Transition Chronicles

Uncovering *people-centric* approach

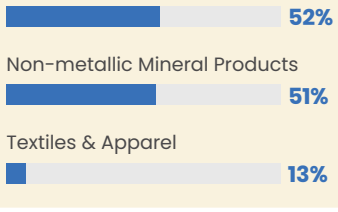


Why Supporting MSMEs Matter in Industrial Decarbonisation?

Micro, Small and Medium Enterprises (MSMEs), often described as the backbone of India's economy, are critical in driving the country's economic growth, employment, and industrial output. Across approximately 75 million enterprises, the sector provides livelihoods to nearly 320 million people and contributes to 31% of the country's GDP. While only 20% of these enterprises are manufacturing MSMEs, they account for 35.4% of India's manufacturing output.[1]

The workforce engaged in the sector is a heterogeneous mix, in terms of social backgrounds, gender, skill sets, education, access to economic opportunities etc. Many MSMEs are concentrated in clusters that form the foundation of local ecosystems and drive state economies. A large proportion of MSMEs operate informally, mirroring high informal employment within the sector. The Annual Survey of Industries 2023-24 suggests that almost 36% of people employed under the manufacturing industries were contractual employees. This diversity underlines the indispensability of MSMEs, as well as the vulnerability they face.

- **99.29%** of registered MSMEs fall under the micro category
- **Contractual employment is highest in sectors like**



Source: MSME Dashboard; Contractual employment data extrapolated from Annual Survey of Industries (ASI) 2023-24

Globally, nearly 60% of business emissions originate from industry supply chains,[2] with a significant portion emerging from SMEs sitting deep within those chains. Now, with accelerated efforts to combat climate change, industries are coming under pressure to reduce emissions, move towards cleaner supply chains, and comply with sustainability standards and emissions reporting requirements. The West Asia crisis also showcased how fuel dependencies and supply chain shocks translate into ripple effects across workers, migrants, and consumers. In this light, decarbonisation is not just a climate imperative but an economic opportunity for these enterprises.

- **135** $MtCO_2e$ emitted by India's MSME sector in 2022
- **>60%** of total MSME emissions come from 5 sub-sectors

Textile	18%
Paper and Pulp	22%
Foundry	7.18%
Forging	7.11%
Steel Re-rolling	9.1%

Source: Roadmap for Green Transition of MSMEs, Niti Aayog, Pg. 117

However, decarbonisation pressures land uniquely on the MSME sector. Most MSMEs in India depend largely on fossil fuels for heat, operate ageing equipment, and have limited capacity for water and waste management. So, asking small enterprises to decarbonise is asking them to change almost everything at once: how they produce and operate, what they invest in, how they comply, how they hire. These shifts will carry implications for costs, employment, skills requirements, market access and the MSME workforce. The burden will fall mostly on the energy intensive enterprises and vulnerable enterprises such as women-owned MSMEs and micro units.

The encouraging signal is that change is already underway. Some MSMEs are pioneers in adopting cleaner technologies and sustainable processes. They are also being backed by an evolving policy environment which is increasingly focusing on championing MSMEs to become green. To further this transition at scale, we require an environment that drives decarbonisation embedded in local context, profitability, and capacities.

This edition of the Transition Chronicles unpacks some of the developments happening in these realms, and provides perspectives from industry players themselves. It reiterates that for MSME decarbonisation to become a reality, the industrial ecosystem needs to converge across policy, finance, skilling, technology access, and an overall institutional mandate to realise meaningful gains.

Women in the MSME space

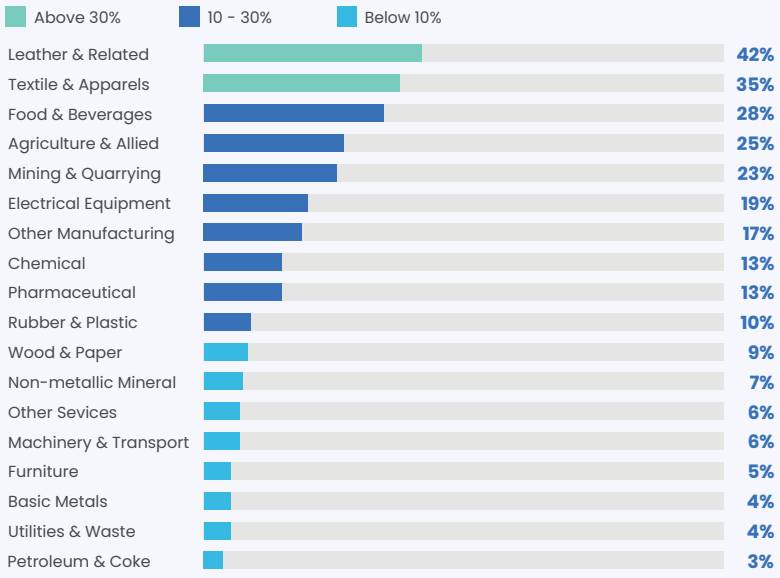
28.8% of MSMEs are women-owned (as of Dec 2024)

On average, male workers earn **1.2 times** more than female workers in sectors like manufacturing of Furniture, Basic Metals, Petroleum & Coke, Leather & Related, Textiles and Apparels

Highest wage disparity: A male worker earns **2.3 times** more than his female counterpart in the chemical Industry

Women on factory floor

Share of women workers by manufacturing sub-sector



Why this trend Matters?

Energy intensive and capital-heavy industries like petroleum, utilities, basic metals witness lesser number of women; while labour intensive and low margin industries like textiles and leather have higher women on the factory floor. The sectors with the fewest women today are also the sectors at the centre of decarbonisation, witnessing an underlying transition. If they are absent at the start of the transition, new green jobs in these sectors risk becoming gender blind again unless actively interrupted.

Source: Annual Report 2024-25, Ministry of MSME; Gender data extrapolated from ASI 2023-24

How India's MSME Policy Is Adapting to the Energy Transition

India's MSMEs generated 135 million tonnes of CO_2e emissions in 2022 and the energy demand in this sector is projected to rise by 50% by 2030.[3] A low-carbon pathway is indispensable for fighting the current global energy crisis. NITI Aayog recently released the Roadmap for Green Transition of MSMEs which positions MSMEs at the core of India's green transition agenda and provides a policy landscape for their low-carbon growth.

Financial assistance remains the foundation of MSME policy. We can see a gradual shift from generic credit support through schemes like Credit Guarantee Scheme for Micro and Small Enterprises (CGSMSE), Pradhan Mantri MUDRA Yojana (PMMY), Credit Guarantee Fund for Micro Units (CGFMU), and the Self-Reliant India (SRI) Fund to **dedicated financial support for green technologies and practices**. Sub-schemes under the Raising and Accelerating MSME Performance (RAMP scheme) like **MSE-GIFT** offers an interest subvention of around 2% and risk sharing benefits for loans up to ₹2 crore for adopting green technologies. Similarly, the **MSE-SPICE** sub-scheme provides a credit linked capital subsidy of up to 25% on plant and machinery for adopting circular practices like recycling and waste management in sectors like Pplastic, rubber, and electronics waste. The **ADEETIE Scheme** will assist MSMEs in 60 clusters across 14 sectors, upgrade to energy-efficient technologies by providing interest subvention of 3-5% to MSMEs.

These schemes also provide MSMEs with technical guidance and hand-holding support such as assistance for audits, identification of viable technologies, development of project reports, and awareness generation.

Embedding sustainability is also becoming critical for MSMEs to remain competitive as standards become more stringent. The **MSME Sustainable (ZED) Certification scheme** raises awareness and incentivises the promotion of 'Zero Defect Zero Effect' practices. Overall, ZED certifications have increased from 1,76,341 certifications in 2023-24 to 6,35,539 certifications in 2025-26.[4] Progress is being led by Uttar Pradesh (19.58%), Gujarat (18.29%), Karnataka (12.58%), and Maharashtra (8.21%). The **MSME Competitive (LEAN) Scheme**, subsidises adoption of lean tools and techniques to help MSMEs increase efficiency, reduce waste, and enhance product quality while lowering costs and production lead times. Maharashtra leads LEAN certifications at 14%, followed by Bihar (10.83%) and Uttar Pradesh (10.53%).[5]

Moving forward, we must aim at strengthening centre-state coordination for program implementation, improve awareness on ESG aspects in the MSME sector, enhance access to schemes, especially for smaller enterprises, and develop the overall industrial ecosystem.

A Deep Dive Into Industrial Perspectives

Topics such as energy security, decarbonisation, and adherence to environmental standards are increasingly coming to the forefront as these shifts become necessary for MSMEs to grow and sustain themselves. We sought perspectives from different MSME owners and managers across various industries to get insights on what the energy transition means for their unit, the impact of the recent West Asia crisis on their operations, and how they are planning to move forward.





Photo Credit: Pexels.com

Prayag Clay Products, Varanasi

Pioneered the zig-zag combustion technology in 2014, which has since become the primary mandated pathway for cleaner brick production for all existing brick kilns. Prayag Clay Products also manufactures hollow bricks.

> **"The future of India's brick industry will depend on how effectively it can balance affordability, energy efficiency, and environmental compliance in a rapidly changing construction landscape"**
>
> **Mr. O.P. Badlani**

The good practices shaping a cleaner Brick Industry

Interview of Mr. O.P. Badlani, Chairman, Prayag Clay Product

What does decarbonisation mean for a brick unit like yours?

India's brick industry, with ~1,50,000 units producing on average 4.5 to 5 million bricks annually per unit, is one of the largest yet most fragmented industrial sectors in the country. Most kilns rely on coal, mostly domestic coal and some on imported coal, especially kilns located in coastal regions.

Decarbonisation in the brick sector is being driven largely through regulatory mandates and market-led transformation to zig-zag technology and a shift from solid to hollow bricks. The former delivers 25-30% fuel savings and up to 75-80% reduction in emissions. Hollow bricks improve buildings' thermal and sound insulation, enhance resource efficiency, and reduce mortar usage by ~70%, building weight (lowers steel and concrete requirement). It also reduces firing fuel consumption.

However, gaps in enforcement lead to uneven implementation. While brick kilns in Bihar and around Varanasi lead the way with a ~90% conversion rate, such high adoption is not the case across the nation.

What economic and structural barriers do units face?

Challenges to transition include high CAPEX for modern technologies, reluctance of banks to lend given the long payback periods for investment in hollow brick plants, and low profitability. There are also weaker institutional structures compared to sectors like steel or cement, with limited financial and policy instruments available to the brick industry.

Brick production is also highly seasonal, operating 6-7 months per year. Recent global developments have led to coal and gas prices increasing significantly. Workers are indirectly affected by production disruptions, rising costs, and reduced operational windows.

What steps do you envision for the future?

Promoting hollow bricks, reducing sectoral fragmentation through better coordination and organisation, institutional strengthening, providing financial tools like interest subvention and subsidies, as well as targeted government programmes towards brick industry modernisation. Any transition in the sector must integrate skilling and reskilling, ensuring that decarbonisation does not come at the cost of livelihoods for informal workers.

Why the West Asia Conflict Matters to Morbi's Ceramic Hub?

Interviews of Mr. Jaideep Patel (Director, Soriso Ceramics), Mr. Vilpara Ishwarhai (Foton Ceramics) and Dr. Shailesh Makadia (Radhe Renewable Energy Development), members of Morbi Ceramics Cluster.

What is the significance of the Morbi ceramics cluster?

Gujarat's Morbi ceramic cluster is India's largest ceramic and tile manufacturing hub, accounting for nearly 70-75% of India's ceramic tile production and hosting ~1000 ceramic manufacturing units. It includes 650-700 units operating spray dryers and over 400 operational roller kilns. The cluster exports extensively to Vietnam, Europe, Africa, and Latin America.

What are the energy dependencies of the ceramic cluster?

The ceramic manufacturing process is highly energy intensive, particularly during spray drying (process of converting ceramic slurry to granulated powder for hydraulic tile pressing) and roller kiln operations. A typical spray dryer producing 18-19 MT/hour of dry powder consumes nearly 125 Kg of lignite or Indonesian coal per ton of power. The cluster collectively consumes nearly 2,000 tonnes per day (2,000 TPD) of coal. Kiln Firing requires Liquefied Natural Gas (LNG) with each ceramic unit consuming ~10,000-25,000 Nm^3 of LNG per day, with total LNG demand in Morbi estimated at nearly 8 million Nm^3/day.

How has the West Asia crisis impacted your cluster?

Morbi's dependence on imported LNG and its geopolitical volatility has emerged as a major structural risk for India's ceramic manufacturing ecosystem. Recent disruptions in the LNG supply chains, surging fuel prices, and shipping disruptions have sharply increased the production costs, reduced capacity utilisation, and affected their export competitiveness.

During the initial phase of the West Asia Conflict, there was a near-complete shutdown or suspension of production across Morbi except for a handful of large integrated manufacturers. Initially, fewer than 5-10% units remained operational and later nearly 20% resumed operations. Currently, while 60-70% units are operational, they are functioning at barely 50% production capacity due to elevated fuel costs and labour shortages. Several smaller units have reportedly remained shut for over three months.

The rise in LNG prices has directly increased the tile manufacturing costs, with ceramic tile prices reportedly rising by 30-40% across domestic and export markets.

LNG expenditure in the cluster previously ranged between ₹400-₹500 million per day, with annual LNG imports valued at nearly ₹140–₹150 billion. Higher energy costs, delayed shipments, labour migration have further intensified operational stress.



Photo Credit: ANI

Morbi Ceramics Cluster

India's largest ceramic manufacturing hub is navigating rising energy costs, fuel supply volatility and workforce disruptions while remaining a key export engine for the sector.

> **"Apart from fuel costs, labour shortage has emerged as a major operational challenge, with migrant workers leaving due to prolonged shutdowns and uncertain production schedules"**
>
> **Mr. Jaideep Patel**


Photo Credit: Hex Worldwide

HEX Worldwide, Vapi

Manufactures electrical high-conductivity copper and aluminium cable accessories and components. Approximately 80% of their products serve the export market.

> **Export-oriented manufacturers are increasingly exposed to geopolitical risks through rising logistics costs, shipping disruptions, etc.**
>
> Mr. Chetan Kuvadia

Transitions in an Electrical Component Manufacturing Unit: Automation, Skills, and Fuel dependencies

Interview of Mr. Chetan Kuvadia, General Manager, HEX Worldwide

What are the energy dependencies for your unit?

Manufacturing the components and cables requires a combination of electricity, LPG, and oxygen. Most key operations run on electricity, including cutting, machining, semi-automatic production systems, forging, finishing, quality control, and effluent treatment plants (ETP).The unit also faces regular power supply disruptions, particularly during monsoon. The company operates Diesel Generators for backup power generation.

The unit has an in-house ETP to recycle and reuse water for production, gardening, and non-process applications. Scrap copper and aluminium is sent back to suppliers/recyclers for reprocessing, thereby reducing raw material procurement cost and wastage.

What does a people-centric transition mean for your unit?

The unit is transitioning at various levels in the manufacturing process, shifting towards semi-automation, and skilling of labour.

The unit has upgraded from conventional oxidising annealing (a pre-forging process to prevent cracking of copper) to bright annealing systems which minimises oxidation and blackening of copper, thereby improving product finish and quality. It also improves worker safety and shop-floor conditions by reducing smoke, heat exposure, as well as skin irritation and allergies. Operations are also increasingly transitioning from manual to semi-automatic systems. The initial transition required worker adaptation and training.

How has the West Asia Crisis impacted the unit?

The unit requires LPG during the high temperature-brazing process of copper strips and cable components. Due to price volatility and supply disruptions, an intermittent shift to acetylene is being made. However, it is ~1.5 times costlier than LPG, increasing the monthly fuel expenditure from approximately ₹2,00,000 to nearly ₹5,75,000.

The crisis has also impacted export orders, international shipping routes, and increased transportation and logistics costs. Additionally, diesel prices have risen and its procurement has been affected.

What steps do you envision for the future?

The company is considering solar energy adoption and energy-efficient process modernisation. We are looking to transition towards advanced automation for establishing remote monitoring and inspection systems, and real-time process control. It will require workforce re-skilling and technical training. Additionally, stable fuel supply and reduced dependence on volatile LPG and diesel markets will be a priority.

Inside Perundurai's Dye House: Process Optimisation, Resource Efficiency, and Energy Transition

Interview of Mr. Jayakumar, Chief Operating Officer, Dyeing Division, Shakthi Knitting

What are the energy dependencies for your unit?

The facility processes and dyes fabrics with integrated finishing and compacting operations. The dyeing process itself is highly energy-intensive. Temperature requirements for cotton dyeing ranges between 35 °C-95 °C, and can go up to 135 °C for polyester-cotton. The facility uses indirect steam heating systems.

They consume 70-75 TPD of steam, which requires 20-30 TPD of solid fuel depending on production mix and processing intensity. The company transitioned from furnace oil to firewood-based thermal systems following buyer-driven sustainability expectations. They use a mix of firewood, briquettes, agro-waste from Kerala, whatever is sustainably and commercially available. Unlike conventional textile processing units, the company consciously avoids coal usage.

What economic and structural barriers are faced by units?

Fuel procurement and management is an operational challenge. Firewood moisture levels fluctuate between 30-60%, fuel availability is seasonal, and agro-residue sourcing remains inconsistent across the Perundurai region.

Tamil Nadu's textile MSMEs are increasingly being pushed to balance sustainability, export competitiveness, and operational efficiency amid tightening global buyer expectations. So long-term sustainability depends on process optimisation and improving thermal efficiency.

Additionally, in a dye house, there can easily be more than 200-250 variables influencing shade output. If those variables are not controlled, the same fabric gets processed again, meaning more steam, more water, more chemicals, and more energy for the same product. The company also follows a Zero Liquid Discharge (ZLD) framework and procures only ZDHC (Zero Discharge of Harmful Chemicals) Level-3 compliant chemicals and dyes. Yet, increasingly stringent market expectations around shade matching are unintentionally driving resource inefficiency across the textile sector.

What does decarbonisation mean for your unit?

Environmental responsibility comes with an additional cost. Unless responsible sourcing practices become uniform across brands and markets, sustainability investments will remain difficult for many MSMEs.

Textile dyeing operations require extensive steam and heating across multiple stages, including pre-treatment of grey fabric, dye fixation, washing, drying, heat-setting, and finishing operations. While some units use LPG and agro-waste-based systems, many existing boilers are approaching 20 years of operation and were originally designed for manual coal or firewood-fired configurations.

Most dyeing units continue to operate relatively small-sized boilers, often running at only one-third of their rated capacity because dyeing is an inherently batch-based process with fluctuating steam demand. Advanced automatic boilers capable of handling multiple fuel types remain expensive for MSMEs, particularly when combined with increasingly stringent air pollution control requirements. Technologies like Electro Static Precipitators and Bag Filters are economically difficult for smaller boilers. At the same time, traceability is becoming equally important as retailers increasingly want farm-to-fuel traceability for biomass and agro-waste fuels.

The cluster is now exploring broader decarbonisation pathways, including fuel switching options.


Photo Credit: Vasudha Foundation

Shakthi Knitting, Perundurai SIPCOT

The Perundurai-based unit operates a knitwear processing facility with nearly 20 tonnes per day processing capacity, catering largely to European garment markets and global apparel brands.

> **We cannot afford to waste water, chemicals, steam, or energy anymore. Sustainability today is not a separate activity – it is part of operational survival**
>
> Mr. Jayakumar

Cleaning Up Industrial Heat: A Decarbonisation Opportunity for India's MSMEs

Industrial heat pumps can cut energy use by 40–60% in MSME clusters, and clean up the factories that quietly power a third of India's manufacturing emissions.

India's industrial decarbonisation narrative is often dominated by future-oriented solutions such as green hydrogen, carbon capture, and advanced fuels. While these technologies will play an important role in hard-to-abate sectors, a large and immediate opportunity already exists in cleaning up industrial heat across India's MSMEs.

The challenge is significant. Industry accounted for nearly half of India's final energy consumption in 2025,[6] much of it is linked to process heat generated through coal, biomass, and gas. The opportunity for electrifying process heat is particularly relevant for MSMEs operating in sectors such as textiles, food processing, paper, chemicals, and pharmaceuticals. Although MSMEs account for approximately 17% of India's industrial emissions, their emissions are highly fragmented and concentrated in thermal energy-intensive sectors. In textiles alone, MSMEs contributed for nearly 47% of sub-sectoral emissions, while the share rises to 57% in food processing and 36% in paper manufacturing.[7]

To understand why heat matters, it is useful to examine how heat is actually produced and consumed inside a typical textile processing facility.

Firstly, there is no single way to deliver process heat. Textile manufacturing relies on multiple heating pathways including steam, hot water, hot air, and flue gas. While these technologies serve different production requirements, they remain overwhelmingly dependent on fuel combustion. Steam boilers support wet-processing operations such as dyeing, printing, and washing, while thermic fluid heaters are commonly used for drying and surface heating.

Secondly, steam systems dominate industrial heat demand. Analysis of a medium-sized textile processing unit in Surat shows that nearly 92% of total energy demand is thermal, while electricity accounts for only 8%. Within thermal systems, steam-based processes contribute approximately 59% of useful heat demand. Thermal demand itself fluctuates considerably from an average of nearly 4 MWth to peak loads of approximately 5.6 MWth, reflecting the variations in production schedules and operating conditions.

However, the significance of these numbers lies not merely in how much heat is consumed, but in how that heat is generated and delivered. Many textile units continue to operate ageing boilers that are oversized relative to actual demand. While installed steam generation capacities may reach 7-8 tonnes per hour (TPH), operating loads often remain at only 40-50% utilisation. Boilers perform most efficiently near rated loads; prolonged part-load operation increases fuel consumption, lowers efficiency, and raises operating costs.

More importantly, much of the steam generated never directly heats the product itself. Instead, it is used for indirect applications such as hot-water generation, maintaining vessel temperatures, and heating rollers or stenters. In many cases, high-temperature steam produced at 120 °C-160 °C is ultimately used for applications requiring temperatures below 100 °C. This thermal mismatch represents a fundamental inefficiency in conventional industrial heating systems.

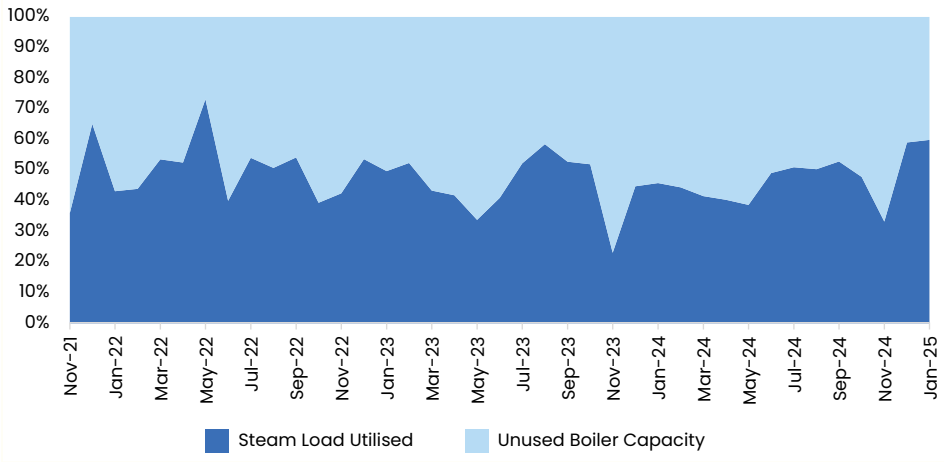
Thirdly, industrial heat pumps offer one of the most practical pathways to address these inefficiencies. Unlike boilers that generate heat through combustion, heat pumps transfer and upgrade existing heat using electricity. Industrial heat pumps typically achieve a coefficient of performance (COP) of 3-5, meaning they can deliver three to five units of useful heat for every unit of electricity consumed. When powered by renewable electricity, they also create a direct pathway toward low-carbon industrial production.

Their relevance extends beyond carbon reduction. By matching heat quality more closely with process requirements, heat pumps can reduce overall energy consumption by 40-60% in suitable industrial applications. They can also recover waste heat from dyeing effluent streams, pre-heat boiler feedwater, support washing and dyeing operations, and simultaneously provide heating and cooling where required.

Ultimately, cleaning industrial heat is not simply a technology transition. It is a systems transition. If supported through affordable electricity, targeted financing, and better process integration, industrial heat pumps could become one of India's immediate and scalable opportunities to decarbonise MSMEs.

Boiler Capacity Utilisation Profile

(% of Cumulative Installed Capacity in TPH)



Credits

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New-Age Financing for Greener MSMEs

MSME Sector accounted for 51% of the total priority lending sector (PSL) credit disbursement in 2024. Since 2019, the overall PSL credit disbursement to MSMEs nearly doubled from ₹10.99 trillion to ₹21.73 trillion in 2024.[8]

One of the critical enablers for MSME to grow is finance. Despite this, access to credit, particularly formal credit remains an issue.

A SIDBI report[9] which surveyed approximately 2000+ MSMEs found the current credit gap to be at 24% or ~₹30 trillion. The gap is sharpest where it can least afford to be. Rural MSMEs face a 32% credit shortfall against 20% in urban areas, while women-owned units face a 35% gap versus 20% for male-owned enterprises, making women less likely to access formal credit.

MSMEs will also need capital support to transition to greener practices and technologies, comply with emerging sustainability standards and future proof their workforce. Financial flows from the banking sector towards green financing is still presently low, primarily due to a lack of awareness within the banking sector, as well as technical difficulties in underwriting loans for these new technologies, especially for smaller units.

For MSMEs themselves, finance often hits three walls. First is access: how proximate a formal lender is to a unit, particularly in rural and remote areas. Second is availability: whether the standard loan underwriting procedure is viable for the MSME, particularly units lacking documentation, collateral, or a formal credit history. Third is the cost of capital: if the interest rates are affordable for businesses running on thin working capital margins.

To improve access to finance, we must move towards a system where financial offerings account for and embed the existing constraints faced by MSMEs. During a webinar on Opportunities for MSMEs in Energy Transition hosted by Vasudha Foundation, we heard from Kinara Capital, a fintech NBFC providing innovative lending solutions to MSMEs.

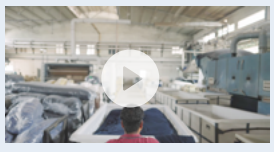
They effectively provide loans to small players by assessing them without collateral and underwrite loans based on their revenue instead. They also provide disbursals in 24-48 hours subject to bank formalities, which is a much smaller turnaround time compared to conventional lending.

Some of their targeted products include 'Her Vikas', a gender focused product offering an unsecured loan for asset and equipment purchase, and a Green and WASH (water, sanitation, and hygiene) financing product designed to nudge MSMEs to adopt cleaner practices.

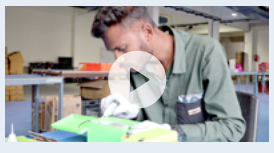
Protecting lenders can help incentivise green lending and improve the risk to reward ratio for institutions wary of underwriting green loans. This can be done through credit guarantee schemes for green end-use products and by expanding warranty covers for green infrastructure and technology. Moreover, to make financing products effective for informal MSMEs, collateral-free loans with clear terms and language on interest rates and collection methods must be provided.

Such good lending practices can help bridge the finance gap and positively impact the industry ecosystem.

Watch, Read, Explore



Title: **Electrification, Enterprises and Equity: The 3' Es Defining India's Industrial Transition.**



Title: **From Linear to Circular: Reimagining India's Auto Sector.**

Blog Series: **Clean Heat, Clean Production**

- Part 1- **India-EU FTA: Powering the Next Phase of Textile Exports Through Electrification.**
- Part 2- **Energy Security and Stability: Rethinking Fuel Dependence.**
- Part 3- **Cutting the Inefficiency Chain: Electrification as a Transition Opportunity for India's Textile Cluster**

Report: **Electrifying the Textile Industry**

For access, scan QR

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