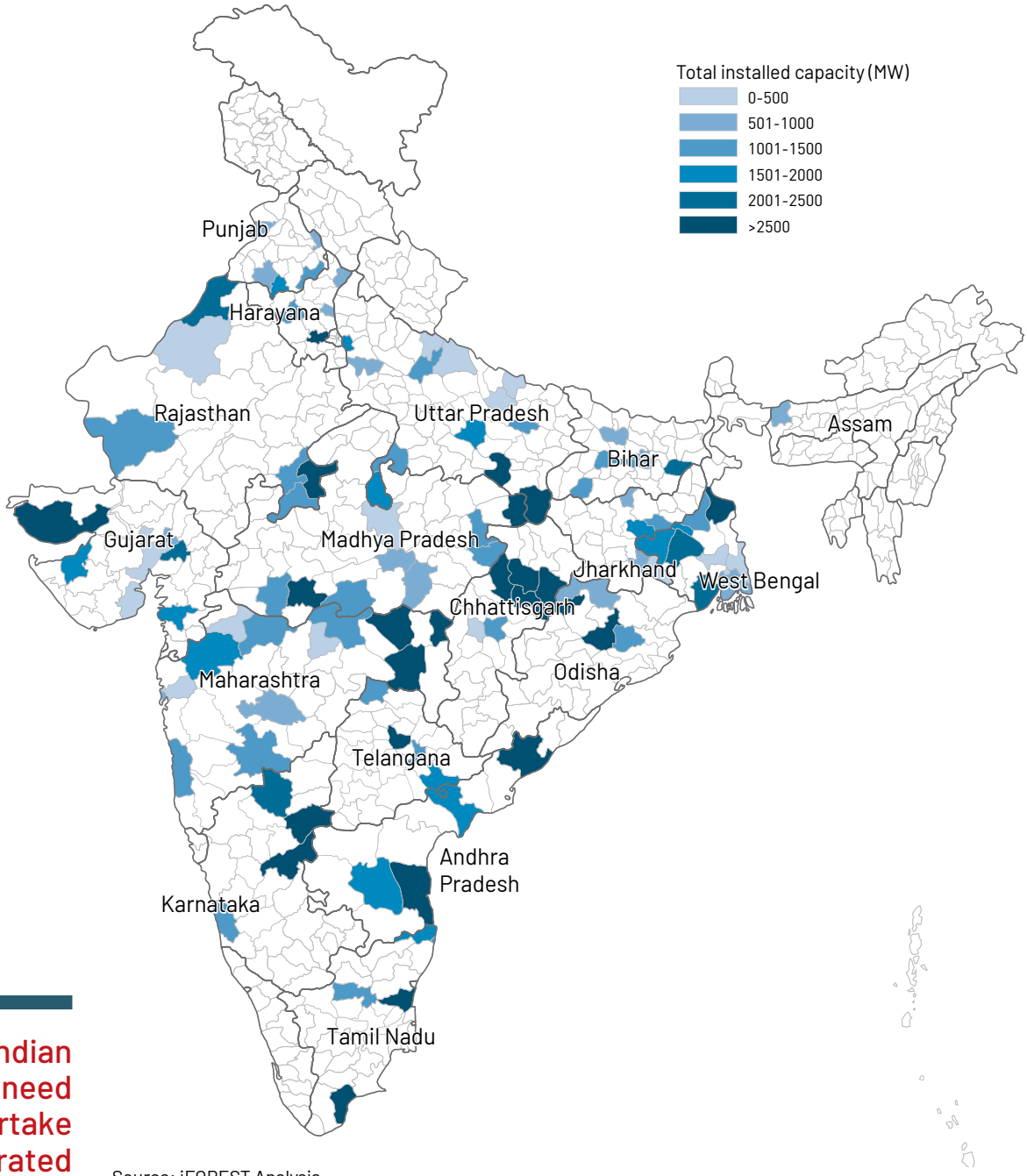
a. Law to mandate decommissioning: Decommissioning of TPPs should be mandated by law. Either a new law should be enacted, or an existing law can be amended to mandate decommissioning. The simplest way to do this is by amending the EIA notification, 2006.

As all TPPs are required to obtain Environmental Clearance (EC) under the EIA notification, an amendment can be made in the notification to make decommissioning compulsory. The compliance conditions for EC should be amended to include the need and requirements of decommissioning.

- For new plants, the decommissioning plan should be part of the Environment Impact Assessment (EIA) study and the Environment Management Plan (EMP).
- For the existing plants, submission of a decommissioning plan well before the date of retirement should be mandatory. For instance, to ensure a just decommissioning, the plan submission should be made five years before plant retirement.

b. Just transition plans for districts with large power plant capacity: Coal-based power plants are concentrated in the coal-mining regions or the coastal areas due to easy access to domestically produced or imported coal. Twenty-five districts across 13 states account for about half of the country's total installed coal-based power. These districts have more than 2,500 MW capacity. Singrauli (Madhya Pradesh), Sonbhadra (Uttar Pradesh) and Kutch (Gujarat) are the top three power plant districts of the country. Many of these districts also have coal mines and coal-dependent industries. These 25 districts will need an integrated just transition plan to deal with the closure of mines, power plants and coal-dependent industries over the next few decades.

Map 4.1: District-wise distribution of coal-based thermal power capacity



Source: iFOREST Analysis

25 Indian districts need to undertake integrated just transition planning over the next few decades due to high dependence on coal economy

c. Certification of decommissioning companies: The decommissioning of TPPs is witnessing a new industry of "professional TPP dismantling companies" in the global north. In light of this, the Government should develop a system for accredited decommissioning companies by specifying the bare minimum standards for technical capability, human resources, machinery and equipment, and finance to undertake demolition, dismantling, remediation and reclamation.

4.2.2 Reforms in environment-related laws and regulations

a. A new Act for decommissioning: The Draft Environmental Guidelines for Decommissioning a Coal/Lignite-Fired Power Plant lists multiple permit and compliance requirements for decommissioning. It also proposes an Environmental Impact Assessment (EIA) and an Environment Management Plan (EMP) for guiding the decommissioning process. Interestingly, under the EIA notification, 2006 another EIA study and EC would be required for repurposing. If the draft guidelines are implemented, then from closure to repurposing, multiple studies and clearances and consent would be required. This would make decommissioning a highly time-consuming and cumbersome process.

New environmental Act need consolidate all the environmental-related provisions and remove multiplicity in clearances and permit procedures

Figure 4.3: Clearance and consent under the existing laws

For dismantling, clean-up and remediation	• New or revised CTO under Water Act • New or revised CTO under Air Act • Authorisation under Hazardous Waste Management Rules, 2016 • Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for the decommissioning process (proposed) • Waste management plan and authorisation from local authority under Construction and Demolition Waste (Management) Rules, 2016
For repurposing	• CTE and CTO for the new project under Water Act • CTE and CTO for the new project under Air Act • Authorisation under Hazardous Waste Management Rules, 2016 (if applicable) • EIA and EC for the new project under EIA notification, 2006 (if applicable) • FC under the Forest Conservation Act (if forest land involved)

Source: iFOREST Assessment

To avoid the multiplicity, a new Act – Decommissioning of Industries and Power Plant Act should be enacted to consolidate all the environmental-related provisions and remove multiplicity in clearances and permit procedures. The Decommissioning Code, applicable to all red-category industries, including TPPs, should specify a simple process to obtain a permit for decommissioning and provide regulatory oversight. Some of the key elements of the new Act could include:

1. A single permit for decommissioning. This should eliminate the need to obtain new consent under Water and Air Acts and hazardous waste, C&D and fly ash rules etc.
2. A clear timeline for decommissioning from closure to repurposing.
3. A process for development and approval of the decommissioning plan. Decommissioning plan should be submitted at least five years in advance.
4. Procedure for compliance reporting and verification.
5. Grant of the final decommissioning certificate.
6. The process to obtain an integrated consent/ clearance for repurposing. This should amalgamate the existing consents/ clearances.

b. Environmental guidelines for decommissioning of TPPs: The Draft Environmental Guidelines submitted by the CPCB to the NGT is a generic document with little guidance on how to proceed with the decommissioning process for various types of repurposing of the site. In addition, there are no standards for remediation. There is, therefore, a need to develop new guidelines that can guide the decommission of TPPs.

Environmental decommissioning guidelines should include the following:

1. Guidelines to determine future land use depending on the site's prevailing environmental and socio-economic condition
2. Procedure for site investigation and assessment
3. Guidelines on dismantling and disposal of plant and machinery, including hazardous and C&D wastes
4. Standards for clean-up of contaminated areas such as coal storage and handling yards
5. Setting remediation requirements based on repurposing
6. Guidelines for remediation and closure of ash ponds
7. Health and safety guidelines
8. Procedure for approval of the decommissioning plan
9. Procedure for approving decommissioning completion
10. Monitoring and reporting during and after the decommissioning
11. Approval of repurposing plan

The decommissioning of a TPP must be seen in an integrated manner, and the guideline must describe it as a step-by-step procedure. Dismantling, remediation, and redevelopment are interrelated concepts and must be clearly defined in the guidelines.

4.2.3 Reforms in land-related policies and regulation

a. Policy for repurposing: The vast amount of land available after the retirement of TPPs must be repurposed for a just transition of workers and communities. The Government should develop a policy to incentivise the repurposing of power plant sites.

b. Empowered committee for repurposing: To take a timely and prudent decision, the Government should create an empowered committee for managing and transferring land at the Central level. The State Governments may do so in their respective states.

c. Clarity on leasehold land: The leasehold land will be returned to the State or the Central Government as specified in the lease contract. In most lease documents, the condition in which land is to be returned is vaguely defined. For example, in a standard land lease agreement for setting-up energy project, developed by the World Bank and widely used by companies worldwide, the agreement has the following condition on the return of land: *"Lessee shall return the Site to Lessor upon the termination of the Agreement in good condition"*.[82] This is vague and unimplementable. It is vital that the condition for dismantling and remediation are clearly spelt out in the lease document to avoid future conflict, especially if the leaseholder is a private sector entity. For this, the Government should amend the Land Acquisition Acts to specify dismantling and remediation standards.

4.2.4 Reforms in labour-related policies and regulations

Dismantling, remediation and redevelopment are interrelated concepts, must be clearly defined in guidelines

a. A just transition policy: None of the existing labour laws/Codes adequately and comprehensively address the transition requirements of informal and formal contractual workers employed at a power plant. A just transition policy is essential to deal with the large-scale closure of coal mines and TPPs. This should address issues of worker support, training and skilling, repurposing of existing coal infrastructure, economic revitalisation of coal-dependent districts etc.

b. A just transition fund: Coal-dominant countries are putting in a just energy transition fund to support income, health insurance, pension fund protection, job training, and job placement for workers affected due to the closure of power plants. South Africa has set

up such a fund with contributions from developed countries. India should also set up a just transition fund with domestic, international and philanthropic contributions.

c. Review and revision of the existing laws and codes: All the current labour laws and Codes need to be reviewed and revised from a just transition perspective.

1. The Industrial Disputes Act needs to be amended to an Industrial Harmony Act to ensure that the decommissioning process is smooth and all adequate measures are taken to safeguard the interests of workers as well as GENCOs.
2. The Contract Labour (Regulation and Prohibition) Act needs to be amended to include provisions relating to the safeguards available to the workers in case the TPP closure.

d. Standard guidelines for PSUs: A comprehensive policy for transfers, re-employment, reskilling, and rehabilitation of displaced or unemployed workers needs to be developed and implemented. The Ministry of Power should lay down such a guidelines, especially for PSUs, to enable a just transition and reduce conflict.

All existing labour laws and Codes need to be reviewed and revised from a just transition perspective

4.2.5 Reforms for managing financial aspects of closure

a. A financial framework to fund decommissioning: A framework to fund decommissioning and repurposing will need to be developed to ensure a just decommissioning. This framework should include the following:

- Corpus funds for decommissioning: A corpus fund must be created from money received from the consumers. This fund should be used only for decommissioning-related activities at the end of the life of the TPP. This fund would be similar to that of an Escrow account created in in the case of coal mines.
- Institutional set-up to administer the fund: An institution at the central level should be responsible for approving the decommissioning plan, collecting the fund, administrating the fund and giving final clearance.
- Empowered committee: An empowered committee at the central and state-level is needed to decide on repurposing (as mentioned in land-related reforms).
- The responsibility for decommissioning should be with the GENCOs. Every TPP should be asked to develop a decommissioning plan and estimate the required funds. The corpus fund should support gap funding to plants with PPA to achieve the goals of just decommissioning.
- Merchant power plants should incorporate the decommissioning costs in their cost of doing business and accordingly set the sale price of power. In addition, they should be mandated to deposit a certain amount of money in an Escrow account as a surety for decommissioning. This money should be reimbursed based on the decommissioning progress.

b. Report on decommissioning cost: Decommissioning is a liability, and hence it must be reflected in companies' balance sheets. In the US, publicly listed companies are required to report decommissioning costs as asset retirement obligation (ARO), an obligation associated with the retirement of a tangible long-lived asset, to the US Securities and Exchange Commission. Securities and Exchange Board of India should also implement similar reporting and disclosure.

c. Bankruptcy and decommissioning: The decommissioning of TPPs has just begun in India, and so far, complicated issues relating to bankruptcy at the decommissioning stage have not emerged. This calls for a prudent approach where the Centre and the State power agencies should develop policies to ensure that issues relating to bankruptcy are addressed efficiently if required.

Annexure

Decommissioned coal-based power units in India during 2016-2021

State	Name of power plant	Unit numbers
Assam	Chandrapur (Assam)	1,2
Chhattisgarh	Korba-II	1,2,3,4
	Korba-III	1,2
Delhi	Badarpur TPS	1,2,3,4,5
	Rajghat TPS	1,2
Gujarat	Gandhi Nagar TPS	1,2
	Kutch Lig. TPS	1,2
	Sabarmati (C Station)	15,16
	Sikka Rep. TPS	1,2
	Ukai TPS	1,2
Haryana	Panipat TPS	1,2,3,4,5
Jharkhand	Bokaro `B` TPS	1,2, 3
	Chandrapura (DVC) TPS	1,2,3
	Patratu TPS	1,2,3,4,5,6,7,8,9,10
Madhya Pradesh	Amarkantak TPS	3
Maharashtra	Bhusawal TPS	2
	Chandrapur (Mah) STPS	1,2
	Koradi TPS	1,2,3,4,5
	Parli TPS	3,4,5
	Trombay TPS	4,6
Odisha	Talcher (Old) TPS	1,2,3,4,5,6
Punjab	Bhatinda TPS	1,2,3,4
	Ropar TPS	1,2
Tamil Nadu	Ennore TPS	1,2,3,4,5
	Neyveli TPS-I	1,2,3,4,5,6,7,8,9
Telangana	Kothagudem TPS	1,2,3,4,5,6,7,8
Uttar Pradesh	Harduaganj TPS	5
	Obra TPS	1,2,8
	Panki TPS	3,4
West Bengal	Bandel TPS	3,4
	Chinakuri TPS	1,2,3
	Dishergarh TPS	1,3,4,5
	Dpl TPS	3,4,5,6
	Durgapur TPS	3
	New Cossipore TPS	1,2,3,4
	Santaldih TPS	1,2,3,4
	Seebpore TPS	1,2,3,4

Source: CEA

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