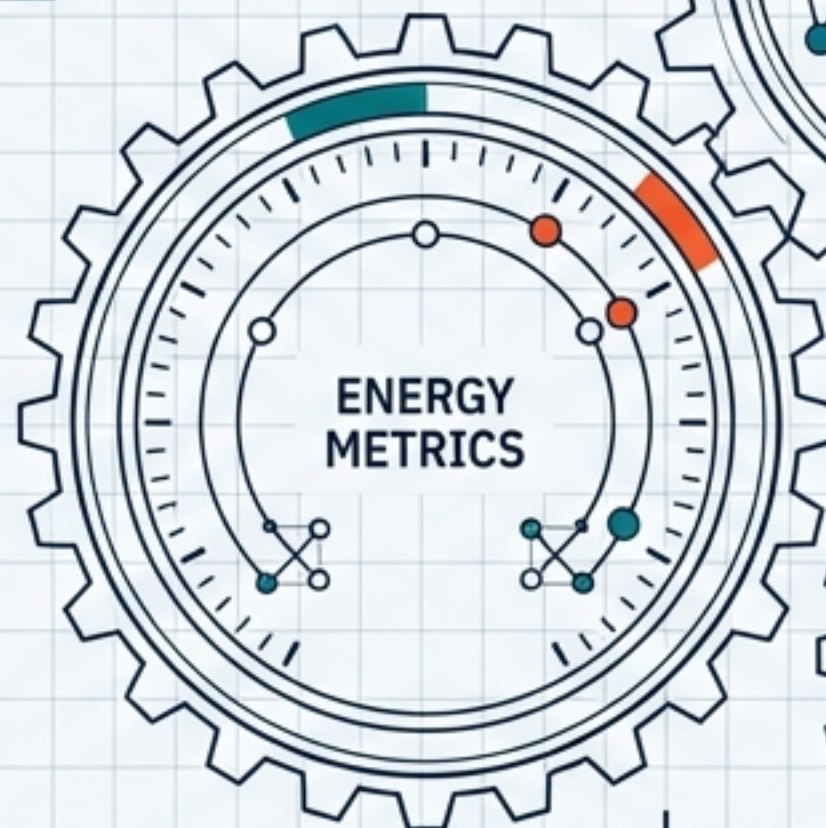


# India's Critical Minerals & Green Steel Transition

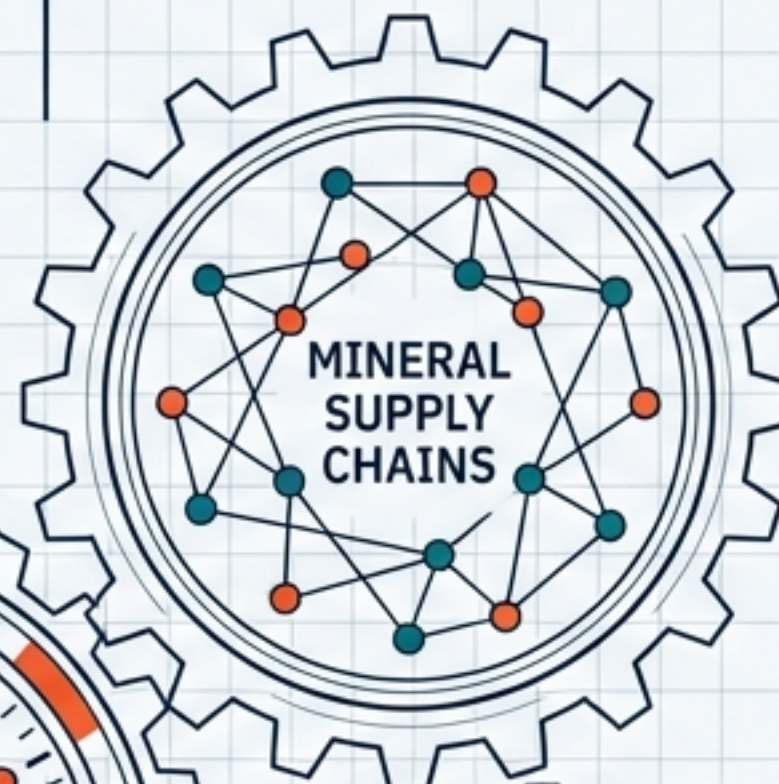
A Strategic Roadmap for Securing the Energy Transition Value Chain

CO<sub>2</sub>: 240 MT  
EFFICIENCY: 92%



MINERAL  
SUPPLY  
CHAINS

CAPACITY: 300 MT  
RESERVES: 1.2 BT  
IMPORTED: 58%  
IMPORTED: 58%



FINANCIAL  
GOVERNANCE

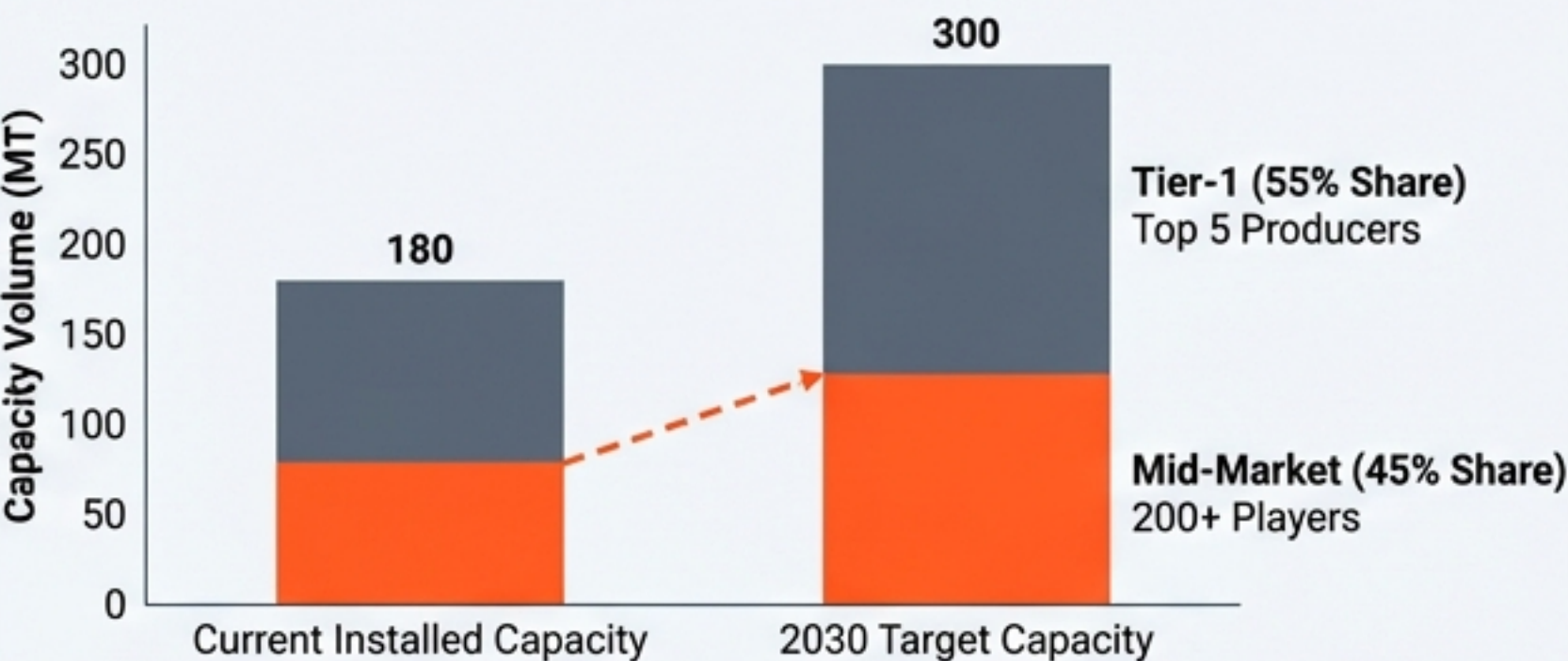
NCNM: ₹16.3K Cr  
ESG FUNDING: ₹8.5K Cr  
ROI: 14%



CONTEXT LABEL //  
PREPARED FOR  
METALS & MINING ADVISORY

The overarching metaphor is engineered precision—reflecting an industry transitioning from brute-force extraction to high-tech, governed, and decarbonized operations.

# The Mid-Market Decarbonisation Gap



## MECHANICS: STRUCTURAL BIFURCATION

|   |                                     |                                                                                                  |
|---|-------------------------------------|--------------------------------------------------------------------------------------------------|
| 1 | Tier-1 Integrated (Tata, JSW, AMNS) | BF-BOF routes, international R&D JVs (Tata-JFE), dedicated ESG infrastructure.                   |
| 2 | 200+ Mid-Market Players             | Coal-based DRI + EIF, compliance strictly as a cost centre, lacking strategic transition levers. |

## CONTEXT: MACROECONOMIC SCALE

|           |                                                                                                                |
|-----------|----------------------------------------------------------------------------------------------------------------|
| Position: | 2 <sup>nd</sup> largest steel producer & largest DRI producer globally.                                        |
| Economy:  | ~2.5% of national GDP, supporting 11M jobs. H1 FY26 crude steel hit 82.31 MT.                                  |
| Threat:   | 300 MT target threatens to double 8% share of national CO <sub>2</sub> (currently 240 MT CO <sub>2</sub> /yr). |

## STRATEGY & EXECUTION

The 45% mid-market capacity is the primary consulting frontier.



Owner-managed operations face existential regulatory pressure but lack institutional transition capacity. **Partner-led, sector-specialist advisory models must target this demographic.**

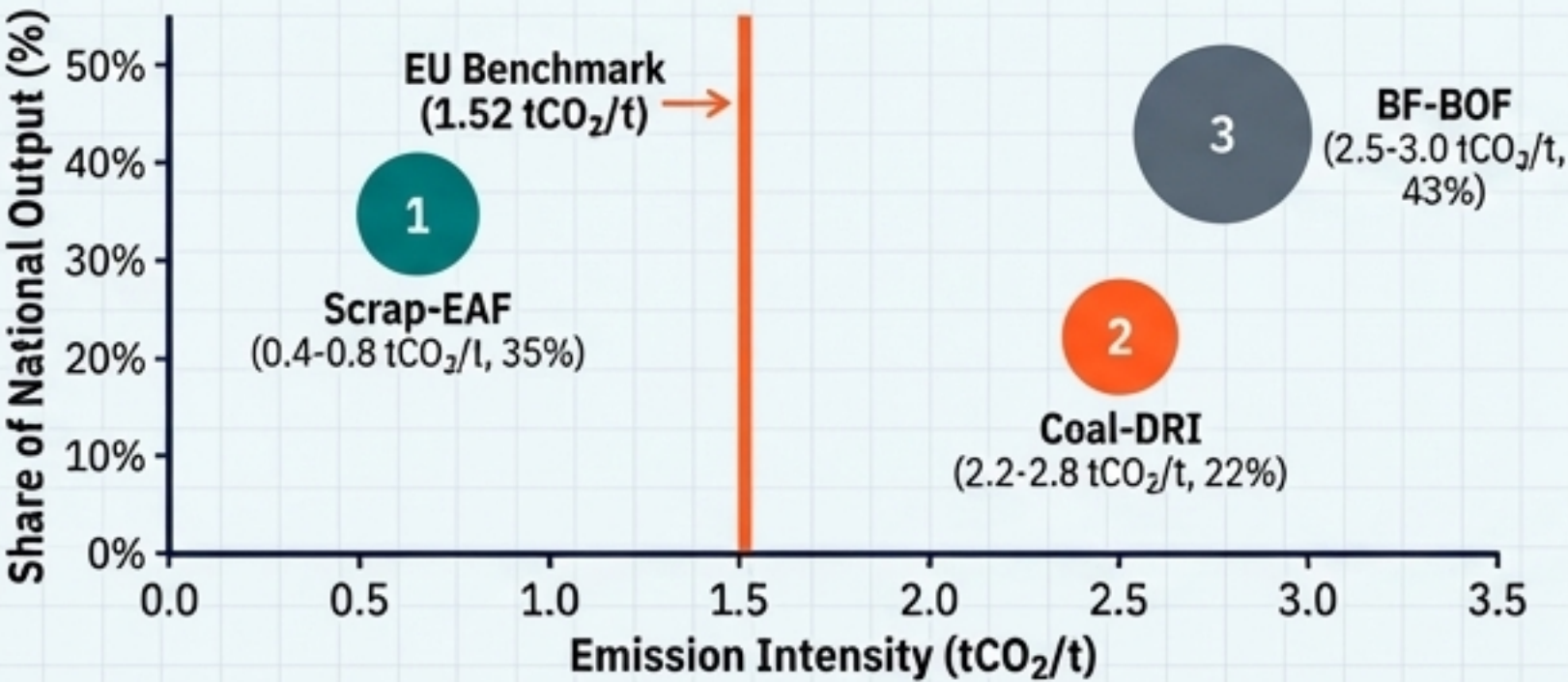
The Indian steel sector's 300 MT ambition is threatened by a bifurcated market structure. The 200+ mid-market players represent the largest, most underserved advisory opportunity in the global metals transition.

# The Policy & Regulatory Acceleration

|                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div><h3>Gantt-style Step Chart, transparent Capital Overlay</h3><p>Regulatory Velocity / Capital Deployed</p><p>2023 2024 2025 2026+</p><p>IBM Plex Mono</p><p>MMDR Amendment Act</p><p>Jan 2025</p><p>₹16,300 Cr + ₹18,000 Cr PSU expected</p><p>141 Mineral Blocks Auctioned</p><p>Unconventional Pilots</p><p>₹100 Cr</p></div>                                                                       | <div><h3>MECHANICS: LEGISLATIVE CATALYSTS</h3><ul style="list-style-type: none"><li>✓ 1. MMDR Amendment Act triggers central auctions for 24 critical minerals.</li><li>✓ 2. Budget 2026 removes import duties on capital goods for critical mineral processing.</li><li>✓ 3. Tax deductions enabled for Schedule XII mineral exploration.</li><li>✓ 4. Establishes <b>Dedicated Rare Earth Corridors</b> in Odisha, Kerala, and AP.</li></ul></div> |
| <div><h3>CONTEXT: SPEED OF DEPLOYMENT</h3><p>The regulatory landscape has shifted faster in 36 months than in the prior 30 years.</p><p>7-Year Mission</p><p>January 2025 launched the National Critical Mineral Mission (NCMM), empowering GSI with 1,200 targeted exploration projects by FY31 and accrediting 28 private exploration agencies. Area limits expanded to 100 sq. km per lease.</p></div> | <div><h3>STRATEGY: AGGRESSIVE CAPITALIZATION</h3><p>Defensive Compliance → Aggressive Capitalization</p><p>Immediate ROIs:</p><ul style="list-style-type: none"><li>- Structure joint ventures for the 141 newly auctioned blocks.</li><li>- Capture FY27 NCMM allocations (₹440 Cr BE) for client processing infrastructure.</li></ul></div>                                                                                                        |

Regulatory velocity has transformed compliance into a competitive advantage. Firms that align capital expenditure with the MMDR amendments and NCMM outlays will capture first-mover market share.

# Green Steel Decarbonisation Economics



## MECHANICS: 3-PHASE ROADMAP

### Phase A (2026-2028): Efficiency-First

Deployment of Waste Heat Recovery, PCI, and Coke Dry Quenching.

### Phase B (2028-2032): Gas-DRI Transition

Via CGD networks (40-60% emission cut).

### Phase C (2032+): Green H2 Integration

H2-DRI-EAF adopted once electrolyser costs fall.

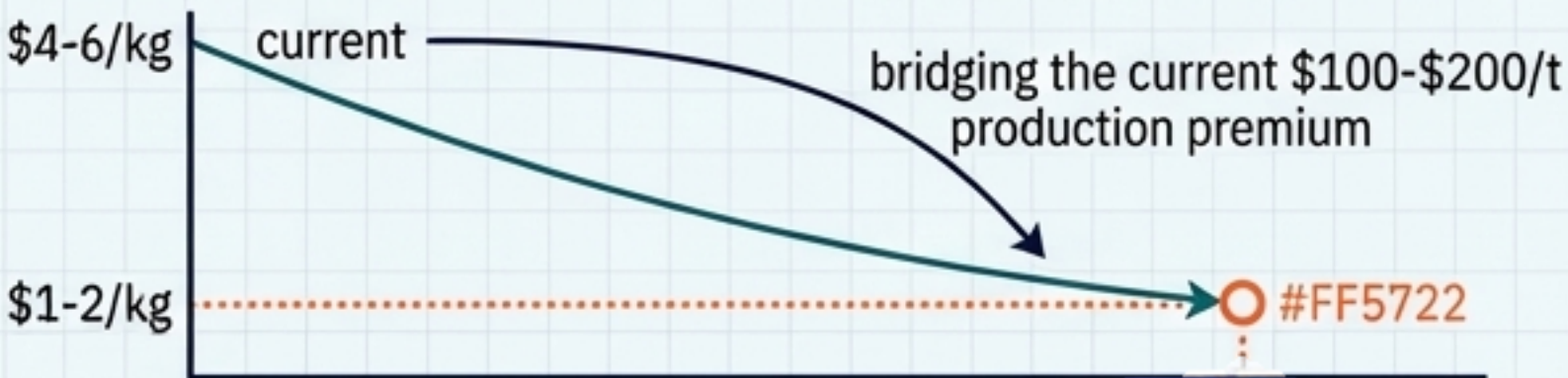
## CONTEXT: THE CBAM PENALTY

The EU CBAM enforces an implicit carbon price of \$50-\$100/t starting in 2026, directly threatening the 15% of Indian steel exported to Europe.

India Avg (2.8 tCO<sub>2</sub>/t) - EU Benchmark (1.52 tCO<sub>2</sub>/t) = **Margin-Destructive Penalty**

## STRATEGY: ECONOMIC TIPPING POINTS

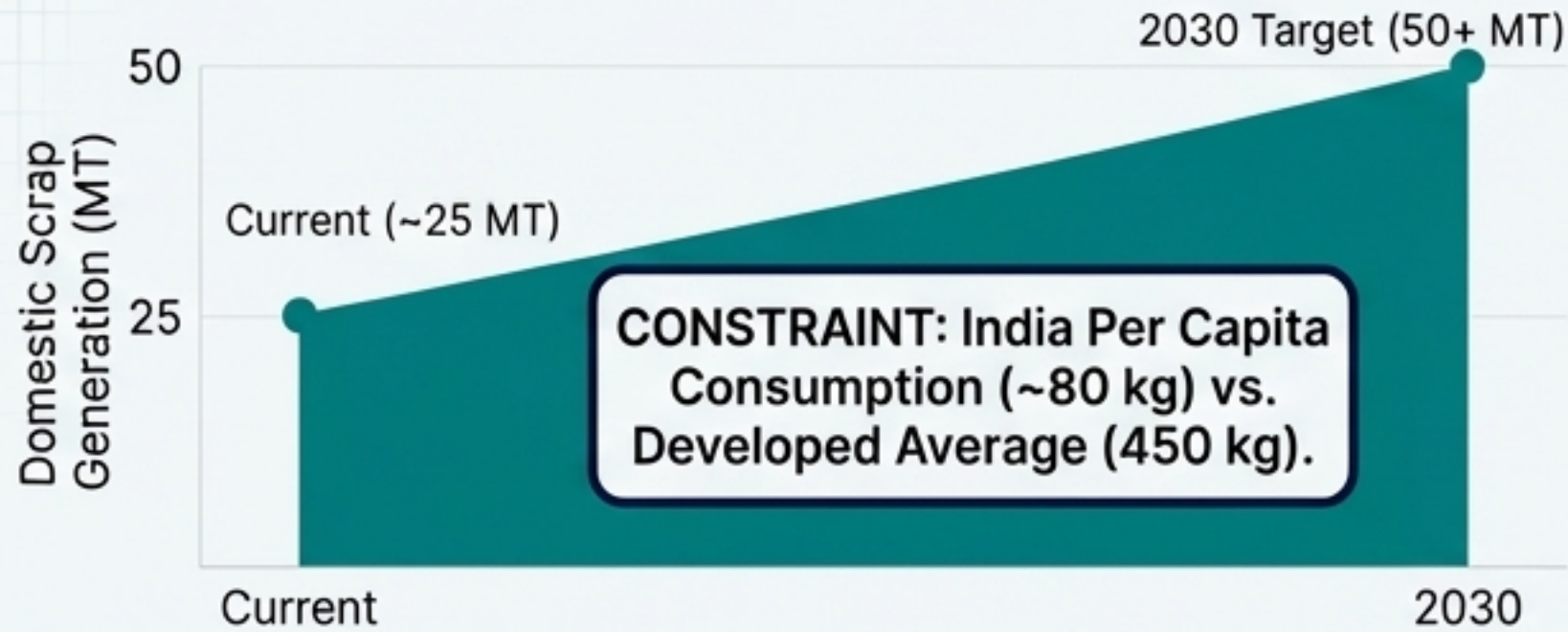
Mid-market survival requires immediate bankable business cases for negative-abatement-cost technologies (Phase A, sub-25% penetrated).



India's unique dominance in DRI production makes the Gas-to-Hydrogen pathway the definitive national strategy. Immediate advisory focus must be on structuring project finance for sub-25% penetrated Phase A efficiency technology

# The Scrap Supply Chain Paradox

## DOMESTIC SCRAP GENERATION (MT)



## MECHANICS: EAF EXPANSION LIMITS

EAF/EIF operations currently account for ~35% of output with optimal low emissions (0.4-0.8 tCO<sub>2</sub>/t). Expanding this requires:

- ⚙️ - Scaling the vehicle scrappage policy.
- 🔄 - Capturing infrastructure demolition cycles.
- 🏭 - Industrializing the informal collection sector.

## CONTEXT: THE FLAWED ASSUMPTION



A structural constraint exists: India cannot simply 'transition to scrap' because low historical per-capita steel consumption restricts the domestic scrap pool. The assumption that increasing EAF capacity naturally solves decarbonisation is fundamentally flawed without reliable feedstock.

## STRATEGY: LOGISTICAL ARBITRAGE

The advisory mandate is supply chain redesign, not metallurgical technology.

Alang Shipbreaking Yard  
(World's Largest)



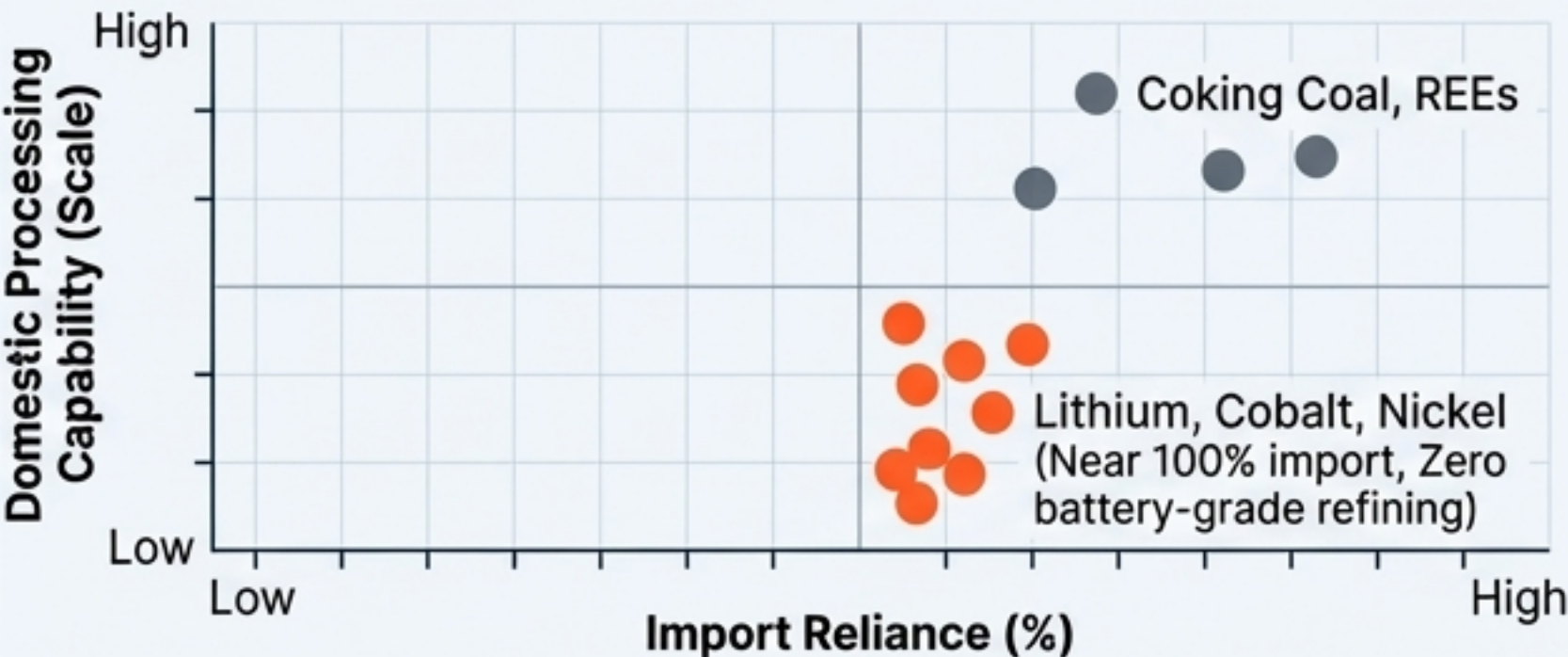
High-Quality Processed  
Scrap Conduit

Building Tier-2 cluster processing infrastructure represents a high-yield logistical arbitrage.

The scrap-steel transition is constrained by low historical consumption, not furnace capacity. Securing feedstock requires institutionalizing informal networks and exploiting the Alang shipbreaking infrastructure.

# The Critical Minerals Processing Bottleneck

India's 30 Critical Minerals



## MECHANICS: THE TRUE BOTTLENECK

The primary bottleneck is intermediate processing, not discovery. India lacks commercial-scale facilities to refine critical minerals to battery-grade or defence-grade purity.



## CONTEXT: COMPOUNDING DEMAND

Strategic vulnerabilities driving the demand curve.

- **EV/Storage Targets:** Requires **Li, Co, Ni**.
- **500 GW RE by 2030:** Requires **Si, Te, Nd, Dy**.
- **Aerospace/Defence:** Requires **Tungsten, Beryllium** (Flagged as severe risk at Dec 2025 CENJOWS roundtable).

## STRATEGY: GREENFIELD FEASIBILITY

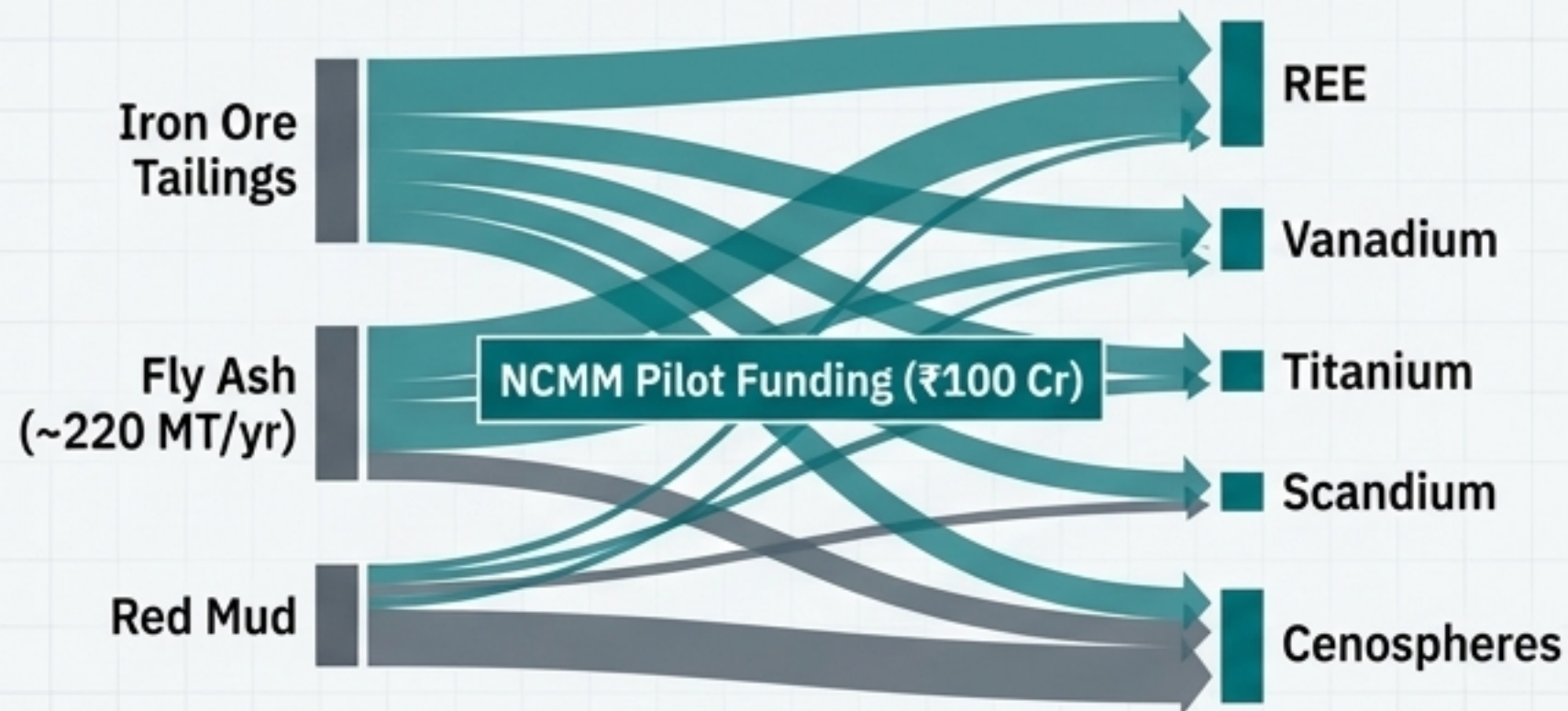
High-value consulting engagements must target greenfield processing feasibility studies along the newly announced Budget 2026 **Rare Earth Corridors** (Odisha, Kerala, AP).

Immediate focus areas:

1. Structuring **tech JVs** with **Australian, Japanese, and South Korean** processors.
2. Modelling long-payback project finance.

Framing India's critical minerals gap as a 'discovery problem' misdiagnoses the threat. The critical advisory and investment void is in commercial-scale, battery-grade, and defence-grade intermediate processing.

# The Tailings Arbitrage



## MECHANICS: UNCONVENTIONAL RECOVERY

- **Iron Ore Tailings:** Hold decades of accumulated REE and Vanadium.
- **Fly Ash:** Yields commercial-value Cenospheres and early-stage REEs.
- **Red Mud Ponds:** Holdings from NALCO & Vedanta contain highly commercial Scandium and Titanium.
- **Mine Overburden:** Translates from a management cost to a revenue stream.

## CONTEXT: FIRST-MOVER ADVANTAGE

Existing mining lease holders hold an insurmountable first-mover advantage over these waste assets in regions like Odisha, Jharkhand, and Goa.

The NCMM explicitly subsidizes pilot projects exploring these **unconventional sources** through a dedicated **₹100 crore** allocation.

## STRATEGY: ASSET MONETIZATION

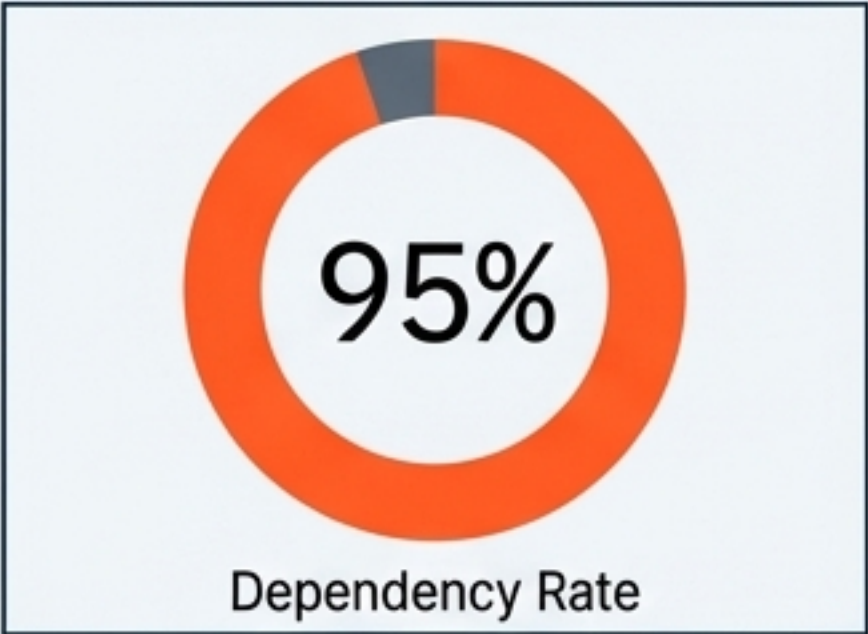
Advisory Intervention:

1. Conduct mineral characterisation for mid-market sponge iron producers sitting on 30-40 years of tailings.
2. Structure feasibility studies leveraging NCMM pilot capital to monetize historical waste, fundamentally altering the client's asset valuation.

Unconventional recovery transforms legacy mining liabilities into strategic critical mineral assets. Existing leaseholders possess a localized monopoly on these tailings that must be aggressively monetized via NCMM grants.

# The Coking Coal Reclassification

## RIGOROUS KPI DASHBOARD

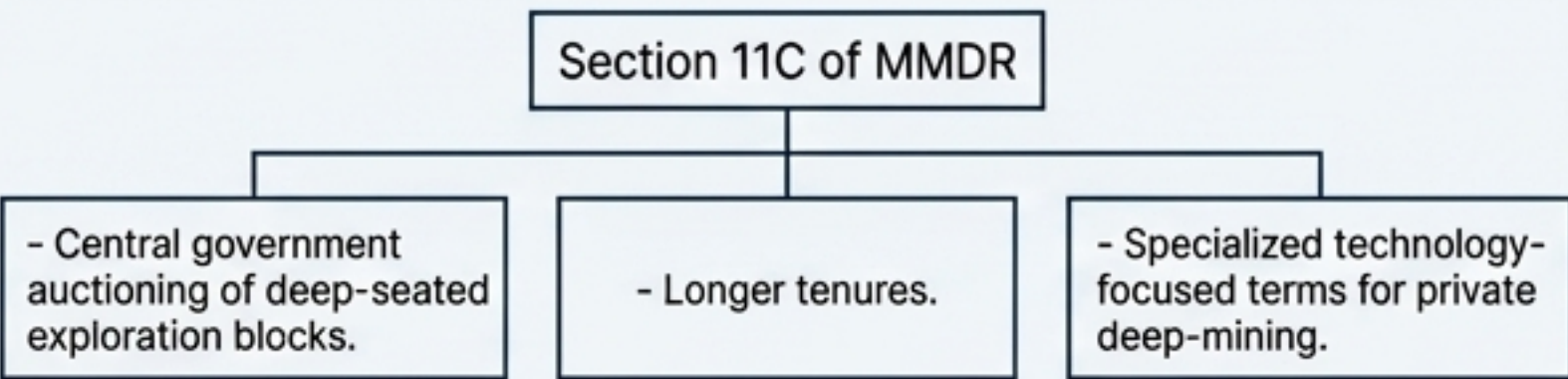


Metric 1:  
~58 MT Annual Imports

Metric 2:  
Target Steel Capacity:  
300 MT by 2030  
(Altering Demand Curves)

## MECHANICS: LEGISLATIVE SHIFT

January 2026 MMDR reclassification officially labels coking coal as a “critical and strategic mineral.”



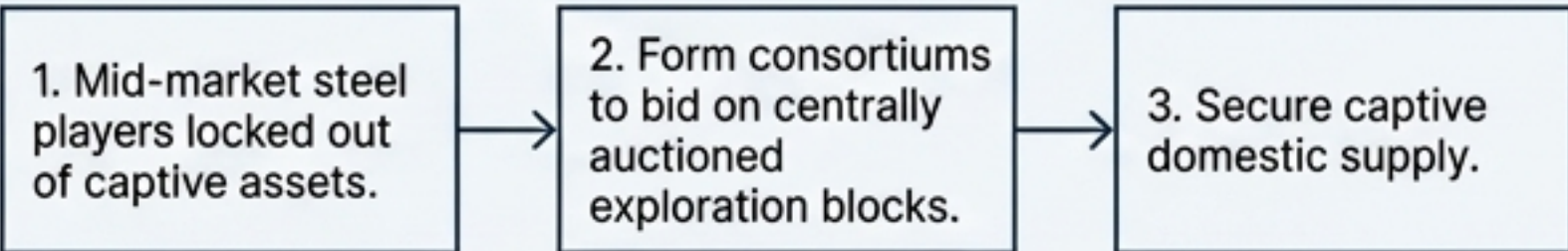
## CONTEXT: THE FOREIGN EXCHANGE DRAIN

BF-BOF capacity expansion relies entirely on coking coal.

The current 95% import dependence drains foreign exchange and exposes the domestic 300 MT target to extreme geopolitical supply shock and volatile Australian/Mozambican pricing.

## STRATEGY: BACKWARD INTEGRATION

Reclassification unlocks unprecedented backward integration pathways.



The January 2026 critical mineral classification of coking coal rewrites the upstream steel supply chain. It grants private, mid-market producers their first viable pathway to centrally auctioned captive fuel security.

# The Hyperlocal Coal Transition



## MECHANICS: ASSET REPURPOSING

Coal India Ltd (CIL) drives >80% of production. Transition requires pivoting 299 closed mines into commercial assets:

- Fisheries
- Solar Parks
- Data Centres

**The CCL Ramgarh, Jharkhand case study proves ecological remediation (acid mine drainage) can establish self-sustaining circular community enterprises.**

## CONTEXT: PHASE-DOWN REALITIES

India's official policy is coal "phase-down," not "phase-out."

Low regional skill levels and poor social security dictate that generic national reskilling templates will fail; solutions must be intensely localized to the 5km dependency radius.

## STRATEGY: JUST-TRANSITION ENGINEERING

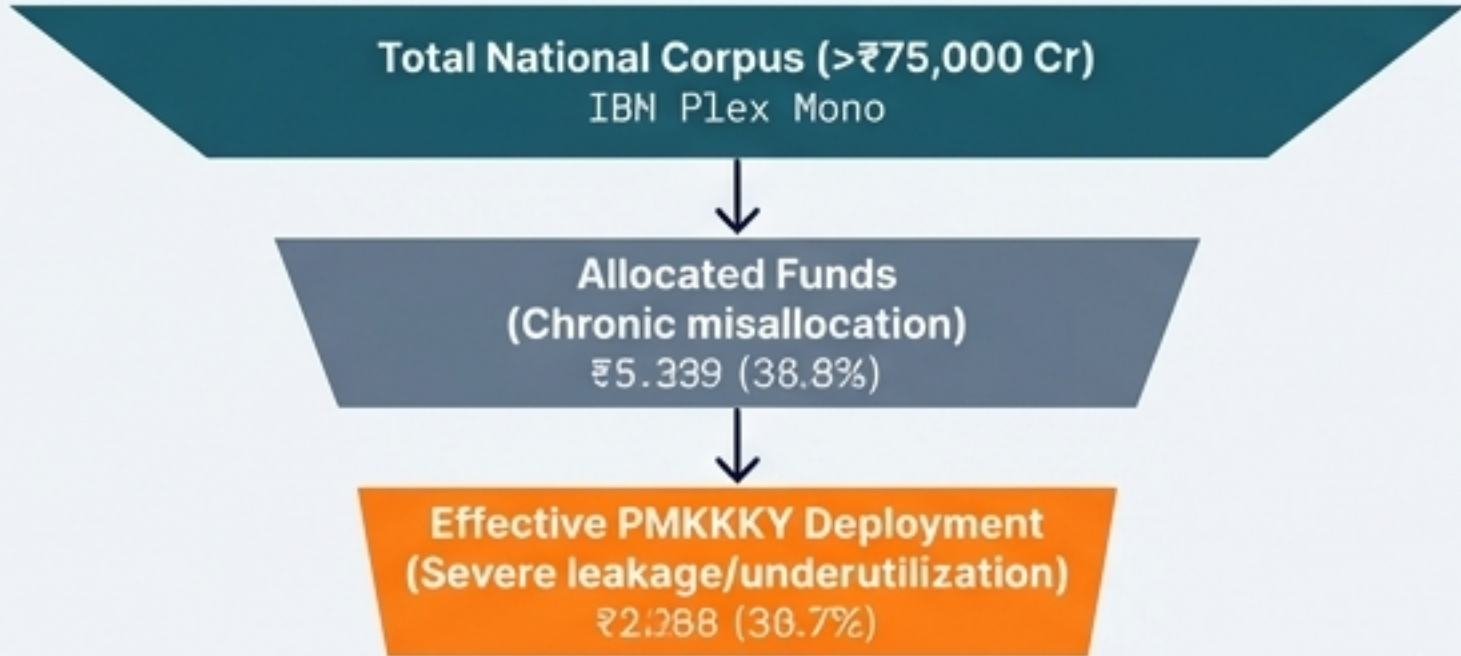
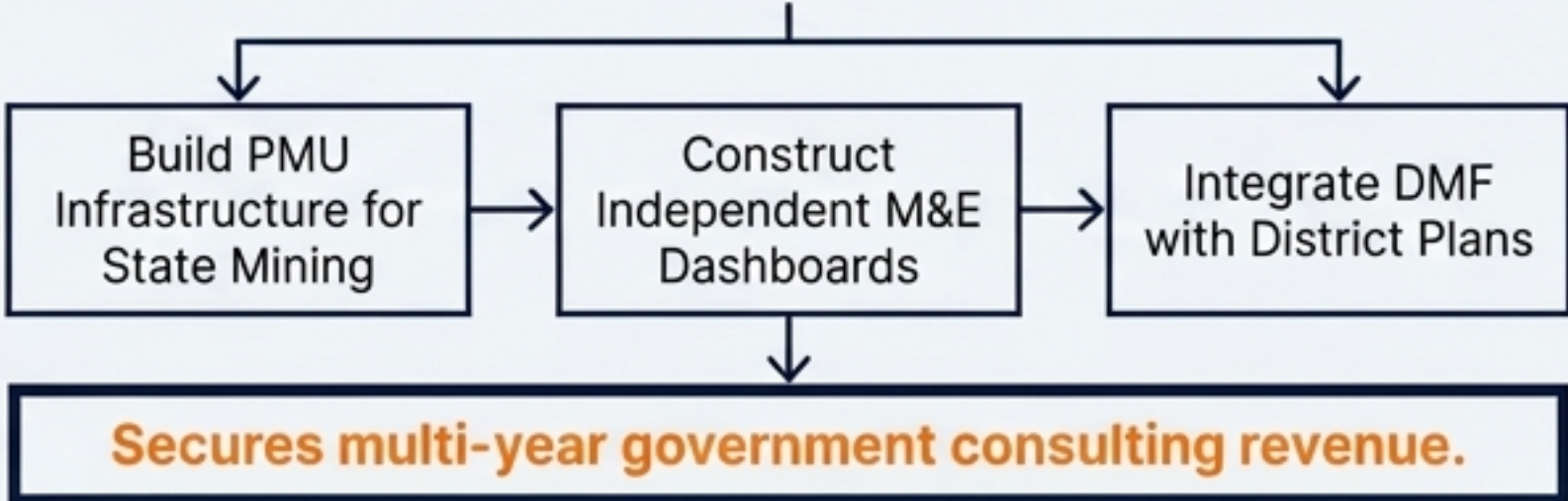
Advisors must engineer district-specific just-transition plans that merge:



Financial audits consistently show current mine rehabilitation funds are structurally inadequate, requiring ring-fenced financial structuring.

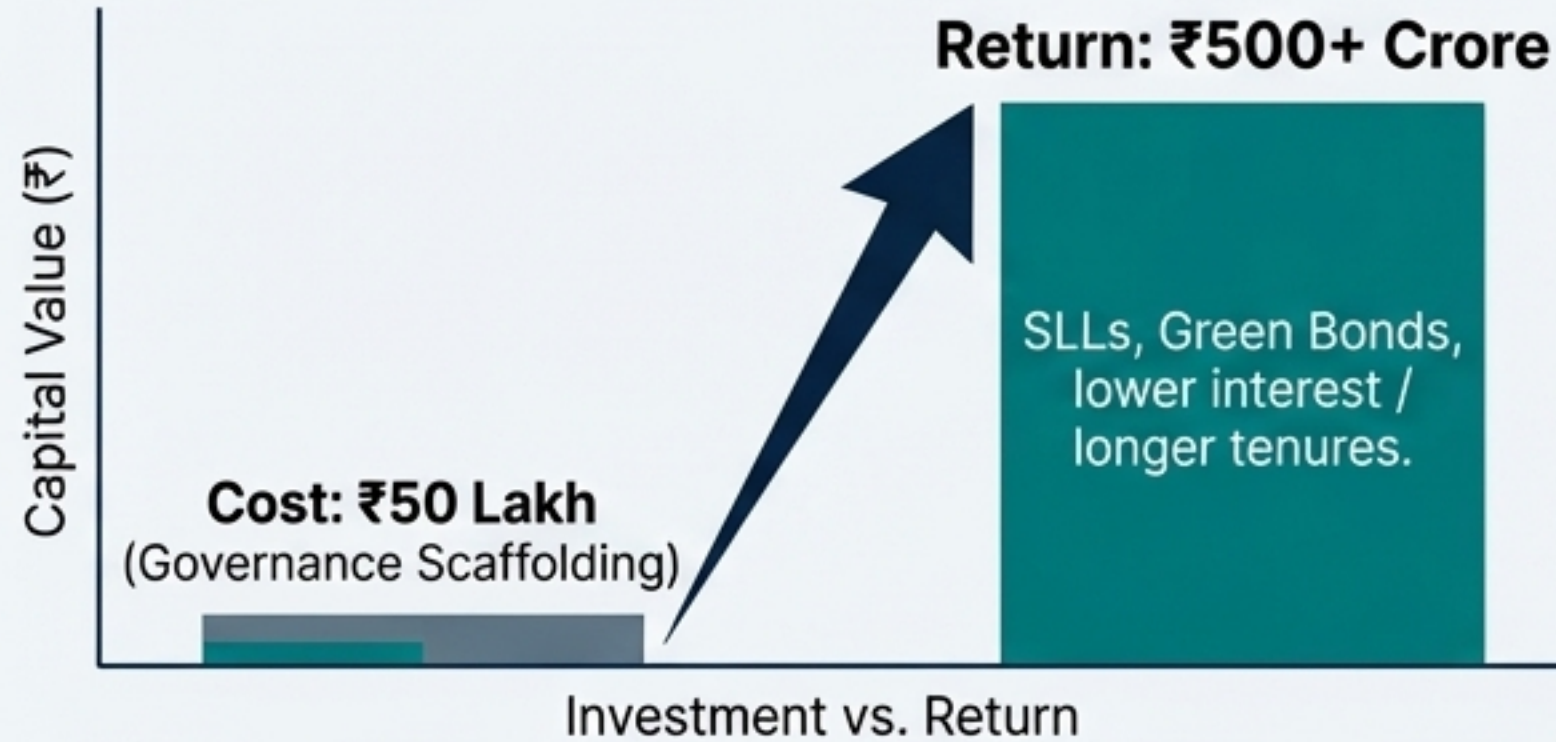
Coal mine closure is a highly localized spatial crisis concentrated within a 5-kilometre radius. Successful transition planning requires converting environmental liabilities into commercial real estate and community enterprises, as proven in Ramgarh.

# DMF Governance & Fund Deployment

|                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p><b>Total National Corpus (&gt;₹75,000 Cr)</b><br/>IBN Plex Mono</p> <p>↓</p> <p><b>Allocated Funds (Chronic misallocation)</b><br/>₹5.339 (38.8%)</p> <p>↓</p> <p><b>Effective PMKKKY Deployment (Severe leakage/underutilization)</b><br/>₹2.288 (30.7%)</p> | <p><b>MECHANICS: THE IMPLEMENTATION VOID</b></p> <p>Mining companies pay statutory MMDR contributions directly to District Mineral Foundations (DMFs). The Jan 2024 revised PMKKKY guidelines demand tighter implementation, but districts structurally lack:</p> <ul style="list-style-type: none"><li>❑ Professional PM capacity</li><li>❑ Independent M&amp;E frameworks</li><li>❑ Transparent beneficiary identification systems</li></ul>                                                                                                              |
| <p><b>CONTEXT: THE BROKEN PLUMBING</b></p> <p>Despite a massive ₹75,000 crore capital pool intended to fund welfare in mining-affected communities, relentless state audits reveal a systemic failure in capital deployment.</p> <p>The funds exist, but the institutional plumbing to deploy them is broken.</p>                                   | <p><b>STRATEGY: PUBLIC SECTOR ADVISORY</b></p> <p>Public Sector Advisory Opportunity:</p>  <pre>graph TD; A[Public Sector Advisory Opportunity] --&gt; B[Build PMU Infrastructure for State Mining]; A --&gt; C[Construct Independent M&amp;E Dashboards]; A --&gt; D[Integrate DMF with District Plans]; B --&gt; C; C --&gt; D; C --&gt; E[Secures multi-year government consulting revenue.];</pre> <p><b>Secures multi-year government consulting revenue.</b></p> |

A ₹75,000 crore capital pool is stalled by local governance deficits. Deploying professional project management infrastructure into state mining departments is the highest-leverage public sector advisory opportunity.

# The ESG Governance Gate



## CONTEXT: REGULATORY MANDATES

BRSR Core is mandatory for the top 1,000 listed companies by FY26-27, demanding audited disclosures on 9 attributes including GHG and water. Concurrently, the Green Steel Taxonomy lays the legal groundwork for future green public procurement mandates.

## MECHANICS: FINANCE REQUIREMENTS

Accessing preferential ESG-linked finance strictly requires:

- 1) Third-party validated transition plan with science-based targets.
- 2) Baseline Scope 1/2/3 measurement via accredited auditor.
- 3) Board-level ESG oversight.
- 4) BRSR/TCFD/CDP aligned annual reporting.

## STRATEGY: REDIRECTING CLIENTS

Mid-market clients fundamentally misunderstand green finance, believing it requires immediate, massive capex in new tech. Advisory must redirect them:

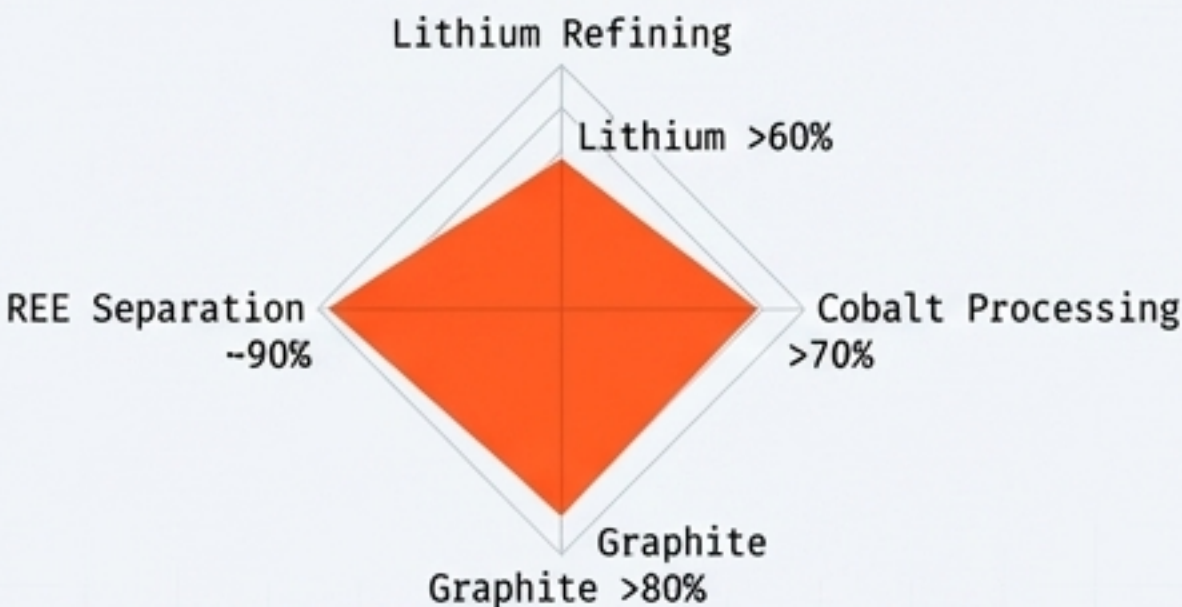
**Gate to Capital = Governance Infrastructure**  
(NOT "Immediate Technological Overhaul").

**₹50 Lakh in compliance -> unlocks -> ₹500 Cr in liquidity.**

Technology does not unlock transition finance; governance does. Establishing BRSR compliance and verified emission baselines is the highest-ROI intervention available to mid-market metals companies.

# Global Geopolitics & Supply Realignment

## Chinese Processing Monopoly



## MECHANICS: STRATEGIC COUNTERMOVES

| China                                                                                                 | India                                                                                                                                   |
|-------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| Aggressive African resource lock-up (e.g., DRC Copper-Cobalt concessions via CMOC, Zimbabwe Lithium). | Counters via bilateral MoUs (Australia Li/Co, Argentina, Saudi Arabia) and the execution of Khanij Bidesh India Ltd. off-take mandates. |

## CONTEXT: STRUCTURAL MARKET SHIFT

The global market has structurally shifted from “lowest-cost sourcing” to “**security-of-supply sourcing**,” accelerated by the US-China tech war, export controls, and rising resource nationalism (e.g., Indonesia nickel ban).

## STRATEGY: RISK MITIGATION

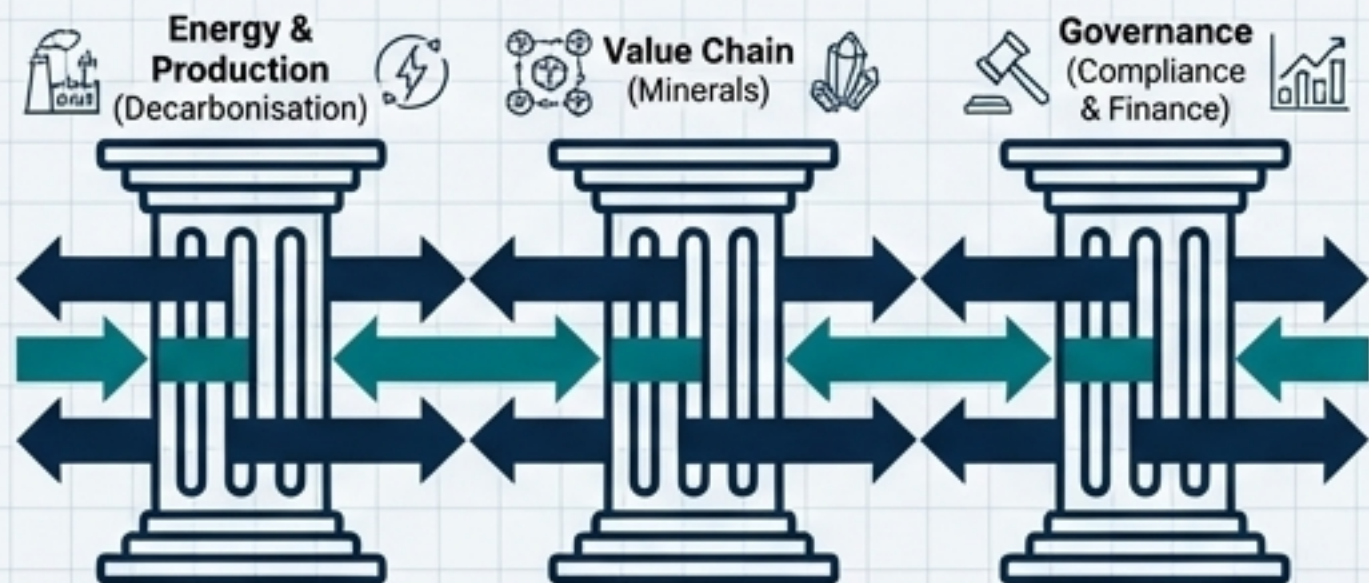
Both Tier-1 and mid-market players must institute geopolitical risk modelling. Strategic imperatives include:

- Diversifying coking coal away from Australia (Mozambique/Russia).
- Forging deep tech partnerships with Japanese (JFE) and European (Salzgitter) processors to bypass Chinese bottlenecks.

The critical minerals supply chain has permanently shifted from cost-optimization to geopolitical risk-mitigation. Indian processors must leverage Western ‘China+1’ diversification to establish themselves as an alternative global refining hub.

# The Triple Transition Framework

## THE UNIFIED ADVISORY MATRIX



## MECHANICS: CONCURRENT PATHWAYS

- **Transition 1 (Energy):** BAT deployment -> Gas-DRI -> Scrap-EAF -> H2-DRI.
- **Transition 2 (Value Chain):** Backward integration, tailings recovery, mine repurposing.
- **Transition 3 (Governance):** BRSR compliance, CBAM docs, ESG-linked finance readiness.

## CONTEXT: THE SILO FAILURE

The mid-market fundamentally lacks the bandwidth to manage regulatory, supply chain, and energy shocks concurrently. Attempting to solve CBAM (Transition 3) without fixing DRI energy intensity (Transition 1) **guarantees failure**.

## STRATEGY: INTEGRATED AGENDA

Advisory firms must abandon siloed service lines. Engagements must deploy Operational, M&A/JV, and Risk/Tax teams simultaneously.

Client needs Decarbonisation Roadmap + Tailings Feasibility + BRSR Setup executed as a **single integrated agenda**.

The energy, supply chain, and governance transitions are concurrent and deeply interdependent. Advisory models must **integrate engineering, corporate finance, and risk assurance** into a singular strategic framework.

# Execution: Project Smelter Blueprint

4-Phase Gantt Timeline



Engagement Value:  
**₹1.5–2.5 Cr**

Cross-functional:  
**4 service lines**

## MECHANICS: PHASE DELIVERABLES

**Phase 1:** Delivers **CBAM** gap assessment.

**Phase 2:** Maps **BAT** adoption (**NPV/IRR**) and **Gas-DRI** feasibility.

**Phase 3:** Structures **NCMM**-funded **REE** recovery from accumulated tailings.

**Phase 4:** Establishes **Board ESG** charters and **SLL** transition finance readiness.

## CONTEXT: CLIENT PROFILE

Client: ₹2,500 Cr Odisha mid-market producer.  
1.2 MTPA capacity, 2.8 tCO2/t intensity.

**PAIN POINT:** EU buyers demanding CBAM compliance by 2027, threatening **12–18% export margin erosion** due to the EU benchmark gap.

## STRATEGY: GUARANTEED ROI

Project Smelter operationalizes the Triple Transition Framework. By directly addressing the **12–18% CBAM** margin threat, identifying monetizable tailings, and unlocking SLL capital, the ₹2.5 Cr advisory fee guarantees an exponential ROI and sets up a multi-year retainer.

Project Smelter demonstrates how integrated advisory protects export margins and unlocks trapped asset value. Deploying a \*2.5 Cr, 18-week engagement transforms compliance from a cost centre into a capitalization strategy