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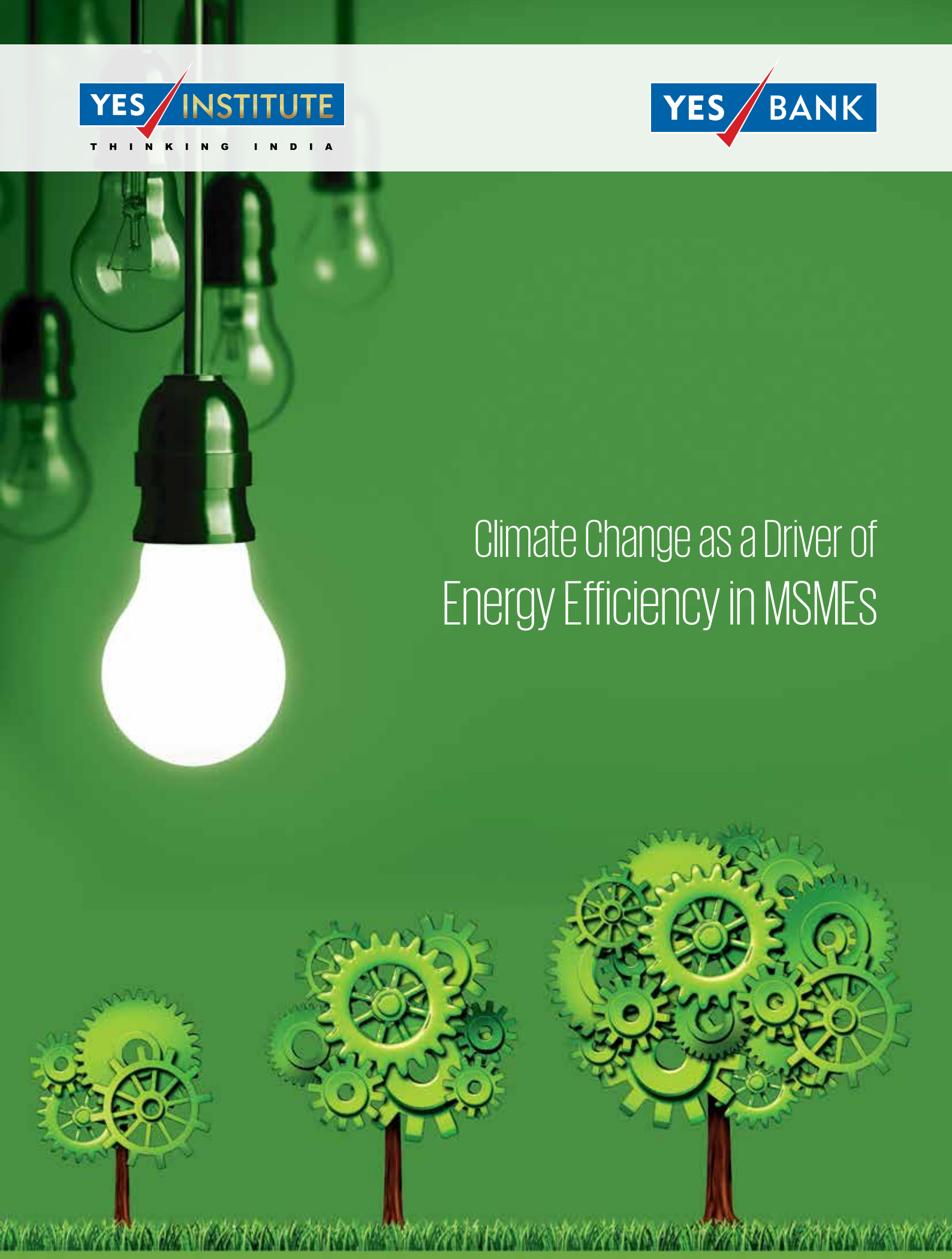

Climate Change as a Driver of Energy Efficiency in MSMEs

TITLE	***Climate Change as a Driver of Energy Efficiency in MSMEs***
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FOREWORD

Climate Change as a Driver of Energy Efficiency in MSMEs

With Climate Change, transition towards a green growth economy is highly imperative for the manufacturing sector, including Micro, Small and Medium Enterprises (MSMEs), which account for a large part of the world's consumption of resources.

With over 51 million MSME units in India, contributing to 38% of India's GDP and accounting for a workforce of 117 million it becomes a meaningful contributor of employment generation and poverty alleviation. Given India's recent upward revision of its GDP forecast to 7.8% for FY17, sustaining the MSME sector and enabling its low carbon performance is highly important. Additionally, low carbon growth within this core sector would not only contribute towards India's Nationally Determined Contributions (NDCs) on climate action, but is also a key to the large-scale uptake of a green growth model.

However, the missing link between MSMEs and green growth is lack of management resources, technology and innovation abilities, skilled workforce, robust infrastructure and access to finance, which has been limiting the sector's contribution towards climate action.

An enabling policy framework and linking climate action to the overall productivity of MSMEs would fast-track the transition towards low carbon growth. Energy efficiency, a key driver of lean and clean manufacturing, is a focus area of the Government of India, in line with its commitment of reducing emission intensity of its GDP by 33-35% by 2030 and therefore needs particular attention within the MSME sector.

YES BANK, in its endeavor towards 'Make in India', has initiated a movement to support MSMEs across India, with a multidimensional approach. The first intervention is targeted towards energy efficiency, in view of significant costs incurred on energy consumption, scope for optimization and towards overall energy intensity reduction. Enhancing MSME energy efficiency entails equipping with requisite knowledge, expertise and finances for it, to become sustainable and climate resilient.

YES BANK, through its unique program 'Say YES to Sustainable MSMEs in India', is promoting environmental sustainability and occupational health and safety within the Indian MSME sector. So far program has supported 973 MSME units in enhancing their energy efficiency performance and improving health and safety systems, resulting in reduction of over 6,000 metric tons of CO_2 emissions per annum for these MSMEs and positively impacting 11,780 workers. Such initiatives can certainly realize the vision of 'Zero Effect, Zero Defect' and harness opportunities of green growth.

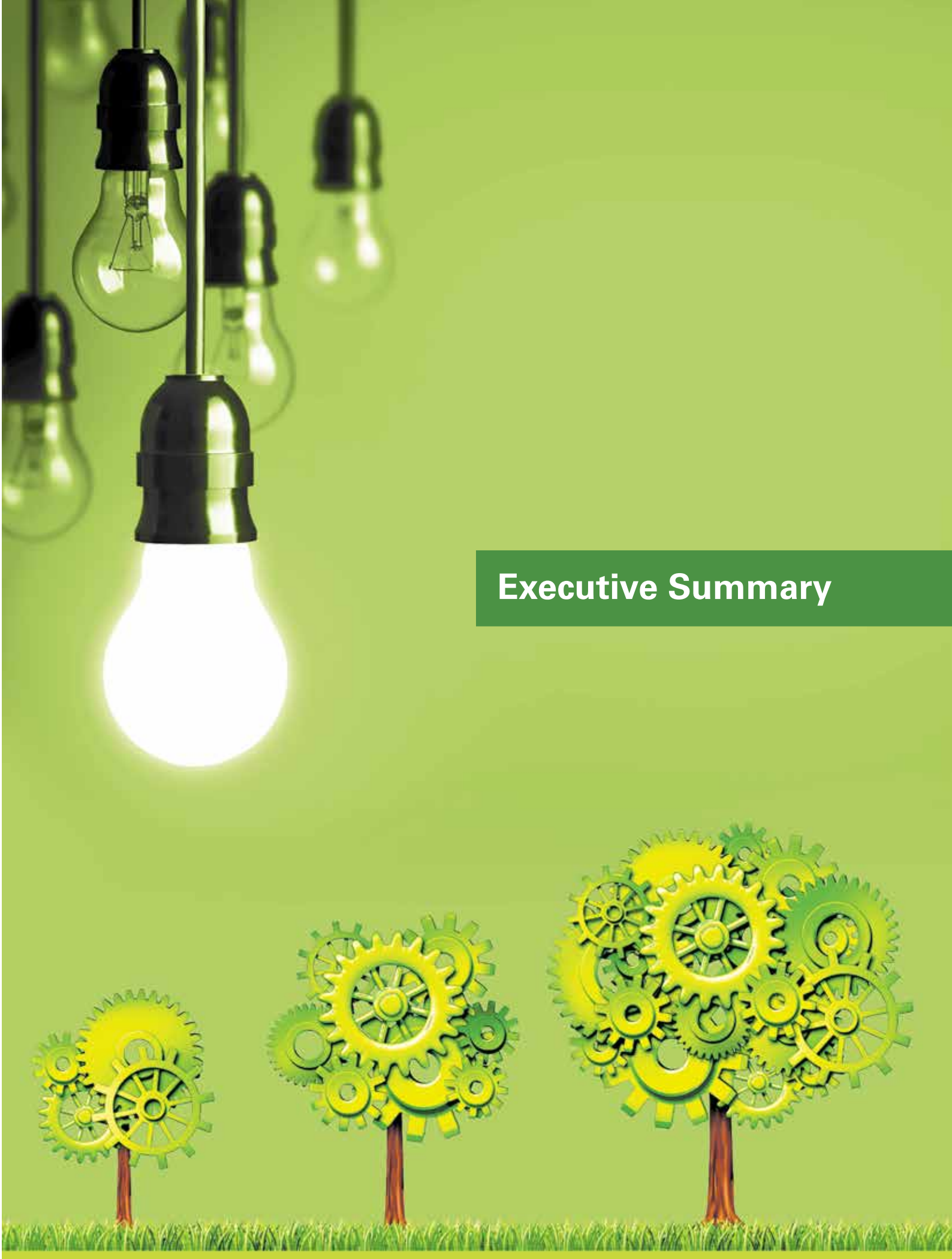
In order to enhance the overall competitiveness and sustainability of this agile sector, financial institutions need to play the role of sustainability influencers with differentiated and innovative financial models and products. Transforming financial systems to become inclusive and make MSMEs and climate finance a part of core business strategy is paramount for Banks and Financial Institutions to be successful in this era of green development and de-carbonization of economies.

I am pleased to present this report titled "Climate Change as a Driver of Energy Efficiency in MSMEs" which is a step towards exploring new and innovative mechanisms to facilitate energy efficiency projects in the MSME sector basis on-ground primary information from six MSME clusters across the country. The report is a reflection of policy measures that can ensure faster adoption of these practices and looks at technology as an enabler for achieving the objectives. It puts out climate-targeted development which is focused on 'hardware' such as technology, infrastructure, financing and on 'software' such as skill development, collaboration and inclusivity.

I am confident that this report will trigger discussions between Government, financial community and MSME sector in addressing Climate Change through a cluster based holistic approach resulting in a Clean and Green India.

Thank You.
Sincerely,

Rana Kapoor
Managing Director & CEO YES BANK
Chairman YES INSTITUTE



Executive Summary

Executive Summary

The Micro, Small and Medium Enterprises (MSMEs) contribute to 38% of India's GDP and provide employment to 117 million people. In addition, they also account for nearly 40% of the exports from the country. The strong influence of the MSME sector in the economy also reflects its potential to contribute positively towards a low carbon and more climate resilient Indian economy.

Climate resilience is increasingly becoming a core sustainability issue for Indian MSMEs, who are affected by rising fluctuations in energy costs, strained resource availability, evolving environmental regulations and increasing frequency of extreme weather events. Floods in Chennai last year, for example, caused losses of over INR 1,700 crores for the local MSME clusters and affected more than 50,000 jobs. Given the increasing frequency of such events, it becomes important for MSMEs to prepare themselves for these emerging challenges.

This Report explores energy efficiency as one of the core solutions to these challenges, and if enabled through conducive policy framework and financial support, could equip MSMEs with the necessary and self-sustainable means to fight climate change. Energy efficiency projects typically require a lower capital expenditure as compared to Greenfield renewable energy projects and have a quicker payback. This makes such projects most suited to enhance overall performance levels while achieving lower carbon emissions.

The Report presents cluster-specific studies to identify opportunities in six clusters, two each in, dyeing, casting and plastic sectors. During the surveys undertaken at these clusters, it was observed that energy costs (as percentage of total cost) were as high as 25%. The surveys further substantiated that energy efficiency projects have quicker paybacks, with the longest payback of less than a year. These six clusters alone demonstrated a potential to save close to INR 190 crores and offset 866,000 tonnes of emissions through activities with payback of less than three months. The survey also revealed that the potential savings from other energy efficiency measures (with payback ranging from 3 to 12 months) was almost INR 300 crores annually, and a reduction of nearly 1,000,000 tonnes of CO_2 emissions. The Report discusses the survey in detail.

While energy efficiency may be an easy choice to make, implementing these projects comes with its own set of challenges. In general, MSMEs are expected to be relatively less efficient, owing to limited access to finance and conventional, labor intensive practices. A Report by the IFC suggests that MSMEs operating in developing countries face an estimated financing gap in the range of USD 2.1 to 2.6 trillion, and 200 to 245 million enterprises do not have a loan or overdraft.[1]

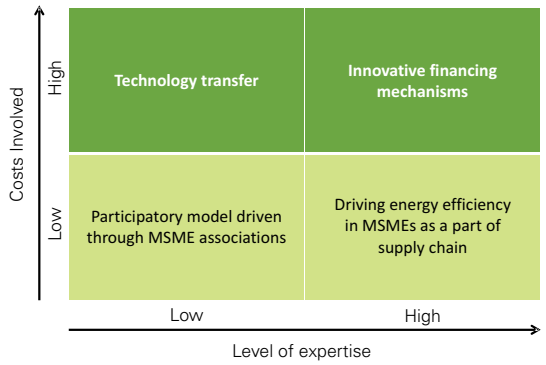
[1] *http://www.ifc.org/wps/wcm/connect/4d6e6400416896c09494b79e78015671/Closing+the+Credit+Gap+Report-FinalLatest.pdf?MOD=AJPERES*

In such a scenario, it becomes important for the Government to facilitate investments in the sector. The Report highlights few of the major initiatives taken up by the Government, such as the Partial Risk Guarantee Fund for Energy Efficiency, Venture Capital Fund for Energy Efficiency, Credit Linked Capital Subsidy for Technology Upgradation and Technology and Quality Upgradation Support to MSMEs. The Hon'ble Prime Minister himself introduced the concept of Zero Effect, Zero Defect (ZED), of which energy efficiency will be a very critical component.

Such initiatives have lit a spark in the energy efficiency market and are supporting investors to create bankable projects. As most investors perceive energy efficiency projects in MSMEs to be of relatively higher risk and limited ticket size, with Government backed schemes such as PRGFEE which would provide 50% guarantee, various banks and NBFCs who had previously stayed away, would come on board. The Partial Risk Sharing Facility of SIDBI, which provides 75% guarantee cover, has already been initiated and is open to MSMEs and ESCOs to apply for loans under the scheme.

The Report draws attention to the need for focusing on new and innovative mechanisms to scale up and drive energy efficiency in the MSME sector and presents four solutions:

1. **Participatory model driven through MSME Associations:** MSME Associations tend to enjoy greater trust of the member enterprises, on basis of which it would become easier to change behavioural patterns and perceptions to drive energy efficiency measures. MSME Associations could locally drive certain activities which can reap immediate benefits. MSME Associations can also act as aggregators for investors to draw greater investment and diversify risks



2. **Driving energy efficiency in MSMEs as a part of supply chain:** Large organizations which have expertise in implementing energy efficiency projects in-house can work with their suppliers to identify and address the need for optimizing their energy demand. MSMEs could leverage the expertise of such customers / clients and save incurred costs due to energy wastage. The customers / clients in turn could pass on the savings due to increased energy efficiency to end users, to create greater competitive advantage

3. **Technology transfer:** Multilateral and bilateral agencies / organizations which bring in modern technology to developing countries like India may look to equip users with the know-how of such technologies. This is especially important in the case of Indian MSMEs where a black-box approach of dumping new, energy efficient technology may not work without proper training and capacity building

4. **Innovative financing mechanisms:** Financing energy efficiency needs of the MSME sector is not straight forward and would need innovative financial mechanisms to be developed and leveraged by various stakeholders, be it financial institutions or ESCOs. A recent example is of Energy Efficiency Services Limited (EESL) which intends to raise USD 100 million through a green bonds issue in London, possibly in November 2016.[2] Such investments can be leveraged to focus on MSMEs which, though relatively risky, may provide much higher returns to investors. Another example is to leverage the Green Climate Fund (GCF) to promote investment in energy efficiency. The GCF Secretariat is already seeking to diversify its MSME portfolio by capping USD 65 million per geographic region (for Africa, Latin America and Asia)

Namita Vikas
Group President & Managing Director,
Climate Strategy & Responsible Banking,
YES BANK

[2] *http://www.thehindubusinessline.com/companies/eesl-to-raise-100-m-through-issue-of-green-bonds/article8871512.ece*

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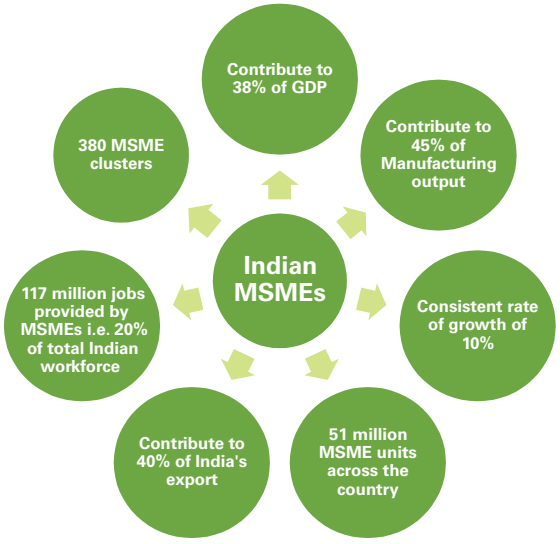
1 Climate Change and Impact on MSMEs

Climate Change and Impact on MSMEs

Micro, Small and Medium Enterprises (MSMEs) play a very important role in a country's development. Growth of MSMEs and their increasing contribution to the economy is often considered as an indicator of development. Talking about a more localized role of MSMEs, they have been important actors for creating greater livelihood opportunities, customized solutions, rural industrialization, greater financial inclusion and bringing in valuable foreign exchange to the country. Today, 51 million Indian MSMEs contribute to about 38% of the GDP, provide livelihood to over 117 million people and contribute to about 40% of the exports.[3]

Snapshot of Indian MSMEs



Often regarded as one of the most diverse and dynamic part of the industries, MSMEs have over 6,000 product offerings[4] varying from simple / traditional products such as coir and handlooms to more complex and hi-tech ones like electronics and pharmaceuticals. The level of customization which is offered by the MSME sector is not always available with large scale manufacturing thus forming a very critical lever to enable many other sectors to operate successfully.

MSMEs have also been pivotal in taking industrialization to the rural masses which would be important to ensure equitable growth of all regions and impede rural-urban migration.

These achievements of the MSME sector have not come easy. MSMEs across the country face a variety of challenges including limited finances, lack of skilled workforce, regulatory requirements and fluctuations in energy / raw material costs.

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[3] *Annual Report 2015-16 Ministry of Micro, Small and Medium Enterprises, Government of India*

[4] *www.makeinindia.com*

Climate Change as a New Challenge

Climate change has been one of the new entrants on the list of challenges faced by MSMEs. Apart from the direct impacts of climate change on MSMEs in form of damages to physical assets and supporting infrastructure, it has much more significant indirect impacts affecting the entire business environment and further accentuating the existent challenges.

- **Fluctuations in energy costs:** Climate change is known to negatively impact energy prices and induce prices shocks which can significantly impact the production cost in the sector. Climate change also poses the threat of increased disruptions in the power generation, distribution and reduced efficiency in thermal power plants. MSMEs especially are vulnerable to fluctuations in energy prices and may face a risk of many units being rendered economically unviable

- **Evolving regulatory requirement:** Government has adopted the Zero Effect, Zero Defect approach basis which it seeks to reduce the environmental impact of the industries on the environment. This approach comes from the fact that MSMEs tend to have a significant impact on the environment as they are generally liable to be equipped with relatively obsolete, inefficient and polluting technologies and processes.[5] According to Planning Commission's report on 'Effectively Integrating Industrial Growth and Environment Sustainability', 70% of the total industrial pollution load of India is attributed to MSMEs. It further states that regulatory mechanisms are framed in a manner which may not always be well suited to the MSMEs thus making it difficult for the MSMEs to comply with them

- **Resource availability:** Rise in temperature as well as changes in precipitation can have negative impact on ground water availability, crop yields and harvests. In fact, increase in raw material prices are expected due to the impact on the available resources as well as harvest. Such scenarios create risks from procurement / sourcing perspective. Risks such as these make Indian MSMEs extremely vulnerable as they may not have the financial muscle to withstand any disruption in their supply chain, operations or demand as compared to large industries

- **Increasing frequency of extreme weather events:** Researchers suggest that the frequency of heatwaves have increased from once in three years to once every 200 days due to global warming.[6] In India, specifically, extreme rainfall events have increased by 50% in the past 50 years.[7] Such increased erratic weather events cause supply chain disruptions for MSMEs which may not always depend on local procurement or markets. Moreover, with increasing frequency of extreme weather events, the potential loss from damages to physical assets is expected to rise. The situation is aggravating for MSMEs that are located in low lying flood prone regions as well as near the coastal areas

An example of the disastrous impact of climate change on MSMEs is the recent floods which hit Chennai in 2015. Floods disrupted the economic activities in the region, causing huge losses in form of the physical damages and lives lost. According to estimates, around INR 1,700 crores worth of direct losses were borne by the MSME manufacturing sector alone especially affecting the leather, gold and jewelry and auto component sectors according to the report released by Small and Medium Industries Rating Agency (SMIRA).[8] Around 10,000 MSMEs in Chennai alone were affected by the flood leading to a loss of employment to the tune of 50,000 from the sector.[9]

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[5] *Report of the Working Group on "Effectively Integrating Industrial Growth and Environment Sustainability", Twelfth Five Year Plan (2012-2017), Planning Commission*

[6] *https://www.theguardian.com/environment/2015/apr/27/extreme-weather-already-on-increase-due-to-climate-change-study-finds*

[7] *http://www.business-standard.com/article/news-ians/india-should-prepare-to-face-extreme-weather-warn-scientists-115032400458_1.html*

[8] *http://timesofindia.indiatimes.com/india/Chennai-floods-cause-50000-job-losses-in-MSME-sector-Centre/articleshow/50248661.cms*

[9] *http://indiatoday.intoday.in/story/chennai-floods-wash-out-rs-1700-crore-of-msme-business/1/556553.html*

Direct and Indirect Loss Estimates for MSMEs in Chennai Floods

Particulars of damages to MSMEs	Conservative figures (approx)
Number of units affected due to loss of machineries and raw materials in all rain affected districts	8,500
Number of workers affected by floods in industries (direct employment)	56,000
Number of units affected by floods indirectly	20,000
Number of workers affected (indirect labour)	1,60,000
Value of damage by machinery and building	INR 1,000 crores

Source: Preparing MSMEs for effective disaster management [Report]. - [s.l.] : KPMG, 2016, KPMG and CII

The impacts of Chennai floods are not only confined to the affected region alone. The manufacturing industries in Chennai alone contribute to around 3% of the national GDP and the event had significant adverse impact on the national economy overall. Such incidents reflect a clear need to add momentum to the current efforts of tackling climate change and the degree of impact on the MSME sector.

Reducing Before Adding

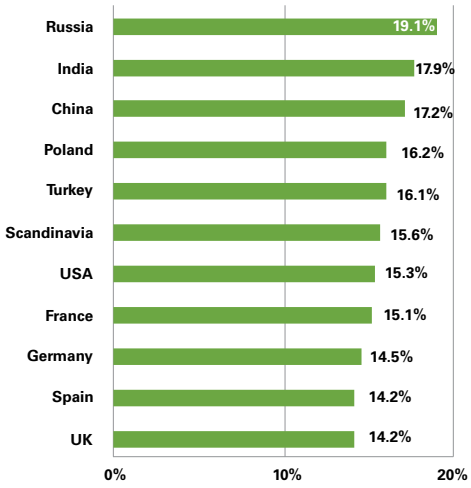
While the Indian Government has committed to enhance its renewable energy capacities to 175 GW by 2022, there is a need to optimize the current infrastructure to make it more efficient.

According to a research conducted in 2015, among the global top 20 industrial equipment manufacturers, India had one of the highest untapped potential for electricity-efficiency (usage and cost-savings, expressed as a proportion of total electricity consumption) in the manufacturing sector.[10]

Energy efficiency projects typically require lower capital expenditure as compared to new renewable energy projects. Moreover, energy efficiency projects pay for themselves quickly thereby helping the MSMEs save costs. Investment potential in energy efficiency in India has been estimated at INR 330 billion with energy savings potential of over 183 billion kWh.[11] Considering this saving to be only in form of electricity saving, there is a potential to reduce 150 million tCO_2 through energy efficiency.[12]

Industrial Electricity-Efficiency Potential

(proportion of current electricity consumption that could be saved if more electricity-efficient equipment currently available on the market were installed)



Source: Report 'More from less', Siemens Financial Services, 2015

To capitalize this opportunity within the MSME sector, it is necessary to equip the enterprises with knowledge, resources, finances and technology.

This report delves further to provide policy backed financial options that exist for the MSMEs to address energy efficiency and reap twin benefits of addressing climate change and improving profitability.

[10] *Report 'More from Less' by Siemens Financial Services, 2015*

[11] *http://www.indiasavesenergy.in/Uploads/Documents/635955334060334484.pdf*

[12] *Considering all saving to be in form of electricity savings; average grid emission factor of 0.82 as per Central Electricity Authority, User Guide, 2016*

Indian Context – Policy, Technology and Finances 2

Indian Context – Policy, Technology and Finances

During COP21, the world came to a consensus that the current response to climate change is inadequate and would require higher participation from all stakeholders. This would also include the MSME sector which is a strong 51 million[13] in India. For enabling MSMEs to contribute to combating climate change and for improving their own sustainability, there are some factors that need to be taken into account.

MSMEs tend to have limited access to finance because of which they cannot move to modern technology thus creating an infinite loop of inefficiencies and limited returns. Enabling policy environment can address both these aspects and thus open doors to new technology and promote cleaner and leaner MSMEs. In turn, addressing the three quintessential dimensions of tackling climate change - Policy, Technology and Financing.

Policy Framework for Addressing Energy Efficiency in MSMEs

While there may not have been a very clear national strategy specific to MSMEs to address climate change and develop capacities, India's approach to achieve Nationally Determined Contributions has suggested some key measures for the sector.

Under the National Mission for Enhanced Energy Efficiency (NMEEE) and through Bureau of Energy Efficiency (BEE), a number of energy efficiency initiatives have been initiated ranging from efficient lighting, energy rating, Partial Risk Guarantee Fund for Energy Efficiency (PRGFEE), Venture Capital Fund for Energy Efficiency (VCFEE) and Zero Effect, Zero Defect (ZED).

- **Partial Risk Guarantee Fund for Energy Efficiency (PRGFEE) Rules** were notified by BEE in May 2016 to create bankable energy efficient projects. PRGFEE provides a risk sharing mechanism to the lenders with a partial coverage of the project risks associated with energy efficiency projects. The guarantee amount covered under the scheme should not exceed INR 10 crores per project or 50% whichever being less. Initially, the support was supposed to be limited to Government buildings and municipalities, however, the rules in their final form include MSMEs as well

[13] *Annual Report 2016, Ministry of MSME*

- Another similar scheme was launched, under a World Bank initiative, by Small Industries Development Bank of India (SIDBI)[14] to provide partial guarantee of 75% of the loans up to INR 15 crores for energy efficiency projects. Under this **Partial Risk Sharing Facility (PRSF)** the focus would remain on MSMEs and working through Energy Service Performance Contracting (ESPC) delivered through Energy Service Companies (ESCOs). In July 2016, YES BANK became the first Financial Institution to sign an MoU with SIDBI to implement this scheme

- In July 2015, Government launched **Venture Capital Fund for Energy Efficiency (VCFEE)**, which is a trust fund to provide 'last mile' equity capital to specific energy efficiency projects, limited to a maximum of 15% of total equity required, through Special Purpose Vehicles (SPV) or INR 2 crores, whichever is less

- **'Zero Effect, Zero Defect' (ZED)** under the 'Make In India' campaign, ZED is a policy initiative which aims to rate MSMEs on quality control, energy efficiency, enhanced resource efficiency, pollution control, use of renewable energy, waste management, etc using ZED Maturity Assessment Model. The scheme launched in 2015, envisages coverage of about 1 million medium and small enterprises.[15] Energy efficiency has been placed as a key enabler under Products and Processes category and energy performance as an outcome parameter of the ZED Model

Some of the other policy initiatives which focus on MSMEs and complement energy efficiency are:

Scheme	About the scheme	Nature of assistance	Whom to reach
Credit Linked Capital Subsidy (CLCS) for Technology Upgradation	Technology covering various products in the Indian SME sector including improved quality, environmental conditions and energy conservation machinery	15% upfront capital subsidy	All scheduled commercial bank, scheduled cooperative bank
ISO 9000/ ISO 14001 Certification Reimbursement	Incentives to MSMEs/ ancillary undertakings who have acquired ISO 9000/ISO 14001/HACCP certification and includes reimbursement of expenses for acquiring ISO 14001 certification	75% of expenditure for acquiring ISO-9000/ISO-14001/HACCP certification subject to a maximum of INR 75,000 in each case	Submit application, duly completed, to their local Director, MSME-DI
Technology and Quality Upgradation Support to MSMEs	Scheme advocates the use of Energy Efficient Technologies (EETs) in manufacturing units so as to reduce the cost of production and adopt clean development mechanism. Capacity building and implementation of EET are both covered under the scheme	• 75% for awareness programmes subject to maximum of INR 75,000 per program • 75% of actual expenditure for cluster level energy audit and preparation of model DPR • 50% of actual expenditure subject to maximum INR 1.5 lakh per DPR towards preparation of subsequent detailed project reports for individual MSMEs on EET projects • 25% of the project cost as subsidy by Government of India, balance amount to be funded through loan from Banks/Financial Institutions/ SIDBI; minimum contribution as required by the funding agency to be made by the MSME	Submit application, duly completed in specified format, to local Director, MSME-DI

Source: YES BANK Analysis

[14] *An independent financial institution aimed to aid the growth and development of MSMEs*

[15] *http://www4.unfccc.int/submissions/INDC/Published%20Documents/India/1/INDIA%20INDC%20TO%20UNFCCC.pdf*

Technology Development for Promoting Energy Efficiency in MSMEs

A significant portion of the MSMEs, especially the energy intensive clusters work with relatively inefficient technologies and practices. This has been due to lack of MSME specific cleaner alternatives, limited awareness and in-house capacities on cleaner technologies, perceived commercial viability of cleaner options and under-developed support services / institutions / mechanisms.

Adoption of energy efficient technologies which are commercially viable in industrialized countries can play an important role in 'leapfrogging' onto a low carbon energy pathway. Considering this, major bilateral and multilateral agencies have been working actively towards promoting energy efficiency in the MSME sector. Bilateral agencies like Japan International Cooperation Agency (JICA), Kreditanstalt für Wiederaufbau (KfW) and Agence Française de Développement (AfD) have been supporting concessional financing of energy efficient equipment among MSMEs, through SIDBI. Other agencies like Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) have also supported awareness generation and capacity building of bankers on financing of energy efficiency projects. Multilateral agencies like Global Environment Facility (GEF), through World Bank and United Nations Industrial Development Organization (UNIDO) are funding projects which support energy audits in selected energy-intensive MSME sub-sectors.

These agencies along with other partners, have taken up various initiatives to present the proof of concept and sustainability of energy efficiency initiatives in MSMEs to improve the acceptability of new and energy efficient technology which can help the MSMEs reap benefits in the long term. Like some agencies mentioned, YES BANK too worked towards promoting environmental sustainability and occupational health and safety within the Indian MSME sector, by launching the 'Say YES to Sustainable MSMEs in India' program in 2015.

YES BANK collaborated with Foundation for MSME Clusters (FMC), European Union, UNIDO, GIZ, GRI, IICA and SIDBI to support MSME clusters in India, enabling the adoption of sustainable environment and social business practices. In the first phase of the initiative till March 31, 2015, the initiative aimed at:

- Improving energy efficiency by 15-25% in 20 Foundry MSMEs in Punjab and Uttar Pradesh and reducing coke consumption by 800 metric tons per annum, resulting in savings of approximately INR 1.1 crore
- Strengthening Occupational Health and Safety (OHS) systems and improving living conditions of workers in 50 Foundry MSMEs

In FY 2015-16, the Bank expanded its partnership with the Foundation for MSME Clusters (FMC) and Entrepreneurship Development Institute of India (EDII) to scale up this initiative across nine Indian states. This initiative continues to be a part of the broader project funded by the European Union named 'Scaling Up Sustainable Development of MSME Clusters in India', with UNIDO, GRI, SIDBI, IICA and GIZ as partners.

In this second phase, the program supported 973 MSME units by enhancing their energy efficiency and improving their health and safety systems through sensitization workshops, health camps, providing drinking water facilities, first aid kits and distributing personal protective equipments. Under the initiative, OHS systems were strengthened in 627 MSMEs benefiting 11,780 workers and energy efficiency projects were implemented in 71 MSMEs, improving their energy efficiency in the range of 15-20%. The project is expected to result in a reduction of over 6,000 metric tonnes of CO_2 emission per annum for these MSMEs. Additionally, 275 MSMEs benefited from energy efficiency sensitization workshops.

Some other such initiatives that have been taken up are presented below:

Title	Main features
TERI–SDC Partnership project in the foundry, glass, and brick sectors (1994-2013)	• EE technology development, demonstration, and dissemination • Unit/cluster level capacity building; development of knowledge products • Collaborative partnerships with other institutions • Advisory support for policy formulation • Development and support for Small and Medium Enterprises: Energy Efficiency Knowledge Sharing (SAMEEEKSHA) platform
World Bank–GEF Project: Financing energy Efficiency at MSMEs (2010-2014)	• Targeted at five selected energy intensive clusters • Capacity and awareness building • Support for walk-through/detailed energy audits and preparation of Investment Grade DPRs • Performance-linked grants to early adopters • Knowledge management and sharing
TERI–IGES Research Partnership for application of low-carbon technologies (2010-2014)	• Focused on transfer of low-carbon technologies from Japanese manufacturers for adoption and dissemination among MSMEs in India • Supported by JICA and Japan Science and Technology Agency (JST) • Pilot EE projects implemented at the unit level in select MSME clusters • Technologies included heat pump applications for foundries and dairies (Rajkot, Ahmedabad, and Chandigarh)
JICA–SIDBI Financing Scheme for Energy Saving Projects in MSME Sector (2008-ongoing)	• Line of credit from JICA for financing EE projects • Financial assistance to MSMEs through SIDBI, as well as through refinance to banks and other financial institutions • Provides list of EE equipment eligible for financing
GIZ: Indo German Energy Programme (IGEN) (2003-2014)	• Support for EE through insulation solutions; collaboration with KAEFER, one of the world's largest provider of complete insulation solutions, under the PPP project 'Moving India's MSMEs towards Energy Efficiency' (MovIEE) • Providing access to advisory services, training, and credit schemes; awareness generation through 'Energy Bus' initiative • Pilot projects in different clusters

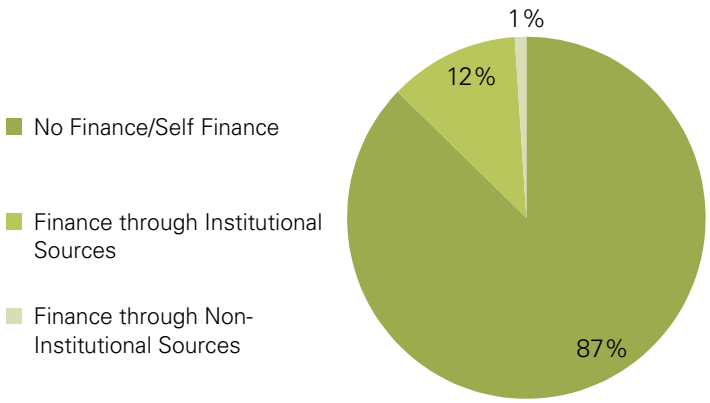
Source: TERI- YES BANK Report on 'Enabling Finance for Scaling up Energy Efficiency in MSMEs, 2015

Financial Aspects of Energy Efficiency Projects in MSME Sector

According to a study, India's energy efficiency market is estimated at INR 74,603 crores with an investment potential of INR 12,100 crores in the MSME sector alone.[16] International Energy Agency states that India would need INR 2 lakh crores on an annual basis to improve energy efficiency.[17]

Moreover, some of these energy efficiency projects may involve relatively higher upfront cost (even though there may be quick payback) as compared to conventional equipment which makes the MSMEs refrain from investing in newer technologies. Moreover, if the sources of finance for registered MSMEs are analyzed, it is clear that MSMEs depend most on self financing. One of the reasons for this pattern is that MSMEs are considered to be a risky proposition by Financial Institutions. Financing energy efficiency in MSMEs further adds to complexity of the situation. The concept of energy efficiency remains relatively new and only a few financial institutions have developed expertise to analyze and appraise energy efficiency projects. As a result, they depend on external agencies to analyze projects. Guaranteed savings to be ascertained basis the monitoring and evaluation are also contested by the host and ESCO in certain cases leading to strained cash flows. Small size of the energy efficiency projects in the MSME sector is another reason for financial institutions being avert to financing energy efficiency projects in MSMEs.

Source of Finance in MSMEs



Source: Fourth Census of MSME sector for Registered Units

However, on the other hand certain financial institutions who are trying to promote energy efficiency in the sector suggest that there is little demand from the MSMEs. Even though certain banks and institutions have specific products for energy efficiency, the uptake of these products is limited.

Energy Service Companies (ESCO) model, which is considered to be one of the most successful models, has also received partial success in the MSME sector. The ESCO financing model involves new kind of payment plans which require specific energy valuation techniques. The clarity on actual savings and payments do not link directly to the current monitoring and accounting parlance. This difference between actual and calculated saving is contested by the ESCO and host, creating confusion over the success of the project. Another factor for mixed success of ESCO model in MSMEs is the higher transaction costs (assessment, appraisal and audit) for the ESCOs.

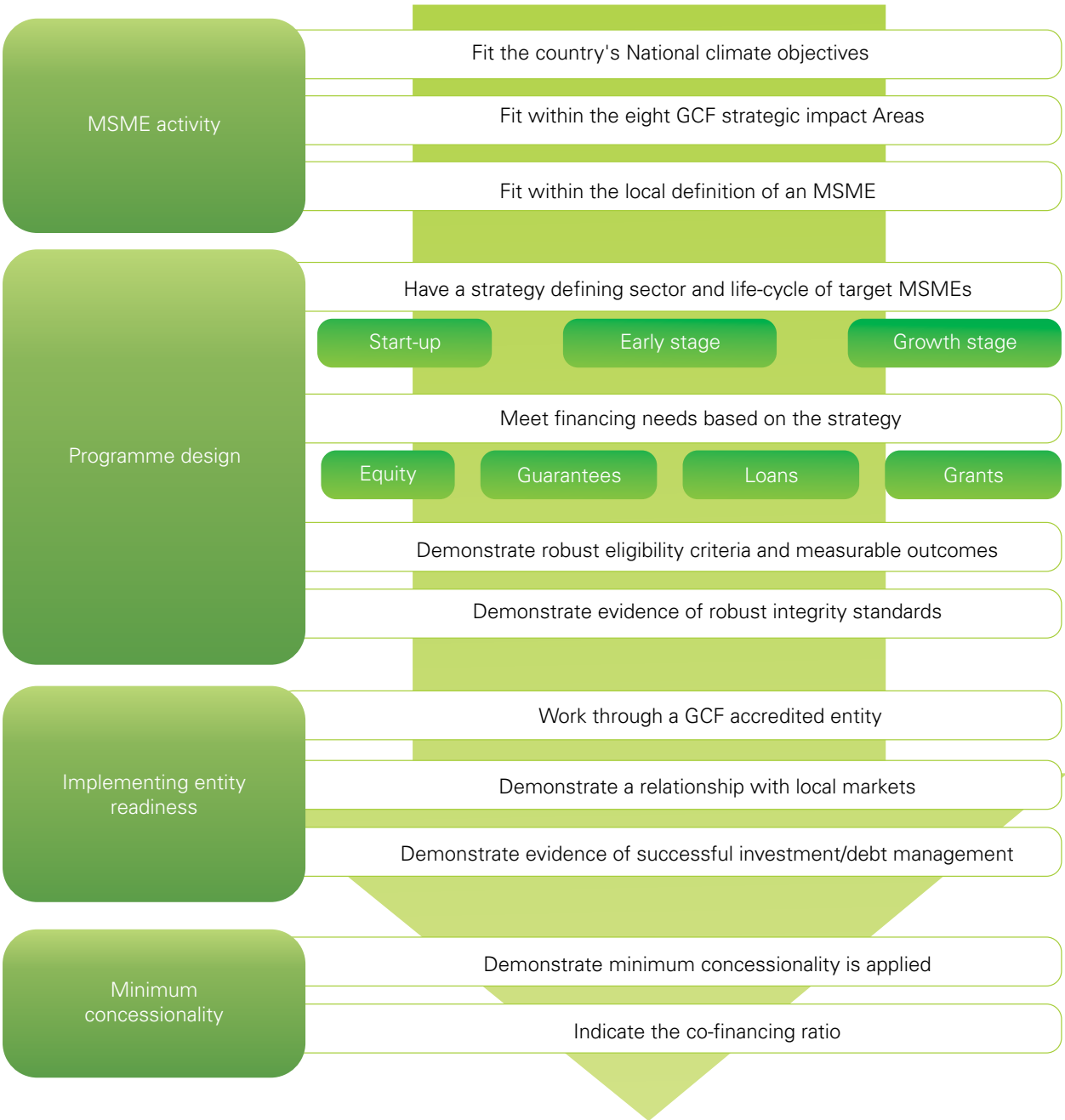
To overcome these constraints, to create bankable energy efficiency projects and to promote energy efficiency in MSMEs, Government of India has been working on developing specific financing lines as a result of which VCFEE, PRGFEE and PRSF have been launched. These schemes are being endorsed by certain banks who have registered with SIDBI (for PRSF) and BEE (for PRGFEE).

[16] *http://www.iaeme.com/MasterAdmin/UploadFolder/ENERGY%20EFFICIENCY%20IN%20INDIAN%20SME%20SCOPE%20AND%20POLICY%20REVIEW/ENERGY%20EFFICIENCY%20IN%20INDIAN%20SME%20SCOPE%20AND%20POLICY%20REVIEW.pdf*

[17] *http://www.renewableenergyfocus.com/view/43387/increased-investment-needed-to-maintain-indias-energy-demand-claims-iea/*

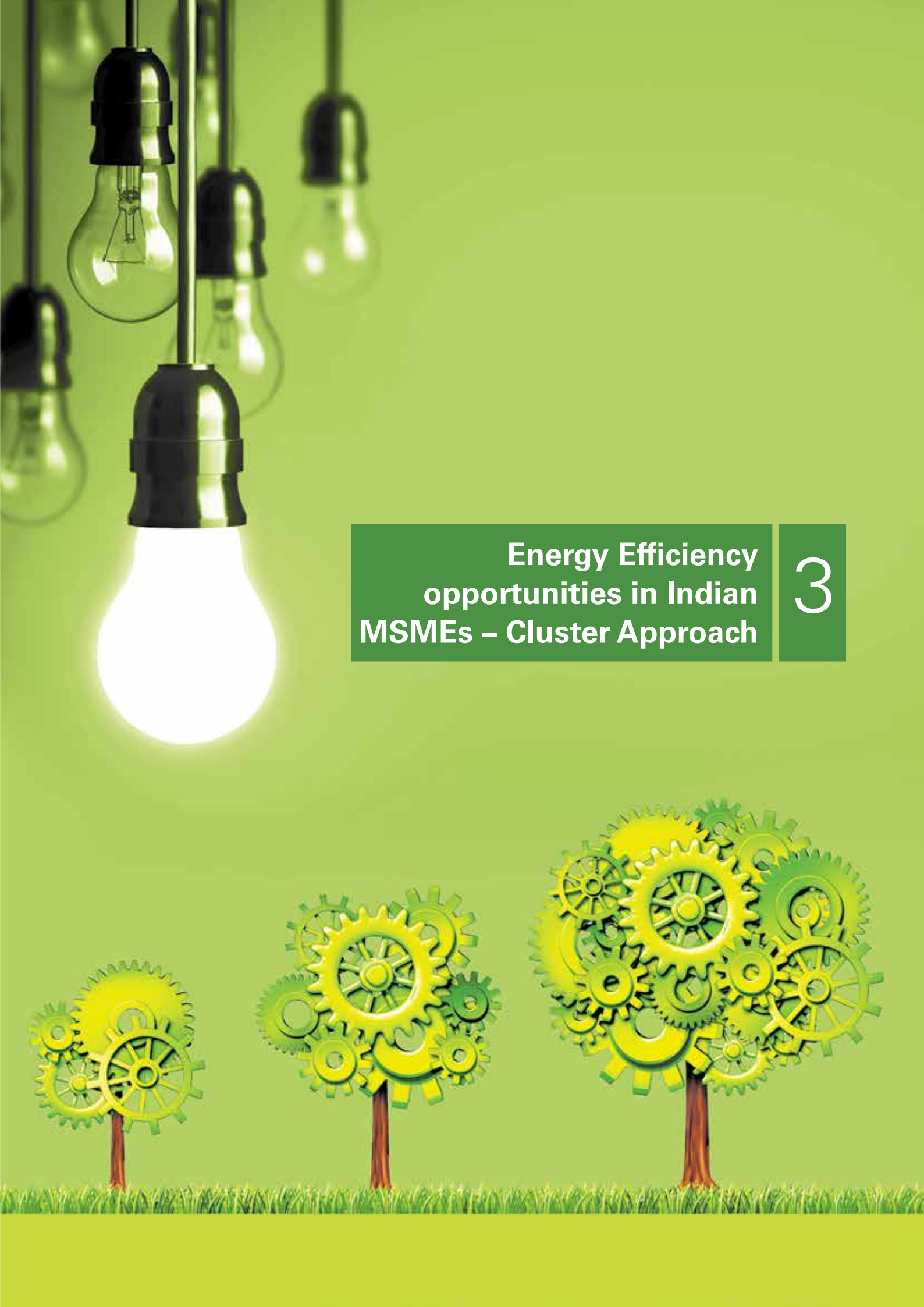
Another line of investment for financing energy efficiency projects in MSMEs can be through the Green Climate Fund (GCF). GCF recognizes the importance of including MSMEs for climate action and has approved the creation of specific MSME program under the Private Sector Facility (PSF) to increase the MSME sector involvement. GCF Board has allocated USD 200 million for the MSME program over the course of the initial resource mobilization period with USD 65 million for Africa, Latin America and Asia. GCF projects are open to supporting MSME projects on energy efficient approaches for lighting, buildings and refrigerators, which in the end enhances the profitability and sustainability of portfolio companies.[18]

GCF MSME Project / Program Criteria



Source: Establishing a programmatic framework for engaging with micro-, small- and medium-sized enterprises, GCF, June 2016

[18] *Establishing a programmatic framework for engaging with micro-, small- and medium-sized enterprises, GCF, June 2016*



Energy Efficiency opportunities in Indian MSMEs – Cluster Approach

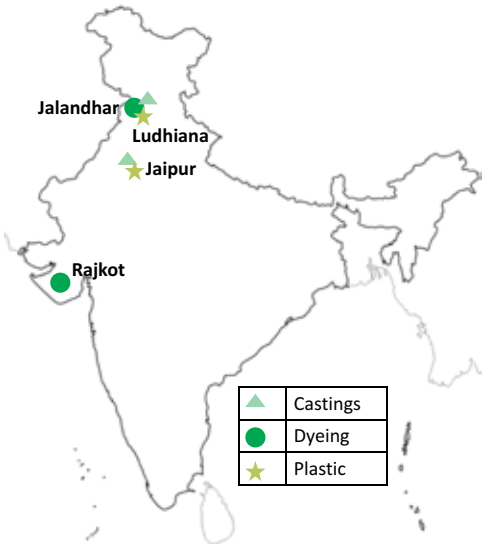
3

Energy Efficiency opportunities in Indian MSMEs – Cluster Approach

Studies on the MSME sector suggest that energy accounts for 15-50% of the total production costs. Reducing these costs can result in saving 49 billion units and avoiding 7,000 MW of additional capacity. The investment potential in the MSME sector has been estimated at INR 12,100 crores and the overall energy efficiency market in the country at INR 74,603 crores.[19]

In order to explore this potential further within the MSME sector, YES BANK worked with Foundation for MSME Clusters (FMC) to ascertain the scope and potential of energy efficiency in six MSME clusters.

During the survey conducted at these clusters, 15 stakeholders were interviewed individually followed by group discussions in each cluster. An energy audit was carried out on a sample basis in each cluster to identify and demonstrate immediate energy efficiency measures.



An open forum organized in each cluster incorporated suggestions given by participants while an Expert committee with representatives from The Energy and Resources Institute (TERI), Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Federation of Indian Micro and Small & Medium Enterprises (FISME) and ex-CMD of National Small Industries Corporation (NSIC) were a part of the consultation process.

Jaipur Dyeing Cluster

Jaipur Dyeing Cluster has 900 dyeing units in Sanganer and 4 medium sized integrated units that sell dyed and printed cloth in Bagru, and a collective turnover of the cluster is estimated at INR 266 crores. The cluster provides direct employment to 11,050 people that work in dyeing and finishing of cotton, acrylic and polyester fabrics on a job work basis.

[19] *http://www.iaeme.com/MasterAdmin/UploadFolder/ENERGY%20EFFICIENCY%20IN%20INDIAN%20SME%20SCOPE%20AND%20POLICY%20REVIEW/ENERGY%20EFFICIENCY%20IN%20INDIAN%20SME%20SCOPE%20AND%20POLICY%20REVIEW.pdf*

Type of Unit	No. of Units	Turnover (in INR Crores)	Total Employment
Small	4	20	150
Micro	140	140	9,400
Micro Household	760	107	1,500
Total	**904**	**267**	**11,050**

Source: FMC Survey

Sanganer and Bagru have limited number of bank branches, given the geographical location and low business opportunities. Two organizations, Sanganer Rangayi and Putai Association (SRPA) and Jaipur Integrated Textile Park (JITP) cater to several needs of the local area. Established in 1996, SRPA has 51 dyers from Sanganer. The organization has been able to collect an average contribution of INR 5 lakh / unit from 600 dyers. JITP was established in 2006 has a total of 20 members, 4 of them being dyeing members.

Production Process

The production process involves pre-treatment for Dyeing and Finishing. For pre-treatment of dyeing, raw fabric is singed, de-sized, scoured, bleached, and then mercerized. These treatments remove natural non-cellulosic constituents / impurities and increase the affinity of cellulose for dyes and finishes. Post pre-treatment, fabrics are dyed with a number of dye classes, including reactive, azoic, direct, indigo, pigment, sulphur, and vat dyes. Dyeing can be done on raw stock / fiber as well as yarn. In most cases, jigat machine is used for dyeing which is a traditional low cost technology at INR 1 lakh - INR 1.5 lakh approximately. However, the units in Bagru use boilers which cost INR 5-10 lakh approximately. In the final finishing stage, fabrics are treated with chemicals to instill attributes such as antimicrobial, softening, flame resistance, soil release, water repellence, stain resistance, durable press/wrinkle resistance/easy-care, cellulose enzymes to improve hand (bio-finishing), etc. Dyeing and finishing are done to enhance the quality of the fabric as per market requirements.

Production Costs

Cost break up of dyeing and processing enterprises is similar across the cluster, varying only if there's no job work involved.

Cost Centres	Job Work based Dyeing Enterprises (INR/Kg)	% Contribution (Job Work based Dyeing Enterprises)	Integrated Dyeing Enterprises (INR/Kg)	% Contribution (Integrated Dyeing Enterprises)
Raw materials	N.A.	N.A.	210	73.9%
Dye & Chemicals	40	53.3%	40	14.1%
Energy	18	24%	16	5.6%
Labor	5	6.6%	5	1.7%
Transport	3	4%	3	1.1%
Finishing & Packaging	N.A.	N.A.	1	0.3%
Other Misc. (depreciation, loading and unloading, admin)	9	12%	9	3.1%
Total	**75**		**284**	

Source: FMC Survey

Overall energy cost is 24% for household and micro units and that for integrated units it's around 6%, but cost of energy as percentage of value additions is around 22% for integrated units. Thus energy costs are significant in both cases.

Major Challenges

- **Energy usage:** Basis the Energy Audits conducted at the integrated dyeing units at Bagru (boiler based), several issues have been identified such as heat loss in several processes, lack of insulation, usage of improper raw material, usage of worn out machinery, excess air presence, and improper handling of machinery
- **Skills:** Lack of skilled labor often hampers efficient production. The cluster was found to have limited knowledge of efficient water usage, optimum ratio of color and binder for achieving softness in pigment printing, usage of litmus test, prevention of steam loss in a continuous steam ager, prevention of thermal loss in boiler and steam setup
- **Inefficient technology:** Almost all units operate using the traditional 'jigat' technology which is low on productivity and involves burning of wood directly which is inefficient as well as a pollutant
- **Water pollution:** Effluents that are released during the process are toxic in nature and need to be treated
- **Financing Issues:** Due to unorganized nature of dyeing industry and non-availability of required documents, banks are unable to provide loans. The requirements of the unit are in the range of INR 4-5 lakh primarily for procurement of raw material. This has made the units resort to unsecured loans / informal borrowing on a much higher rate than banks or delayed but extra payment to the supplier

Potential Areas of Intervention to Improve Energy Efficiency

Issue	Potential Solution	Investment (INR)	Annual Savings (INR)	Return on Investment (Months)	Annual Savings – Electricity (kWh)	Annual Savings (MT of CO_2)
High heat loss due to lack of proper insulation	Insulate the steam distribution lines with insulating material	3,000	20,000	2	10,865	10
Absence of insulation on input pipe line to the steam chamber machine	Insulate the pipe lines with insulating material (glass wool with Aluminium cladding)	1,200	8,000	2	4,180	4
Heat loss due to improper condensate hot water recovery	Recover the condensate hot water properly by installing pipes to existing condensate recovery tank	2,000	16,000	Immediate	8,358	8
Heat loss due to steam wastage	Install a heat exchanger to recover waste heat	45,000	96,000	6	46,387	44
Feeding of improper sized coal	Install a coal crusher machine (coal size 25-40 mm) with mesh to avoid heavy lumps being fed into the boiler.	1,25,000	2,80,000	6	1,46,265	137
Excess air detected in the flue gas analysis	Installation of portable oxygen analyser and Variable Frequency device (VFD) on ID fan	2,50,000	2,40,000	12	1,25,370	118

Issue	Potential Solution	Investment (INR)	Annual Savings (INR)	Return on Investment (Months)	Annual Savings – Electricity (kWh)	Annual Savings (MT of CO_2)
Deposition of dust, grease and leftover cotton on motors	Clean and maintain the motors periodically and cover the motors with proper air circulation	0	27,300	Immediate	3,036	3
Contract billing demand is 90 KVA	Could reduce the contract billing demand to 70 KVA	0	40,800	Immediate	N.A.	
Waste steam from Loop Hauser machine is directly released into the atmosphere	Provide the steam based on the pressure gauge install and as per lowest pressure demand	Minimal	25,800	Immediate	12,540	12
Use of V-Belts, instead of cogged V-Belts, in all electric motors	Replace V belts with cogged V belts for better transmission efficiency, replace in a phased manner	Minimal	20,498	Immediate	2,277	2
Use of old & rewound motors, damaged by water & dust	Replace the old motors on which rewinding has been done more than 3 times with energy efficient motors. Motors should be protected from colour, water and dust, & also air circulation should maintained	21,000	21,384	12	2,376	2
Compressor pressure settings were found to be higher than required	Reduce the set cut-off pressure as per requirement	0	21,000	Immediate	2,400	2
Compress air leakages were observed at printing machine and various other places	Arrest compressed air leakages. Implement "red tag" system (every identified hole is marked with a red tag so that maintenance people can easily spot holes and repair them)	Minimal	10,080	Immediate	1,120	1

Issue	Potential Solution	Investment (INR)	Annual Savings (INR)	Return on Investment (Months)	Annual Savings – Electricity (kWh)	Annual Savings (MT of CO_2)
Loose belt of Stentor motor	Tighten the belt to reduced the transmission losses & also lubricate the chain gear system for better transmission efficiency	Minimal	4,536	Immediate	904	1
Compressed air tank valves is not closed at night	Close the air tank valves in night to reduce the starting time of compressor in the morning	Minimal	604	Immediate	67.2	0
	Total	**4,47,200**	**8,32,002**		**3,66,145**	**344**

Source: FMC Survey

Assuming that at least 50 units will shift to the Jaipur Integrated Texcraft Park Pvt. Ltd. (JITPPL), the units can start implementing these practices and save about INR 4.16 crores by investing INR 2.24 crores also leading to a savings of 17,200 tons of CO_2 per annum.

Some energy interventions identified during the audit have a payback period of 3 months or less and can be prioritized for implementation. As per the study, with an investment of less than INR 10,000, a unit can get savings of INR 1,80,000 immediately, i.e. 25% of the total savings can be achieved immediately.

Ludhiana Dyeing Cluster

The cluster provides employment to 7,000 people and has a total turnover estimated at INR 330 crores per annum.

Type of Unit	No. of Units	Turnover (INR Crore)	Employment
Micro	50	30	1,000
Small	200	300	6,000
Total	**250**	**330**	**7,000**

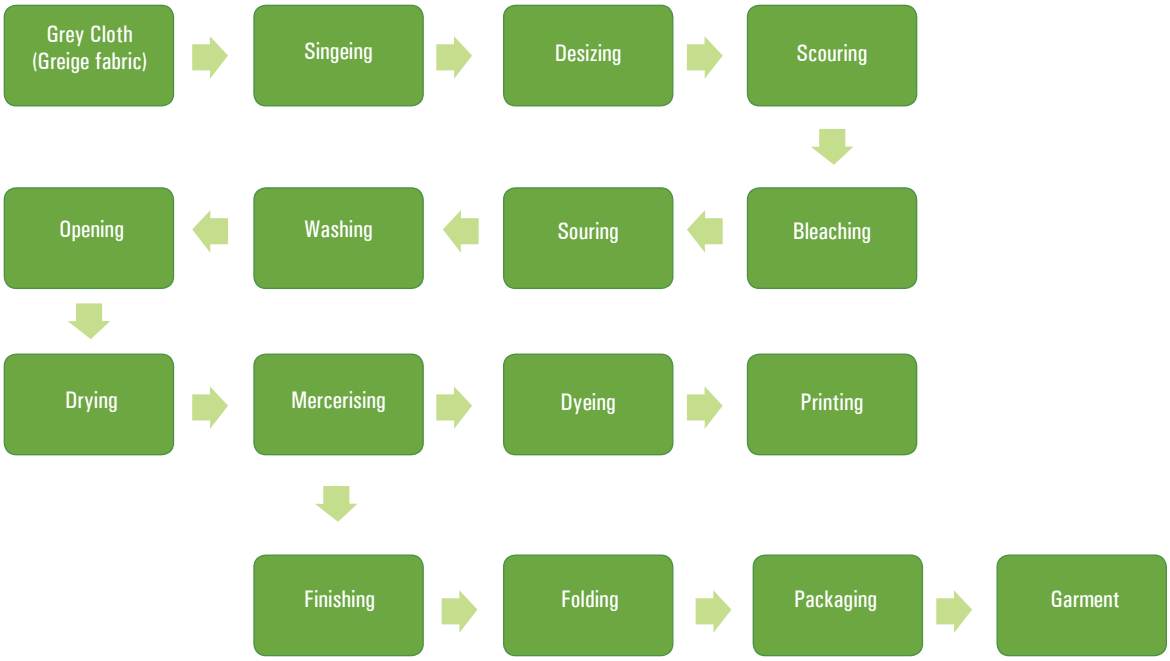
Source: FMC Survey

Apart from principle firms, cluster consists of 5 yarn suppliers, 3 machinery service providers and government departments along with all the major banks of India.

Established in 2008 to cater to specific needs of dyeing units in the cluster, Punjab Dyers Association (PDA) has 280 members. PDA works towards promoting relevant schemes of Government and is advocating for establishment for a common effluent treatment plant.

Production Process

Majority of cluster enterprises are involved in the processing of cotton, acrylic and polyester fibers on a job work basis.



Production Costs

Representative cost break-up for 1 kg yarn (Polyester Acrylic-medium shade colour) dyeing is as follows:

Particulars	Cost (INR)	% Contribution
Dyes and Chemicals (raw material)	12	30%
Water	4	10%
Labour	12	30%
Energy	10	25%
Transport (loading labour)	2	5%
Total	**40**	

Source: FMC Survey

Energy cost is 25% of process cost and as high as 42% of value added which reflects significant potential for introducing energy efficiency measures.

Major Challenges

- **Energy**: As per the energy audit, it has been observed that major sources of energy are coke (60%), Electricity (38%) and diesel (1-2%). Major issues include steam leakages, wastage of hot condensate, high oxygen levels, compressed air leakage, and lack of proper insulation
- **Water pollution**: The severity of environmental degradation is quite high due to discharge of effluents and improper waste disposal methods are adding to the damage. Only 10% of the units have their own Effluent Treatment Plant

Potential Areas of Intervention to Improve Energy Efficiency

Issue (Energy)	Potential Solution	Investment (INR Lakhs)	Savings /Annum (INR Lakhs)	Return on Investment (Months)	Savings / Annum (KWh)	Annual Carbon Savings (MT of CO_2)
Steam leakage found at several spots	Insulation of steam line	1	5.36	3	2,80,000	263
Wastage of hot condensate at 90° celsius	Condensate water should be recovered and feed to boiler input water	0.60	4.3	1	2,03,000	190
Oxygen % in flue gas is very high which leads to high energy loss in dry flue gas	Air supplied for combustion should be controlled by oxygen sensor mount in exhaust gas which provides signal to VFD and thus controllers the input amount of air through FD fan	2.00	44.5	1	23,28,000	2,184
Hot pigmented water is wasted at high temperature	Heat should recovered by putting Heat Exchanger to rise feed water temperature of Boiler	2	10	3	5,26,000	493
Compressed air leakage found in the compressed air network	Zero compressed air leakages	0	0.65	Immediate	8,640	8
Steam pipe line is not insulated at several place	Insulation of steam line	0.50	5.36	2	2,80,000	263
	Total	**6.1**	**70.17**	**10**	**36,25,640**	**3,401**

Source: FMC Survey

At a total estimated investment of INR 15.25 crores, the cluster can look at a potential saving of INR 175 crores along with CO_2 reduction of 8.5 lakh tons per annum. Apart from the above interventions, following may be considered as additional best practices such as fixing and regular repairing of the hooks, tubes, valves and other sources of leakage, insulation of bare heater, recycling of water in the boiler, modifying the fan or combustion machine with Variable Frequency device / drive (VFD), controlling air supplied for combustion through oxygen sensor and VFD in FD fan, replacement with energy efficient labelled motors, rewinding of motor less than twice and shifting to LED electricity system.

Jaipur Plastic Cluster

With over 800 High-density polyethylene (HDPE) and Polyvinyl chloride (PVC) pipes manufacturers, Jaipur is the hub of plastic industries in Rajasthan. The units are concentrated in the Vishwakarma Industrial Area, the Malviya Nagar Industrial Area and the Jhotwara Industrial Area of Jaipur city. With an annual production of 93,000 tons, the industry has an annual turnover of INR 970 crores out of which only 5% is exported. The cluster provides employment to around 14,400 people.

Type of Unit	No. of Units	Annual Turnover (INR Crores)	Total Employment
Micro (70%)	560	520	8,400
Small (30%)	240	450	6,000
Total	**800**	**970**	**14,400**

Source: FMC Survey

Almost 80% of the firms produce HDPE and PVC pipes while only 20% of the firms produce containers, water tanks, toys, bottles and other plastic related products.

Established in 1983 with 752 registered members, the Plastic Manufacturers Association of Rajasthan (PMAR) undertakes various activities like policy advocacy, supporting new entrepreneurs, information dissemination through workshops on technology innovations, facilitating and handholding the members to take part in exhibitions, etc.

Production Process

Raw materials include plastic granules of different grades—depending on the product (virgin and recycled plastic granules), plasticizers, fillers and colorants. Polymers are processed by various techniques such as extrusion, injection moulding, blow moulding and rotto moulding.

Extrusion is the most commonly used process in the cluster and accounts for nearly 80% of the total consumption by downstream plastic processing industries. Injection moulding is the next popular process accounting for nearly 10% followed closely by blow moulding accounting for 8%. Rotto moulding accounts for 2% only.

Cost of the machinery installed in the units varies from INR 2.0 lakhs to INR 1.5 crores depending on the type of machinery—manual, semi-automatic or automatic machines. Almost 70% of the units use semi automated extrusion machines while remaining use injection moulding. Barely 0.03% use fully automated injection moulding machine which costs more than INR 1 crore.

Production Costs

Products produced in the cluster are raw material intensive and limited value addition is done. Almost 60% of the product cost consists of raw material while cost of energy is only at 5%. Cost breakup of manufacturing HDPE pipes (1 Kg by weight) is mentioned below:

Particulars	Cost (INR)	% Contribution
Raw Material (virgin & recycled granules)	65	69.14%
Plasticizers / Fillers	8	8.5%
Energy	5	5.3%
Labour	3	3.19%
Transport	2	2.12%
Wastage	1	1.06%
Depreciation and Admin	10	10.6%
Total	**94**	

Source: FMC Survey

Energy cost is around 5% of total cost and 17% of value added.

Major Challenges

There are two fold challenges:

- **Energy issues:** Electricity is the major source of energy and there is scope for energy cost reduction of up to 10% in almost all units. Energy audits revealed several issues such as lack of insulation, lack of separate transformers and stabilizers, inefficient lights and lower efficiency cooling tower
- **Lack of skilled labour:** Requirement of skilled workforce is highest for operators on the shop floor. The operators that are currently working in units have not received any formal training which limits their efficiency and productivity

Potential Areas of Intervention to Improve Energy Efficiency

Energy Saving Area	Estimated Annual Energy Savings (kWh)	Estimated Investment (INR Lakhs)	Annual Savings (INR Lakhs)	Return on Investment (Months)	Annual Carbon Savings (MT of CO_2)
Install automatic power factor control unit to maintain power factor near unity	N.A.	1	2.13	6	N.A.
Insulation of Electric Heater of Extruder Machine and Injection Moulding Machine	14,388	0.55	1.14	6	13
Sub Total (I)	**14,388**	**1.55**	**3.27**		**13**

Energy Saving Area	Estimated Annual Energy Savings (kWh)	Estimated Investment (INR Lakhs)	Annual Savings (INR Lakhs)	Return on Investment (Months)	Annual Carbon Savings (MT of CO_2)
Install Separate Lighting Transformer or Servo Stabilizer for lighting feeder	1,354	0.10	0.11	11	1
Replace inefficient light (T12 & T8 FTL & CFL) with LED light	3,336	0.29	0.27	13	3
Sub Total (II)	**4,690**	**0.39**	**0.38**		**4**
Replace Cooling Tower with New Energy Efficient Chiller	1,16,022	10	9.13	13	109
Grand Total	**1,35,100**	**11.94**	**12.78**		**126**

Source: FMC Survey

With an investment of INR 95.5 crore, annual savings will be INR 102 crores approximately and total potential CO_2 reduction would be an estimated 1.01 lakhs tons per annum.

Unlike other clusters, there is no potential of low investment initiatives that offer quick payback but at an average payback of 14 months, all identified initiatives have immense energy savings potential.

Jalandhar Plastic Cluster

The cluster is spread over four different regions of Jalandhar city in a radius of 30 km. Demarcated for industrial development by the Punjab State Government, the total number of plastic enterprises in the cluster is around 150 out of which 120 are micro units and 30 are small enterprises. The cluster employs around 2,300 people directly and more than 500 people indirectly. The annual turnover of the cluster is estimated at INR 475 crores. It is expected that around 15% of the total estimated turnover is export-dependent and the rest is through domestic sales.

Type of Unit	No. of Units	Turnover (INR Crores)	No. of employees
Micro	120	300	1,380
Small	30	175	920
Total	**150**	**475**	**2,300**

Source: FMC Survey

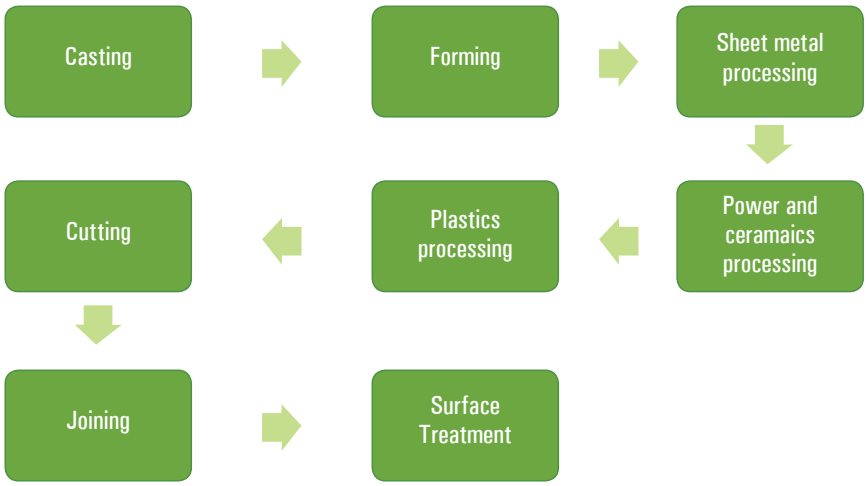
The major products of the cluster are polybags, carrybags, pouch, polycoat and warmer. It was found that most of the micro units produce polybags for food grains and manufacture around 1,500 to 1,800 kg per month.

There are no specific organizations for supporting plastic manufacturers and most units are members of the Laghu Udyog Bharti (LUB) which was established in 1994 with 400 members.

Production Process

A wide variety of plastic raw materials (polymers) such as Polyethylene (PE), Polyvinyl Chloride (PVC) and Polypropylene (PP) are used. To manufacture finished products, the polymers are processed through various techniques such as extrusion, injection moulding, blow moulding and roto moulding. Micro units mostly operate on traditional semi automated machines like extrusion machines while some of the small units possess certain high capacity machineries such as the moulding machine, film blowing, printing, denser and lamination plant.

Production Process of Plastic Products



Production Costs

The cost break up of manufacturing plastic bags for 50 kg (by weight) is as follows

Cost Component	Amount (INR)	% Contribution
Estimated cost of raw material per kg	100	68.9%
Processing Cost (time taken 4 to 5 hours)	22	15.1%
Lose	4	2.7%
Labor charges (10 workers)	15	10.3%
Transportation	2	1.3%
Electricity	2	1.3%
Total	**145**	

Source: FMC Survey

Since, cluster firms operate mostly on semi-automated technology, cost of electricity in current production process is estimated at 1 to 2% only and is around 4.5% of value addition.

Major Challenge

The primary energy source is electricity which is used by injection moulding machines, printing machines, ACs, lighting, etc. The total annual electricity bill for a micro unit varies from INR 4 lakhs to 5 lakhs. Issues identified during energy audits include lack of insulation and inefficient light.

Potential Areas of Intervention to Improve Energy Efficiency

Issue (Energy)	Potential Solution	Investment (INR Lakh)	Savings /Annum INR	Return on Investment (Months)	Savings / Annum (KWh)	Annual Carbon Savings (MT)
Insulating the Bare Heater at Injection Moulding Machine	Replacement with Energy Efficient Labelled motors	0.10	0.30	3 – 4	4,800	4.5
Inefficient light (T12 & T8 FTL & CFL)	Replacement of inefficient light (T12 & T8 FTL & CFL) with LED light	0.04	0.02	18	405	0.4

Source: FMC Survey

735 tons of CO_2 can be saved annually by investing INR 21 lakhs along with savings of INR 48 lakhs at a cluster level. Introduction of energy efficiency motors in the existing injection moulding machine would help save energy as well.

Rajkot Investment Castings Cluster

Rajkot is centrally located in the Saurashtra region of Gujarat, India. The geographical spread of the cluster includes the AjiVasahat, Bhaktinagar Industrial Area, Mavdi Plot, Samrat Industrial Area and Atika Industrial Area within a radius of 20 km. A large number of engineering units including foundries are located in the fast expanding industrial neighbourhoods such as Metoda GIDC and Sapar-Veraval.

Type of Unit	No. of Units	Avg. Annual Turnover/unit (INR Crores)	Total Turnover/ Annum (INR Crores)	No. of Employees	No. of Female Employees
Medium	100	22	2,200	15,000	2,000
Small	25	8	200	1,250	175
Total	**125**	**30**	**2,400**	**16,250**	**2,175**

Source: FMC Survey

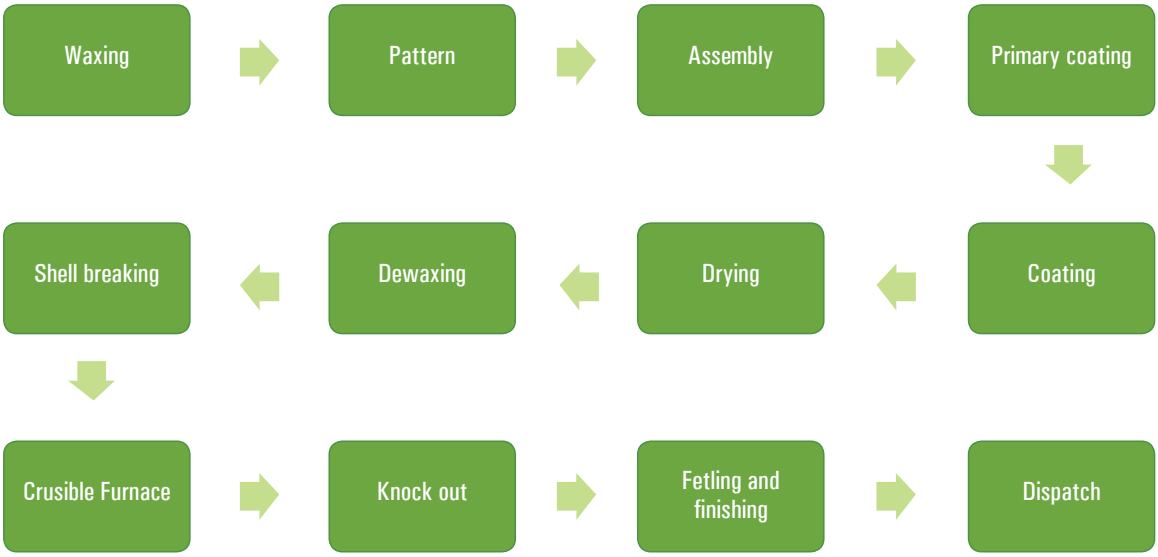
Cluster produces high end products likes valve, auto parts, machinery parts as well as products which are also used in airplanes or military equipments.

Apart from 125 investment casting units, there are approximately 10-12 raw material suppliers, financial institutions including banks, service providers in the area of energy, finance, quality certification along with Government departments like Gujarat Pollution Control Board.

All investment casting units are members of the Institute of Indian Foundrymen (IIF) as well as Rajkot Engineering Association (REA). Rajkot has the largest number of foundry units (around 110 units) producing precision / investment castings in a single cluster internationally.

Production Process

Molten metal is passed through wax to create the required pattern. The wax coating is allowed to dry. Once dried, de-waxing / shell breaking is carried out. Stage wise production process is depicted in the figure.



Various technologies such as wax injection press, jar mill, slurry coating drum, chiller, sand raining engine, dust collector blower, shell baking furnace, induction furnace, knockout machine, sand blasting machine etc. are used in the production process of investment casting.

Production Costs

The cost break up of Investment Casting producing Grey Iron Foundry is as follows:

Processes	With good operating practices cost (INR/kg)	% Contribution
Moulds in green sand molding	1.95	5.3%
Cores in no-bake sand	3.55	9.7%
Metallic raw material cost	21.50	59.04%
Energy cost for melting	4.50	12.36%
Fettling & finishing cost	1.50	4.1%
Testing & inspection cost	1.00	2.7%
Cost of rejections	2.41	6.6%
Total	**36.41**	

Source: FMC Survey

It can be observed that cost of energy is 12.36% of the total production and nearly 30% of value added. Hence reduction in energy cost will have significant impact on its business viability.

Major Challenges

- **Energy Issues:** The plant uses thermal and electrical energy for its processes. Natural gas and electricity are used as the primary energy source. Four equipments namely, Induction melting furnace, Shell baking furnace, Air compressor and Chiller were selected for performance assessment and energy savings basis the following parameters:
  - o fuel consumption
  - o percentage share in total consumption
  - o operating hours
  - o significance in process
  - o existing conditions
  - o operating methods
  - o energy savings potential

Potential Areas of Intervention to Improve Energy Efficiency

MF Induction Melting Furnace	Air Compressor	Shell Baking Furnace	Air Conditioner (chiller)
• Do not insert metal above coil-level • Give full power to furnace from starting, untill it reaches pouring temperature • Provide cover on furnace opening during melting and pouring operation to avoid heat loss from top • Make record of inserted metal, energy consumed, time for melting, time for pouring, time for sampling, life cycle of refractory linings etc. and prepare chart of specific energy consumption for each heat • Use high refractory linings to reduce refractory losses& there by energy for relining & sintering processes • Harmonic filters should be installed to reduce harmonics within limits as specified by IEEE-519-1992 standard	• Clean air filters and oil filters at regular interval of time • Reduce delivery pressure from 8.5 bar to 7.5 bar to reduce energy consumption • Install PRV (Pressure Regulating Valve) mechanism for pneumatic press section to avoid wastage of energy • Replace pneumatic operated equipments by electrically operated equipments in grinding section • Install small blower for cleaning instead of compressed air to reduce wastage of energy • Replace conventional motor by PM motor and VFD (Variable Frequency Drive) to reduce specific power consumption	• Tune air-fuel ratio for complete combustion of fuel • Refurbish Recuperator with efficient and proper design • Do thermography at regular interval of time • Make record of inserted shells, energy consumed in each heat, time for heating, time for shell inserting, life cycle of refractory linings etc. and prepare chart of specific energy consumption for each heat • Use high refractory linings to reduce refractory losses	• Clean air filters at regular interval of time • Replace conventional motor by PM motor and VFD (Variable Frequency Drive) to reduce specific power consumption • Install AirCoSaver energy saving device to reduce energy consumption • Do not install outdoor unit of chiller in open hot space to avoid direct sunlight penetration

Source: FMC Survey

A potential savings of INR 50,000 / month can be achieved with these practices along with INR 1,000 / month reduction of electricity bill by changing the air compressor mode.

Potential Energy Savings

Equipment	Energy Savings (kWh/annum)	Cost Savings (INR/annum)	Approx. Investment (INR)	Simple Payback Period (Months)
MF Induction Melting Furnace	77,376	6,19,008	0	Immediate
Shell Baking Furnace	11,517[20]	4,48,505	4,00,000	11
Air Compressor	1,572	12,580	0	Immediate
Air conditioner (chiller)	2,506	20,048	10,000	6
Total	**92,971**	**11,00,141**	**4,10,000**	**17**

Source: FMC Survey

A total of 125 firms can save upto 10 million Kwh (10,000 tons of CO_2) with an initial investment of INR 5 crores.

Jalandhar Cupola Based Foundry Cluster

With 100 units, Jalandhar Cupola based Foundry cluster is located in four different regions of Jalandhar, namely, Industrial Estate, Industrial Area, Kapurthala Road, and Focal Point. It is estimated that 20% of the total turnover is comprised of exports and rest 80% is domestic sales.

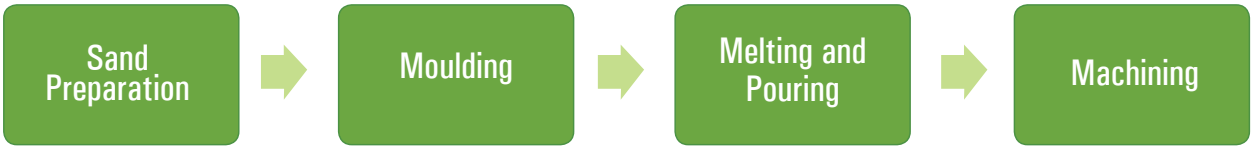
Type of Unit	No. of Units	Turnover (INR Mn)	No. of Employees
Micro	70	1,050	2,800
Small	30	750	1,800
Total	**100**	**1,800**	**4,600**

Source: FMC Survey

The cluster manufactures agriculture equipments, castings, auto parts, valves, chaff cutters, hand tools and motor parts. Major machinery required in the foundry cluster are moulds, mixers, blower, motor, sand blaster and pattern making.

Production Process

These foundries mainly use Single Blast Cupola (SBC) with an average cross section of (inner diameter of cupola) ranging between 21 inches to 42 inches. These foundries produce iron and at times aluminum castings, which are cast in different shapes by creating cavity and using patterns made of wood, iron, aluminum, etc. The process can be sub-divided broadly into four phases:



[20] *Gas savings in standard cubic meter (SCM)*

Production Costs

The cost break-up for 1 kg of Cast Iron (Coke:Metal ratio is 1:4) is as follows:

Input Description	Cost (INR)	% Contribution
Coke (250 gm) (28% ash at INR 1400 / home)	3.65	7.06%
Pig Iron (200 gm)	7	13.5%
Scrap (800 gm)	25	48.4%
Limestone and additives	0.25	0.4%
Labor charges	4	7.7%
Others charges (sand, silicate, silicon, manganese, gas, thinner, graphite powder, chrome, refractory)	1	1.9%
Maintenance & admin	3	5.8%
Burning losses (7%), Pouring and Runner losses (15%) and Rework and Rejection (8%) of items 4, 5, 6 and 7	2.70	5.2%
Burning losses (5%), Pouring and Runner losses (20%) and Rework and Rejection (10%) of item 1	1.55	3%
Machinery	2.0	3.8%
Total	**51.65**	

Source: FMC Survey

As it can be seen, energy (coke) consists of nearly 7% of total cost and 30% of value added. Hence reduction in energy cost will have a significant impact on its business.

Major Challenges

- **Energy issues:** SBC based technology is used for melting operation which results in poor melting ratio. Melting ratio of the SBCs is also high due to various inefficiencies such as irregular quality and size of coke, size of charge and charge metal used, inappropriate blast pipes, motors, etc
- **Lack of skilled labor:** Availability and retention rate of unskilled workers is low and the workforce tends to shift jobs to other industries having better/easier working conditions. Majority of the workers are untrained workers; they learn and polish their skills on the job.

Potential Areas of Intervention to Improve Energy Efficiency

For SBCs, the following interventions have been identified:

Activity	Cost Saving per annum (INR)	Coke Saving (kg) per annum	Investment (INR)
Proper repairing of cupola	11,250	0	0
Appropriate quantity of bad Coke	1,51,200	180	0
Appropriate Coke size	1,84,800	220	0
Charge size	2,39,400	285	0
Appropriate size of charge metal	1,84,800	220	0
Sub-total (1 to 5)	**7,71,450**	**905**	**0**
Installation of weighing scale	2,39,400	285	30,000
Appropriate Blast pipe, Tuyers, Motor, Blower,	18,06,000	71,000	2,10,000
SBC to DBC	3,00,000	21,000	6,00,000
Sub-total (6 to 8)	**23,45,400**	**92,285**	**8,40,000**

Source: FMC Survey

Note: Calculations are based on a 30" SBC using 28% ash coke, ideal 1:7 melting ratio, 20 tons of metal per run, 5 runs per month and 12 months a year

It may be noted that not all of these inefficiencies happen at the same level and overall the inefficiency can be said to be at 1:4 ratio in an SBC, as compared to 1:8 in a perfectly running DBC, under the given conditions. Even if we assume that the coke metal ratio is 1:5, under optimum conditions (coke metal ratio 1:7), it can save up to 60 tons of coke per year. If the unit adopts DBC, (coke metal ratio 1:8) it can save a further 21 tons. Hence estimated total savings can be 3,000 tons per year, assuming that there are 50 such firms who will adopt better practices and go for DBC. If 90 firms can adopt DBC, there will be an additional savings of 1,890 tons. Hence there is a potential to save 5,000 tons per annum. Monetarily, 50 units can save about INR 11,20,000 with an investment of INR 8,40,000 each and INR 2,80,000 for other 40 units with an investment of INR 6,00,000 each.

For 300 tons casting per month (large foundries) which means 10 cycles of cupola run having cast size of 2 kg to 20 kg, there is a scope for modernisation with an additional investment of INR 4.6 million per unit:

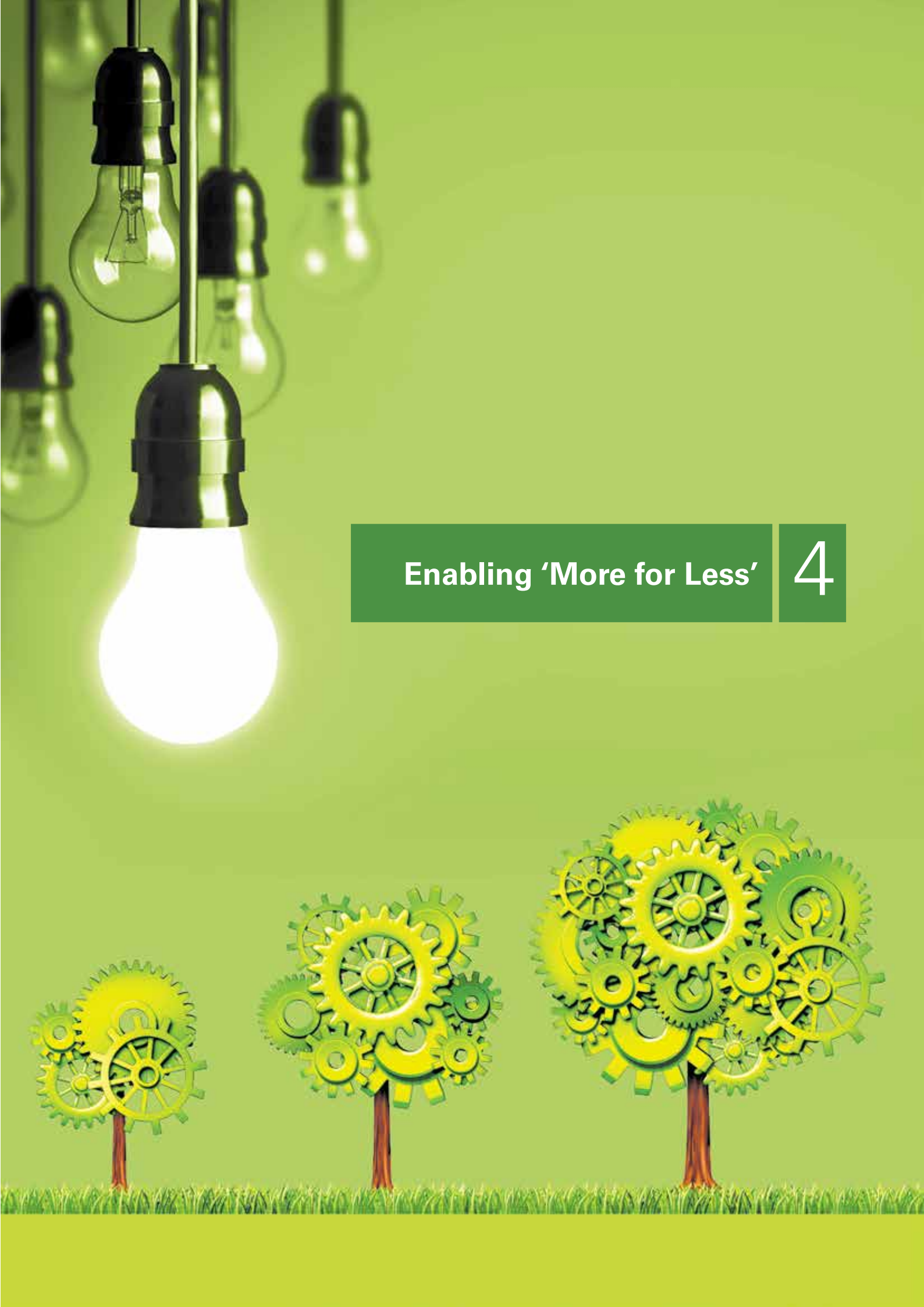
Cost Implications for Creation of Modern Specialised Units

Name of Machine	Price (INR) per unit	No. of Pieces	Total Price (INR)
Moulding Machines	6,00,000	4	24,00,000
Sand making plant with knock out	18,00,000	1	18,00,000
Mould boxes, Pouring buckets, other machines	N.A.	N.A.	4,00,000
Total			**46,00,000**

Source: FMC Survey

Possible solution for recycling the waste has been explored by FMC in consultation with Development Alternatives by using slag for making paving blocks. Currently slag is dumped in landfills which causes land degradation. Given the slag generation is to the tune of 12,000 tons in Jalandhar, an additional investment of INR 9 million would be needed for machinery (15 new units) to make for paver blocks. This will have a huge positive impact on the environment.

Enabling ‘More for Less’ 4



Enabling 'More for Less'

Climate change is clearly the priority for businesses across the board including the MSMEs and energy efficiency will continue to be a compelling and cost-effective mechanism to counter this challenge. It is also in the best interest of the MSMEs, who are stressed for resources, to use this as a means to improve their own sustainability.

Cases, presented earlier, suggest that there is a strong correlation between the improvement in profitability and adoption of energy efficiency measures and technologies. However, it is also clear that MSMEs have limited capabilities to handle technical, financial and at times policy aspects of energy efficiency.

Financial mechanism such as PRGFEE and PRSF are some of the breakthrough initiatives which can create bankable energy efficiency projects in the MSME sector. Scheduled Commercial Banks and NBFCs are already enrolling themselves with these schemes. However, dissemination of information and benefits to the last mile would be important to bring about an actual change at the ground level.

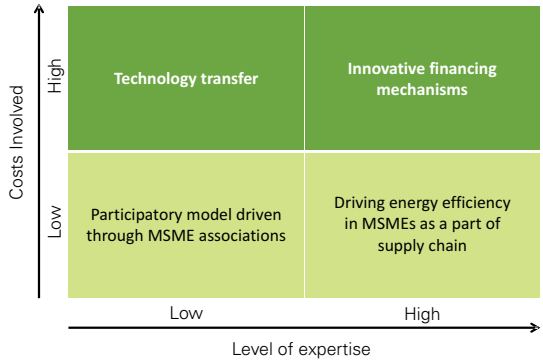
Improving energy efficiency across 51 million MSMEs that exist across the country will need participation from not just the conventional stakeholders–Government agencies, Financial Institutions and sector experts but look at new and innovative mechanisms to break through the existing challenges and barriers. It would thus be important to adopt innovative and inclusive approaches to facilitate and empower MSMEs with the existing policies and financial mechanisms. Three such approaches which can achieve scale are presented below.

For the MSMEs, By the MSMEs

Given the present state, in spite of the various initiatives taken up, it is important to improve participation of MSMEs in the existing programs through collective and inclusive programs which are led through MSME associations. These MSME associations may bring in greater confidence to both MSMEs as well as investors.

On one hand, it would help break perception based barriers of the MSMEs and encourage greater participation. Associations would also speak and understand the language of the MSMEs and could be instrumental in developing specific and standardized documentation which is required for accessing capital from financial institutions.

MSME cluster based associations can also take up local capacity building to build expertise, and deploy local experts to identify low hanging fruits which require minimal / no financial help, can be taken up as a part of the regular business operations and provide immediate savings.



Bringing in associations to develop collective projects would also diversify project specific risks, providing greater confidence to the investors thus making them more bankable. This would also solve the problem of unattractiveness due to small size of the loans as associations can act as aggregator for the various projects proposed by its members. This will create win-win situation for all stakeholders.

Associations can work within their clusters to organize programs and campaigns which can later take shape of awards / incentives to further promote energy efficiency which can spur the enterprises to participate further in the initiatives.

Market Driven Efficiencies

MSMEs often act as ancillaries and suppliers to large organizations which are focused on enhancing sustainability. Inefficiencies in the supply chain of these large organizations may lead them to lose their competitiveness in the market. There are ample global and local examples of how supply chain issues have led to significant reputational risks to some of the world's largest and most established organizations.

Many leading automobile companies in India are working with their suppliers to work on a low carbon transition through energy conservation and efficiency. These established organizations which have implemented energy efficiency projects in-house can pass their knowledge to their suppliers to enable a quick transition to energy efficient methodologies. This does not only help the automobile manufacturers reduce the impact of the their value chain but also save on cost of energy that was earlier being wasted, allowing them to pass on this advantage to their customers and hence gain greater competitiveness in the market. Such solutions need to be replicated across other sectors as well.

Learn to Lead

MSMEs are often challenged by the lack of expertise in the energy efficiency domain. Skilling MSME workforce needs to be taken up on priority to enable these enterprises work towards improved energy efficiency levels.

Technology without skills may not always be useful thus making it important to enable the workforce with knowledge before they are exposed to new technology. It is therefore important not to present new technology as a 'black box' but provide complete 'know-how'.

In this regard, various international agencies can take lead to initiate technology transfer with small customizations to suit the Indian context. Developing local cluster level experts who can work with these technologies and their variants can further enhance local level R&D and promote home grown solutions. Such solutions can then be further scaled up across similar clusters.

In order to build capacities of MSMEs, financial institutions would also have to participate and present the key factors basis which the projects are appraised by the lenders. This would need to account for technical and financial appraisal and various aspects.

Innovative Financial Mechanisms

Green Bonds and Green Climate Fund are some of the new financial instruments / mechanisms to draw greater investment in the climate finance space. Recently India's largest energy saving services company, Energy Efficiency Services Limited (EESL), declared that it intends to raise USD 100 million through a Green Bonds issue in London, possibly in November 2016. Earlier, World Bank has used Green Bond proceeds to fund project in China which reduced costs through improved energy efficiency in factories and is estimated to cut greenhouse gases by 4 million tons a year.[21]

Another example is of leveraging Green Climate Fund (GCF) to promote investment in energy efficiency. The GCF Secretariat seeks to diversify the MSME portfolio by capping USD 65 million per geographic region (for Africa, Latin America and Asia).[22]

Latin American countries have further merged both these instruments to addressing energy efficiency in Latin America and the Caribbean through Green Bonds, by using the concept of aggregation to mobilize institutional funds at scale toward small and medium sized energy service companies. The program employs a two step approach, funding energy efficiency projects using loans in the first step and bundling them, in the second step, to underpin the issuance of partly guaranteed green bonds. This model, in the initial phase, is deployed in each of the targeted country which involves four Latin America and Caribbean countries – Colombia, the Dominican Republic, Jamaica and Mexico (as pilot country) – of which two are Small Island Developing States.

About 93% (or USD 306 million) of the program is co-financed by the Inter-American Development Bank while the remaining is financed through GCF in form of guarantee (USD 20 million) and grant (USD 2 million).

The program targets minimum emission reduction of 13.2 million tCO_2 and USD 780 million of private investments with potential for further up-scaling and replication in other developing countries.

[21] *http://www.worldbank.org/en/topic/climatechange/brief/green-bonds-climate-finance*

[22] *http://www.greenclimate.fund/documents/20182/226888/GCF_B.13_15_-_Establishing_a_programmatic_framework_for_engaging_with_micro-__small-_and_medium-sized_enterprises.pdf/558ec8ba-f0f8-455a-a8ce-8544de51f719*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