

Vichaar-Vimarsh **JUST** Transition NEWSLETTER

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INTERNATIONAL PERSPECTIVES ON JUST COAL TRANSITION

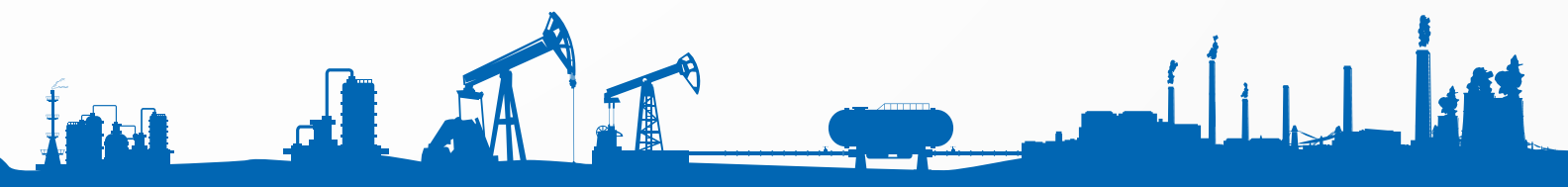
Message from the Desk of Senior Director, TERI

TERI is delighted to present the ninth edition of Vichaar-Vimarsh: Just Transition Newsletter, themed "International Perspectives on Just Coal Transition." As countries across the world accelerate their climate ambitions, transitioning away from coal has emerged as a critical component of achieving net-zero goals. However, facilitating a fair, inclusive, and equitable transition remains a significant challenge.

Experiences from different countries suggest that just transition pathways are shaped by diverse socio-economic and institutional contexts. Nevertheless, several common lessons emerge, highlighting the importance of stakeholder engagement, economic diversification, social protection measures, and long-term strategic planning.

Through this edition, we seek to bring together global experiences, policy innovations, and emerging research to foster cross-country learning and enrich the discourse on just coal transition. We hope this issue stimulates meaningful dialogue and contributes towards building resilient transition pathways that leave no worker, community, or region behind.

A K Saxena
Senior Director
Electricity and Renewables Division

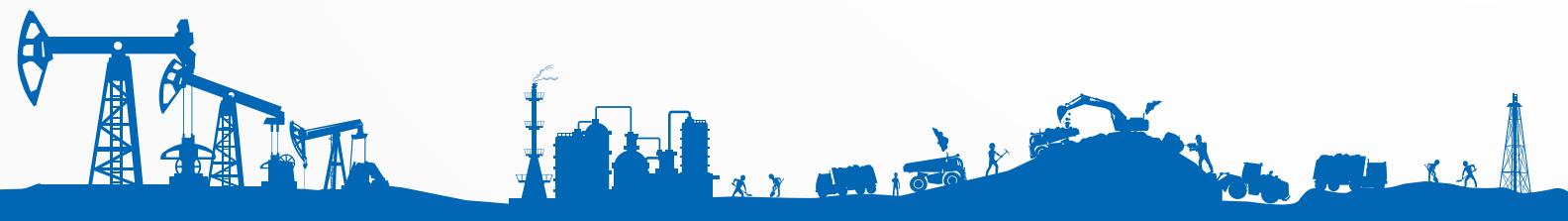




Local community members sorting pilfered coal to sell in local markets in Giridih, Jharkhand

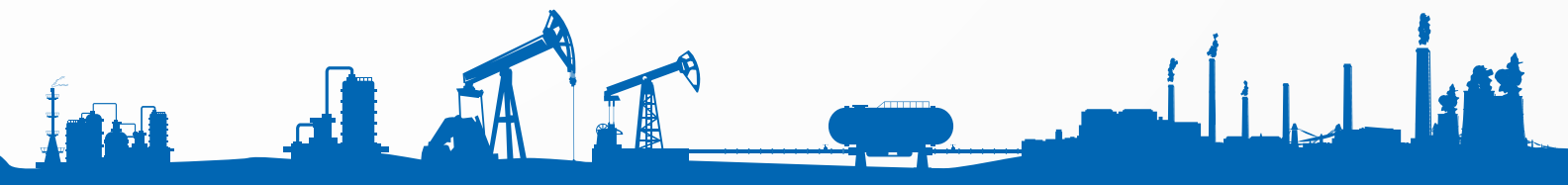
“Despite the world being up to seven times richer in gross domestic product in the last 30 years, labour’s share is like a roller coaster going down. The shared prosperity that the world should function on simply doesn’t exist. So, we need equality in terms of income as well as gender and race. And we need inclusion, including multilateral reform in line with a just transition model so that we are not creating further inequalities.”

- Sharan Burrow
Former General Secretary, International Trade Union Confederation



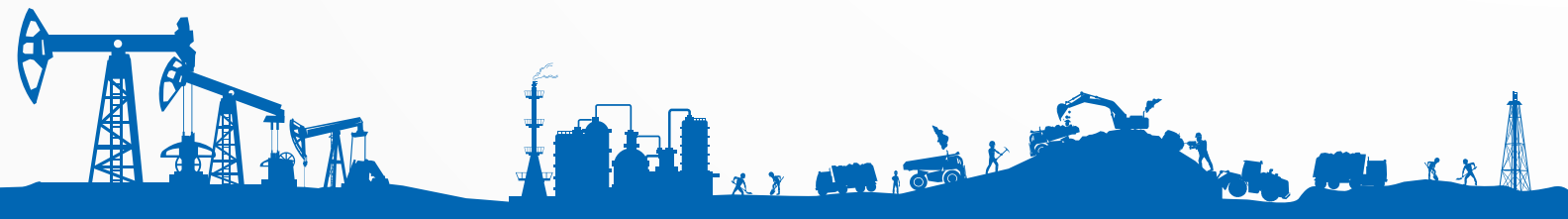
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A Landscape view of the Mine II, NLC India Limited, Tamil Nadu, India



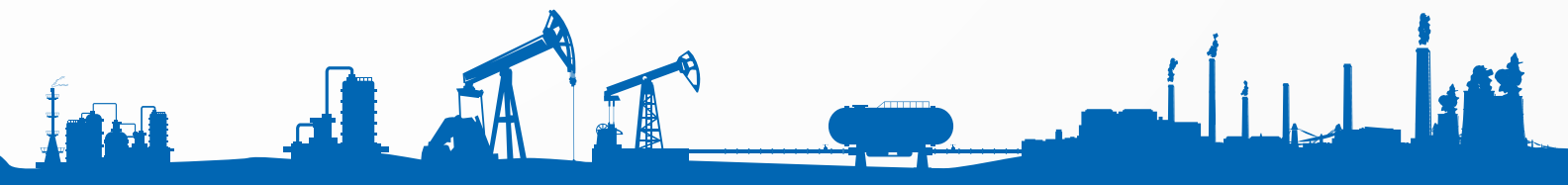
Editorial

The global discourse on just transition has evolved significantly in recent years, with countries across the world exploring diverse pathways to transition away from fossil fuel while safeguarding livelihoods, ensuring energy security, and fostering regional resilience. As climate ambitions intensify, understanding these varied experiences has become increasingly important for informing equitable and context-specific transition strategies.

This edition of Vichaar-Vimarsh brings together international perspectives on just coal transition, highlighting experiences, policy approaches, and lessons from different regions. While socio-economic and political contexts differ across countries, several common themes emerge, including the need for inclusive governance, social protection, economic diversification, and long-term planning.

Through articles, case studies, and expert insights, this issue seeks to facilitate cross-country learning and contribute to the growing body of knowledge on just transitions. We hope the perspectives presented in this edition encourage critical reflection and inspire innovative approaches to advancing equitable and sustainable coal transition pathways in India and beyond.

- Jayanta Mitra, PhD, Senior Fellow, TERI



AUSTRALIA'S COAL TRANSITION: POLICY LESSONS FROM THE LATROBE VALLEY

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Figure 1.1: Yallourn coal mine

Introduction

Policy momentum for decarbonization is accelerating in Australia, with national commitments to reduce greenhouse gas emissions by 63–70% by 2035 and reach net zero by 2050 (Australian Government Department of Climate Change, 2025). Despite being one of the world's largest exporters of metallurgical coal, with coal revenues contributing significantly to the national economy,

Australia is gradually phasing out coal-fired power generation through the decommissioning of plants and the closure of ageing assets (Australia, 2025).

Coal mining and power generation in Australia are concentrated in regional areas, including the Hunter Valley in New South Wales, Latrobe Valley in Victoria, and the Bowen Basin in Queensland (Della Bosca & Gillespie, 2018). In this piece, we share lessons from the sudden closure of the Hazelwood Power Station



in the Latrobe Valley. The case highlights the need for governance frameworks that support anticipatory, coordinated, and place-based approaches to navigate the complexities of closure-related development challenges. These challenges are particularly acute in regions that have maintained long-standing social and economic dependencies on coal extraction and use.

The Latrobe Valley and Hazelwood Closure

Known as the powerhouse of Victoria, the Latrobe Valley has been at the centre of brown coal-fired power generation in Australia (Musil & Gerrard, 2024). The region historically hosted three large coal-fired power stations: Loy Yang A and B, Yallourn, and the Hazelwood Power Station, alongside their respective open-cut mines (Coenen et al., 2018). From the beginning of large-scale region-wide coal extraction in the 1920s, electricity generation was managed by the State Electricity Commission of Victoria, including the construction of Hazelwood in the 1960s. For decades, this coal-fuelled industrial system fundamentally shaped local and regional patterns of employment, settlement, and regional identity (Coenen et al., 2018).

This arrangement continued until the 1990s. Thereafter, the privatization of the electricity sector fundamentally altered the region's character. The shift to private ownership contributed to rapid socio-economic disadvantage in the region, marked by large-scale unemployment, out-migration, and the erosion of institutional mechanisms that had previously supported structural disturbances (Duffy & Whyte, 2017). These experiences of disadvantage were further exacerbated by the Hazelwood mine fire, which lasted 45 days, and played an important role in the subsequent closure of the Hazelwood power station in 2017, announced with only five months' notice to the regional government and communities (Reeves et al., 2022).

Latrobe's Transition Insights

Looking back, this experience offers four insights into the key policy issues that emerged after the closure. Although drawn from a single case in the Latrobe Valley, the experiences represent broader policy challenges that will resonate with communities undergoing coal-related transitions elsewhere.

THIS SUDDEN CLOSURE OF THE POWER STATION UNSETTLED THE COMMUNITY IN WAYS THAT CONTINUE TO INFLUENCE THE REGION TODAY.

1. Closure timing

The sudden closure of the power station generated considerable mistrust within the community, with locals interpreting the shutdown as abandonment, compounding earlier disruptions from the privatization in the 1990s (Reeves et al., 2022). The limited five-month notice also constrained opportunities for inclusive dialogue and meaningful consultation, contributing to feelings of neglect and resentment (Duffy & Whyte, 2017). It provided little scope to bring early attention to areas such as workforce transition, retraining, and regional planning, including maintaining public services and infrastructure.

2. Economic diversification and regional resilience strategy design

Lack of economic diversification is one of the major reasons for community vulnerability in many coal-dependent regions undergoing transition (Sharma et al., 2021; Weldegiorgis, 2025). Due to the coal industry's labour-intensive nature and its presence in mostly remote or regional mining towns, there is a strong tendency for these regions to turn into mono-industrial settings in which systems of labour, land, and capital become oriented towards a single sector (Niftiyev, 2024).

In the Latrobe Valley, while alternative economic diversification pathways existed in the paper mills, timber, and food processing industries, the regional economy remained primarily tied to coal-fired power generation (Holm & Eklund, 2020). After the Hazelwood power station closed, economic diversification became an urgent, region-wide priority.

As a result, the Latrobe Valley Authority was created to oversee a transition-focused agenda centred on new energy, food and fibre, health, and allied sectors. Two of the earliest measures undertaken by the Authority included the mapping of a 'Smart Specialization' strategy that identified regional strengths and long-term investment priorities, and the 'New Energy Jobs and





Figure 1.2: Loy Yang coal mine and power plant in Latrobe

Investment Prospectus, which promoted clean-energy employment and attracted pilot projects including a wind farm, a magnesium-recovery plant, and an electric-vehicle factory (Feigl et al., 2019).

3. Reactive public spending

After the power station's closure, both the federal and state governments stepped in with significant public investment packages. The Victorian state government announced a A\$266 million package, the largest investment package in the state's history, to lead integrated support for labour market adjustment and economic renewal. This led to the creation of the Latrobe Valley Authority, responsible for programme design and delivery. The federal government also made an additional contribution of A\$43 million (Wiseman et al., 2020).

Notwithstanding the financial promise of these interventions, experts observed that the funding announcements on the same day as the closure announcement appeared politically motivated (Duffy & Whyte, 2017). The timing of the funding was misaligned with local planning cycles, leading to a reactive design approach that focused on short-term goals, including labour-market fixes such as worker transfer schemes and back-to-work grants (Weller, 2017). Funds were allocated to projects that did not create lasting value for the region and the local community (Feigl et al., 2019). The funding burst was widely considered a political stopgap arrangement, fuelling community mistrust of state and federal agencies.

4. Governance (mis)coordination

The region's transition was significantly affected by a fragmented governance architecture. Since privatization, institutional responsibilities across the Valley had been divided among federal, state, and local institutions, resulting in poorly integrated, siloed approaches to policymaking and governance (Weller & Tierney, 2018; Weller, 2017).

Although efforts were made to better coordinate and manage the impacts of the transition through "networked governance" structures, such as the Latrobe Valley Transition Committee, these efforts have been criticized for lacking decision-making authority or funding and for operating mainly as a conduit for state-level priorities while excluding key local actors. For example, key region-based agencies often bypassed elected local government, eroding local capacity and promoting agriculture-focused projects that were misaligned with local strengths (Weller & Tierney, 2018).

The Latrobe Valley transition was thus characterized by overlapping jurisdictions, weak inter-agency linkages, and top-down structures. This, in turn, reduced the effectiveness of public investment and limited grassroots actors from meaningfully engaging in the transition process.

Key Lessons

The impacts experienced in the Latrobe Valley post-Hazelwood power station closure represent a complex array of social and economic vulnerabilities that often surface following a poorly planned, sudden transition. Closure was announced without prior planning frameworks. Diversification was pursued after the economic damage had already occurred. Public investment was mobilized in response to political crises rather than the region's long-term needs and strengths. Governance institutions were created that caused further unintended harm rather than steering the transition. In summary, impacts from the Hazelwood transition were not due to the absence of political will, funding, or resources to help the region navigate the change. Instead, the crisis in the Latrobe Valley worsened quickly due to a lack of a long-term vision, exacerbated by a persistent failure to build strong institutional architecture in the immediate aftermath of closure.

Lessons drawn from this experience have led to better planning for subsequent closures of the remaining power



stations in the Valley. For example, measures are already in place to shift workers from Yallourn to Loy Yang when it shuts down in 2028. This will give workers a buffer of another seven years until 2035, when Loy Yang is due to close. Meanwhile, worker training programmes and alternative diversification efforts are already underway, with investments in new energy, manufacturing, and tourism growing.

TRANSITION POLICY DISCUSSIONS AND DESIGN MUST BEGIN SUFFICIENTLY EARLY, WITH COMMITMENTS TO INSTITUTIONAL COORDINATION, ADEQUATE FUNDING, AND LOCAL GOVERNANCE CAPACITY-BUILDING PROGRAMMES.

Latrobe offers important, timely lessons to inform transition management policy and practice worldwide. Its experiences suggest that the harsh impacts of a transition can be softened with careful planning. Meaningful engagements on the ground are critical as an ongoing, anticipatory component of the planning process. However, these are only possible if there is a clear policy intent with adequate system-wide agility in the implementation phases. Acknowledging regional strengths when mapping diversification options is essential. Equally important is enabling workers to move gradually across sectors rather than through crisis-driven schemes. When planned early and in consultation with those on the frontlines, such approaches offer critical pathways to restoring trust between communities and government institutions.

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A JUST TRANSITION FOR COAL MINE CLOSURES: CASE OF GERMANY & LESSONS FOR INDIA

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Figure 2.1: Elevated view of a surface coal mine in Germany
Credit: Gettyimages, Monty Rakusen

“One cannot simply pick up Germany’s policy strategy (in general and also in the case of just energy transition) and apply to it India. There’s some merit in what’s colloquially said – German systems work because of rule of law while in case of India, it is despite rule of law.”

- Anonymous Interview with a public policy professional in Berlin having Indian origin on August 24, 2025

Without delving into the semantics or arguments around this statement, the principle of contextually conscious adaptations of globally recognized policies and practices is the key takeaway that holds true for the synthesis of this article as well. This paper presents an account of principles, processes and oversight mechanisms of coal mine closure in Germany, particularly from the point of view of upholding the virtues of justice and equity in energy transition.



Germany, by no stretch, is reflective of a NorthStar of just transition practices. Concerns of environmental harm, social conflicts, legal and regulatory hurdles, deforestation and resource degradation, cultural and political repercussions and other such issues have been reported and highlighted in academic and grey literature. At the same time, legally backed institutional efforts and certain participatory practices of moving beyond coal and post-coal economic structural interventions have been lauded by many experts also.

As of 2026, Germany is working to implement a legally mandated phase-out of lignite mining and coal-fired power generation by the year 2038, having officially closed down all domestic hard coal mines in 2018. There have been ongoing discussions to pull-forward the deadline of 2038 to 2030, depending on a review in 2026 and 2029 – which is yet to happen. At the same time, there has been a structural policy support of €40 billion for developing post-mining regions into renewable energy hubs, or industrial areas or tourism and recreational sites. One of the key features of this ‘moving away from coal’ development in Germany is the focus on job losses and avoiding social hardships by miners and other people employed in regions facing a phase-out through ‘just transition principle’.

In this article, I present 04 lessons of relevance for India from Germany’s experience of just transition in coal; along with key contextual and regional considerations that India needs to be mindful of while planning and implementing mine closures in the coal sector.

1. Un-tabooing discussions on coal mine closure: In particular, non-state policy actors seem to shy away from this, despite the Government of India through the Ministry of Coal taking several policy initiatives in this regard. A science-based, socio-environmentally sustainable and just framework for coal mine closure is the need of the hour, which is what the Ministry of Coal aims to achieve through the recently rolled out official mine closure guidelines and the R-E-C-L-A-I-M framework. Efforts need to be made, not necessarily at legislative level but more at research-based policymaking levels, by government actors to debunk the ongoing narrative that talking about coal mine closures will land non-state actors in trouble; and that talking about coal mine closure is against the concerns of energy security, and by and extension of it, national security. Hence, concrete actions, not merely legislative acts, within the existing political framework are the need of the hour in the Indian context.

BEING COGNIZANT OF THE FACT THAT DEVELOPMENTAL AND ENERGY SECURITY NEEDS OF INDIA ARE WAY DIFFERENT AND SIGNIFICANT IN THE INDIAN CONTEXT, NONETHELESS, THERE IS ALMOST A POLITICAL TABOO AROUND DISCUSSIONS CONCERNING COAL MINE CLOSURES.

2. Defining just transition works: It can be argued that Germany’s approach of just transition is perhaps too job-centric in nature, paying less heed to concerns of different types of justices. In the case of India, one can endeavour to broaden the scope of what constitutes just transition, however, that runs the risk of burdening too much on a concept that is open to appropriation and different interpretations by different actors to satisfy their own interests. Hence, a consensus-based, theoretically-sound and practically feasible enlisting of just transition works in specific regional and sectoral context (such as coal mine closure) should be laid out by official actors. For a job-centric approach, as was followed in Germany, efforts such as skilling, early retirement and adjustment money (Anpassungsgeld) for workers aged 58+ to bridge the gap to retirement, are relevant instruments that can be modified and adapted in the Indian context. However, the organization and challenges of Indian labour in coal mines is very distinct from the formal miners of Germany; hence such job-centric instruments need careful scrutiny to see whether they would cover casual and other informal workers in the Indian coal industry.



Figure 2.2: Group of men in an underground coal mine in Germany

Credit: Gettyimages, Andres



3. Proper utilization of just transition finance: In the case of Germany, via the Structural Development Act, the funding is split between direct state-level investments and federal-level projects:

a. **€14 Billion (Direct State Aid):** Distributed directly to the states (Länder) for regional investments such as local infrastructure and business support.

b. **€26 Billion (Federal Measures):** Invested by the Federal Government to enhance regional attractiveness through national transport infrastructure (rail/road), the establishment of new federal research institutions, and digital expansion.

This sum has been further broken down regionally, on the basis of differential dependence of regions on coal, as detailed out in Table 1.

Table 1: Region-wise break-down of structural support

Source: <https://www.bundesregierung.de/breg-en/service/archive/kohlregionen-foerderung-1665150>

Mining Region	Federal States Involved	Key Focus Areas	Approximate Allocation
Lusatia (Lausitz)	Brandenburg & Saxony	Science hubs, rail connectivity, innovation	€17.2 billion (~43%)
Rhenish District	North Rhine-Westphalia	Renewable energy, hydrogen, industrial park	€14.8 billion (~37%)
Central German	Saxony & Saxony-Anhalt	Bio-economy, chemical industry transition	€8 billion (~20%)
Helmstedt	Lower Saxony	Smallest district; focus on renaturation	Included in lower shares

In the Indian context, coal mine closure is the prerogative of coal mine owners, regulated and monitored by official authorities of the Ministry of Coal. Finance for coal mine closure is also to be ensured by coal mine owners, at the time of opening the mines itself. Hence, the challenge in this case is not specifically about raising more finance, but actually ensuring proper utilization of it. This is even more important to ensure that coal mine closure does not remain a techno-environmental exercise, but rather a socio-economic one that gives due consideration to aspirations and values of mine-affected local communities. Furthermore, a regional distribution of financial needs and requirements by official state actors can be drawn for Indian coal districts as well, to further a contextually conscious flow of funds.

4. Upholding principles of justice: Germany's case provides ample evidence of how different types of justices were held in high regards while planning and implementing coal mine closures. Table 2 summarizes this, and also presents contextually relevant lessons for India.

In sum, learnings on instruments, tools and mechanisms on policymaking, planning and implementation can

serve as a good starting point for India to discuss and ensure contextually conscious and relevant policies on just transition, in general, and coal mine closures in particular. It is utmost important that any potential recommendation or learning for Indian government must be viewed from the lens of Schedule 7 of the Indian Constitution that demarcates subjects of governance between central and state governments. Hence, synergizing policy lessons from other countries' contexts in the existing domestic policy rubric on specific issues and efforts such as coal mine closure, can yield positive results in India.

MERE LEGISLATIVE OR REGULATORY INTERVENTIONS, WITHOUT CAREFUL CONSIDERATION TO REGIONAL, SOCIO-ECONOMIC, POLITICAL AND CULTURAL CONTEXT IS MORE LIKELY TO REMAIN AN INEFFECTIVE INTERVENTION.



Table 2: Principles and mechanisms of delivering justice in coal mine closures

Source: https://newclimate.org/sites/default/files/2022-11/coal_phase_out_paper_nov_2022.pdf

Type of Justice	Example from Germany	Relevance for India
Procedural Justice (Participation)	<ul style="list-style-type: none"> • Early Involvement: Policy mandates the early engagement of regional actors in designing their own exit pathways. • Decentralized Power: While the Coal Commission was national, regions like the Rhenish District established their own agencies (e.g., Zukunftsagentur Rheinisches Revier) to conduct local workshops and public participation charters. • Multi-Stakeholder Representation: In 2018, the German Coal Commission (Commission for Growth, Structural Change, and Employment) brought together 31 members from industry, trade unions, environmental NGOs, academia, and local mining regions. • Negotiated Consensus: This “top-down” dialogue aimed to balance competing interests, reconciling climate protection with economic security. • Tripartite Agreements: Unions like IG BCE leveraged institutional power to secure collective bargaining results that are now legally enshrined, ensuring “socially acceptable” (sozialverträglich) closures. 	<p>Early Involvement: Policy mandates the early engagement of regional actors in designing their own exit pathways.</p>
Distributive Justice (Resource Allocation)	<ul style="list-style-type: none"> • Compensation for Consumers: To prevent transition costs from falling on households, €16–32 billion is earmarked to offset potential electricity price spikes. • Regional Rebalancing: The €40 billion structural fund is distributed based on need and vulnerability of coal-dependent regions. 	<p>Mainstreaming concerns of vulnerable and marginalized groups of people in specific coal regions (local tribes, socio-economically marginalized communities, women, youth, elders, etc.) and ensuring fair distribution of costs and benefits of mine closure in different coal regions.</p>
Restorative & Recognition Justice (Worker Support)	<ul style="list-style-type: none"> • Adjustment Money (Anpassungsgeld): Direct financial support for workers aged 58 and older, bridges the gap to retirement, recognizing their lifelong contribution to the industry. • Exclusion of Compulsory Redundancies: The policy prioritizes “social plans” that use retraining and internal recruitment to avoid involuntary job losses. • Legitimate Expectations: By setting a clear 2038 deadline, the law protects the legal certainty of both companies and workers, preventing abrupt economic shocks. 	<p>Positioning restoration as something much broader than just environmental restoration to ensure restoring people’s social, economic, cultural and other forms of capital in coal mine closure scenarios.</p>



TWO STEPS FORWARD, ONE STEP BACK: INDONESIA'S CONTINUOUS LOVE AFFAIR WITH COAL AND WHAT TO DO ABOUT IT

Stefan Bobner, Research Fellow and Policy Lead, Stockholm Environment Institute, Thailand



Figure 3.1: Aerial view of an opencast mine in South Kalimantan, Indonesia
Credit: Gettyimages, Afriadi Hikmal

Much ink has been spilled in the past about the importance of coal in Indonesia. The country is usually the third largest coal producer in the world, producing 580 million tonnes (or 9.3% of global production) in 2024 (Energy Institute, 2025). Coal is important for government revenues (coal mining accounts for around 1.5–2% of Indonesian GDP depending on coal prices), an important electricity source (around 67% of power comes from coal) and, regionally, a large employer of people (Böbner et al., 2023). However, coal is also the most polluting fossil fuel

and the international scientific community agrees that it has to be phased out almost completely as a source of electricity generation by 2050 if the international community wants to meet its obligation under the Paris Agreement (IPCC, 2022). Moreover, coal mining is harming the environment due to the leakage of metals and chemicals into the ground water and the destruction of ecosystems. Most importantly, coal kills people. A new report by the Centre for Research on Energy and Clean Air (CERA) suggests that if unaddressed, 20 coal power plants



in Indonesia will likely cause 156,000 premature deaths between 2026 and 2050 due to respiratory diseases associated with air pollution from coal power (CELIOS & CERA, 2026).

his dichotomy of economic boon and environmental and societal bane is also reflected in the Indonesian politics and policies.

On the one hand, the coal industry is well connected to the Indonesian political establishment and coal players often go into politics and former politicians find employment in the coal industry (Ordenez et al., 2022; Prihandono & Widiati, 2023; Singgih, 2022). Similarly, revenues from coal often builds new infrastructure (promise during election campaigns), particularly in the coal mining provinces. Counterproductively, coal prices are also often kept artificially low to incentivize consumption (Bößner et al., 2023). On the other hand, Indonesia has introduced a net-zero target by 2060, adopted a moratorium on building new coal-fired power plants in 2021 and several of the country's planning documents such as the Long Term Development Plan 2025–2045 provide some coal phase out scenarios (CELIOS & CERA, 2026). In addition, the country is a member of the Southeast Asia Energy Transition Partnership (ETP) a donor led initiative that supports Indonesia, Vietnam and the Philippines on the energy transition journey and the National Electricity Plan 2024–2060 aims at scaling renewable energy sources (RES) to 75.6 GW.¹

But the implementation of policies and regulations to facilitate this energy transition and/or a coal phase out is mixed at best. While some plans foresee the scaling of renewable energy sources, other plans, such as the above mentioned National Electricity Master Plan, still foresee an additional 26.8 GW of coal power to come online in the near- and medium-term future (Setiawan, 2025). The market design of the country's electricity market is still inflexible, incentivizes coal power, doesn't allow renewables to recover their full costs due to price caps on electricity prices while at the same time exhibiting a general overcapacity of (thermal) power plants in the system at least until 2030 (Kuneman et al., 2024). In addition, Indonesian researchers mention unfavourable regulation for rooftop solar as a barrier to RES development (Shalati, 2024) as well as governance shortcomings such as the lack of communication

between national and regional governance units as major hinderance for phasing out coal and scaling renewable energies (IESR, 2024). And finally, energy transition planning and coal phase out lack elements of justice particularly when it comes to justice for fossil fuel workers, environmental protection and restoration or citizen participation in the energy transition (Bößner et al., 2025).

The wars in Ukraine and Iran have further added complexity as energy security concerns rose to the top of the political agenda. Donors are shifting from development to defense spending which impacted the ETP and the ambitions to retire some coal power plants in the country. As of early 2026, much of the pledged \$20 billion to do so is still missing.² The war in Iran and Lebanon and the closure of the Strait of Hormuz further added stress to Indonesia's coal phase out ambition, as countries in Asia – a region highly dependent on Middle Eastern crude³ – seek to alleviate their energy security concerns by ramping up coal production (Ratcliffe and correspondent, 2026), including in Indonesia⁴ to the detriment of global climate goals.

So where does Indonesia go from here?

It is important to acknowledge that political will is needed to phase out coal and transition to a low-carbon energy system. Without tackling the entrenched fossil fuel interests that have built up a resilient system of power and influence for decades, setbacks will remain inevitable. It is therefore important for civil society organizations, think tanks and academia to continue exercising pressure and holding decision makers accountable for the unsustainable actions they take.

For policy makers, they must realize that a decentralized energy and electricity system based on renewable energies is strengthening energy security. In many countries, renewables account for more than 50% of electricity on the grid while Germany is setting up its grid for 100% renewable power generation in the near future.⁵ Renewables have become the cheapest forms of energy in many parts of the world (IRENA, 2025) especially compared against the billions of dollars spent on fossil fuel subsidies (and fossil fuel imports from

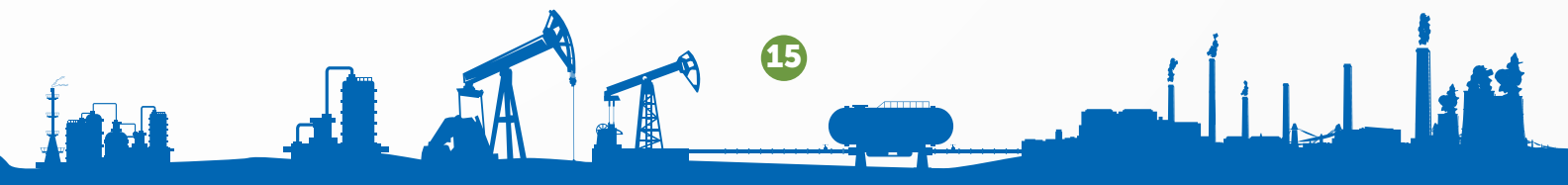
¹ <https://energyandcleanair.org/publication/indonesia-can-surpass-national-renewables-targets-by-fast-tracking-prospective-projects/>

² <https://www.channelnewsasia.com/business/exclusive-indonesia-coal-power-phase-out-plan-risk-due-stalled-international-funding-5472936>

³ <https://www.reuters.com/business/energy/why-is-asia-so-reliant-middle-eastern-oil-2026-03-04/>

⁴ <https://asianews.network/indonesia-approves-580-million-tonne-coal-production-plan-signals-output-boost/>

⁵ <https://www.bundeswirtschaftsministerium.de/Redaktion/EN/Dossier/system-stability-roadmap.html>



volatile regions): In 2024, Indonesia spent more than IDR 500 trillion on oil imports⁶ and IDR 700 trillion on energy subsidies, most of which went to oil, gas, and coal.⁷ This calculation doesn't even factor in the trillions in dollars of damage climate change is expected to impose on societies around the world.⁸

But no one is saying the energy transition won't come at a cost. That is why, it is important that this transition from fossil fuels to renewable forms of energy is conducted in a just and equitable manner that empowers people to buy into the transition.



Figure 3.2: Digger lifting coal from an opencast mine in Kalimantan, Indonesia

Credit: Gettyimages, Afriadi Hikmal

This means that comprehensive stakeholder consultations should be conducted to determine which transition pathways are supported by the people, as different stakeholders may have differing views on what should be prioritized.

Fossil fuel companies that made juicy profits over decades should be held accountable to clean up the polluted environment they often leave behind.⁹ Market reforms should allow flexibility on the electricity grid, independent power producers to sell renewable energies to the grid at cost recovery and community energy initiatives should be incentivized.¹⁰ Lastly, governance

structure needs to be improved to facilitate the flow of knowledge between ministries and working groups and between the national and sub-national level. The recently established Energy Transition and Green Economy Task Force in Indonesia is a step in the right direction.¹¹

ECONOMIC DIVERSIFICATION IS NEEDED IN REGIONS HIGHLY DEPENDENT ON COAL REVENUES AND FORMER FOSSIL FUEL WORKERS SHOULD BE SUPPORTED TO FIND NEW JOBS IN THE EMERGING GREEN SECTOR, BY RESKILLING AND DEDICATED JOB PROGRAMMES.

The knowledge and recommendations on how to transition our energy system have been available for years, now it's time to use political will to translate this knowledge into reality.

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DYNAMIC, LONG-TERM PROCESS OF COAL PHASE-OUT IN REGIONAL, COAL-DEPENDENT ECONOMIES: A MODEL-BASED FRAMEWORK TO LEARN FROM PAST TRANSITIONS IN INDUSTRIALIZED COUNTRIES

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Figure 4.1: A boy overlooking the transformed mining landscape in Jharkhand

Introduction

The research on coal transitions is rapidly expanding in response to the stringent climate goals set under the Paris climate change agreement. As a specific policy initiative, around 70 countries are now part of the Powering Past the Coal Alliance (PPCA) which has committed to coal phase-out at the Glasgow Conference

of the Parties to the UNFCCC (COP26) in 2021 (PPCA, 2022). The research and subsequent assessments of the literature on energy transitions by the intergovernmental panel on climate change (IPCC), which guides global and national policymakers, often relies on integrated assessment models (IAMs) that project future scenarios to understand the implications of coal phase-out for the



national and international energy mix and emissions trajectories (for IAMs and modelling methods in latest IPCC report, see Guivarch et al., 2023). These scenarios are also helpful to understand the socio-economic implications like income and employment impacts of coal transitions. However, the effects are often averaged over national and global levels and may not project the full picture for a regional, coal-dependent economy. Apart from the climate impacts, coal mining, transport and combustion activities also affect local environment and health of people. The global premature mortality due to fossil fuel-related air pollution was estimated to be around 8.7 million in 2018 (Vohra et al., 2021). These factors have made coal phase-out central to the debates surrounding climate change, local pollution and public health. On the other hand, coal is also central to many local economies that rely on its mining, transportation, energy production, and exports. In most cases, the responsibility of international climate agreements and national commitments to phase-out coal ultimately falls on few regional, coal-dependent economies undertaking the energy and socio-economic transitions. Some examples of these coal-dependent, sub-national regions include Ruhr in Germany, Appalachian region in the United States, the Shanxi province in China and Jharkhand in India. Thus, finding ways for coal phase-out without impacting the regional economies has become a major challenge.

JUST COAL TRANSITIONS ENTAIL THAT CLIMATE POLICIES DO NOT CAUSE UNDUE HARM TO LOCAL COMMUNITIES THAT HAVE A MAJOR DEPENDENCE ON COAL-BASED INDUSTRIES FOR THEIR SUBSISTENCE AND EMPLOYMENT

(Wang & Lo, 2021). Based on the past experiences of coal phase-out and the current pressures to counter climate change, the demand for just transitions has gained pace in recent years. If we look at the past instances of coal phase-out, they were mostly driven by economic reasons like availability of alternate energy sources (ex. case of shale gas in the US) or coal imports becoming cheaper than mining them domestically (ex. Germany). Past studies have explored these transitions in industrialized countries where coal consumption is now on a declining trajectory. These studies suggest that the re-distributional policies of coal transitions in recent years

have not always benefited the intended communities (Oei et al., 2020; Weller, 2019). Further, there are few studies on the political economy and welfare implications of coal transitions in low and middle-income countries where investments in new coal projects are underway (Diluiso et al., 2021). There is a need to systematically address the distributional and welfare impacts of energy transitions resulting from decarbonization policies and environmental regulations in different socio-economic settings. To this end, the JUSTCOAL project at the International Institute for Applied Systems Analysis (IIASA) was conceptualized to develop a mathematical framework to study the welfare impacts of coal transitions in sub-national, coal-based economies.

JUSTCOAL framework

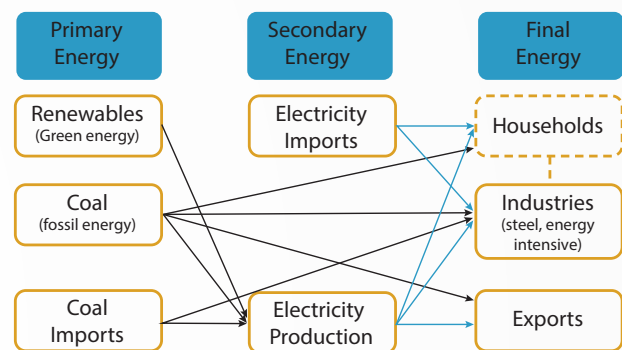


Figure 4.2: Schematic of energy system in a small, coal-based economy

The JUSTCOAL framework (Grass et al., 2025), based on optimal control theory, allows us to systematically model and analyze the welfare implications of a coal phase-out in the context of a small, open, coal-dependent regional economy. In this model, we consider four sectors – coal mining, coal power plants, renewable power plants and industries that use coal and electricity for producing material goods and services. The coal-based economy is run by a social planner (say, sub-national government) who can decide to invest in each of the four sectors in different time periods with an aim to optimize the inter-temporal social welfare of the region. As a small, open economy, the region can import or export coal and electricity, but the prices of both these energy commodities are externally determined in the national or international market. The investment costs in mining, coal power and industries are assumed to remain constant as these are mature technologies. For renewable power plants, we assume investment costs falling over time using a learning curve that closely follows the solar photovoltaic technology. The subnational government

optimizes its welfare which goes up with increasing production from these four sectors but also declines exponentially with rising pollution levels (from increasing coal use). Figure 4.2 provides an illustration of this set-up and further details of the model and overall approach can be found in Grass et al., 2025.

One advantage of our approach is the ability to carry out dynamic sensitivity analysis, demonstrating the possible path dependency (or history dependence) of the regional planner's optimal solution depending on international energy prices. This means, based on the initial conditions of the economy, we may end up with two different types of equilibrium for the same set of coal and electricity prices in the international markets. For example, if in the initial stages, the coal region invested heavily in coal mining, then if the electricity prices are low and as the renewable investment costs fall, the subnational government may phase-out coal power plants and replace them with renewables to avoid a local pollution penalty. However, it will still continue to mine the coal to sell in the international markets. On the other hand, if there isn't a substantial investment in coal mining in the initial years, the same region would phase-out coal completely (mining as well as power plants) when conditions for alternate (renewable) technologies are favourable.

Based on these results, the first case with high coal mining investments in initial years constrains the local governments when it comes to acting on coal phase-out commitments at the national level. The model and its findings also acknowledge the fact that coal phase-out is a dynamic, long-term process and it may get affected by international energy prices and availability of alternate technologies. Without favourable renewable technologies and energy prices, a possibility of just transition for these coal-dependent economies becomes bleak, as suggested by evidence in countries such as Germany, Australia, and the US. Further, policy interventions for complete phase-out need to recognize that proposed solutions may or may not work depending on the historic mining investments in the region.

In general, our results show that energy transition follows non-trivial time paths and may, indeed, enter into an array of different long-run equilibria, corresponding to different degrees of phase-out, depending on the energy price structure in the international markets. For a given long-run cost of renewable energy, and depending on the energy prices (electricity, coal), the optimal solution may either tend to a unique equilibrium state or be

subject to bifurcation, based on the initial conditions. The results from this analysis can be used to draw practical policy insights, in particular as to how national policies can and should be used for the simulation of a coal phase-out in regional fossil-fuel dependent economies like Shanxi (China) or Jharkhand (India) that are staring at drastic change if coal businesses are shut down in these regions.

Next steps and implications for India



Figure 4.3: An example of coal mining in close vicinity to the forest area in central India

As next steps, we intend to further develop the framework to include detailed labour markets and household sectors to study the impacts of proposed transitions on jobs and household incomes (including energy transition at a household level). We also intend to apply this model in developing country contexts, such as India. First, Indian mining output is still growing with policy support to increase the coal output that provides energy security in the current circumstances. The labour employed in coal mines is mostly contractual and does not get paid enough when compared to industrialized nations. Many of the coal mines are also located in close vicinity to protected forests in India, thus adding to the challenge of just transition for forest-dependent communities (Figure 4.3). Another important aspect is the expected timeline for coal phase-outs. As mentioned earlier, most industrialized countries did not transition out of coal due to environmental concerns. Regions like Ruhr and Appalachian did not get sufficient time to plan the transition which made the communities vulnerable, at least in the short run. A dynamic, long-term modelling study may offer some insights on how the short- to long-



term socio-economic situation will change if the region is subjected to gradual or disruptive coal phase-out. The federal and subnational governments can use such insights to better understand and plan a just transition away from coal to meet the climate and developmental goals.

IN CASE OF COAL-DEPENDENT REGIONS IN INDIA, THE REALITIES DIFFER WHEN COMPARED TO REGIONS IN GERMANY OR THE US.

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STORIES OF CHANGE FROM BETUL'S PEOPLE-CENTRIC TRANSITION

TERI has successfully implemented a range of initiatives aimed at fostering a people-centric and inclusive transition in the coal-dependent Pathakhera region of Betul district, Madhya Pradesh. Under the CSR project, "People-Centric Transition in Coal Mining Regions through Holistic Development of Betul, Madhya Pradesh," TERI has undertaken targeted interventions to promote economic diversification and create sustainable livelihood opportunities beyond coal.

As part of these efforts, TERI has established six community-based enterprises that support income generation, entrepreneurship, and local economic resilience. These enterprises include a Tailoring and Stitching Centre, Beauty Parlour, Vermicompost Unit, Hair Salon, Sanitary Pad Production Unit, and a Common Service Centre. Together, these initiatives are contributing to livelihood security, skill enhancement, women's empowerment, and the development of alternative economic pathways in the region.

Presented below are the voices and experiences of the beneficiaries who are successfully managing and sustaining these enterprises, demonstrating how locally driven livelihood opportunities can support a just and equitable transition in coal-mining regions.

Pooja's journey towards financial independence



Pooja, a 27-year-old resident of Dhumkadha village in Chhatarpur Gram Panchayat, Ghoradongri Block, Betul district, comes from a low-income family. Her father works as a construction and fitting mason, while her brother assists him in the same occupation. Despite completing her higher secondary education, Pooja remained unemployed and financially dependent on her family. Determined to support her household and pursue her aspirations, she sought opportunities to become self-reliant.

Her turning point came through TERI's livelihood initiative under the project aimed at promoting people-centric transition and economic diversification in coal-mining regions. Recognizing her interest in beauty and personal care services, TERI enrolled her in a Beauty Parlour Training Programme conducted in Bagdona during December 2025–January 2026. The project covered all training-related expenses, including course fees and travel costs. Through the programme, Pooja acquired practical skills in beauty care, makeup, facial treatments, hair styling, and salon management.

Following the training, TERI provided her with a beauty parlour kit, essential products, and branding support to establish her enterprise. With this assistance, she successfully launched a beauty parlour in her village.

Pooja's enterprise has filled a critical service gap, as women and girls previously had to travel nearly six kilometres to access basic beauty services. Today, she offers affordable and accessible services within her community while earning an additional income of approximately INR 2,000–3,000 per month. Her earnings support her graduation studies and household expenses, while her success has inspired other young women to pursue skill development and self-employment opportunities.



Scissors, skills and success



Pravin, a 36-year-old resident of Gandhigram village, Shaktigarh Gram Panchayat, Ghoradongri Block, Betul comes from a farming family where his father, Mr Prashant Mandal, is engaged in agriculture, and his younger brother supports him in his business activities. About a year ago, Pravin started a small salon with limited resources and basic facilities. Although he was motivated to establish his own livelihood, a lack of professional skills, modern equipment, and financial resources restricted the growth of his business. At that time, his monthly income was only INR 1,000–2,000.

Through TERI's livelihood initiative, Pravin received professional salon training, where he learned modern grooming techniques, hair styling, customer handling, and service management. In addition, the project provided essential salon machines and equipment, helping him upgrade the quality of services offered at his salon.

With improved skills and better infrastructure, his salon gradually gained popularity among local customers. As customer satisfaction increased, so did his earnings. Today, his monthly income has increased to approximately INR 6,000, making his business a reliable source of livelihood.

The improvement in income has strengthened his family's financial condition and enhanced his confidence and social recognition within the community. Pravin's journey demonstrates how skill development and access to productive assets can transform a small livelihood activity into a sustainable rural enterprise. Today, he serves as an inspiration for other rural youth who aspire to build a better future through self-employment and entrepreneurship.

From Adversity to Entrepreneurship: Savita's Story of Resilience



Savita, a 40-year-old resident of Shobhapur Gram Panchayat in Ghoradongri Block, Betul exemplifies the transformative impact of women-led entrepreneurship. Supported under TERI's People-Centric Transition Sustainable Livelihood Program, implemented with CSR support from Coal India Limited, Savita has successfully rebuilt her life through determination and collective enterprise.

Nearly three years ago, Savita's husband passed away unexpectedly due to a heart attack, leaving her solely responsible for her family. In addition to supporting her son and daughter, she also cared for her differently-abled sister-in-law. With limited resources, she relied on small tailoring assignments from home, earning approximately INR 1,000 per month, an income insufficient to meet her family's growing needs.

A turning point came in February 2026 when TERI facilitated her participation in an exposure visit to a sanitary napkin manufacturing unit in Gwalior. The visit, followed by hands-on training in sanitary pad production, quality control, packaging, and marketing, inspired her to explore entrepreneurship as a sustainable livelihood option.

After completing the training, Savita joined three other women to establish Aadi Sanitary Healthcare, a women-led production group. TERI supported the enterprise by providing machinery, financial assistance for raw materials, Udyam Registration, branding, packaging, awareness campaigns, and market linkages.

Since commencing operations in March 2026, the enterprise has generated encouraging results. Savita now earns approximately INR 2,500–3,000 per month, helping her support her children's education and household expenses. Beyond income, the enterprise has restored her confidence and social standing, making her a role model for women's empowerment, rural entrepreneurship, and community-led development.

The Village Digital Champion



Kritika, a 21-year-old resident of Chhatarpur Gram Panchayat in Ghoradongri Block, Betul, represents the transformative potential of digital skills and rural entrepreneurship. Supported under TERI's livelihood initiative, Kritika has not only created a sustainable source of income for herself but has also improved access to essential digital and financial services for her community.

Coming from a small farming family, Kritika completed her Bachelor of Science (BSc) degree despite financial hardships. However, after graduation, she struggled to find a stable livelihood and relied on occasional honorariums earned through Panchayat-related activities. At the same time, residents of her village had to travel nearly eight kilometres to Bagdona to access basic services such as government certificates, online applications, banking transactions, and welfare scheme benefits.

Recognizing her interest in technology, TERI enrolled Kritika in specialized training on computer operations

and Panchayat-level digital services. The project further supported her with a computer system, printer, branding materials, and assistance in establishing a Kiosk/Common Service Centre (CSC). TERI also facilitated her Udyam Registration, enabling her to operate as a recognized micro-entrepreneur.

Today, Kritika's digital service centre provides online documentation, government applications, and Aadhaar Enabled Payment System (AEPS) services, significantly reducing travel time and costs for local residents. She now earns approximately INR 2,500–3,000 per month, supporting her education, household expenses, and her mother's healthcare needs. Beyond income generation, Kritika has emerged as a role model for rural youth, demonstrating how digital skills, institutional support, and determination can create pathways for self-reliance, entrepreneurship, and community development.

Stitching a Future of Confidence and Self-Reliance



Ms Vinita, a 39-year-old resident of Gwadidhana village in Shobhapur Gram Panchayat, Ghoradongri Block, Betul, has transformed her life through perseverance, skill development, and entrepreneurship. Born with a disability in one leg, Vinita faced numerous social and economic challenges throughout her life. Living with her parents and siblings, she remained unmarried due to family responsibilities and financial constraints. Although



she completed her education up to high school, employment opportunities remained limited.

Nearly a decade ago, Vinita learned basic blouse stitching from a local woman and began taking small tailoring assignments from home. However, limited skills, resources, and market access restricted her earnings to only INR 500–600 per month, making it difficult to achieve financial independence.

A significant turning point came in February–March 2026 when she participated in a 45-day tailoring training programme organized by TERI under its livelihood initiative. The training enhanced her skills in advanced stitching, garment finishing, quality control, and market-oriented production practices. Upon completion, TERI provided her with a tailoring kit and motor to strengthen her enterprise. The project also established a Production Group Centre in the village, equipped with modern sewing machines and finishing equipment, enabling women to work collectively.

Today, Vinita is actively engaged in garment production through the centre. She is part of a team fulfilling an order of 10,000 frocks from Lakshmi Industries, earning income through commercial stitching work. The opportunity has significantly improved her earning potential, strengthened her confidence, and enabled her to support her aging parents. Her journey demonstrates how targeted skills training, productive assets, and market linkages can empower vulnerable individuals to build sustainable livelihoods and lead lives of dignity and self-reliance.

Cultivating Resilience through Sustainable Farming



Ms Parvati, a 41-year-old resident of Gwadidhana village in Shobhapur Gram Panchayat, Ghoradongri Block, Betul district, exemplifies resilience and determination in the face of adversity. In 2011, her husband passed away due to a heart attack, leaving her solely responsible for raising her seven-month-old daughter and managing household responsibilities. With support from her father-in-law, Parvati persevered through difficult circumstances, relying on agriculture and livestock rearing to sustain her family.

Despite her hard work, uncertain farm incomes, rising cultivation costs, and limited livelihood opportunities often made it challenging to meet household needs. Seeking to improve her economic situation, Parvati joined TERI's livelihood initiative and actively participated in its skill development programmes.

A turning point came when she attended an exposure visit to Kamdhenu Gaushala in Harradhana, where she learned about sustainable farming and the economic potential of vermicompost production. This was followed by a three-day hands-on training programme that equipped her with practical knowledge on producing high-quality organic manure.

To support her enterprise, TERI provided a vermicompost unit comprising a vermi bed, earthworms, and a green net structure. Using the skills and resources gained through the project, Parvati successfully established and independently manages her vermicompost unit.

Today, she has produced nearly 10 quintals of vermicompost, valued at approximately

INR 10,000, creating an additional source of income while promoting environmentally sustainable farming practices. The use of organic manure has also reduced her dependence on chemical fertilizers. Beyond financial gains, Parvati has gained confidence and recognition within her community, inspiring other women farmers to adopt sustainable livelihoods and pursue greater self-reliance.



Pilfered coal gathered for trade in nearby markets in Giridih, Jharkhand

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