CEEW
THE COUNCIL

Assessing Worker and Community Dependence on Thermal Power Plants

A Case Study

Gunjan Jhujhunwala, Tarun Mehta, Ganesh Dileep, and Muskaan Malhotra

Report | July 2024

Image: iStock

Executive summary

At an installed capacity of 218 GW in 2024, coal-fired thermal power plants (TPPs) constitute over 70 per cent of India's annual electricity generation and directly employ 3.2–4 lakh individuals across the country (CEA 2022[1]; CEA 2024). Presently, 32 GW of coal and lignite capacity – or approximately 15 per cent of the installed capacity – is 30 years or older (ibid.). These units are in the end-of-life stage and will need to be repurposed or decommissioned.

Repurposing plans for TPPs focus on three aspects: affordable and suitable alternative technologies, quality finance, and citizen-centric planning. Our estimates suggest that ~3.2-4 lakh individuals are currently employed across TPPs in the country (Authors' analysis based on CEA (2022, 2024)). While they constitute a small percent of the workforce in India, decommissioning or repurposing of TPPs will have significant impacts on the local regions. (Dsouza and Singhal 2021; Dsouza 2021) To mitigate this impact and ensure a smooth transition, our report focusses on enabling a citizen-centric transition of TPPs. Citizen-centric plans aim to realise a **'just' transition (JT) – that is, a transition to cleaner energy without compromising social and economic vulnerabilities** (The World Bank, n.d.). Thus far, these plans and frameworks have largely focussed on the source of coal production – that is, coal mines (NITI Aayog 2022; Mitra, Singh and Victor 2023; Banerjee 2022) – but they also needs to be devised for high-end use sectors for

1 Direct employment based on authors' analysis of the installed capacity of various power plants and employment factors provided in CEA (2022).

coal – TPPs. There is a need to develop distinct JT plans for TPPs and coal mines since the two differ in their occupational structures, transition timelines, the scale of surrounding economic activities, repurposing options, the inter-generationality of workers, and the nature of labour unionisation.

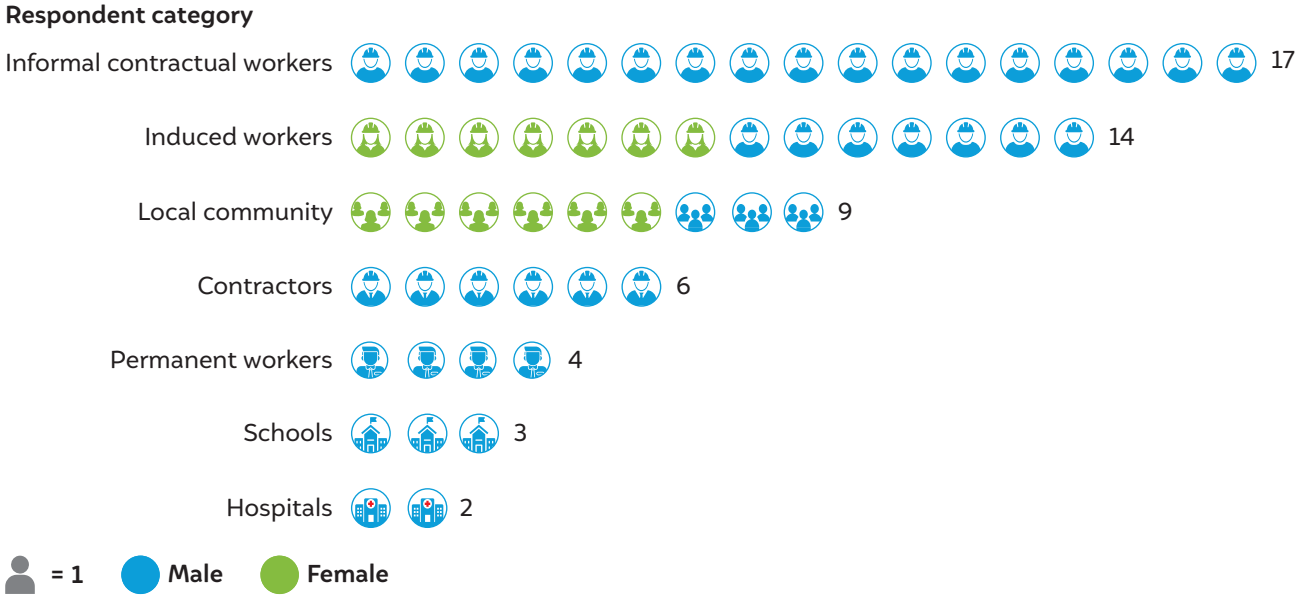
Our report examines workers' and communities' dependence on coal-fired TPPs and how they might be affected if TPPs are repurposed.[2] This understanding is necessary to mitigate the people-related challenges that may arise in implementing a repurposing plan.[3] We explain dependence and vulnerability by examining the nature of work and the types of workers at a TPP, the gender composition of this workforce, and the factors that make workers (direct[4] and induced[5]) and communities dependent on TPPs not just for their livelihoods but also for other social benefits.[6]

Using qualitative research methods, we designed an in-depth case study of a state-owned TPP[7,8] to explore these differentiated dependencies among workers and the surrounding community. To create a robust case study that allows for cross-examination of the TPP, we designed a carefully curated sampling strategy. Figure ES1 illustrates the respondent categories and sample size (totalling 55).

We assessed the dependency and vulnerability of different categories of stakeholders in the event of plant repurposing. Figure ES2 demonstrates the parameters we used to determine dependency on a TPP.

Data gathered through in-depth interviews with each respondent category, organised and analysed along a framework-analysis matrix, revealed the following insights.

Figure ES1 Sampling distribution of respondent categories



Source: Authors' compilation

2 Here, the TPPs we refer to are those that are in the end-of-life stage. We are not proposing any early retirement of TPPs. In contexts where repurposing is not possible due to various reasons, TPPs typically look to decommission.

3 Several journalistic accounts have highlighted that TPPs face significant resistance from communities, which impacts the power plants' plans of either inaugurating a new unit or repurposing existing infrastructure (The New Indian Express 2021; Sandhu 2016).

4 Those working at the TPP.

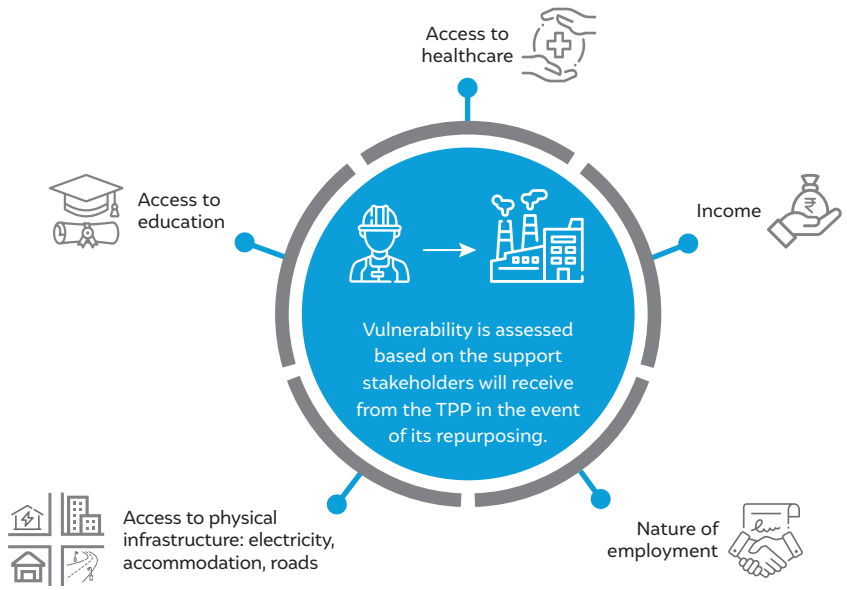
5 Those not working at the TPP but whose livelihoods may come from the local spending of TPP employees.

6 Our study examines both direct and induced dependency on TPPs but does not examine indirect dependency (sectors that use a by-product of the TPP such as fly ash–based cement and brick factories).

7 The name of the TPP has been anonymised intentionally.

8 The identified TPP reflects the transition journey of most other TPPs in India that have replaced old and inefficient units with newer units either within the plant premises or in the vicinity. Housing both old and newer units, the sampled plant itself is operational.

Figure ES2 Factors for assessing dependency on TPPs



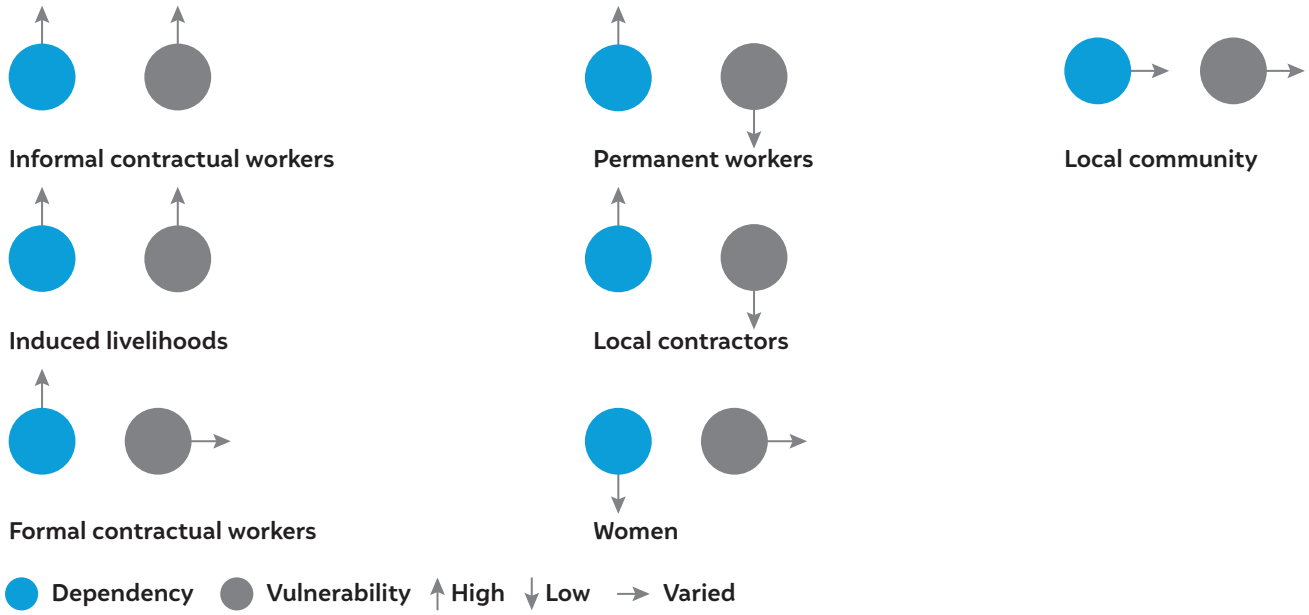
Source: Authors' compilation

A. Key insights

Our study finds that there is no uniform correlation between dependence and vulnerability across categories. For some categories such as permanent workers, local contractors and formal contractual workers – high dependence accompanies low or varied vulnerability. However, the high dependence of informal contractual workers and induced livelihoods translates into high vulnerability to TPP repurposing. Women and local community show a different pattern of dependence and vulnerability. While they are less dependent primarily because of negligible employment at the plant, their vulnerability is varied and is based on their ability to access employment through an active push to create livelihood opportunities for them.

The key insights on how each category is dependent and vulnerable are presented in Figure ES3.

Figure ES3 Workers and the surrounding community show varied dependency and vulnerability in case of the repurposing of the TPP



Source: Authors' compilation

Our study revealed the following nuances in each category's dependence on the TPP and vulnerability to repurposing:

- **Contractual workers – including informal workers[9] – and induced livelihoods are dependent on the TPP and vulnerable to repurposing:** Contractual and informal workers engaged in the operations and maintenance (O&M) of TPPs mainly possess niche skills specific to the plant's machinery. For these workers to retain employment in the repurposed plant, whose O&M will be vastly different from the TPP, or to gain alternate employment, reskilling or upskilling efforts will be necessary. Here, informal workers will require greater support owing to lower educational levels, uncertified skills, and limited access to formal reskilling opportunities. In the case of induced livelihoods, local enterprises' dependence stems from their reliance on spending by TPP workers and the local community. If repurposing results in a shrinking of the workforce employed at the plant[10] and in other ancillary services, induced livelihoods will be impacted negatively.
- **Permanent workers and local contractors are dependent on the plant, but they are less vulnerable to repurposing:** Permanent workers rely on the plant for employment, but they enjoy benefits such as access to retraining, redeployment, or severance pay if their current roles are impacted, thereby making them less vulnerable. Local contractors earn by supplying labour or leasing machinery or vehicles to the plant. Their services will remain in demand if the new production processes are equally labour-intensive and if they can redeploy the machinery they currently lease to the TPP. Contractors may also be able to diversify to other economic sectors on account of their accumulated capital, assets, and ability to supply labour to other industries.
- **TPPs employ a negligible number of women, whose ability to engage in gainful livelihoods is impacted by the plant:** We found that few to no women work in TPPs in either technical or labour-intensive roles. High pollution levels in the area prevent women from practising alternative livelihoods, including agriculture. Further, long distances to the nearest town impact their ability to seek jobs.
- **The local community finds employment at the plant and remains vulnerable to repurposing:** TPPs employ a combination of local and migrant workers. While the plant identified for our study primarily employed migrant workers,[11] discussions with officials at other TPPs revealed that at least a third of the workforce comes from local communities. Many local workers are trained to perform relatively low-paying O&M roles at the plant. Their jobs will be at risk in case of a transition. A JT plan must prioritise ensuring gainful employment for such workers in the repurposed plant or provide them alternative jobs in the vicinity, given their cultural and historical connection with the land used by the plant.
- **The local community is dependent on the plant for social infrastructure, but it is also impacted by the environmental pollution it causes:** The sampled TPP contributes to social infrastructure in the surrounding areas, such as healthcare and educational services, which are accessed by all staff, permanent and contractual (both formal and informal) – the latter with the help of contractors (especially for healthcare services). Healthcare services do not include highly specialised care such as that required to treat ailments resulting from air and water pollution. While the educational services supported by the TPP span primary schools to vocational training institutes, these are mostly accessed by the local community. Most migrant workers do not access educational services, since they have relocated to the plant site without their families. If the repurposing leads to reduced pollution, the local community stands to gain. However, the healthcare and educational services must be continued regardless.

> Even informal workers possess niche technical skills that need to be 'retrained to retain' in the repurposing scenario.

9 The informal contractual worker category can also be understood as casual wage labour. As per the National Sample Survey Office (NSSO) definition, casual wage labour is "(a) person who was casually engaged in others' farm or non-farm enterprises (both household and non-household) and, in return, received wages according to the terms of the daily or periodic work contract, was a casual wage labourer" (NSSO 2015).

10 As per CEEW analysis through stakeholder consultations, the overall demand for the workforce will decrease if the plant were to repurpose to battery energy storage systems options and will mostly remain the same if the plant were to be repurposed through a complete fuel change, for instance, to biomass.

11 Our data suggests that this predominance of migrant workers can be attributed to the threat of local community resistance to the plant's day-to-day activities.

These critical insights reveal workers' and communities' varying dependencies on a TPP. A holistic JT framework for TPPs in India should clearly demarcate areas of intervention, identify the corresponding governance approaches required for these areas, and offer financial estimations and pathways to meet these needs. Our study provides a vital first step in this direction and recommends the following interventions, with a greater focus on enabling workers and communities to find employment after the repurposing.

B. Recommendations

Our recommendations are focussed on 'retrain to retain' workers by bringing existing skill development opportunities closer to affected workers. We also suggest ways to improve livelihood opportunities of women and other community members.

- **Align funding and facilitate ease of access to initiatives across skill development and social safety:** To ensure that workers and communities affected by repurposing have access to skilling programmes and essential social safety schemes, (i) spending from state and centrally sponsored schemes can be aligned with corporate social responsibility (CSR) activities and support from multilateral development banks (MDBs), (ii) consolidated databases such as mySchemе and UMANG, which facilitate one-stop access to social safety programmes, should be strengthened and promoted, and (iii) access to these programmes can be improved by engaging community resource persons for enrolling affected workers and community members.
- **Design worker-responsive skill development programmes:** In addition to the existing placement-related targets established under the *Common Norms for Skill Development Schemes,* monetary incentives should be provided to training partners engaged in training ex-TPP workers to improve accessibility to skill development programmes (GoI 2015). To enhance worker participation in skilling programmes, targeted skill development initiatives must complement workers' existing skills and communicate the expected work opportunities and wage returns from the training.
- **Develop clear gender metrics for baseline assessment and the skill development programme:** Skill perceptions and aspirations within the local community, and among women in particular, should be surveyed using a gender-disaggregated assessment. Skill development programmes must also include training for women in otherwise male-dominated job roles in flexible, non-residential, and self-paced formats. In conformance with the objectives of the *National Policy for Skill Development and Entrepreneurship* (2015), skill development initiatives must be encouraged to develop gender metrics in terms of the training and placement rates of women (MSDE 2015).

Image: Alamy

Several of these ecosystem-driven efforts will need to be actualised at the decentralised level at the TPP itself. In this regard, we suggest the following:

- **Independent, third-party entities should conduct a baseline skills assessment survey among informal contractual workers and the local community:** A survey to assess the number and skills of informal contractual workers engaged at the TPP must be conducted. This will help establish a skills baseline which can be used to design skilling initiatives to meet the needs of the repurposed plant and prepare workers for engagement in an alternative industry. This survey can be conducted with sector skill councils and the district skill committee. It can also cover communities dependent on the TPP for induced livelihoods.
- **A skills information portal should be maintained at the plant level:** A single-window management information system (MIS) portal can be established to facilitate skill-matching between displaced workers and the skills required in the repurposed plant or in alternative industries. This portal can also be connected to myScheme and UMANG to help workers identify relevant government skill development initiatives and training partners for skill training.
- **Benefits from the repurposed plant must be redistributed among the local community:** Repurposing existing assets for alternative energy uses will allow for the reemployment of a part of the existing workforce and will perpetuate demand for small businesses in the vicinity. To mitigate social resistance to plant closure, the local community must be assured gainful employment by promoting extensive skill development initiatives. If there are practical limitations to offering employment, social infrastructure that is accessible to all in the community must be provided instead. The management of the repurposed plant will need to assure the local community that it will provide healthcare and educational services as well as reliable power (if the repurposed plant continues to generate electricity).

While these recommendations call for further assessments, our study helps to further the extant discourse in planning citizen-centric energy transitions by demonstrating that a JT plan for the coal sector will need to include the particularities of TPPs for layered and comprehensive planning.

1. Introduction

The thermal power plant (TPP) ecosystem in India is complex owing to its diversity in terms of ownership and management (private/state/central), scale (utility/captive[12]), and location (pithead[13]/non-pithead). Though the need to transition to cleaner energy sources is widely acknowledged, TPPs are considered a source of reliable power and thus are central in ensuring India's energy security. Generation data from the Central Electricity Authority (CEA) suggest that TPPs currently meet more than 70 per cent of India's annual electricity needs, making them critical to maintaining India's energy supply[14].

Such reliance on TPPs necessarily implies that the shift away from thermal power will be a gradual process contingent on India meeting its energy security needs. For instance, the National Electricity Plan (NEP) proposes to retire 2.1 GW of TPPs by 2032, but India will also have added approximately 51 GW of TPP capacity in the decade between 2022 and 2023 (CEA 2023).[15] Currently, 32GW of coal and lignite capacity – or approximately 15 per cent of the installed capacity – is 30 years or older (CEA 2024). Additionally, as renewable energy and other non–fossil fuel energy sources scale up, India must implement a planned transition of TPPs to meet its goal of becoming a net-zero economy by 2070.[16]

> **3.2 to 4 lakh workers are directly dependent on thermal power plants in India.**

12 In contrast to large utility-scale power plants, captive generating plants are set up by industrial and commercial consumers to meet their own electricity needs.

13 Pithead power plants are located near coal mines.

14 Authors' analysis based on CEA monthly generation reports.

15 According to the NEP, India is projected to add a coal capacity of ~25.6 GW in 2022–27 and 25.5 GW in 2027–32.

16 Dispatch data published by the Ministry of Coal (MoC) suggests that TPPs consume 90 per cent of the domestically produced non-coking coal in India. TPPs are also responsible for nearly one-third of India's greenhouse gas emissions and 47 per cent of its fuel-related carbon dioxide emissions (Manchanda 2022).

At the current thermal power generation capacity of around 218 GW, TPPs are estimated to directly employ approximately 3.2–4 lakh people across the country (CEA 2024).[17] As the overall TPP capacity increases to 260 GW by 2032 there will be a corresponding increase in the total workforce dependent on TPPs (CEA 2023; MoC 2022). While the overall number of affected individuals – those employed in TPPs and allied industries – constitute only a small percent of the workforce in India, decommissioning and repurposing of TPPs can have significant impacts on the local population that may impact transition timelines (Dsouza and Singhal 2021; Dsouza 2021). Moreover, the regulations related to TPP decommissioning and repurposing in India inadequately address environmental remediation and labour rehabilitation (Bhushan, Singh, and Chaudhari 2022).

An assessment of worker and community dependence and vulnerability is crucial because a just energy transition must not only consider technology accessibility and financial adequacy but also citizen-centric planning. A citizen-centric plan, or a 'just' transition (JT), accounts for social and economic vulnerabilities that the communities dependent on a TPP will face if it is repurposed – wherein the premises and core infrastructure of a TPP are re-used to serve other, potentially greener solutions, such as replacing coal with biomass-based pellets, battery energy storage systems, or solar power. Where repurposing is not possible, the TPP may be decommissioned.

The existing literature on socio-economic concerns surrounding India's coal ecosystem focuses mainly on coal-mining regions – the political economy of coal; the dependence of formal and informal coal mine workers; indirect workers and induced livelihoods; and local-level planning in the event of mine closure (Lahiri-Dutt 2014; Dsouza and Singhal 2021; Pai et al. 2021; Gupta 2021; Bhushan et al. 2022; Banerjee, Shalya, and Joseph 2022). However, findings on effecting just transitions in coal-mining regions will likely be inapplicable to TPP areas due to differences in occupational structures, transition timelines, the scale of surrounding economic activities, repurposing options, the inter-generationality of workers, and the nature of labour unionisation. Thus, evidence-based assessments are needed to understand the potential impact of TPP repurposing or decommissioning on workers and communities.

Our study aims to add nuance to the discourse on just energy transitions in India, by providing insights into the workings of a TPP. We examine the heterogeneous dependencies and vulnerabilities of various categories of workers and communities in the context of TPP repurposing or decommissioning.

We studied dependence in the form of multiple factors, including income, employment, education, healthcare, and access to public utilities, such as water, electricity, and roads. For each of the worker categories, we examined vulnerability by checking for the presence of a company policy that safeguards against termination of employment either through an early retirement package or through the provision of alternate roles within the company; an institutional authority responsible for reskilling/upskilling; access to institutions for skill development; and continued access to quality social goods such as healthcare and education. We analysed community vulnerability by examining the factors that make them dependent on TPPs: jobs and livelihoods and access to social and physical infrastructure such as schools, hospitals, roads, water connections, and electricity.

As a first step in facilitating such deliberations and to contribute evidence on the socio-economic implications of TPP repurposing or decommissioning, our report aims to:

- explain the intricacies of a TPP from the viewpoint of various categories of workers employed by the plant,
- examine differential dependencies and the corresponding vulnerabilities of direct workers, induced livelihoods, and local communities in the context of an energy transition, and
- propose recommendations to plan a citizen-centric transition.

The research methodology we adopted for this study is discussed in Section 2; Section 3 presents research findings on workers' and communities' varied dependencies on a plant; and in Section 4, we detail recommendations for planning a just transition.

We studied dependence in the form of multiple factors, including income, employment, education, healthcare, and access to public utilities.

17 Authors' analysis based on CEA (2022).

2. Research methodology

In this section, we discuss the research questions, case study methodology, site sampling approach, identification of respondents and sample size, and the approach deployed for data collection and analysis.

2.1 Research questions

As mentioned in the introduction, our research objective was to examine the intricacies of TPPs from a worker and community viewpoint, identify varying dependencies and vulnerabilities, and, consequently, make recommendations for planning a JT for TPPs.

The research questions are as follows:

- How do workers at a TPP differ from each other vis-à-vis terms of employment? What implications do these differences have on their dependence on the power plant and vulnerability to TPP repurposing?
- How do workers approach their current roles and acquire skills necessary for their jobs? What is their preferred approach to skill development?
- How is the local community dependent on the TPP for its livelihoods?
- How are workers and the local community dependent on the TPP for access to other social goods such as healthcare and education?

2.2 Use of a qualitative research methodology: A case study approach

To address these research questions, we adopted a qualitative research methodology, specifically, a case study approach. An exploratory case study is a qualitative research tool that enables the examination of relationships within a particular context (Njie and Asimiran 2014). This approach provides a holistic view of an individual case and helps answer all research questions pertinent to one site (Rebolj 2013). Beyond the empirical–analytical paradigm of quantitative research, qualitative methodologies emphasise developing accounts of human events, activities, behaviours, and social contexts from the perspectives of those involved (Fossey et al. 2002).

Since this study was one of the first attempts at examining the working structure of a TPP, as well as the dependencies and vulnerabilities of its workers, it was imperative to employ a case study approach which allows for a focused examination, particularly, of the relationships of the key stakeholders. Justice in the context of an energy transition entails involving those who would be affected in decision-making processes and recognising those who are most vulnerable due to their socio-economic status (McCauley et al. 2019). A qualitative research approach was indispensable for the study because it enabled us to engage with the concerned workers and community and thus examine areas that require policy engagement to ensure citizen-centric planning of TPP repurposing or decommissioning.

2.3 Approach to site sampling

To leverage the strength of the case study methodology, we chose a case that represented a 'typical' state-owned TPP – a TPP with a total generation capacity of 1270 MW.[18] Older unit(s) of the sampled plant had been decommissioned recently, with newer units constructed in the vicinity. This pattern of replacing old and inefficient units with newer units is now typical of Indian TPPs (CEA 2015).

We also took into consideration plant location. The sampled TPP is a non-pithead plant, located approximately 15 km from the nearest commercial city/town. Based on data from the CEA, approximately 90 per cent of TPPs in India are located outside a 10 km radius of cities with a million-plus population, which is in line with the parameters of the selected TPP as well (CEA 2023).

While this study is specific to non-pithead plants, and serves as an examination of TPPs in isolation from coal mines, there is scope for subsequent research on worker and community dependence in a non-pithead plant versus a pithead plant. Similarly, analyses may also vary in the case of large clusters of TPPs in a region. The findings of our report are also specific to plants located at least 10–15 km from high-density cities. Our analysis of the Kota Super Thermal Power Station (KTPS), Rajasthan, suggests that this difference in the location of the power plant is a considerable factor in determining the extent and of workers' and communities' economic dependence on a plant. Box 1 briefly describes a pilot visit to the KTPS.

> **Our findings are most relevant for large, non-pit head plants located far away from densely populated regions.**

18 The median and mean size of power plants in India is 1,000 MW and 1,139 MW, respectively.

Box 1 The diversified local economy near Kota Super Thermal Power Station and its implications for worker and community dependence on the power plant

Kota Thermal Power Station (KTPS), whose first stage was commissioned in 1983, is a 1,240 MW coal-based power plant owned and operated by the state generation company, Rajasthan Rajya Vidyut Utpadan Nigam Limited. The plant is spread over 204 hectares of land and has an ash dump area of 423 hectares. Its township – or thermal colony – is situated around 2.5 km from the plant. The plant itself is located around 8 km from Kota – Rajasthan's principal industrial city. Therefore, KTPS serves as a suitable example for examining worker and community dependency on a power plant located near a city.

The plant employs nearly 2,500–3,000 contractual workers who stay in localities in and around the plant. The densely populated localities of Nanta and Karni Nagar have expanded close to the plant. Grover and Swami (2023) attribute the evolution of these settlements to KTPS. However, despite the power plant being the prime cause for the emergence of the settlements, these communities are no longer solely dependent on the plant. The Karni Nagar market, which features small pharmacies, eateries, kirana stores, tea and vegetable stalls, garments and footwear shops, among others, serves the daily needs of the local community. Behind the market are several residential clusters, inhabited by migrant workers employed at the plant and elsewhere.

Additionally, fly ash from the plant is an important input for the 40–50 brick-and-stone businesses in the nearby Paryavaran Industrial Area. Despite the power plant being an important source of livelihoods, direct and induced, we observed that these localities were not solely reliant on it for their employment or access to other socio-economic goods. Our conversations with the local community and workers at the local labour adda revealed the abundance of diversified employment opportunities in the area, such as in transportation, construction, plumbing, and manufacturing industries. Further, there were four to five health centres, colloquially called pharmacies, and schools, both private and government-run, that attended to the needs of the local community and were not associated with the plant.

Source: Authors' analysis

Image: unsplash

2.4 Approach to respondent sampling and sample size

We conducted a pilot visit to assess the site's feasibility and map local communities. This exercise – along with desk-based research, an assessment of human resource documents, and consultations with plant officials – contributed to identifying respondent categories. Qualitative research is flexible and allows for identifying or revising new respondent categories as part of the data collection exercise. During data collection, our team realised the need to add further nuance to the category of contractual workers.

The literature on labour in India shows that there are degrees of informality within contractual labour (Sengupta et al. 2007). Informality stems from a host of often intersectional factors such as educational levels, presence of a written contract, pay schedule and frequency, termination clause, employee benefits, and workplace protection, among others. We made note of these learnings, in addition to the knowledge uncovered in early discussions with plant officials, to understand the overall worker structure at a TPP to arrive at the respondent categories (Table 1). We identified community respondents based on their induced dependency on the plant and their belonging to the surrounding communities.

Table 1 Respondent categories and rationale

Respondent category	Description
Permanent workers	Salaried employees of the TPP; no end date on the contract; have income security; pension upon retirement; and other employee benefits. They were asked about their roles and responsibilities at the TPP; work benefits; educational qualifications; access to formal training; and the work profile of the informal contractual workers in the plant.
Formal contractual workers[19]	Workers who are not on the direct payroll of the TPP and are employed by a contracting company. They were asked about their roles and responsibilities at the TPP; access to social goods and services; access to formal training; alternative livelihood opportunities; and grievance redressal mechanisms.
Informal contractual workers[20]	Workers who are not on the TPP payroll and are employed through local contractors. They were asked about their roles and responsibilities at the TPP; access to social goods and services; access to formal training; alternative livelihood opportunities; and grievance redressal mechanisms.
Induced livelihoods	Workers who earn their livelihoods based on spending by the workers at the TPP and local community members such as local business owners. They were enquired about their occupation; the dependence of their livelihood on the TPP; and alternative employment opportunities present in the vicinity of the TPP.
Local community	Workers who live in the vicinity of the TPP; may or may not have any economic engagement with the power plant. This category was crucial for data triangulation and was enquired about access to job opportunities and socio-economic goods and services in the area.
Contractors	Contractors are identified as private individuals who supply labour to the power plant. They do so either directly, in response to work orders issued by the plant administration, or, indirectly, as subcontractors to larger private companies that the utility has contracted for work in specific division(s). These respondents were asked about their engagement with the power plant; relationship with workers in terms of wage disbursement; training; safety concerns and incidents; diversified sources of income; support offered by the TPP; role in grievance redressal; and potential impact of plant repurposing.
Schools and hospitals	We also surveyed schools (private and government) and health centres in the vicinity of the TPP. These respondents were interviewed to collect information on typical ailments in the local community and access to these facilities by the workers (across categories).

Source: Authors' compilation

19 Information on formal contractual workers was sought from permanent and informal contractual workers. This exception can be attributed to the non-accessibility of formal contractual workers during the feasible hours (daytime only, to keep with safety protocols) of data collection.

20 The informal contractual worker category can also be understood as casual wage labour. As per the National Sample Survey Office (NSSO) definition, casual wage labour is "(a) person who was casually engaged in others' farm or non-farm enterprises (both household and non-household) and, in return, received wages according to the terms of the daily or periodic work contract, was a casual wage labourer" (NSSO 2015). Table 2 of this report discusses these employment characteristics.

Table 2 Worker categories at the TPP

Worker category	Factors determining worker categorisation								
	Contract type	Social security benefits	Source of job	Job Role	Salary range	Salary payment	Education level	Termination clause	Source of skilling for the job
Permanent	Written	Provident fund (PF); gratuity; health care; maternity benefits; compensation on death; accommodation in colony	Competitive exams conducted at the state/ national levels	Includes managerial staff, engineers, and technicians performing supervisory role	INR 50,000/ month; dependent on the Pay Commission	Provided as per the terms of contract	Bachelor's and above	As per the terms of the contract, with a notice period	Formal training on the job and technical education
Formal contractual	Written	Healthcare and PF. Other benefits vary based on the contracting company	Placement through training institutes or through family, friends, and local networks. Clear hiring process of the company.	Assist permanent workers or work in an independent managerial/ engineer/ technician position	INR 20,000/ month	Provided as per the terms of contract	Industrial training institute (ITI)/ diploma; bachelors	As per the terms of the contract	Formal training on the job and technical education
Informal contractual	Written/ verbal	Healthcare and PF. Other benefits vary based on the local sub-contractor	Provided by the contractor through family, friends, and local networks. No clear hiring process.	Work as welders, fitters, gas cutters, etc., doing regular maintenance works	INR 9,000–INR 18,000/ month	Salary given after a delay of 22 days	Higher secondary or below	No notice is provided	Peer-to-peer

Source: Authors' analysis

Table 3 Qualitative survey sample size

S. no.	Respondent category	Sample size
1	Permanent workers	4
2	Informal contractual workers	17
3	Contractors	6
4	Induced workers (male)	7
5	Induced workers (female)	7
6	Local community (male)	3
7	Local community (females)	6
8	Schools	3
9	Hospitals	2
	Total	**55**

Source: Authors' compilation

Since our study focused on worker and community dependency on TPPs, we did not include the workers and communities engaged in allied industries such as fly ash brickwork, cement, etc. We also did not include supplier businesses for two reasons: (i) these products are rarely supplied exclusively to a power plant and (ii) the logistical challenges of having the deliveries coincide with the field visit.

2.5 Data collection and analysis

The data was collected using semi-structured interviews. Separate survey questionnaires were designed to comprehensively understand and map worker and community dependencies for each respondent category (refer to Annexure 1 for the survey questionnaires). A total of 55 semi-structured interviews were conducted using a snowball sampling approach.[21] We selected the sample size using the principle of data saturation. Data saturation is achieved when further interviews with a respondent category are unlikely to provide new information (Guest, Bunce, and Johnson 2006; Sandelowski 2008; Fusch and Ness 2015; Saunders et al. 2018; Grady 1998). For our study, data saturation was considered achieved only when all the researchers involved in data collection reached a consensus through daily debriefs.

In addition, we also held a series of consultations with government officials from the Ministry of Skill Development and Entrepreneurship (MSDE), the National Power Training Institute (NPTI), NITI Aayog, the management at other power plant utilities, and the Skill Council for Green Jobs, especially when framing the recommendations.

Data analysis was conducted at two levels: first, through systematic debriefs during data collection and then through framework analysis. Debriefs were performed with the dual purpose of assessing (i) the quality of data collected, making subsequent amendments to the data collection tool where required to ensure quality responses, and (ii) the saturation of data for determining sample size.

For data analysis, we employed framework analysis. In this method, data is arranged in a framework designed around the themes of enquiry and respondent categories. This method allows data to be analysed by category and theme, through a process of summarisation, which produces a series of themed matrices (Spencer and Ritchie 1994). In our study, the themes of enquiry were dependency and vulnerability. The metrics for dependency were income through jobs or livelihoods directly related to the plant; skills specific to a power plant; employer-related access to social safety; and access to public infrastructure built and maintained by the plant. The metrics for vulnerability were access to upskilling and the role of the employer in locating alternative jobs or providing post-job security such as severance pay, ability to diversify to alternative incomes, existing alternative sources of income, and continued access to any social security benefits (Annexure 2).

3.Study findings: Worker and community dependence on a TPP in India

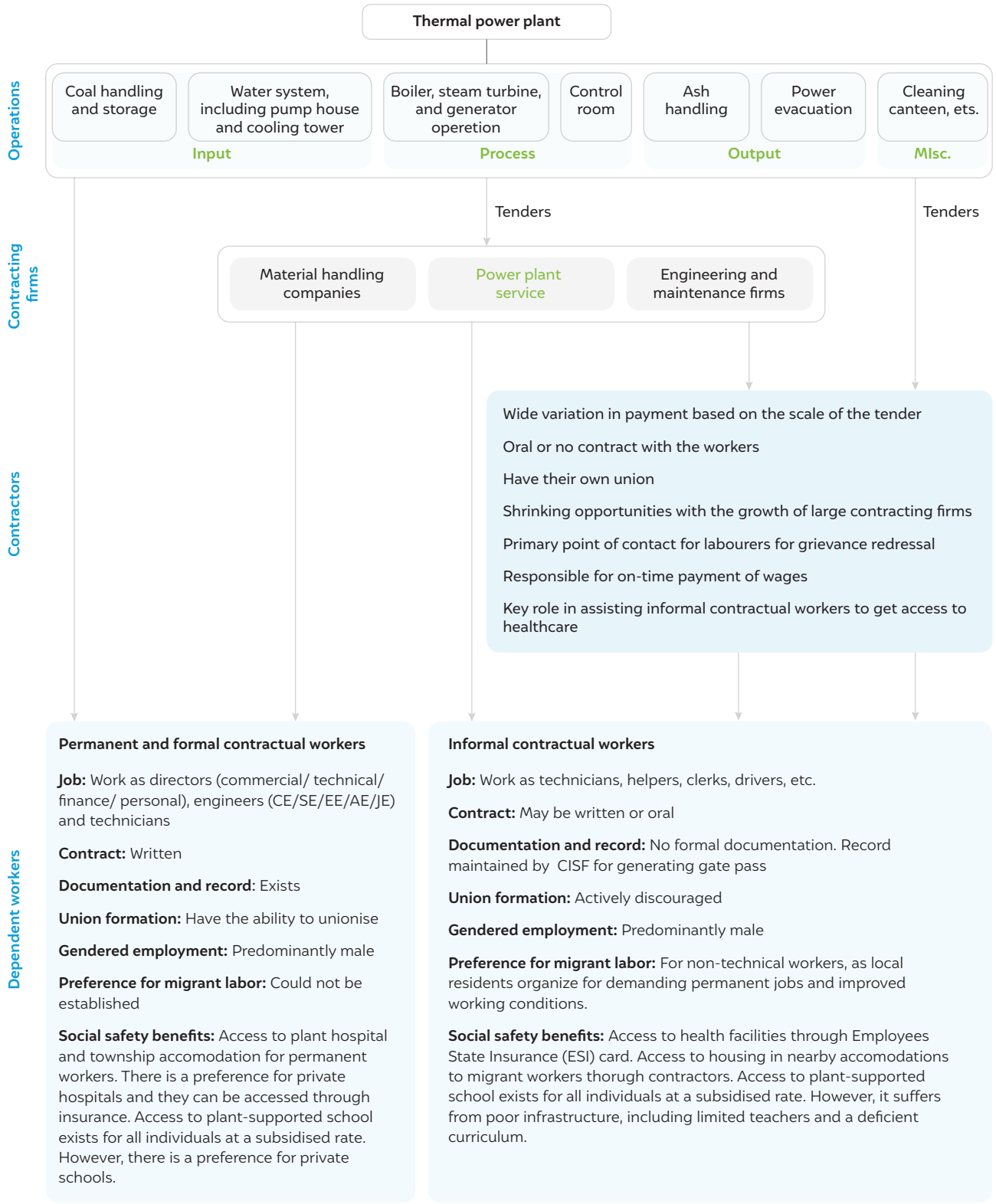
In this section, we present the study analysis in two parts: Section 3.1 is a descriptive analysis of TPP operations and corresponding worker composition and Section 3.2 is an analysis of worker and community dependencies and vulnerabilities in the context of TPP repurposing.

3.1 Examining worker distribution in a TPP

The figure 1 is a diagrammatic cross-section of a thermal power plant along areas of operations and corresponding worker categories.

21 This sample only includes complete interviews. Approximately 15–20 interviews have not been included in the sample size owing to their incompleteness or mistargeted respondents.

Figure 1 A cross-examination of TPP operations



Source: Authors' analysis

Areas of operation in a typical TPP are best considered through three categories: input, process, and output.

- **Input:** Coal and water are two key inputs used by TPPs for generating power. The coal-handling unit at the TPP is responsible for the storage and continuous supply of coal to the boiler. This involves unloading the coal from the truck/wagon; straining it for extraneous substances such as grains and metal dust; crushing and pulverising it to finer particles; storing it; and feeding it into the boiler for combustion. The water treatment and circulation system is responsible for controlling water intake and supplying it for various purposes such as condensing steam, ash handling, and coal dust suppression.
- **Process:** The heat from coal combustion in the boiler is used to transform water into steam, which is then directed towards the turbine. The turbine spins the generator, producing electricity that is then fed into the grid. The operations of all the equipment involved in these processes are managed remotely from the control room.
- **Output:** In addition to electricity, the operation of TPPs also generates hazardous by-products and pollutants such as ash, particulate matter, and sulphur dioxide. These by-products require careful removal and handling. For instance, an ash handling system collects and transports ash to the ash pond, from where it is retrieved and utilised for various purposes, including road construction, mine filling, and brickmaking. Similarly, various emission control technologies are used to mitigate overall pollution levels.

Categories of workers at the TPP

Technical skills in the electrical, power, and electronics domains are essential for all three stages of power generation.[22] The operation and maintenance (O&M) functions are critical to a TPP and are managed under the close supervision of permanent workers, with assistance from formal and informal contractual workers.

Power plant authorities contract companies mainly for three types of services: material handling of coal and ash, operations, and maintenance. These contracting companies in turn provide employees to the TPP to perform technical roles and serve several power plants on rotation over the course of their careers. Local contractors are further subcontracted by these companies or by power plant officials to provide informal contractual workers. These workers perform the technical roles of fitters, welders, and gas cutters or fulfil supportive functions such as maintenance work across the input, process, and output functions of the plant.

In addition, ancillary services such as safety and security, cleaning, cooking, and food services are critical for the smooth operation of TPPs. These are non-technical jobs and are performed by informal contractual workers. Considering these skills are not typical of the power plant and can be useful for any other sector, this study does not evaluate the dependence and vulnerability of workers involved in ancillary services at TPPs.

The power plant surveyed in this study had negligible participation of women in all technical functions. Respondents highlighted that owing to restrictions on women's work near heavy machinery and in night shifts under the Factories Act (1948), women are not hired for technical power plant roles. Notably, this aspect has been internalised among the local women, who do not consider employment in the power plant a viable option.

Local contractors hire workers largely based on non-written contracts and mediate wage negotiations with contracting companies and plant officials. They ensure timely disbursement of wages – typically, wages are disbursed 22 days after the previous wage month – and also help workers access medical care when needed. Local contractors hire mostly based on references from existing workers and the worker's experience and not through assessment of their formal technical skills, educational qualifications, or industrial training institute (ITI) certifications. Workers included in the study also reported having developed their technical skills informally by working with more experienced mentors, that is, through a system of informal apprenticeship. A group discussion with workers revealed their approach to acquiring skills at a power plant:

> "We have all studied until the 8th or 10th standard, then we left our villages to start work here at the age of 20–21 after getting married. We did not know the work at all and learnt it on the job…(points to the person with over 25 years of experience)…he guided us but now we can also guide. (On incentive to guide others) …if I guide and train others, I can show to my seniors that I am skilled and can thus negotiate a better wage."
>
> — Informal contractual worker
> [Translated and paraphrased from Hindi]

22 CEEW analysis based on PLFS 2022–23 (Ministry of Statistics and Programme Implementation, 2023).

It is critical to not disregard informal labour of their skills, despite poor certification or documentation. Identifying their skills will help in upskilling and retaining this human resource pool to fulfil technical functions in a repurposed TPP scenario. In the words of a power plant official on how the management perceives the skills of these workers:

> "If one of the engineers comes and tells us that there is an issue with any of the operations, we definitely verify the complaint before taking action. But if one of them (the informal contractual workers) tells us, we do not need to verify, we act immediately; they know the operations and all the machines the best."
>
> — Permanent worker
> [Translated and paraphrased from Hindi]

When there is no written contract, we observed that the contractor–worker relationship operates on trust. The informal contractual workers comprise migrant workers and local workers. Nonetheless, consultations with officials of other plants suggest that the number of migrant workers does not always exceed the number of local workers, as was the case in the sampled plant. Discussions with contractors and officials at other plants also revealed that some TPPs preferred to work with migrant workers as they were easier to manage than local workers.

Table 3 elaborates on the respondent categories. Understanding these key worker characteristics is important, especially in the context of planning for a worker transition. For instance, the knowledge that informal workers rarely access the formal training offered by government schemes or the NPTI indicates that in case of a repurposing, pathways for formal skill training of workers should be identified. Similarly, a baseline assessment of workers' technical skills[23] is important to identify upskilling opportunities.

3.2 Comparing current dependency on TPPs with vulnerability in the context of a transition

We divide our analysis in two parts: (1) stakeholders who are more vulnerable to a transition and (2) those who are less vulnerable. This categorisation helps to prioritise and differentiate between interventions needed for a citizen-centric transition.

More vulnerable to a transition in terms of loss of jobs and livelihoods

- **All contractual workers are dependent on the plant, but informal contractual workers are more vulnerable than formal contractual workers because they have limited access to skill development:**[24] The two contractual worker categories differ in their pay scales, work benefits, contract durations, and educational qualifications, which are higher for formal contract workers. In the context of a transition, the two categories also differ in their ability to access alternate employment or upskill in case of repurposing. The formal contractual workers will have access to reskilling opportunities through ITIs and diplomas in addition to the retraining offered by certified government bodies such as the NPTI, and short-term training courses. Further, they will also benefit from knowledge of certification processes. On the other hand, informal contractual workers reported that the opportunity cost of enrolling in government schemes (where present) is incompatible with their daily wage earnings. They indicated a preference for module flexibility, with a clear focus on practical on-the-job learning, to be able to bridge the challenge of high opportunity costs.
- **The plant provides significant opportunities for induced employment, and a change in plant operations will impact local livelihoods:** Induced employment opportunities mainly consist of small businesses such as pharmacies and medical services, photo booths, grocery shops,

23 Our study did not conduct a detailed skill mapping exercise to comment on the quality of skills workers possess.

24 A cross-examination of these skills and the extent to which they possess general skills (communication, entrepreneurial, financial, and digital skills) was beyond the scope of this research.

and cycle repair shops, among others. Another source of induced income is renting out local property to contracting companies for worker accommodations. Self-reported incomes are roughly between INR 15,000–INR 20,000 monthly depending on the trade. These induced jobs and livelihoods rely on spending by the workers at the TPP and the local community. One of the units in the sample plant was recently shut down, and respondents reported a drop in income since the need for migrant workers had reduced. Further, should the repurposed plant require fewer workers, induced incomes will also be impacted.

Less vulnerable to a transition in terms of loss of jobs and livelihoods

- **Permanent workers are dependent on the plant but remain less vulnerable to a transition:** Permanent workers are dependent on the plant for their immediate employment. However, their combination of technical and managerial skills makes their skills transferable and applicable to industries other than TPPs. In other words, owing to their skills, permanent workers can find alternate employment in other sectors that require a similar skill set. In addition, in state and central power plants, the parent authority supports retraining or relocation of its employees. If alternate employment is not provided, either owing to the workers' technical skills or a misalignment in the required ratio of workers, severance pay offers a safety net for these workers.
- **Local contractors, who supply labour and rent machinery to the TPP are dependent on the plant but are less vulnerable:** Section 3.1 of the report discusses the role of contractors and their relationship with the contracted workers. In addition, responses from contractors suggest that their incomes are dependent on the TPP and ancillary industries – such as the cement and brickmaking industries – that are typically close to a TPP. These incomes are accrued through the supply of labour but also from renting equipment to the TPP.

  In case of a transition, their incomes will be less affected owing to accumulated capital and the ability to provide labour for other industries. They will have the relative ability to diversify to other economic opportunities and trades.

- **Local community dependence is varied and also conditional on access to the educational and healthcare services provided by the plant:** Our study found that the local community does not have sufficient employment opportunities at the plant. The TPP imposes a negative externality on the community, as the air and water pollution caused by plant operations directly impact their health and livelihoods. For instance, the local population reported that they could not practise agriculture as an alternative livelihood due to poor groundwater quality and the depositing of fly ash on crops, which affects their growth.

  Women reported a high willingness to work in micro trades; however, they also shared that they have very limited employment opportunities in the region. They suggested a host of reasons for this, including the significant distance from the nearest town, high pollution levels, and restrictions on commercial activity that can be undertaken around the plant premises.

  Interviews with the local population, doctors, and healthcare personnel also suggested the prevalence of a range of physical illnesses that some doctors suggested are typical to regions hosting power plants. Several studies have corroborated the direct and indirect impact that living in the vicinity of a TPP has on human health due to noxious emissions and water and food contamination (Conservation Action Trust 2014; Gupta and Spears 2017). Illnesses chiefly include respiratory disorders, skin diseases, cardiovascular problems, and various cancers including those of the lungs and skin (Badman and Jaffé 1996; Yadav and Hopke 2020; Jena and Singh 2017; Munawer 2018).

  In the words of a resident describing their relationship with the plant:

> "The plant took from us and does not give anything in return, not even free electricity. For at least the immediate surroundings, they can give us free electricity; we don't have the option to farm, we suffer due to poor water, and breathe this (polluted) air."
>
> — Local community member
> [Translated and paraphrased from Hindi]

  In the context of a power plant transition or repurposing, depending on the repurposing option and environmental compliances therein, the environmental impact will be relatively positive in terms of potentially reduced pollution of natural resources.

4. Recommendations

Our analysis highlights the need for both retraining vulnerable worker categories so that they can secure work in the repurposed plant and enabling access to alternate employment. Our recommendations are designed to address these core needs through a range of response mechanisms including those that can be adopted by TPP authorities. These mechanisms have been drafted based on extensive consultations with industry experts to ensure feasibility and practicality.

With regards the timeline to implement these recommendations, we propose that these steps be undertaken when the technical repurposing option is being identified or decommissioning is being considered. This alignment will enable coherent planning for both, the technological aspects of TPP repurposing or decommissioning, and the citizen-centric measures necessary to enable its adoption.

Our recommendations are built at two levels: the first three recommendations require the involvement of a range of actors, including multilateral development banks (MDBs) and power sector skill council. The other three recommendations are more specific for the plant authorities.

- **Align funding and facilitate ease of access to skill development and social safety initiatives:** When repurposing a TPP, there will be a need to retain human resources either for their skills or because they are part of the local population. While the quantum of workers that need to be retained will be determined by the labour intensity and technology adopted for the repurposing, the workers will require upskilling. A citizen-centric, inclusive plan will provide for the reskilling of the remaining manpower as well – those who cannot be upskilled to secure work in the repurposed scenario – so that they will be able to access job opportunities outside the TPP. It is imperative to align the spending of state and centrally sponsored programmes, CSR and support from MDBs to catalyse these skill development activities.

> A baseline skills assessment is imperative to know the level of skills training needed for each worker category.

For impacted communities to access existing social safety schemes, there is a need to (i) implement campaigns to spread awareness regarding consolidated databases such as mySchemе and UMANG, which list all the existing social safety schemes in the district, and (ii) engage community resource persons to enrol households in relevant schemes such as the *Pradhan Mantri Shram Yogi Maandhan* (PMSYM) for old age protection and social security of unorganised workers, the *Employee State Insurance Scheme* to provide medical benefits to workers, and the *PM Garib Kalyan Anna Yojana* to enable them to access to ration, among others.

- **Design worker-responsive skill development programmes:** A significant share of the on-the-job learning for contractual workers is acquired through peer-to-peer formats. The TPP, in collaboration with the Power Sector Skill Council, can conduct recognition of prior learning (RPL) drives to certify and endorse workers' existing skills, improving their future employability and remuneration. The RPL exercise also helps set a baseline for existing skills, which can then be improved as per the needs of the repurposing technology. Further, to improve participation among retrenched workers, skill development initiatives must complement their existing skill sets. In addition to the existing placement-related targets established under the Common Norms for Skill Development Schemes, monetary incentives can also be provided to training partners engaged in upskilling TPP workers for employment in related industries (GoI 2015). To encourage workers to enrol in and stick with skill training, programmes should communicate prior to enrolment the work opportunities and wage returns they can gain following the training.

- **Develop clear gender metrics alongside skill development programmes:** Although the TPP had negligible employment of women workers, the local female community expressed a desire for employment opportunities close to their homes. Thus, both the baseline assessment and skill development programmes must be gender-sensitive and consider the local community. We propose that such an exercise should have two aims: one, to develop their skills for roles at the repurposed power plant, and, two, to be able to access employment (including self-employment) outside of the power plant. While the survey must include a gender-disaggregated

assessment of skill perceptions and aspirations among women, the skill development programme must include training for roles that are otherwise male-dominated – such as managing the control room or operating machinery – but are still compliant with the Factories Act (1948). In alignment with the *National Policy for Skill Development* (2015), the training format (for roles both within and outside of the repurposed power plant) must offer flexibility options such as non-residential, hybrid, and self-paced modes of learning to ensure greater participation of women in skilling initiatives (MSDE 2015). Developing a gender metric for each of the initiatives will be an important step in monitoring their performance.

Several of these ecosystem-driven efforts will also need the involvement of the TPP itself. These include:

- **Commission independent, third-party entities to conduct a baseline skills assessment survey amongst informal workers and the local community:** This baseline survey should address the information gap on (i) the number of informal contractual workers working at the TPP on average when the plant is operating close to its average plant load factor, (ii) documentation of existing informal worker skill sets (in comparison to the standards of performance provided by the National Occupation Standards and Qualification Pack for each job role), and (iii) a comparison of these skills and the skill development requirements for either working in the TPP repurposing option identified by the plant or in a relevant alternate industry. The survey can be commissioned in collaboration with sector skill councils and the district skill committee and can also be expanded to cover community members who are indirectly dependent on the power plant for jobs and livelihoods.

- **Maintain a skills information portal at the plant level:** Following the third-party survey, a single-source/single-window management information system (MIS) portal should be created to serve as a user-friendly platform to aggregate information on (i) the skills required across worker categories, including for permanent workers in management and operations, to implement the repurposing option, (ii) employment opportunities and skill requirements in alternative industries in the region, and (iii) the relevant government skill development programmes and affiliated training partners that can be accessed within the district to upskill workers. This portal, connected with myScheme and UMANG, can also be utilised by contractors, since they will be identifying, training, and supplying workers to the repurposed plant.

- **Redistribute benefits from the repurposed plant for the local community:**[25] Historically, coal phasedown has encountered social resistance due to communities' dependence on the sector for livelihood opportunities (Wong, Roser, and Maxwell 2022). Repurposing existing assets for alternative energy uses will allow for the reemployment of a part of the existing workforce and continue to create demand for small businesses in the vicinity. Additionally, countries are increasingly rolling out transition support mechanisms, such as economic diversification strategies and reskilling initiatives, in coal-dependent regions (The World Bank 2022; Stanley 2021; European Commission n.d.; The White House 2023). For instance, if the plant is repurposed to be a biomass-based plant, the local community must be able to accrue gainful employment through extensive skill development initiatives.

Further, if there are practical limitations to offering employment, the provision of social infrastructure that is accessible by the community is recommended. Such infrastructure may include the extension of healthcare services for ailments typical to the region and quality primary and secondary educational services with scholarships for specialised education. Developing and maintaining the physical infrastructure of these regions, such as access to electricity, water, and roads – each of which stands to contribute to the economic development of the community – must be emphasised.

Our study intended to examine worker and community dependency on a TPP. The intention was not to provide a holistic JT framework for TPPs, since such a framework would need to provide clear demarcations for areas of intervention, identify the corresponding governance approach for these areas, and offer financial estimations and pathways to meet these needs. The study focused on citizen-centric considerations rather than an environmental impact assessment or an analysis of regulations adequacy for repurposing TPPs. Our study helps lay out the clear areas of intervention required for worker and community-centric planning for TPP repurposing. In explaining worker and community dependency, it also highlights that planning for a JT of TPPs will require a different approach than planning for the transition of coal mines.

25 Our recommendations do not include environmental cleanup since these are covered under the consents and permissions required under various acts including the 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); and Construction and Demolition Waste (Management) Rules (2016).

References

Badman, David G., and Ernst R. Jaffé. 1996. "Blood and Air Pollution: State of Knowledge and Research Needs." *Otolaryngology - Head and Neck Surgery* 114 (2): 205–8. DOI: 10.1016/S0194-59989670166-3.

Banerjee, Srestha. 2022. *Just Transition of Unprofitable and End-of-Life Mines: A Legal Assessment*. New Delhi: International Forum for Environment, Sustainability & Technology. https://iforest.global/wp-content/uploads/2022/11/Just-Transition-of-Unprofitable-and-End-of-Life-Mines_.pdf

Banerjee, Srestha, Chinmayi Shalya, and Diana Ann Joseph. 2022. *Korba: Planning a Just Transition for India's Biggest Coal and Power District*. New Delhi: International Forum for Environment, Sustainability & Technology. https://www.ijtc.org.in/wp-content/uploads/2022/04/Korba-Report.pdf.

Bhushan, Chandra, Mandvi Singh and Yukti Chaudhary. 2022. *Just Transition Of Power Plants In India: A Policy And Regulatory Review.* New Delhi: International Forum for Environment, Sustainability & Technology. https://chandrabhushan.net/wp-content/uploads/2023/01/Just-Transition-of-coal-based-power-plants-in-India.pdf.

Bhushan, Chandra, Srestha Banerjee, Chinmayi Shalya, and Deeksha Pande. 2022. *Angul: Planning a Just Energy Transition and a New Green Economy*. New Delhi: International Forum for Environment, Sustainability & Technology. https://iforest.global/wp-content/uploads/2022/11/Angul-Planning-a-Just-Energy-Transition-and-a-New-Green-Economy_.pdf.

CEA. 2015. *Report on Replacement of Old & inefficient Sub Critical Units by Super Critical Units/ Retirement / Renovation.* New Delhi: Central Electricity Authority. https://cea.nic.in/wp-content/uploads/2020/04/report_subcritical_sep2015.pdf.

___. 2022. *Norms for Manpower Requirement in Thermal Power Sector.* New Delhi: Central Electricity Authority. https://cea.nic.in/wp-content/uploads/tpm_i/2023/06/FINAL_report_of_the_committee_on_manpower_requirement_norms_in_thermal_power_sector.pdf

___. 2023. *National Electricity Plan (Volume I) Generation*. New Delhi: Central Electricity Authority. https://cea.nic.in/wp-content/uploads/irp/2023/05/NEP_2022_32_FINAL_GAZETTE-1.pdf

___. 2024. *All India Installed Capacity (In Mw) Of Power Stations*. New Delhi: Central Electricity Authority. https://cea.nic.in/wp-content/uploads/installed/2024/02/IC_Feb_2024allocation _wise.pdf.

CEEW, CSTEP, ICLEI, Vasudha Foundation, and WRI India. n.d. "GHG Platform INDIA." Last accessed on May 28, 2024. https://www.ghgplatform-india.org/energy-sector/.

Conservation Action Trust. 2014. *Coal Kills: Health Impacts of Air Pollution from India's Coal Power Expansion.* Maharashtra: Conservation Action Trust. https://www.indiaairquality.info/wp-content/uploads/docs/Air%20Pollution%20from%20India%20Coal%20TPPs%20-%20LowRes.pdf

Dsouza, Swati. 2021. *Global Coal Transitions: Past and Present: Review of Policies, Processes and Politics*. New Delhi: National Foundation for India. https://www.nfi.org.in/sites/default/files/publication/gct.pdf.

Dsouza, Swati, and Kavya Singhal. 2021. *Socio-Economic Impacts of Coal Transitions in India: Bottom-up Analysis of Jobs in Coal and Coal-Consuming Industries*. New Delhi: National Foundation for India. https://nfi.org.in/sites/nfi/files/publication/cti.pdf.

European Commission. n.d. "EU Coal Regions in Transition." Last accessed on May 28, 2024. https://energy.ec.europa.eu/topics/oil-gas-and-coal/eu-coal-regions-transition_en.

Fossey, Ellie, Carol Harvey, Fiona Mcdermott, and Larry Davidson. 2002. "Understanding and Evaluating Qualitative Research." *Australian & New Zealand Journal of Psychiatry* 36 (6): 717–32. DOI: https://doi.org/10.1046/j.1440-1614.2002.01100.x.

Fusch, Patricia I., and Lawrence R Ness. 2015. "Are We There Yet? Data Saturation in Qualitative Research." *The Qualitative Report* 20 (9): 1408–16. DOI: https://doi.org/10.46743/2160-3715/2015.2281.

Grady, Michael P. 1998. *Qualitative and Action Research: A Practitioner Handbook*. London. Bloomington: Phi Delta Kappa International. https://search.worldcat.org/en/title/41516219.

Grover, Simran and Naini Swami. 2023. *Understanding Socio-Economic Complexities and Intersectionality in Thermal Power Plants: A Case of Kota Super Thermal Power Station.* Rajasthan: Centre for Energy, Environment and People. https://ceep.co.in/wp-content/uploads/2023/12/NavigatingEnergyTransitionTPPs.Online.301123.pdf

Guest, Greg, Arwen Bunce, and Laura Johnson. 2006. "How Many Interviews Are Enough? An Experiment with Data Saturation and Variability." *Field Methods* 18 (1): 59–82. DOI: https://doi.org/10.1177/1525822X05279903.

Gupta, Aashish and Dean Spears. 2017. "Health Externalities of India's Expansion of Coal Plants: Evidence from a National Panel of 40,000 Households." *Journal of Environmental Economics and Management* 86: 262-276. DOI: 10.1016/j.jeem.2017.04.007

Gupta, Ruchi. 2021. *Mapping the Impact of Coal Mines and Their Closure: A Case of Betul*. New Delhi: The Energy and Resources Institute. https://www.teriin.org/sites/default/files/2021-03/Mapping-Impact-of-Coal-Mines-Case-of-Betul.pdf.

Jena, Sridevi, and Gurdeep Singh. 2017. "Human Health Risk Assessment of Airborne Trace Elements in Dhanbad, India." *Atmospheric Pollution Research* 8 (3): 490–502. DOI: https://doi.org/10.1016/j.apr.2016.12.003.

Lahiri-Dutt, Kuntala. 2014. *The Coal Nation: Histories, Ecologies and Politics of Coal in India*. New Delhi: Routledge. DOI: https://doi.org/10.4324/9781315614793.

Manchanda, Harish. 2022. "Power Sector: Stumbling Block in India's Net-zero Journey." *Observer Research Foundation*, September 26, 2022. https://www.orfonline.org/expert-speak/power-sector-stumbling-block-in-indias-net-zero-journey McCauley, Darren, Vasna Ramasar, Raphael J. Heffron, Benjamin K. Sovacool, Desta Mebratu, and Luis Mundaca. 2019. "Energy Justice in the Transition to Low Carbon Energy Systems: Exploring Key Themes in Interdisciplinary Research." *Applied Energy* 233–234: 916–21. DOI: 10.1016/j.apenergy.2018.10.005.

Ministry of Coal. 2022. "Coal Demand Likely to Peak Between 2030-2035." *Press Information Bureau*, December 21, 2022. https://www.pib.gov.in/PressReleaseIframePage.aspx?PRID=1885381.

MSDE. 2015. *Common Norms for Skill Development*. New Delhi: Government of India. https://msde.gov.in/sites/default/files/2019-10/Common%20Norms%20for%20Skill%20Development%20Schemes%20implemented%20by%20Government%20of%20India.pdf.

MSDE. 2015. *National Policy for Skill Development and Entrepreneurship*. 2015. New Delhi: Ministry of Skill Development and Entrepreneurship, Government of India. https://msde.gov.in/sites/default/files/2019-09/National%20Policy%20on%20Skill%20Development%20and%20Entreprenurship%20Final.pdf.

Munawer, Muhammad Ehsan. 2018. "Human Health and Environmental Impacts of Coal Combustion and Post-Combustion Wastes." *Journal of Sustainable Mining* 17 (2): 87–96. DOI: https://doi.org/10.1016/j.jsm.2017.12.007.

Ministry of Statistics and Programme Implementation. 2015. *Employment and Unemployment Situation Among Social Groups in India*. New Delhi: Ministry of Statistics and Programme Implementation, Government of India. https://mospi.gov.in/sites/default/files/publication_reports/nss_rep_563_13mar15.pdf.

Ministry of Statistics and Programme Implementation. 2023. *Periodic Labour Force Survey (PLFS), July, 2022- June,2023*. New Delhi: Ministry of Statistics and Programme Implementation, Government of India. https://microdata.gov.in/nada43/index.php/catalog/179.

Mitra, Jayanta, Apoorva Singh and Arpita Victor. 2023. *Just Transition Framework for a Sustainable Future in India's Coal Mining Regions*. New Delhi: The Energy and Resources Institute. https://teriin.org/sites/default/files/2024-02/Just%20Transition%20Framework%20for%20a%20Sustainable%20Future%20in%20India%E2%80%99s%20Coal%20Mining%20Regions.pdf

NITI Aayog. 2022. *Report of the Inter-Ministerial Committee on Just Transition from Coal*. New Delhi: NITI Aayog. https://www.niti.gov.in/sites/default/files/2022-11/Report_Just-Transition-Committee_compressed.pdf

Njie, Baboucarr, and Soaib Asimiran. 2014. "Case Study as a Choice in Qualitative Methodology." *IOSR Journal of Research & Method in Education* 4 (3): 35–40. DOI: 10.9790/7388-04313540.

Pai, Sandeep, Ian Barlow, Mary Margaret Allen, Kira O'Hare, Hugh Searight, Rahul Madhusudanan, and Micheal Ward. 2021. *Understanding Just Transitions in Coal Dependent Communities: Case Studies from Mpumalanga and Jharkhand*. Washington D.C.: Center for Strategic and International Studies. https://www.csis.org/analysis/understanding-just-transitions-coal-dependent-communities.

Rebolj, A. Biba. 2013. "The Case Study As A Type Of Qualitative Research." *Journal of Contemporary Educational Studies*. 28–43.

Sandelowski, Margarete. 2008. "Theoretical Saturation." In *The SAGE Encyclopedia of Qualitative Research Methods*, edited by L. M. Given, 875–76. Thousand Oaks: Sage. DOI: https://doi.org/10.1111/j.1365-2648.2008.04813.x.

Sandhu, Sondeep Singh. 2016. "Contractual employees hold protest against thermal plant closure in Bathinda." *Hindustan Times*. https://www.hindustantimes.com/punjab/contractual-employees-hold-protest-against-thermal-plant-closure-in-bathinda/story-pgulIuntKBRoYJteOlK82L.html

Saunders, Benjamin, Julius Sim, Tom Kingstone, Shula Baker, Jackie Waterfield, Bernadette Bartlam, Heather Burroughs, and Clare Jinks. 2018. "Saturation in Qualitative Research: Exploring Its Conceptualisation and Operationalisation." *Quality & Quantity* 52 (4): 1893–1907. DOI: https://doi.org/10.1007/s11135-017-0574-8.

Sengupta, Arjun, K. P. Kannan, R. S. Srivastava, V. K. Malhotra, T. S. Papola, and B. N. Yugandhar. 2007. *Report on Conditions of Work and Promotion of Livelihoods in the Unorganised Sector*. New Delhi: National Commission for Enterprises in the Unorganised Sector. https://ruralindiaonline.org/en/library/resource/report-on-conditions-of-work-and-promotion-of-livelihoods-in-the-unorganised-sector/

Spencer, Jane, and Liz Ritchie. 1994. "Qualitative Data Analysis for Applied Policy Research." In *Analysing Qualitative Data*, edited by A. Bryman and R. Burgess, 192–214. London: Routledge.

Stanley, Michael. 2021. *Supporting Transition in Coal Regions: A Compendium of the World Bank's Experience and Guidance for Preparing and Managing Future Transitions*. Washington, D.C.: The World Bank.

The New Indian Express. 2021. "Economic Blockade to Protest Closure of TTPS." https://www.newindianexpress.com/states/odisha/2021/Apr/07/economic-blockade-to-protest-closure-of-ttps-2286937.html.

The White House. 2023. *Building a Clean Energy Economy.* Washington D.C.: The White House. https://www.whitehouse.gov/wp-content/uploads/2022/12/Inflation-Reduction-Act-Guidebook.pdf.

The World Bank. 2022. *Eskom Just Energy Transition Project*. Johannesburg: Eskom Holdings SOC LTD. https://documents1.worldbank.org/curated/en/099710010022235233/pdf/P177398075455806oa5e20db9f5d324a4c.pdf
Just Transition for All: The World Bank Group's Suport to Countries Transitioning Away from Coal". Accessed June 24. https://www.worldbank.org/en/topic/extractiveindustries/justtransition

Wong, Jamie, Frauke Röser, and Victor Maxwell. 2022. *Coal Phase-out and Just Transitions.* Berlin: New Climate Institute. https://newclimate.org/sites/default/files/2022-11/coal_phase_out_paper_nov_2022.pdf.

Yadav, Akhilesh Kumar, and Philip Karl Hopke. 2020. "Characterization of Radionuclide Activity Concentrations and Lifetime Cancer Risk Due to Particulate Matter in the Singrauli Coalfield, India." *Environmental Monitoring and Assessment* 192 (11): 1-13. DOI: 10.1007/s10661-020-08619-1.

Scan to view the annexures

The authors

Gunjan Jhujhunwala
gunjan.jhunjhunwala@ceew.in / 𝕏 @GunjanJ3

Gunjan works as the Programme Lead in the Energy Transitions team at The Council. Her focus is on defining the contours of the equity-driven energy transition in the Indian context, especially in relation to the political economy and policy landscape of the country as well as in response to global conversations.

Tarun Mehta
tarun.mehta@ceew.in / 𝕏 @Taarun_Mehtaa

Tarun works as a Programme Associate with the Power Markets team at The Council. His research involves forecasting India's short-medium term coal demand for the power sector from a resource adequacy perspective and unpacking the socio-economic dependencies created by coal in the fossil fuel-rich regions of the country.

Ganesh Dileep
ganesh.dileep@ceew.in

Ganesh works as the CEO's Chief of Staff at The Council. They provide strategic and tactical support for the CEO's executive functions, including institutional advancement, external and internal engagements, and strategic research.

Muskaan Malhotra
muskaanmalhotra12@gmail.com / 𝕏 @MalhotraMusk

Muskaan worked as a Research Analyst in the Power Markets team at The Council. She focused on developing a robust demand-side ecosystem of electricity consumption throughout the end use value chain, boosting energy-efficiency and energy-saving measures.

Suggested citation: Jhunjhunwala, Gunjan, Tarun Mehta, Ganesh Dileep, and Muskaan Malhotra. 2024. *Assessing Worker and Community Dependence on Thermal Power Plants: A Case Study*. New Delhi: Council on Energy, Environment and Water.

Disclaimer: The views expressed in this study are those of the authors and do not necessarily reflect the views and policies of the Council on Energy, Environment and Water.

Peer reviewers: Mohil Mittal, Deputy General Manager (International Business/Business Advisory), NTPC Limited; Suravee Nayak, Associate Fellow, Sustainable Futures Collaborative; Karthik Ganesan, Fellow and Director - Strategic Partnerships, CEEW; and Dr Vaibhav Chaturvedi, Senior Fellow, CEEW.

Publication team: Kartikeya Jain (CEEW); Alina Sen (CEEW); Madre Designs; and Friends Digital Colour Solutions.

Acknowledgment: The authors of this study would like to express their gratitude to the officials at the thermal power plant for extending their support to the study and to the respondents who gave us their valuable time and shared their stories with us. We also acknowledge Priya Yadav, former consultant; Vanya Pandey, Research Analyst, CEEW; and Ayushi Saharan and Samaja Penumaka, former interns, CEEW for the early analysis of data and support for data collection and on-ground consultation.

Organisation: The **Council on Energy, Environment and Water** (CEEW) is one of Asia's leading not-for-profit policy research institutions and among the world's top climate think tanks. The Council uses data, integrated analysis, and strategic outreach to explain — and change — the use, reuse, and misuse of resources. The Council addresses pressing global challenges through an integrated and internationally focused approach. It prides itself on the independence of its high-quality research, develops partnerships with public and private institutions, and engages with the wider public. CEEW has a footprint in over 20 Indian states and has repeatedly featured among the world's best-managed and independent think tanks. Follow us on X (formerly Twitter) @CEEWIndia for the latest updates.

COUNCIL ON ENERGY, ENVIRONMENT AND WATER (CEEW)

ISID Campus, 4 Vasant Kunj Institutional Area
New Delhi - 110070, India
T: +91 (0) 11 4073 3300

info@ceew.in | ceew.in | 𝕏 @CEEWIndia | ceewindia

Scan to download the study