

Integrating Micro and Small Manufacturing Units in India's Low Carbon Pathways: Scope, Challenges and Solutions

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Highlights:

- **Micro, Small and Medium Enterprises (MSME) account for a significant share of economic value, employment and energy consumption in the Indian manufacturing sector. Approximately 90% of current and future employment in manufacturing is in the MSME sector. Therefore, India's effective transition towards low carbon development calls for a focus on MSMEs.**
- **MSMEs are ideal for decentralized renewable energy solutions as the energy demand is usually small and distributed, and renewable power can often be cheaper than an unreliable grid connection or diesel back-up power.**
- **Renewable policy innovations are easier in the MSME sector due to smaller scale, flexible mode of operation and insignificant sunk costs. Introducing and developing novel technologies, knowledge and skill development involves lower economic and transaction costs among the MSMEs.**
- **MSME focused outreach and financial schemes are required as the informal mode of operations of the MSME units keep them out of regular channels for policy intervention, and low turnover and profitability prevent them from investing in sustainable energy options.**
- **Efficient integration into low-carbon pathways is usually hindered by the low technological base and typically rural location of most MSME units.**
- **Lack of reliable information is one of the crippling factors that makes understanding the current status and assessing the scope for sustainable technologies in the MSME sector difficult. We propose to set aside National Clean Energy and Environment Fund to finance comprehensive, dedicated and periodic energy surveys of the MSME segment.**
- **Policies promoting sustainable energy options ought to account for the heterogeneity in scale and mode of operation among the MSME segment. Design and implementation of the policies have to be decentralised to appropriate sectoral and regional level.**
- **Creating a profitable and viable market is the supply side push needed for sustainable energy options to be technologically and economically accessible.**
- **India's gig economy, which has the potential to create 24 million jobs in the medium term, might be considered as a service sector equivalent of micro enterprises. Well-designed policy interventions can ensure that the transportation and mobility need of the gig economy are met entirely by electric vehicles.**



I. Background

Energy consumption in the manufacturing sector accounts for significant amount of carbon emissions. 19 percent of the total carbon emissions emitted due to fuel combustion activities in India for the year 2016 was from the manufacturing sector (MoEFCC, 2021). Industry is one of the biggest consumers of energy in India. According to the recent statistics 41 percent of electricity, 9 percent of coal and 11.5 percent of oil is consumed by the Indian industry (MoSPI, 2022) and (NITI Aayog, 2022).

Micro, Small, Medium Enterprises (MSMEs) are a significant part of India's manufacturing sector. For the year 2019-20, MSME's share of total manufacturing output was 36.9%, and these units contributed to 49.5% of India's total exports for the year 2020-21 (Press Information Bureau, 2022). MSME engages 45.8% of workers employed in overall manufacturing activities (MoSPI, 2021) By 2015, there were 63.3 million MSME units. These units operate at small scale, individually occupy insignificant market share, engage few employees/workers and are technologically poor. These units accounts for nearly 80 percent of the total manufacturing units. If India must effectively shift its manufacturing sector to low carbon pathways, MSMEs play a key role.

II. Moving MSMEs to sustainable/renewable energy options: Push and Pull Factors

MSMEs are ideal candidates through which energy use in India's manufacturing sector can be revolutionized towards sustainable options. Renewable energy technologies that meet the motor power and heat requirements of the manufacturing units, especially decentralised renewable energy (DRE) options that are viable for small enterprises have been developed. State, and non-State actors are actively involved in engaging these units to take-up these technologies (BEE, 2022a). However, MSMEs have been slow to adapt renewable energy options. In the following, we make a

case for renewable energy sources, especially decentralized and distributed renewables, in the MSME sector.

a) A Significant Source of Aggregate Energy Demand:

India's MSME sector consumes energy equivalent to about 50 million tons of oil equivalent (mtoe) annually, which is about 20-25 percent of the energy consumption of the large industries sector (BEE, 2022b). There is significant scope for improvement given the use of old and outdated technologies, inefficiencies, and low skill base in the MSME sector. Therefore, a steady shift of these units to sustainable energy options will reduce reliance on unsustainable and polluting energy sources. It is likely that the cost of energy might also decrease.

b) Small and Distributed Sources of Demand:

MSME units are many in number and majority of them operate in isolation. According to the Fourth MSME Census, only 49 percent of the units operate within structured/semi-structured network systems called clusters (A cluster in a district consists of 100 or more MSME units which are engaged in manufacturing the same product.). The rest of the units operate from scattered locations and independently. This makes moving these MSMEs to clean and sustainable energy sources a challenge. Distributed renewable energy source like solar PV, solar thermal and biomass can play an important role in this case.

c) Need for reliable and viable energy sources:

Despite seemingly significant energy consumption, reliable energy supply continues to plague the MSME sector. According to National Sample Survey conducted by Central Statistical Organisation (NSSO, 2017) , 15 percent of MSME enterprises that reported to have problems in their manufacturing processes cited "erratic power supply/power cuts" as one

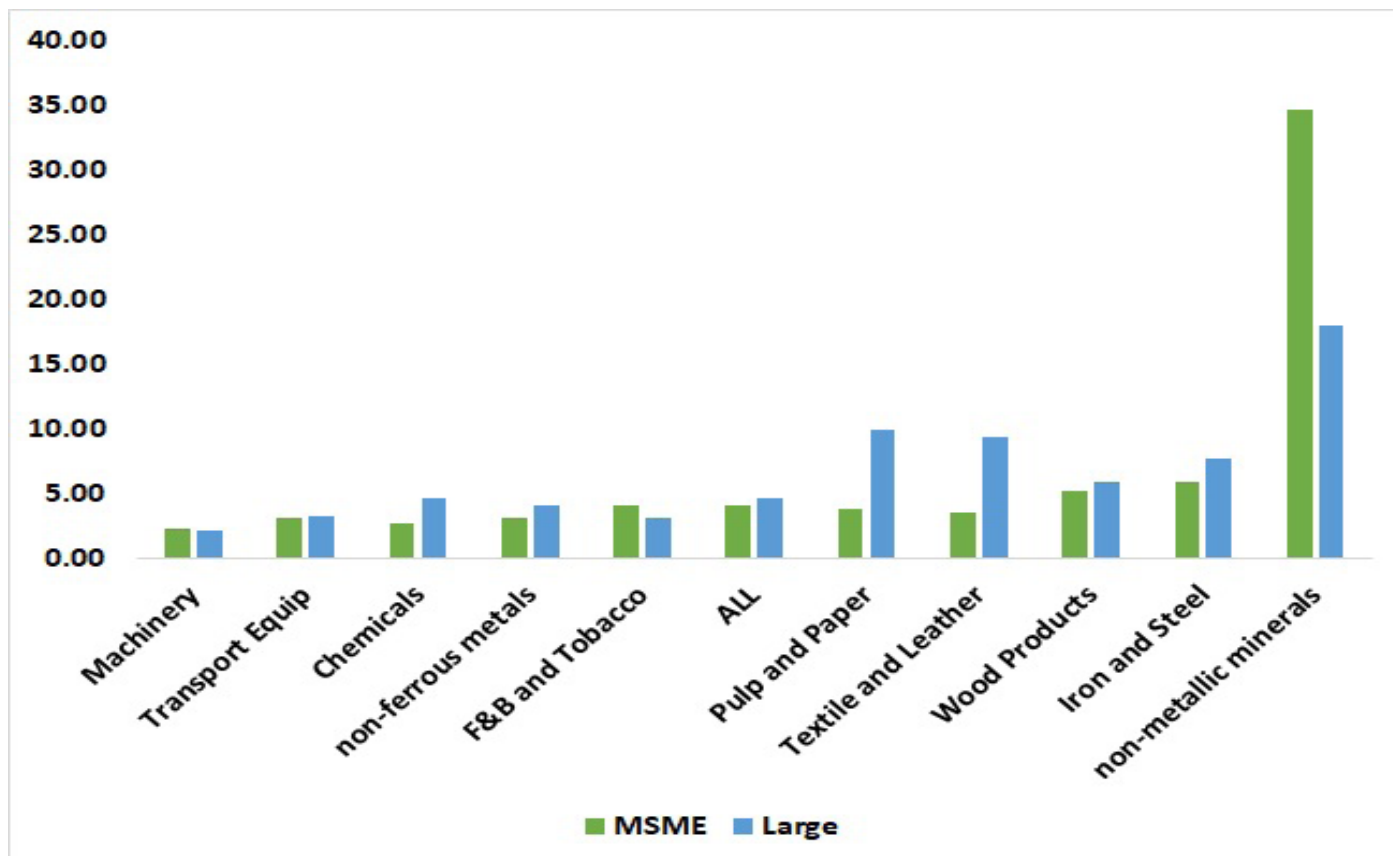


Figure 1: Energy Input Ratio: MSME and Large Units.
 Source: Calculated using Annual Survey of Industries (2018-19).

of severe problems. Approximately 10% of the electricity consumed in the MSME sector comes from diesel generators running as back-up during power cuts, this figure is higher (12%) for micro enterprises (calculations using data from the Annual Survey of Industries conducted in 2018-19 (MoSPI, 2021)). This diesel genset back-up power is generated at an average cost of Rs 18.4 per kWh, an exorbitant figure that is significantly higher than the cost of power from solar PV plus battery storage. In case of power crisis, like the one India had been witnessing in early 2022, production costs of the units that rely on backup power (like diesel generators) increased by 4-5%. And those who cannot afford the backup simply shut their operations down (Baruah, 2022). Due to reliance on outdated technologies and inefficient practices, expenditure on energy amounts to a significant proportion in the total input cost. The energy-input ratio (the total expenditure spent on energy as a ratio of total value of the input) of India’s MSME segment is little over 4 percent (Figure 1). This is only marginally less than that of the large units (4.6 percent). Distributed

renewables like rooftop solar PV could meet part of the power demand for significantly lower cost that power from the grid.

d) Free from lock in:

Unlike large units, the technology and/or skill invested by the MSME units into their operations are not rigid or locked in due to the small and flexible scale of operation. Costs involved in breaking away from existing practices, installing new and efficient technologies, bringing changes in the production processes, skilling/ re-skilling the personnel is less in comparison to larger units that operate on large scale with heavier sunk costs. Also, these units are viable candidates to test and experiment novel sustainable technologies and processes before scaling them up for large scale usage.

e) Electric Vehicles (EVs) for the ‘gig’ economy:

Informal and short-term service sector



employment delivered on-demand, where technology is used match supply and demand at scale (for example, using a mobile phone app interface) is referred to as the gig economy. Uber and Ola (ride-sharing), Swiggy and Dunzo (food/ grocery delivery) and Urban Company (personal services) are typical examples. These kinds of employment are comparable to MSME (at least in the service sector). Research suggests that the gig economy can lead to upto 24 million jobs in the short term, and upto 90 million jobs in the long term (Boston Consulting Group & Michael & Susan Dell Foundation, 2021). Energy intensive components of the gig economy, such as transportation, are suitable for green technology policies given small scale, flexibility and lack of lock-in.

III. Moving MSMEs to sustainable/renewable energy options: Challenges

While there are many good reasons to consider renewable energy sources for MSMEs, this potential has not translated to action yet. Despite the State’s constant efforts to encourage MSMEs there are a few challenges that impede their smoother transition towards

sustainable energy sources.

a) Informality

The informal nature of the MSMEs is a challenge to effectively integrate them into sustainable pathways. According to survey conducted by Central Statistical Organisation, 57 percent of the total MSMEs engaged in manufacturing activities are not registered under State prescribed factory act (Gol, 2020), thus these units are referred to as unorganized/informal units. **Figure 2** depicts the nature of informality among these units. A majority of these units do not maintain accounts nor do they use computers for their operations. Nearly 70 percent of the units either operate in household premises or temporary settings. Most importantly, less than 1 percent of the unregistered manufacturing units received any assistance from the State in the past three years. Due to the informality, these units are often beyond the scope of the State both in terms of accountability and assistance. For example, in the non-metallic industry, one of the most polluting industries, according to the NSSO 73rd round, while 19% of the registered MSME units (that account for 70% of the MSME units in the non-metallic industry) are registered with the

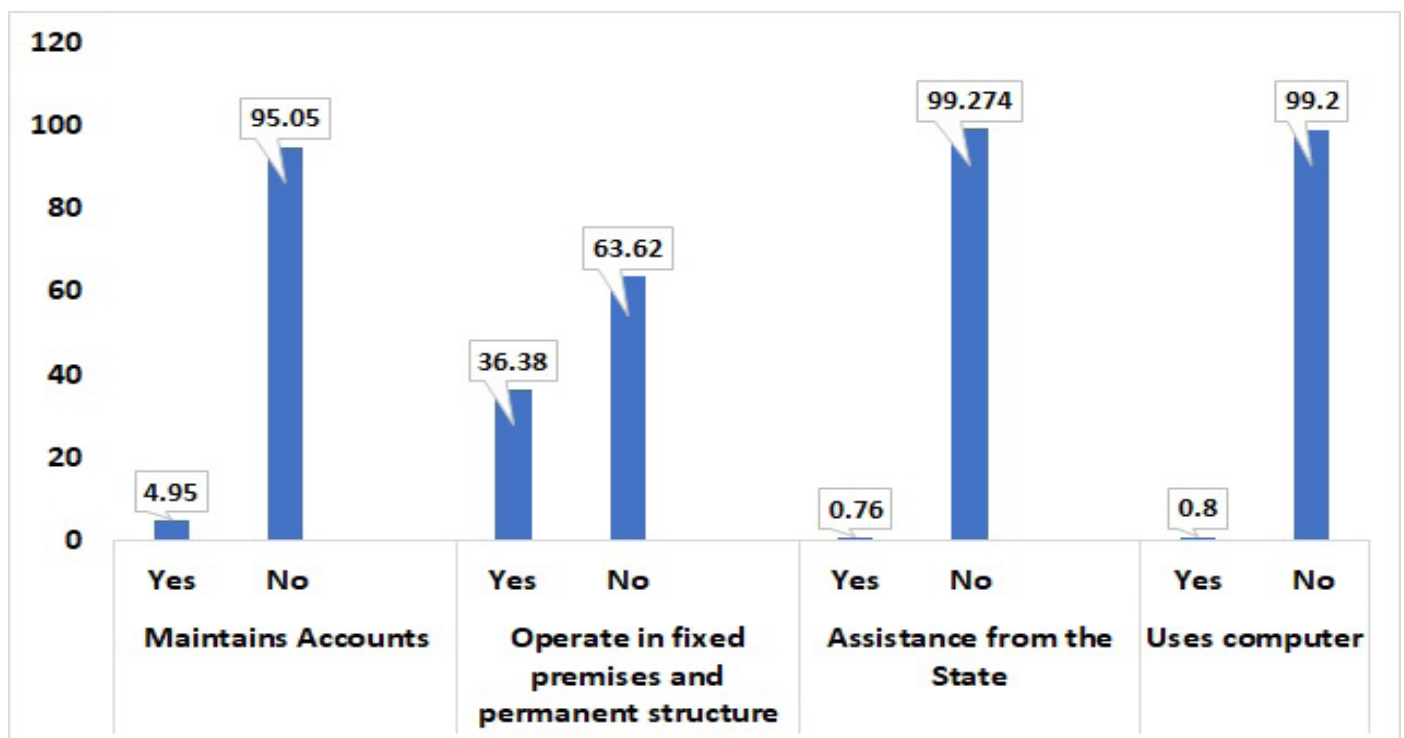


Figure 2: Informal Nature of Unregistered-MSMEs engaged in Manufacturing Activities. *Source: Calculated using National Sample Survey (2017).*



Pollution Control Board, unregistered units are not registered with the Pollution Control Board. Assessing the energy requirements of these units, their technology base, present skill, and know-how is crucial for designing/prescribing sustainable energy options and extend policy support. However, the way these units conduct and account for their day-to-day operations makes it difficult to obtain reliable and much needed information. Further, implementing incentive-reward mechanism to encourage the use of environmentally friendly technologies among these units is challenging for the State.

b) Low turnover and profitability

The small-scale subsistence level operation of many MSMEs with very low turnover and profitability make it difficult to incentivise these units to opt for sustainable energy technologies. Nearly 57 percent of the manufacturing MSMEs are Own Account Enterprises i.e., these units are operated by family members and work for their own account, with no hired workers, nor aspire to expand their operations (85 percent are unregistered units). These units predominantly

work for subsistence and eke out insignificant surplus and seldom invest back into their operations. Therefore, making these units see the benefit of energy-efficient technologies, sustainable energy choices, let alone invest in them, is a challenge.

c) Low Technology Base

Introducing new technologies among the MSMEs involve higher associated costs. In general, MSMEs rely on outdated technologies and operate at a low technological base. Very few of these units invest in technological upgradation, research and development (See **Figure 3**). At the same time, units that invest in technological upgradation proved to be energy efficient. For example, in non-metallic industry, the average energy-input ratio of the units that invest in technological upgradation is 25 percent less than the units that do not. MSMEs operate on low technology base and have less inclination to upgrade their technology or develop appropriate skills to work with new techniques and technologies. This makes introducing new energy sources

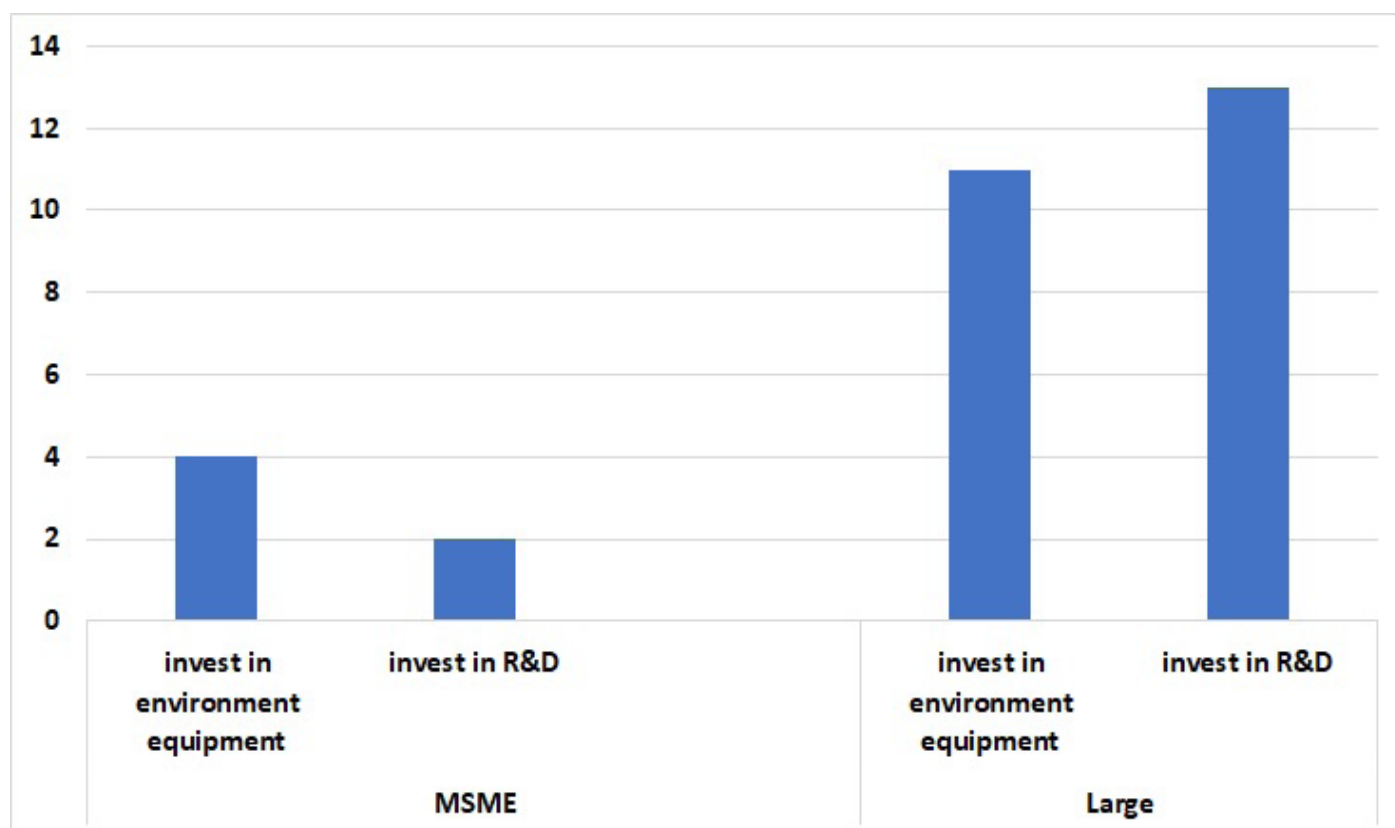


Figure 3: Technological Upgradation: MSMEs vs Large Units.
 Source: Calculated using Annual Survey of Industries (2018-19).



and energy efficient technologies difficult and associated with larger acquisition costs – in terms of training and skilling, and upgradation of existing equipment and operations to be compatible to the new energy sources and efficient technologies.

d) Rural location of most MSMEs

MSMEs that are removed from urban areas are difficult to engage in novel energy technologies effectively and consistently. 47 percent of the MSME units engaged in manufacturing activities are located in rural areas. Rural based units are far from the basic infrastructure and services necessary for day-to-day operations- credit, technology, and markets. Of the units that cited unavailability of affordable credit and poor access to market as major problems in their daily operations, 87% and 70% are rural based units respectively. Therefore, rural based units are in a disadvantage when it comes to investing in new and efficient energy technologies that are not only costlier than the existing technologies, but also call for supportive infrastructure system that provides technical know-how and maintenance services to the user.

Poor access to credit reflects on the limited investment of rural based units in upgrading their technology. According to the Fourth MSME census (2006-07) (Gol, 2011), per unit value of Plant and Machinery among the urban based units is Rs. 8.79 lakh whereas it is only Rs. 4.2 lakh among the rural units. Poor energy efficiency is an indicator and a stark reminder of poor technological base of rural units. Energy input ratio of rural based and urban based MSME units are 6% and 3% respectively, indicating that rural units because of their obsolete and energy inefficient technologies tend to spend more on energy than their urban counterparts. Poor technological base and limited access to credit and services could impede rural MSMEs' implementation and adaptation of sustainable technologies.

Solutions

The size, location, and nature of MSME units make the transition to sustainable

energy source challenging. Having identified the key challenges in the previous section we now consider policies and implementation mechanisms that can help the sector.

a) A Comprehensive Energy Survey:

One of the first steps in bringing MSMEs to effectively integrate with low-carbon pathways is to have reliable information to guide policies. Despite dedicated agencies conduct and publish periodical surveys on MSMEs, information that is critical to understanding energy usage, and identifying obstacles to adopting sustainable energy technologies is absent. We propose a comprehensive, dedicated and periodic energy surveys of the MSME segment. These surveys should collect data on the type, quantity, cost, source of energy used; technical, financial, and institutional bottle necks to adopt efficient and sustainable energy technologies. It is worthwhile to set aside portion of Climate Finance for collection and upgrading comprehensive energy usage data at the micro level. Finance instruments dedicated for mitigation like National Clean Energy and Environment Fund could be very well used for such an endeavor.

b) Inclusivity of the policies:

India's MSME segment is quite heterogeneous, and the policies ought to take this into consideration. State so far made deliberate efforts and succeeded in promoting sustainable energy technologies like DREs among the MSMEs. (Joshi et al., 2020) However, policy efforts to promote, finance, and provide technological aid are primarily focused on the units that are registered under the State's act. For example, The Pradhan Mantry Mudra (The Micro Units Development and Refinance Agency Ltd) Yojna is designed to support the finance institutions which are in the business of lending to micro / small business through formal credit institutions to support their development. However, significant percentage of MSMEs operate in small scale and informal settings. According National Sample Survey, 2017 (NSSO, 2017), 40% of units do not maintain any bank account/post office savings bank account thus making them ineligible for such policy benefits. Estimates suggest that informal



sources of debt account for 84 percent of credit supply to MSME sector (Ashutosh Tandon et al., 2018). Therefore, instead of blanket policies, sustainable energy policies directed towards MSMEs ought to be tailored to the heterogeneity of this segment. These policies should be crafted and implemented at an appropriate regional (State or district) level.

c) Creating a profitable and viable market:

For sustainable technologies- like distributed renewable energy (DRE) systems- to be technologically and economically accessible to MSMEs, a supply side ecosystem is as important as that of the demand side. This calls for a carefully crafted ecosystem that makes DREs viable and profitable. A large and thriving market brings down the prices, make the products technologically superior, address heterogeneity, attract investment and innovations, create necessary support system like finance. In India, the size of the market for clean energy in rural MSMEs is estimated to be 53 billion USD (Jain et al., 2021). Replacing diesel genset back-up with solar PV and storage can lead to substantial savings right away. Extending banking, formal credit systems, or innovative digital lending platforms to meet the needs of the MSME sector is key to the success of clean energy there.

The government in a recent draft policy framework (MNRE, 2021) acknowledged the importance of DREs, and laid a blue print to promote these for “livelihood applications”. The proposed policy will create a roadmap for developing a profitable DRE market, and will make MSMEs aligned with national low-carbon pathways. Nevertheless, the extent of the impact of this policy on MSME segment is contingent on it accounting for the basic characteristics of the segment we discussed so far- very small, scattered, technologically and economically poor, low-end of the value chain and operate for subsistence.

Sustainable energy solutions can often be more affordable than fossil fuel alternatives if the right market is created to provide these solutions. Electric vehicles (EV) are already

the preferred solution for transportation needs of gig economy delivery workers if EV mobility is available on a rental basis (Philip, 2022). Well-crafted policies that incentivise EVs in the gig economy can help scale up the size of the market and accelerate the affordability of EVs.

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