



Green Growth for MSMEs: Overcoming Barriers and Harnessing Opportunities

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Abstract

The Micro, Small, and Medium Enterprises (MSME) sector in India is crucial for the country's economic growth and sustainability efforts, contributing 6.1% to the manufacturing GDP and 29.2% to the Gross Value Added (GVA). This article explores the need to mainstream MSMEs for a sustainable future, focusing on their energy consumption patterns and environmental impact. Analysis of registration data reveals a service sector dominance, with significant contributions from states like Maharashtra, Gujarat, Uttar Pradesh, and Madhya Pradesh. Despite these contributions, MSMEs are heavily reliant on fossil fuels, contributing substantially to greenhouse gas emissions. To meet India's climate targets, transitioning MSMEs to low-carbon practices is essential. The regulatory framework and current policies, including India's commitment to achieving Net Zero emissions by 2070 and the promotion of green technologies, underscore the necessity for MSMEs to decouple growth from emissions. Key strategies include the adoption of green hydrogen, carbon capture, natural climate solutions, and material circularity. However, MSMEs face several barriers, such as financial constraints, lack of awareness, capacity gaps, and regulatory challenges. Addressing these barriers through innovative financial instruments, enhanced green financing access, and comprehensive training programs is crucial. The article further highlights opportunities for MSMEs to adopt energy-efficient technologies, participate in carbon markets, and leverage government programs. Two such case studies demonstrating the benefits of sustainable practices, such as cost savings and reduced carbon footprints by MSMEs have been highlighted. Supporting MSMEs in their transition to sustainability requires concerted efforts from government, industry bodies, and financial institutions to overcome existing barriers and capitalize on available opportunities.

1. Introduction

The MSME sector in India is pivotal to the country's economic growth and sustainability efforts. The MSMEs representing 6.1% of the manufacturing GDP and about 29.2% of GDP in terms of Gross Value Added (GVA), MSMEs are the backbone of India's industrial landscape (Technology, 2021). As of March 30, 2022, nearly 80 lakhs businesses were registered under the Udyam Portal, with micro enterprises forming 95% of the total. The distribution highlights that over half of these enterprises operate in rural areas (Unit, 2022). Analysis of Udyam registration data as of December 31, 2021, reveals a predominant presence of MSMEs in the service sector, accounting for 68 percent of registrations, while the manufacturing sector represents the remaining 32 percent. Notably, states such as Maharashtra, Gujarat, Uttar Pradesh, and Madhya Pradesh have witnessed substantial MSME registrations, with Maharashtra which includes approximately 14,00,000 registrations (Ministry, 2021)

The operations of the industries exhibit a significant dependency on energy resources, with 15% allocated to electricity and an overwhelming 85% to thermal energy, predominantly sourced from fossil fuels such as coal, natural gas, and diesel, among others (TERI, 2022). This heavy reliance on fossil-based fuels renders the sector GHG intensive, contributing to an estimated 175.52 million tCO₂e of cumulative greenhouse gas emissions in the fiscal year 2017-18 alone (TERI, 2022). To align with India's Nationally Determined Contributions (NDCs) aimed at reducing the emission intensity of GDP and fulfil global climate commitments such as achieving Net Zero and Sustainable Development Goals (SDGs), it is imperative for India's MSMEs to transition into a low-carbon emitting sector.

The objective of this article is to explore the imperative of mainstreaming MSMEs for a sustainable future, with a focus on addressing their energy consumption patterns and environmental impact. The subsequent sections will delve into a comprehensive analysis of the regulatory framework governing MSMEs, the barriers hindering their sustainability efforts, and the opportunities available for enhancing their environmental performance.

2. Regulatory framework and current policies

India's commitment to reducing emissions is evident from its participation in global agreements and national strategies. During the Conference of Parties (CoP) 26 held in Glasgow in 2021, India pledged to achieve Net Zero emissions by 2070. India's Long-Term Low Emission Development Strategy (LT-LEDS) and updated Nationally Determined Contributions (NDCs) emphasize the need for a low-carbon industrial system. Among the seven listed strategies, one is to promote economy wide decoupling of growth from emissions and development of an efficient, innovative, low-carbon industrial system from the MSME sector (Ministry of Environment, 2022). Moreover, according to the updated Nationally Determined Contributions (NDCs) targets, India is committed to reduce about 50% cumulative electric power and reduce emission intensity of its GDP by 45% by 2030 (India G. o., 2022). For fulfilling these targets, various long term decarbonisation strategies in MSME sector have been proposed by the government. Few of the decarbonisation levers proposed are:

- Green Hydrogen
- Carbon Capture, Usage, Usage and Storage (CCUS)
- Natural climate solutions and
- Material Circularity

To successfully implement the above mentioned levers, there is a need to develop innovative and dedicated low-risk financial instruments essential for MSMEs to prioritize technologies and accelerate investments. Moreover, there is a need to address the lack of awareness, training, capacity gaps and knowledge about green finance markets and latest low carbon technologies as greening of MSMEs are crucial for India's journey towards climate resilient pathways to achieve ultimate target of net zero.

Transitioning MSME sector to low-carbon resilience requires substantial investments in GHG mitigation and work towards replacement of traditional technologies for cleaner and less carbon intensive alternatives. Current policies which support the above mentioned strategies are:

- *National Green Hydrogen Mission* (Ministry of New and Renewable Energy) will lead to significant decarbonisation of the economy, reduced dependence on fossil fuel imports, enabling India to assume technology and market leadership in Green Hydrogen. Leveraging on India's extensive base of MSMEs, India can lead in the manufacture of green hydrogen and its allied sectors.
- *Energy conservation and efficiency guidelines for 25 MSME sectors*: Bureau of Energy Efficiency joined hand with multi-Lateral organisations for joint implementation of strategic policy focussed initiatives for MSMEs with support from Global Environment Fund (GEF). BEE under the Indo-Japan Energy Dialogue, Developed Energy Conservation Guidelines for Large and 25 MSME Sectors such as foundry, forging, brass, textile etc (Efficiency, Energy Conservation Guidelines for MSME sector, 2019).
- The *Market based mechanism* for MSMEs similar to PAT (Perform, Achieve, Trade) scheme: BEE is planning to operate market-based mechanism for MSMEs, similar to PAT which is a mechanism for improvements in energy efficiency of energy intensive industries with an associated market based mechanism to enhance the cost effectiveness through certification of excess energy saving which can then be traded.
- *Technology and Quality Upgradation (TEQUP)* support to MSMEs: Quality and Technology Upgradation is as an important element for enhancing competitiveness of any manufacturing industry including MSMEs. Through the TEQUP, it aims to sensitize the manufacturing MSME sector in India to the use of energy efficient technologies and manufacturing processes so as to reduce cost of production and the emissions of GHGs and also improve the product quality of MSMEs as well as encourage them towards becoming globally competitive. (MSME, 2010)
- Bureau of Energy Efficiency (BEE) – *National programme on energy efficiency and technology upgradation of MSMEs*: Energy Efficiency (EE) is the centre of improving the competitiveness of the MSME sector and reducing carbon emissions. Adoption of Energy Efficient Technologies (EET) and best operating practices in industrial process is of vital importance for mitigating greenhouse gases (GHG) emissions and tackling climate change. The sector holds immense potential in fostering energy efficiency and upgradation of technologies. To make Energy Efficient India and follow a path of sustainable development, it is important that the

MSME sector adopt the green and efficient manufacturing processes. Various programme/schemes of Govt. of India and BEE remain a key driving force of energy conservation/uptake of energy efficiency among the SMEs (Efficiency, Impact of Energy Efficiency Measures, 2022-23).

- Energy and Resource Mapping Studies – Conducted comprehensive energy efficiency and policy focused studies on 11 sectors which includes (Foundry, Forging, Steel Re-Rolling, Paper, Chemicals, Glass and Refractory, Pharma, Bricks, Leather, Textile and Food processing technologies) (Efficiency, Impact of Energy Efficiency Measures, 2022-23)
- Scaling-up technology implementation in 20 MSMEs clusters for foundry, forging, Steel Re-Rolling and Paper Sectors (Efficiency, 2022-23)
- Empanelment of Urja Mitra: To ensure a sustained presence within any MSME cluster, BEE appoints an experienced CEA personal as the 'Urja Mitra.' This individual plays a pivotal role in promoting energy efficiency and renewable energy adoption within the cluster, while also providing technical assistance and advisory services to MSME enterprises. The Urja Mitra will act as a crucial liaison between the BEE and the stakeholders in the MSME cluster. (Efficiency, 2023)
- Partial Risk Sharing Facility (PRSF) Programme: PRSF project was initiated by Government of India partnering with World Bank to promote an increased level of investments in energy efficient projects, particularly through energy service performance contracting delivered through energy service companies. The programme is implemented by Global Environment Facility("GEF") and the Clean Technology Fund. (Ministry of Power, 2022-23)
- SIDBI “4E (End to End Energy Efficiency)” Scheme: SIDBI 4e scheme was launched to provide financial support to MSMEs and helping them to implement new technology and other energy efficiency measures. It mainly focuses on implementing those technologies in which machinery consumes less energy and provides big output by providing financial and technical assistance at reliable rates of interest. (Efficiency, 2022-23)
- Promoting Energy Efficiency and Renewable Energy in selected MSME clusters of India” BEE - GEF - UNIDO Project: The project aims to develop and promote a market environment for introducing energy efficiency (EE) and enhanced use of renewable energy (RE) technologies in process applications in selected energy intensive industrial clusters, comprising micro, small and medium enterprises (MSMEs). The project was started in 12 MSME clusters across India in five sectors namely Brass (Jamnagar); Ceramics (Khurja, Thangadh and Morbi); Dairy (Gujarat, Sikkim and Kerala); Foundry (Belgaum, Coimbatore and Indore); Hand Tools (Jalandhar and Nagaur) in its first phase. The Project has scaled-up and expanded its activities to additional 14 new clusters to reach out to MSME’s at national level. (Efficiency, 2022-23)

- BEE-GEF-EESL (Energy Efficiency Services Limited): The project aims to deploy 30-35 technologies in selective MSME clusters in the country which have maximum possibility of replication and potential to improve the energy productivity of fellow MSMEs units, hence competitiveness. The project also aims to adopt various business models of ESCO (Energy Servicing Company) where the MSME unit is expected to pay-back to the investor from the monetized energy saving in a period of time. (EESL-UNIDO-MoMSME, n.d.)

Table 1: Impact of implementation of various schemes for MSME sector in India (Ministry of Power, 2022-23)

Program / Scheme			Electricity Savings (BU)	Thermal Savings (MToE)	Total Energy Savings (MToE)	GHG Reduction (MtCO ₂)	Monetary Savings (INR Crore)
Partial Facility Programme	Risk Sharing (PRSF)		0.02	-	0.0019	0.02	13.52
SIDBI Energy Scheme	“4E (End to End Efficiency)”		0.28	0.00089	0.0246	0.23	167.15
BEE-GEF-EESL (Energy Efficiency Limited)	(Energy Services)		0.0015	0.0018	0.0019	0.009	4.49
BEE-UNIDO-SME (Small and Medium Enterprises)			0.00	0.00	0.0057	0.038	36.72
Total			0.603	0.00269	0.0341	0.297	221.88

3. Identifying Barriers

Despite the above-mentioned initiatives, MSMEs face several barriers: Financial and regulatory challenges: MSMEs struggle with limited access to affordable financing for adopting green technologies. Banks perceive MSMEs as high-risk borrowers due to their insufficient assets and low capital, making them vulnerable to market and economic fluctuations (Mund, 2020). The high cost of green financing, along with additional expenses for certification and due diligence, further complicates their financial landscape (Bharati & Patra, 2022). MSMEs also face complex regulatory requirements and a lack of streamlined processes. Clear government regulations on green financing for small businesses are

insufficient. Key barriers include limited access to financial, technical, and qualified human resources, difficulty in securing loans, and inadequate financial, technical, and advisory support from government and industry bodies. Addressing these issues requires government intervention through capital subsidies, incentives like easy credit facilities, soft loans, tax exemptions, mandated priority sector lending, and a conducive policy and regulatory framework (Mitra, 2023).

Lack of Awareness: There is a notable lack of knowledge about green finance markets and low-carbon technologies among MSME entrepreneurs. This includes limited understanding of production costs, managerial skills, and adaptability to changing trade trends (Biswas, 2015).

Capacity Gaps: The sector suffers from a shortage of technical expertise and the skilled labor force required to implement and maintain new technologies. Adopting green finance projects necessitates qualified workers, but skilled labor is expensive for MSMEs due to the high costs of training and development (Bharati & Patra, 2022).

14. Exploring Opportunities

Enhanced Access to Green Financing: The development of innovative and low-risk financial instruments is crucial for MSMEs to adopt green technologies. By creating affordable financing options, MSMEs can prioritize sustainable technologies and accelerate their investments in environmentally friendly practices. This can be facilitated through government subsidies, soft loans, tax exemptions, and mandated priority sector lending.

Adoption of Energy Efficient Technologies (EET): The promotion of energy efficiency and conservation is central to improving MSME competitiveness and reducing carbon emissions. Programs such as the Bureau of Energy Efficiency's national initiatives can help MSMEs adopt EET and best practices, significantly reducing their greenhouse gas emissions. The scaling-up of technology implementation in various MSME clusters can foster widespread adoption of sustainable practices.

Participation in Carbon Markets: MSMEs have the opportunity to generate carbon credits through the 'baseline and crediting' approach by registering their projects with the Indian Carbon Market portal. This can provide financial incentives for reducing emissions and encourage MSMEs to participate in offset schemes. Awareness campaigns and support in minimizing transaction costs can further promote MSME involvement in carbon markets.

Leveraging Government Programs and Policies: Initiatives such as the National Green Hydrogen Mission and energy conservation guidelines for MSME sectors can drive significant decarbonization and reduce dependence on fossil fuels. MSMEs can benefit from these programs by adopting green hydrogen and other sustainable practices, positioning themselves as leaders in the green economy.

Capacity Building and Skill Development: Addressing capacity gaps through training and development programs can equip MSMEs with the technical expertise needed to implement and maintain new technologies. Government and industry bodies can play a crucial role in

providing the necessary support and resources for skill development, making it more affordable for MSMEs to train their workforce.

Technological Upgradation and Innovation: The Technology and Quality Upgradation (TEQUP) support to MSMEs can facilitate the adoption of advanced and efficient manufacturing processes. By investing in technology upgradation, MSMEs can improve their production efficiency, reduce costs, and minimize environmental impact.

Resource Efficiency and Circular Economy Practices: Implementing material circularity and natural climate solutions can help MSMEs reduce waste, enhance resource efficiency, and lower their environmental footprint. These practices can lead to cost savings and open up new market opportunities for eco-friendly products and services.

Collaborative Efforts and Knowledge Sharing: Creating platforms for knowledge exchange and collaboration among MSMEs, industry associations, and government agencies can foster innovation and the dissemination of best practices. Such collaborations can help MSMEs navigate the complexities of green financing and regulatory compliance, while also benefiting from shared experiences and resources.

4. Case Studies

a. Case Study 1: Benefits of Adopting Solar Rooftops by SMEs in Jodhpur

Jodhpur, the second-largest city in Rajasthan, is a prominent industrial hub with over 24,000 registered industrial units. These units, primarily in handicrafts, textiles, and manufacturing, face high power costs. Given Jodhpur's high solar irradiation and favorable state policies, the adoption of solar rooftops has become a viable solution for SMEs to reduce energy costs and carbon footprint (PWC, 2019).

The combination of high solar irradiation (5.64 KWh/M²/Day), the Renewable Purchase Obligation (RPO) enforced by the Rajasthan Electricity Regulatory Commission (RERC), and high industrial power tariffs (INR 6.6/KWh) has driven the adoption of rooftop solar projects in Jodhpur. The presence of utility-scale solar projects has raised awareness and facilitated the implementation of net metering by Jodhpur Vidyut Vitran Nigam Ltd (JDVVNL).

Benefits:

Solar rooftops significantly reduce reliance on fossil fuels, thereby lowering greenhouse gas emissions. SMEs in Jodhpur have collectively installed over 2 MW of solar capacity, contributing to substantial environmental benefits. High industrial power tariffs make solar energy a cost-effective alternative. The levelized cost of solar energy is significantly lower than conventional grid power, resulting in substantial energy cost savings for SMEs. Accelerated depreciation and other tax incentives for solar installations provide financial relief and encourage investment in renewable energy. Solar rooftops enable SMEs to become less dependent on grid power, ensuring energy security and reducing the impact of power tariff fluctuations.

Financial Mechanisms for Adoption

SIDBI Sustainable Finance Scheme: The scheme is available for new and existing MSME units with satisfactory performance records and sound financial positions. Units must have a minimum credit

rating of investment grade or equivalent. Loans are provided at favorable interest rates and repayment terms, with a typical processing time of 15 days excluding technical due diligence.

Bank Loans: Many SMEs leverage their existing banking relationships to secure loans for solar projects. The streamlined loan processing and favorable terms have made solar rooftop installations more accessible to SMEs.

In the absence of organized Renewable Energy Service Company (RESCO) players in the SME segment, informal RESCO arrangements have emerged. SME owners invest in solar projects on third-party roofs, selling power to the roof owner. These projects are based on local relationships and operate without formal credit checks, demonstrating community-driven innovation and collaboration.

b. Case Study 2: Promoting Cluster-Wide Energy Efficiency in the Rajkot Engineering Cluster

Rajkot, located in Gujarat, is one of India's largest engineering MSME clusters. It includes various energy-intensive sub-sectors such as aluminum, bearings, foundry, forging, investment casting, kitchenware, machine tools, pump sets, and plastics. With approximately 700 foundry units, the cluster predominantly produces ferrous castings, including spheroidal graphite (SG) iron, cast iron (CI), and steel, with an annual output of around 460,000 tonnes (TERI, Deep dive approach helps promote cluster-wide energy efficiency in Rajkot engineering cluster, 2017).

The foundry units in Rajkot cater to diverse engineering sectors, including agricultural machinery, air compressors, automotive components, electric motors, electrical transmission, machine tools, pump sets, and more. This diversity highlights the crucial role of energy efficiency in enhancing competitiveness and sustainability across various industries.

Approach to Promoting Energy Efficiency

A comprehensive approach was adopted to promote energy efficiency across the Rajkot engineering cluster. Key steps included:

Detailed Energy Audits: Energy audits were conducted in the foundry units to identify potential Energy Conservation Measures (ECMs). These audits were tailored to the specific energy consumption patterns of each unit.

Stakeholder Engagement: The findings from the energy audits were shared with unit owners and operators to encourage the implementation of recommended ECMs. Detailed discussions helped in creating concrete implementation plans.

Technical Back-Up Support: Regular follow-up visits were conducted to provide technical support during and after the implementation of ECMs. This ensured that unit owners could effectively adopt the recommended measures.

Implementation and Monitoring: By December 2017, 110 targeted foundry units had fully or partially implemented the recommended ECMs. A total of 757 ECMs were implemented, resulting in significant energy savings and CO₂ reductions.

Results and Benefits

The implementation of ECMs across the Rajkot engineering cluster yielded substantial benefits:

Annual energy savings amounted to 1409 tonnes of oil equivalent (toe), reflecting significant reductions in energy consumption and operational costs. The measures led to a reduction of over 12,700 tonnes of CO₂ annually, contributing to the cluster's efforts to mitigate climate change and promote environmental sustainability. Energy efficiency improvements enhanced the competitiveness of the foundry units by reducing energy costs and improving productivity. This also encouraged further investments in advanced technologies.

5. Further research opportunities

As India aims to align with its Nationally Determined Contributions (NDCs) and global climate commitments, it becomes imperative to focus on decarbonizing this sector. Future research must delve into comprehensive strategies that address the unique challenges faced by MSMEs while promoting sustainable practices.

- *Innovative Financial Instruments for Green Investments:*

Focus Areas: Creation of green bonds, soft loans, subsidies, and tax incentives tailored for MSMEs to encourage the adoption of energy-efficient and low-carbon technologies in Indian market context. These financial instruments can provide MSMEs with the necessary capital to invest in energy-efficient and low-carbon technologies (India S. I., 2022). Often, the upfront cost of such technologies is a significant barrier for MSMEs. Green bonds and soft loans, which typically offer lower interest rates or more favorable terms, make these investments more affordable and accessible. Moreover, direct subsidies can reduce the capital cost for MSMEs, making it easier for them to purchase and adopt advanced technologies that contribute to energy efficiency and lower carbon emissions. Tax incentives can reduce the financial burden on MSMEs when they invest in green technologies or processes. For example, tax breaks on energy-efficient machinery or rebates on renewable energy installations can incentivize these investments.

- *Energy Efficiency and Renewable Energy Integration:*

Focus Areas: Assessment of renewable energy options such as solar, wind, and bioenergy for MSMEs; implementation of energy conservation measures (ECMs); development of energy-efficient technologies. By evaluating and adopting renewable energy options like solar, wind, and bioenergy, MSMEs can reduce their reliance on fossil fuels. This directly contributes to the reduction of greenhouse gas (GHG) emissions, aligning with India's NDC targets (Gowthami, Kajol, & Tagotra, 2024). Renewable energy can lower the long-term energy costs for MSMEs, particularly in regions with high energy tariffs. Adopting renewable energy sources can enhance energy security and ensure a consistent power supply, which is crucial for uninterrupted operations especially in rural areas.

- *Technological Innovation and Upgradation:*

Focus Areas: Study of cutting-edge technologies such as green hydrogen, carbon capture, usage and storage (CCUS), and material circularity; development of pilot projects and demonstration units. Green hydrogen, produced using renewable energy, offers a clean alternative to fossil fuels, particularly in sectors that are difficult to electrify, such as certain industrial processes. For MSMEs involved in manufacturing, chemicals, or heavy industry, adopting green hydrogen can drastically reduce carbon emissions. By closing the loop on materials, MSMEs can reduce the demand for new raw materials and lower the environmental impact of their production processes. This is in line with global trends towards sustainability and can enhance the reputation and marketability of MSME products. Pilot projects and

demonstration units allow MSMEs to experiment with and refine cutting-edge technologies before full-scale deployment. This reduces the risks associated with new technology adoption and provides valuable learning opportunities.

- *Carbon Market Participation:*

Focus Areas: Examination of the 'baseline and crediting' approach, development of protocols for MSME participation in carbon markets, and strategies to reduce transaction costs. The 'baseline and crediting' approach involves setting a baseline level of emissions for a sector, organization, or project. For MSMEs, this means establishing a benchmark of current emissions levels based on typical operations. This baseline is crucial for measuring future reductions in emissions. Developing protocols tailored for MSMEs ensures that these small businesses can participate effectively in carbon markets, which have historically been dominated by larger corporations. Protocols that are specifically designed for MSMEs can simplify the process of measuring, reporting, and verifying emissions reductions. By integrating data-driven strategies, government initiatives, and global collaboration, MSMEs are poised to become key drivers in India's pursuit of a low-carbon economy. As they adapt to the evolving dynamics of the Indian Carbon Market, these enterprises have the chance not only to improve their operational efficiency but also to establish themselves as leaders in sustainable and responsible business practices (Chatterjee, 2024). This is critical for India to meet its NDC targets, particularly in sectors where MSMEs are prevalent, such as manufacturing, textiles, and food processing.

6. Conclusion

The MSME sector in India plays a crucial role in the nation's economic growth, contributing significantly to manufacturing GDP and overall Gross Value Added (GVA). However, the sector's heavy reliance on fossil fuels has led to significant greenhouse gas emissions, posing a substantial environmental challenge. Various initiatives, including the National Green Hydrogen Mission and various energy efficiency guidelines, highlight the government's commitment to reducing emissions and promoting sustainable practices. Despite these efforts, MSMEs continue to face barriers such as financial constraints, lack of awareness about green technologies, and capacity gaps, hindering their transition to sustainability.

To further support MSMEs in becoming more sustainable and reducing emissions, several critical steps are necessary. Enhanced access to green financing is paramount, requiring the development of innovative, low-risk financial instruments that make sustainable technologies more affordable. Additionally, there is a need to be a concerted effort to increase awareness and knowledge about green finance markets and low-carbon technologies through comprehensive training and capacity-building programs. Government interventions, such as capital subsidies, tax exemptions, and priority sector lending, can provide the necessary financial support. Moreover, collaboration between MSMEs, industry associations, think tanks and government agencies can further facilitate knowledge sharing and innovation, helping MSMEs navigate the complexities of green financing and regulatory compliance. By addressing these barriers and leveraging existing government programs, the MSME sector can significantly reduce its environmental footprint and contribute to India's climate resilience and sustainability goals.

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