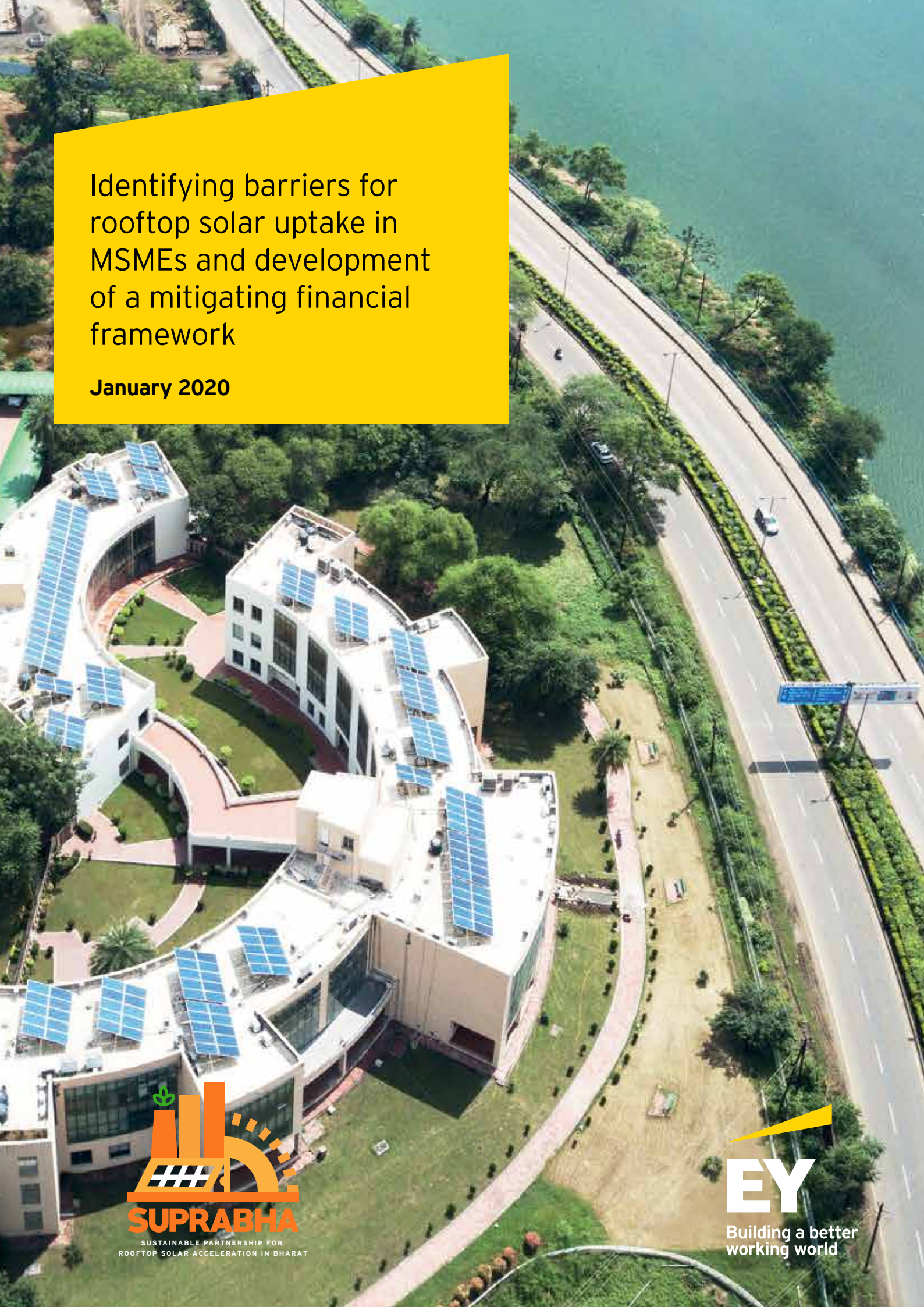
Identifying barriers for rooftop solar uptake in MSMEs and development of a mitigating financial framework

January 2020



SUPRABHA
SUSTAINABLE PARTNERSHIP FOR ROOFTOP SOLAR ACCELERATION IN BHARAT

EY
Building a better working world

Acknowledgements

This study *"Identifying barriers for rooftop solar uptake in MSMEs and development of a mitigating financial framework"* was carried out as part of the SUPRABHA – SBI - The World Bank – MNRE Grid connected rooftop solar PV (GRPV) - technical assistance program. The report was prepared over a period of six months through extensive consultations with a wide spectrum of stakeholders.

The overall engagement team was led by Shuaib Kamili (Senior Manager, EY) under the guidance of Ashish Kulkarni (Associate Partner, EY) and Yuvaraj Dinesh Babu Nithyanandam (Senior Advisor, EY & Program Leader, SUPRABHA). The core EY team members who worked on the research, analysis and drafting of report for this engagement include Hemangajit Kakati, Mankirat Kaur, Faris Zulfiqar, Vishal Sukhija and Ashish George Kuttickal. The core team from EY received valuable support and inputs from the World Bank team comprising Mr. Don Purka, Ms. Mani Khurana and Dr. Amit Jain. We would like to express our thanks to State Bank of India officials for validating the findings, providing suggestions on the report and guiding us to several other bank officials and SME regional managers, who further helped us understand the ground realities in the MSME lending sector. We would also like to express our gratitude to the MSMEs from cold chain and automotive sectors, who were extremely supportive and forthcoming in sharing their views and concerns regarding rooftop solar and financing issues in their interaction with various banks (Refer annexure). This report would not have been complete without the inputs from various solar power developers who narrated their concerns and bottlenecks faced in the sector.

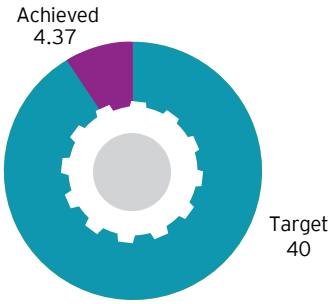
During the course of the report, we interacted with the officials of various leading institutions, who shared their experiences with us. Our colleagues at EY also provided formal and informal guidance throughout the development of this report and we would like to express our gratitude to them as well.

Contents

Executive summary

The study, 'Identification of barriers for rooftop solar uptake in MSMEs and development of a mitigating financial framework', aims to understand and zero in on the barriers faced by micro, small and medium enterprises (MSMEs) in undertaking rooftop solar projects, with a special focus on the issues MSMEs face in financing rooftop solar and also to create a financial instrument, which can mitigate these barriers and lead to rooftop solar propagation among MSMEs.

Rooftop solar scenario (in GW, as of March 2019)



Source: BRIDGE TO INDIA report on India Solar Rooftop Map, June 2019

The uptake of rooftop solar in MSME sector faces a host of challenges ranging from low levels of awareness about the technical and commercial benefits of this form of energy and various business models of deployment, to lack of adequate financing for rooftop solar. The MSMEs also feel the rooftop solar sector does not have a structured and standardized offering in terms of asset quality which discourages MSMEs to invest in the rooftop solar assets, that require high amount of capital. Financial institutions have a similar concern with regard to the lack of standardization in the rooftop solar segment and also about the credit and repayment risks from lending to MSME sector.

A Framework for Uptake of Rooftop solar in MSMEs (FURM) has been introduced which may help in addressing the concerns of various stakeholders and will go a long way in building the rooftop solar market in the country. FURM, which comprises of standardization, credit risk mitigation and insurance cover as the pillars (explained in detail in the report) can help in addressing the concerns of various stakeholders and will go a long way in building the rooftop solar market in the country.

The backdrop of this study is the slow growth in rooftop solar vis-a-vis the ambitious target of the GoI of setting up 100 GW solar installations, including 40 GW of rooftop solar by 2022. This government drive has incentivized the achievement of solar PV, but the pace of rooftop solar installations has been considerably slower. According to India Solar Rooftop Map, June 2019, a report by BRIDGE TO INDIA, around 70% of this capacity has been achieved in the commercial and industrial (C&I) sector in India, but even in this sector the success has been limited to medium- and large-sized players. The uptake of rooftop solar in the MSME sector has been quite low despite the MSME sector comprising the largest number of players in the C&I segment.

Rooftop solar potential in MSMEs and barriers to propagation

The starting point of this study was to estimate the rooftop solar potential of the MSME segment. For that, the study used a two-pronged approach - a top down approach, which takes the overall industrial power demand as a starting point and calculates proportionate MSME consumption, and a bottom up approach, which considers aggregating the power demand of MSME clusters in India. The rooftop solar potential in MSMEs has been estimated after taking a few assumptions regarding the percentage of the power demand that rooftop solar is likely to meet.

Both these approaches point to a huge potential of ~16 GW-18 GW of rooftop solar in MSMEs. This potential, if unlocked, can go a long way in meeting the government's target of 40 GW rooftop solar by 2022. However, despite this huge potential, the rooftop solar sector as a whole, and especially in the case of MSMEs hasn't taken off as planned.

The key reasons for the non-offtake of rooftop solar in MSMEs are financial barriers and operational barriers. The first part of this study looks at the various issues uptake of solar rooftop in the MSME sector in detail while the second part tries to build a framework to mitigate the concerns and provide a stable structure for the rooftop solar installations to grow in the country.

Cluster selection

In order to understand these issues in detail as well as take steps to mitigate them, two electricity-intensive MSME sectors have been selected. A detailed selection methodology has been adopted to arrive at the sectors to be studied as part of this activity.

MSME rooftop solar potential

Source: EY analysis

The process involved trimming down a detailed list of 388 MSME clusters (as given by Development Commissioner (MSME) in India to a list of final 10 sectors for further comparisons, by applying the initial filters of electricity consumption and electricity dependency of sectors, which brings us to a list of sectors which stand to gain the maximum by switching from conventional power to grid connected rooftop solar.

These sectors have then been ranked on the basis of a selected set of macro-economic, technical and financial parameters, assigning appropriate weightages to each of them. Macro-economic parameters give an understanding of growth – historic and prospective, technical parameters help in assessing the energy needs and how much energy could be substituted through rooftop solar and financial parameters provide the credibility of the sector from a lending perspective.

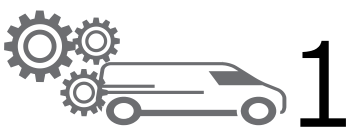
Macro
- Industry contribution to GDP (5%)
- Industry CAGR (15%)
- Sector employment (5%)

Technical
- Electricity cost percentage of the total production cost (25%)
- Rooftop solar suitability (15%)

Financial
- Industry credit growth (17.5%)
- Industry NPA rate (17.5%)

Source: EY analysis

The sectors with the maximum weighted average scores were selected for a detailed study. These sectors were the cold chain sector in the service industry and automobile component manufacturing MSMEs in the manufacturing industry. These two sectors also have a significant presence and geographical reach throughout the country.



1 Auto and engineering products

2 Cold chain/ warehousing

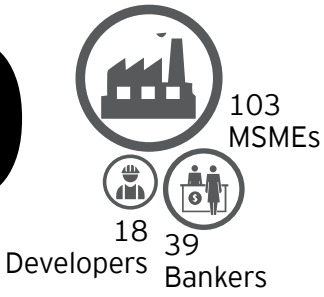
Source: EY analysis

Stakeholder consultations

The cold chain and automobile component manufacturing MSMEs, along with various financial institutions and developers have been consulted through various modes of communication such as one-to-one meets, workshops, site visits, surveys and telephonic interviews to understand their views on the issues in the rooftop solar space.

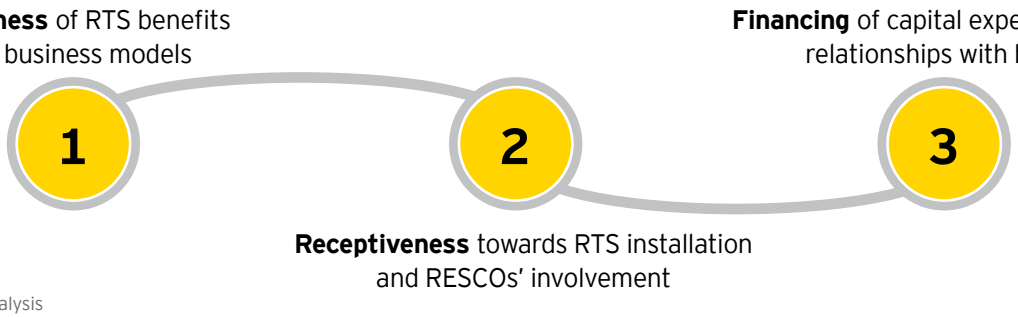
160

Stakeholders consulted



Source: EY analysis

Prominent financial institutions, which have a working relationship with MSMEs, cold storage MSMEs, auto component manufacturers involved in the manufacturing of diverse products such as castings and forgings, lights, wiring, springs, fasteners, etc. and of few leading developers have also been consulted for their insights. Besides this, two workshops were carried out with MSMEs, one in Agra in August 2018 and the other one in Delhi in September 2018. The MSMEs were consulted for their views on rooftop solar, their awareness about and receptiveness to business models such as the renewable energy service company (RESCO) model and their funding sources - self-funding or borrowing from banks, NBFCs, etc. The financial institutions were asked about their views on lending to MSMEs and innovative financial frameworks that can be looked at for mitigating the issues in the offtake of rooftop solar in MSMEs; and the developers on the issues they have faced till date with regard to operations and financing in scaling up. The questionnaires were framed to gauge the various stakeholders including MSMEs, FIs and developers on awareness, receptiveness and financing.



Source: EY analysis

High

- Awareness of cold chain and auto components MSMEs on benefits of RTS
- Receptiveness of auto component MSMEs to RESCO

Low

- Conversion of RTS awareness to RTS installations
- Awareness of cold storage and auto components MSMEs on RESCO
- Receptiveness of cold storage MSMEs to RESCO

Source: EY analysis

The insights from the stakeholder consultations show that the consulted MSMEs are aware about the rooftop solar front, but are not mindful of the various business models such as the RESCO model. When the MSMEs were informed about the prevalence of these two modes namely CAPEX and RESCO, the receptiveness for CAPEX mode was found to be higher in cold chain players (where electricity is a significant operating cost) and the receptiveness for RESCO mode higher in the auto sector (where electricity is a relatively lower portion of operating cost). However, economics of individual players also affect MSME's decision-making. Amongst most players the motivation to move towards rooftop solar is impeded by the high cost of equipment and the lack of capital availability, more so in the case of cold chain MSMEs. MSMEs also seem to be concerned about the varying levels of quality and price of equipment. A snapshot of the key takeaways from the MSME consultation exercise is presented below. The details of these consultations and the insights gathered from the stakeholders have been captured in the stakeholder consultation section of the report.

Salient findings from consultations

1. Medium level of awareness among auto MSMEs around rooftop solar costing and O&M
2. Low awareness around financial benefits from RTS for both auto and cold chain MSMEs
3. Apprehension due to lack of standardization around rooftop solar equipment and RESCO players
4. Concerns around the long-term performance of equipment installed especially in capex mode
5. Cold chain players are more interested in CAPEX model and have low liking for long term PPAs
6. Auto MSMEs are more interested in RESCO mode as preference for taking loan for RTS is low
7. Low awareness around RESCO mode among MSMEs
8. Cumbersome application process and low incentives offered are other prominent barriers for cold chain MSMEs.
9. Saving on electricity bill key motivation for MSMEs

Source: EY analysis

During our interactions with financial institutions, we found that they remain concerned over the low creditworthiness and short business horizon of MSMEs. FIs are interested in financing mechanisms which may mitigate their risk to MSME sector lending. They feel that without the support of enabling financial frameworks, their lending outlook would remain cautious towards MSMEs. Since solar rooftop may not form the core operations of MSMEs, it may invite higher risk perception.

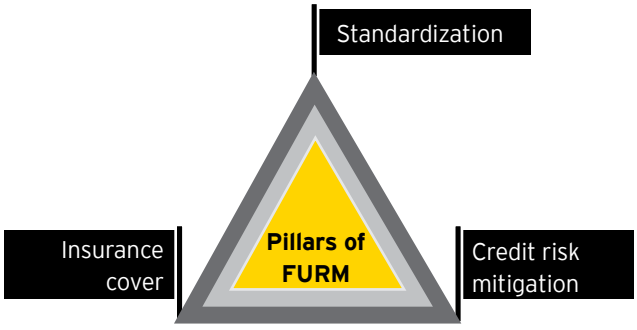
The developers expressed concern over long evaluation and loan disbursement cycle of the banks which adds stress to the RESCOs' future finances. Also, stringent covenants put by banks increases the DSRA size and reduces project leverage.

Framework for Uptake of RTS in MSMEs (FURM)

Based on the insights gathered from the extensive stakeholder consultations, which have been briefly mentioned in the previous section, the study identified a few salient actionable points or areas of concern. The mitigation of these points has the potential to enhance the uptake of rooftop solar significantly in the MSME segment. Deep analysis and extensive brainstorming sessions on measures that can be taken to mitigate these concerns of different stakeholders have thrown up a few relevant steps. These steps have been modelled into a framework, which has been abbreviated as FURM (Framework for Uptake of RTS in MSMEs).

A few barriers identified through stakeholder consultations are:

1. Lack of awareness
2. Quality concerns
3. Credit risk



Source: EY analysis

Quality concerns can be addressed through standardization (of equipment, service companies and operation and management (O&M) regime) and insurance coverage on equipment performance, whereas credit risk can be addressed through measures such as credit guarantee. Lack of awareness can be mitigated through outreach programs, which are beyond the scope of this report.

Standardization can help financial institutions in assessing projects in a more streamlined way. At the same time, it will help MSMEs make an informed choice from among the options available in the market.

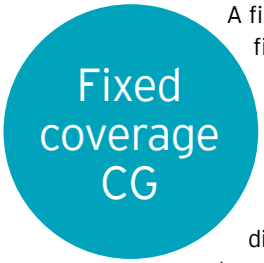
Performance insurance can help financial institutions, developers and MSMEs (in case of CAPEX mode) to mitigate the impact of unpredictability of project yields due to variability of solar irradiance and system underperformance.

While financial institutions and other stakeholders are receptive towards rooftop solar, risks related to payment delay and payment default in lending to MSMEs still remains. To help mitigate these risks, **credit risk mitigation** measures can be taken up which will provide the requisite cushion to financial institutions. Credit Guarantee Mechanism has been zeroed down as a viable risk mitigation option after deliberating on various other mechanisms such as payment security mechanism, supply chain financing, credit insurance, asset-backed securitization, etc. Issues with other financing options pervade such as the possibility of large auto players not willing to be a part of supply chain financing, delay in disbursement of viability gap funding (VGF), premium in credit insurance increasing the cost of financing apart from not being allowed in India, etc. While these instruments have their own set of merits and demerits, a credit guarantee mechanism is highly suitable to mitigate the risks associated with lending to MSMEs as the instrument covers credit risk to an extent and offers ways to mitigate risks. Moreover, it has been used earlier. So the acceptance, ease of operationalization and awareness with the lenders is also high. A credit guarantee mechanism provides guarantees on loans to borrowers by covering a share of the default risk of the loan. In case of default by the borrower, the lender recovers the value of the guarantee from the guarantor. A study of the international experiences on credit guarantee schemes and options on credit guarantee cover was also carried out to understand how the various credit guarantee schemes were implemented across the world and what the scheme dynamics were i.e., the eligibility criteria, coverage ratios, fees and pricing, payment rules and collateral rules. The study of these dynamics helped to prepare an outline of a prospective credit guarantee (CG) mechanism.

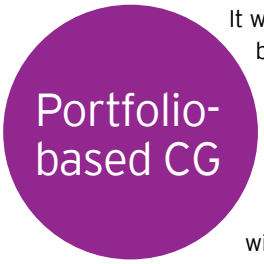
Proposed CG options

Four options of implementing CG mechanism have also been deliberated upon. These schemes will be managed by an implementing agency which will be selected/appointed by the CG provider. This may vary from a bank, an agency or an NBFC who will have the responsibility of administrating the scheme's implementation. The implementing agency will charge a pre-decided percentage fee. To extend the coverage, a number of financial institutions, called as participating financial institutions (PFIs) will be selected on the basis of their financial strength and network of branches to ensure a wide spread outreach. These PFIs will be allocated a CG limit which will be calculated based on the total amount of rooftop solar loans provided.

A snapshot of the four CG options conceptualised as an outcome of the insights received from extensive stakeholder consultations and best practices followed worldwide, has been illustrated hereafter.

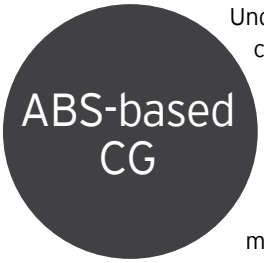


A fixed CG cover to the participating financial institutions is envisaged. Under this, the evaluation of both the borrowers and final power off-takers will be the responsibility of the financial institutions. The CG cover gets activated and disbursement takes place once the loan gets classified as loss asset by the FI. A fixed cover of up to 50% of the loan amount under the CAPEX and RESCO mode will be provided.



It will cater to the RESCOs only and will be operational only under "portfolio lending" approach. Portfolio lending approach refers to the evaluation of the complete portfolio of loans, not on individual basis, but as a single loan. This method of loan evaluation will help in reducing the time taken to evaluate each loan in the portfolio. Under this approach, CG cover gets triggered only when the entire portfolio defaults instead of default by a single loan. This approach gives more freedom to RESCO player to create a portfolio on the basis of its risk appetite, probability of cash flows and excess spread charged to the risky consumers so as to cover the default up to a certain range internally from the portfolio cash flows.

CG coverage percentage for the borrower will be decided on the basis of a matrix which is developed based on the credit rating of the individual MSMEs; higher the rating, the lower maybe the CG coverage percentage. In case of MSMEs, a large number of firms are unrated. In such a case, the banks can develop their internal scoring sheet which accounts for the credit history of the MSME, outstanding loans and credit worthiness and based on the points scored, it can categorize the CG coverage percentage.



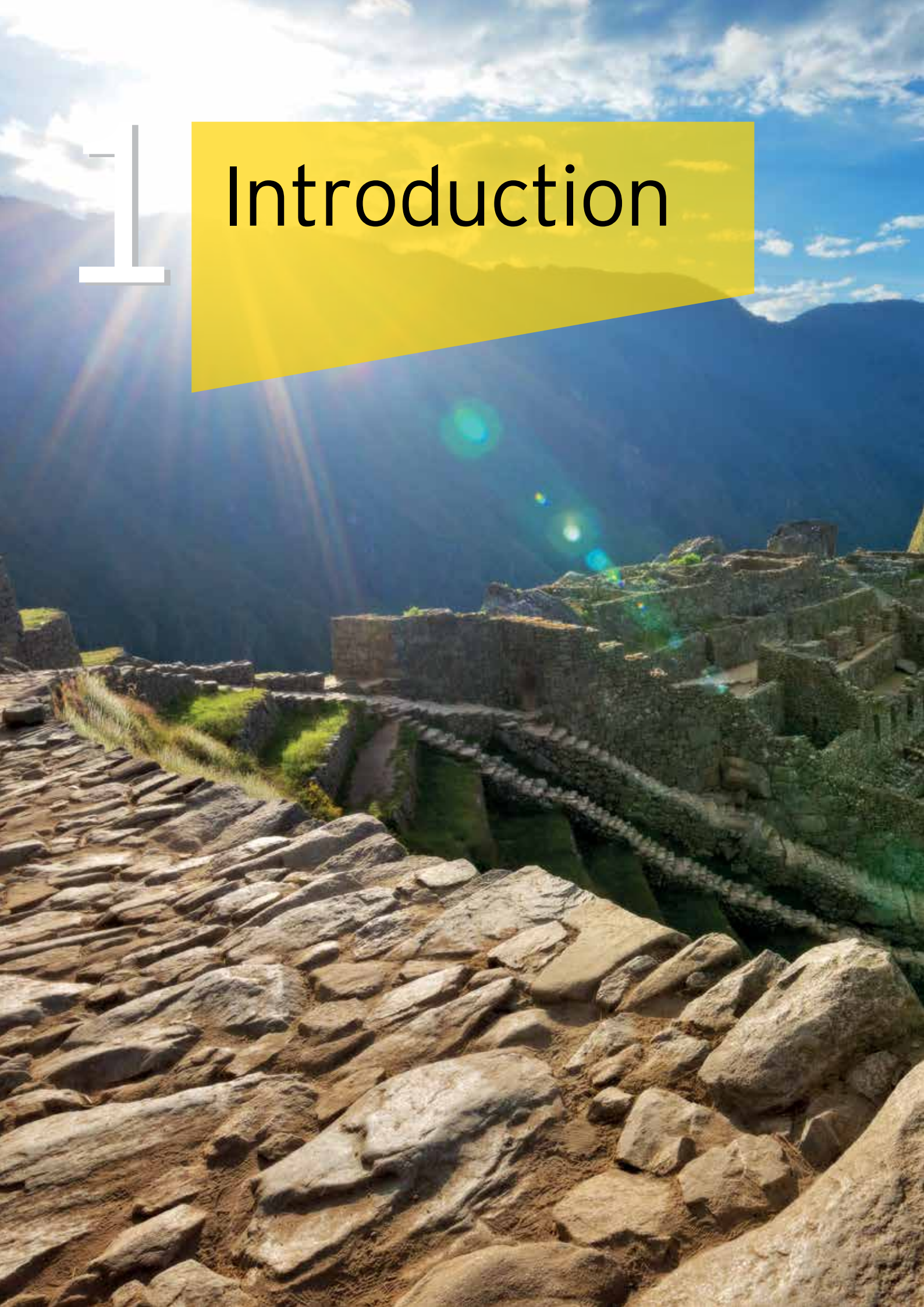
Under this category, CG coverage can be extended to support asset securitization. It is a long-term market making model which can be implemented once the rooftop solar market reaches a certain scale. Asset-based securitization (ABS) model for rooftop solar will initially require credit enhancement support which thereafter can be removed once the market for rooftop solar loans develops significantly and the investors start trusting the viability of rooftop solar segment.

The report also looks at the various scenarios of the leverage generated with CG mechanism and the amount of installations it can lead to has been computed. Assuming a corpus of US$ 200 million available to support the CGM framework, it has been computed that with 50% fixed CG coverage , the total rooftop installation which can be supported is 1535 MW. Under the variable percentage CG coverage, wherein the CG cover is based on the credit rating of the MSMEs, a weighted average CG cover of ~30% has been arrived at, which can support a total of 2623 MW of rooftop solar installations.

Apart from these measures, the study also proposes a media and outreach exercise with the help of the stakeholders associated with MSMEs, such as financial institutions, government bodies, MSME associations, corporates, etc. This will help in the knowledge sharing of the benefits of rooftop solar to MSMEs. All the measures proposed as a part of the report will go a long way in encouraging the MSMEs to turn green, cut down on their energy expenses, become more energy efficient and contribute to a cleaner and better India of the future.

Part

1 Introduction



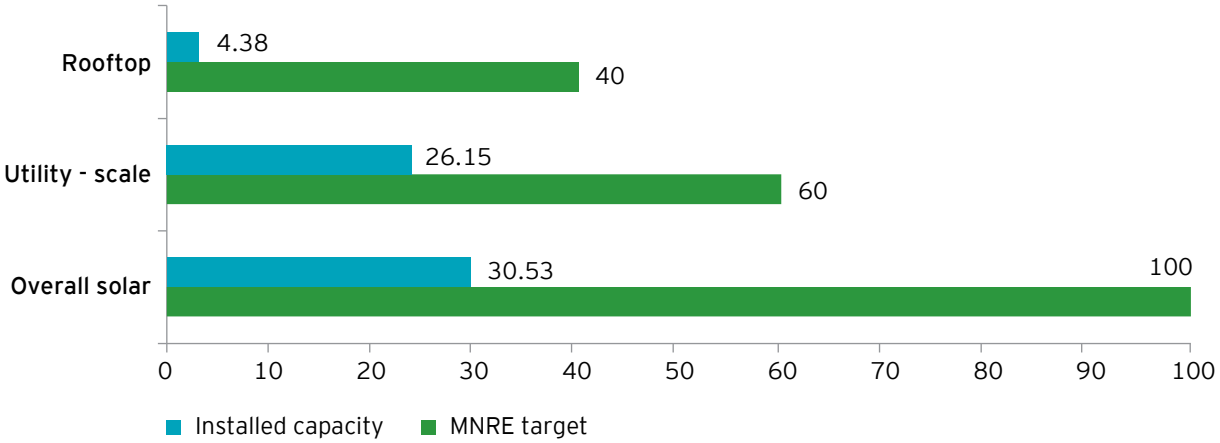
This study is implemented under SUPRABHA – The WB-SBI Rooftop Solar - technical assistance program. The program is presently assisting agencies of 17 states in creating enabling framework for large-scale deployment of grid connected rooftop solar PV (GRPV) projects. As a part of this engagement, the program is undertaking various activities including framing of policy and regulatory framework, streamlining the processes, developing and implementing web-based tools, enhancing technical knowledge and disseminating awareness to help accelerate deployment of GRPV projects in states. The genesis of the study is the target of 100 GW set by GoI for solar installations in the country. Of the 100 GW target, 40 GW is envisaged to be setup for rooftop solar in India.

number of measures to promote the GRPV sector at the state and national level, there has been a modest uptake of GRPV capacities in India. Challenges due to policy, regulation, financing and implementation issues prevail in this sector.

One of the key issues is the prevailing uncertainty in the institutional framework as well as access to finance for GRPV deployment that needs to be addressed through various interventions.

Under Phase-II of Grid Connected Rooftop Solar Programme of MNRE, a comprehensive action plan has been designed for incentivization of rooftop solar uptake by DISCOMs with a special focus on the residential sector. However, any concrete plan for MSMEs in this regard has not been mentioned.

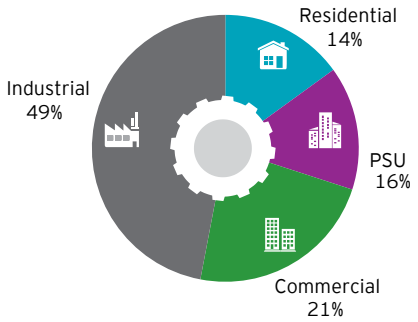
Figure 1. Solar installed capacity in India by March 2019 (in GW)



Source: Industry reports

There has been a substantial growth in solar installations in India during the past few years. Most of the installed capacity, however, have come up in the ground mounted space, while a lot of effort needs to be put in to fast track the growth in GRPV installations in India. GRPV market in India is witnessing substantial interest from entrepreneurs, developers, financial institutions, development banks, end-users, as well as government entities. Although GoI, in partnership with the state governments and regulators, has adopted a

Figure 2. Category-wise split of solar installed capacity in India by March 2019



Source: BRIDGE TO INDIA report on India Solar Rooftop Map, June 2019

As per March 2019 figures, India has installed a total capacity of 31.5 GW of solar PV, GRPV contributing 4.4 GW of the total capacity. A further breakdown of the installed rooftop solar installations shows that the C&I segment is leading the drive towards rooftop solar, comprising around 70% of the total installed rooftop solar capacity. The C&I sector has seen the maximum rooftop installation till date as the higher grid tariffs for these consumers makes installing rooftop solar an attractive commercial proposition in most states. With the trend of decrease in the equipment costs, further benefits for the C&I segment will be seen in the future, provided the issues plaguing the segment are mitigated. Considering the current growth of capacity in solar rooftop, achieving the MNRE target of 40 GW till FY 22 may prove to be a tall order.

On analyzing the C&I rooftop installations, it was found that large industrial players have installed a significant portion of the rooftop. The MSME segment, which contributes to 38% of the Indian economy in terms of the GDP, has a huge geographical presence and presents good scope for additions in rooftop solar installations, which

if tapped properly, can go a long way towards meeting the ambitious targets of 40 GW rooftop solar by 2022.

As per the GoI definition[1], MSMEs are broadly defined as follows:

Table 1. Definition of MSMEs as per GoI

	Enterprises engaged in the manufacture or production, processing or preservation of goods	Enterprises engaged in providing or rendering services
Micro	Where investment in plant and machinery does not exceed INR25 lakhs	Where investment in plant and machinery does not exceed INR10 lakhs
Small	Where investment in plant and machinery is more than INR25 lakhs but does not exceed INR5 crores	Where investment in plant and machinery is more than INR10 lakh but does not exceed INR2 crores
Medium	Where investment in plant and machinery is more than INR5 crores but does not exceed INR10 crores	Where investment in plant and machinery is more than INR2 crores but does not exceed INR 5crores

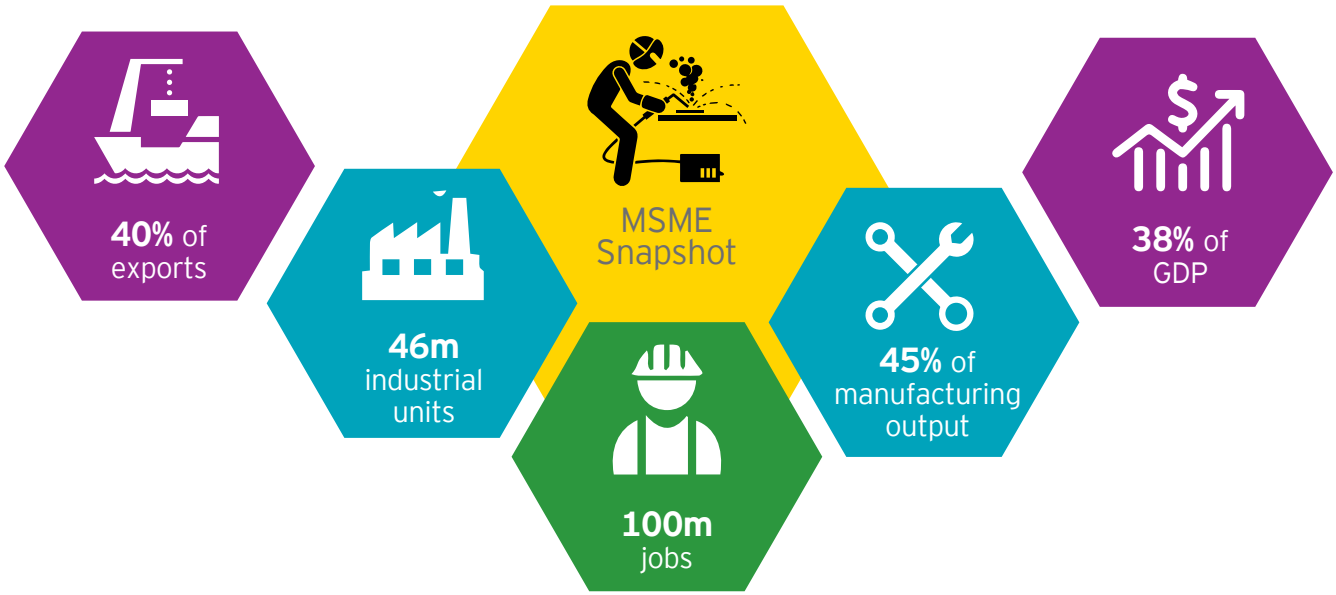
Source: Government of India

The definition of MSME that is used by financial institutions like State Bank of India conforms to the Micro, Small, and Medium Enterprises Development Act, 2006, wherein the definition of MSMEs given by GoI holds true [2].

To give a brief about the magnitude and significance of this sector, as per MSME estimates, this sector generates 100 million jobs, distributed over the expanse of 46 million industrial units throughout the nation. The sector is engaged in the manufacturing of more than 6,000 types of items, which translates itself to a significant 38% contribution to the nation's GDP, and 40% and 45% share of overall exports and manufacturing output, respectively [3].

Realizing the potential of this sector in adding to the country's rooftop solar capacity, this study aims to quantify the rooftop solar potential of MSMEs and the barriers that are preventing the offtake of the rooftop solar in MSMEs. It also studies the existing financial instruments catering to MSME segments and suggests a possible financial framework to address these barriers by laying an emphasis on supporting those sections of MSMEs which have a poor credit rating and find difficulty in accessing finance. (40% of MSME lending done through informal channels, and 25% through invisible (proprietor) borrowing)[4]

1 https://msme.gov.in/faqs/q1-what-definition-msme
2 https://sbiforsme.bank.sbi/SME/ssiCharter.htm?execution=e7s1
3 http://www.makeinindia.com/article/-/v/nurturing-a-manufacturing-culture
4 Credit Disrupted-Digital MSME Lending in India, Omidyar and BCG



> The greatest thing in this world is not so much where we stand as in what direction we are moving.
>
> Johann Wolfgang von Goethe

2

Rooftop Solar potential in MSME sector

As the first step, an attempt was made to find out the rooftop potential available with MSME segment in India. To achieve this, the following two potential approaches were adopted:

Top-down approach | Bottom-up approach

The top-down approach involves estimating the MSME energy consumption by firstly looking at the total energy consumption of industrial consumers in the country, estimating the percentage demand of MSMEs out of the total industrial demand and finally arriving at the rooftop potential for MSMEs, based on the assumptions related to MSMEs meeting a portion of their energy demands through rooftop solar, as shown in Table 2.

The bottom-up approach involves looking at energy requirements of the various MSME clusters in India by estimating the average size of each industrial cluster, the energy profile (energy intensity) of each cluster and the number of clusters, which again gives us the rooftop potential in MSMEs.

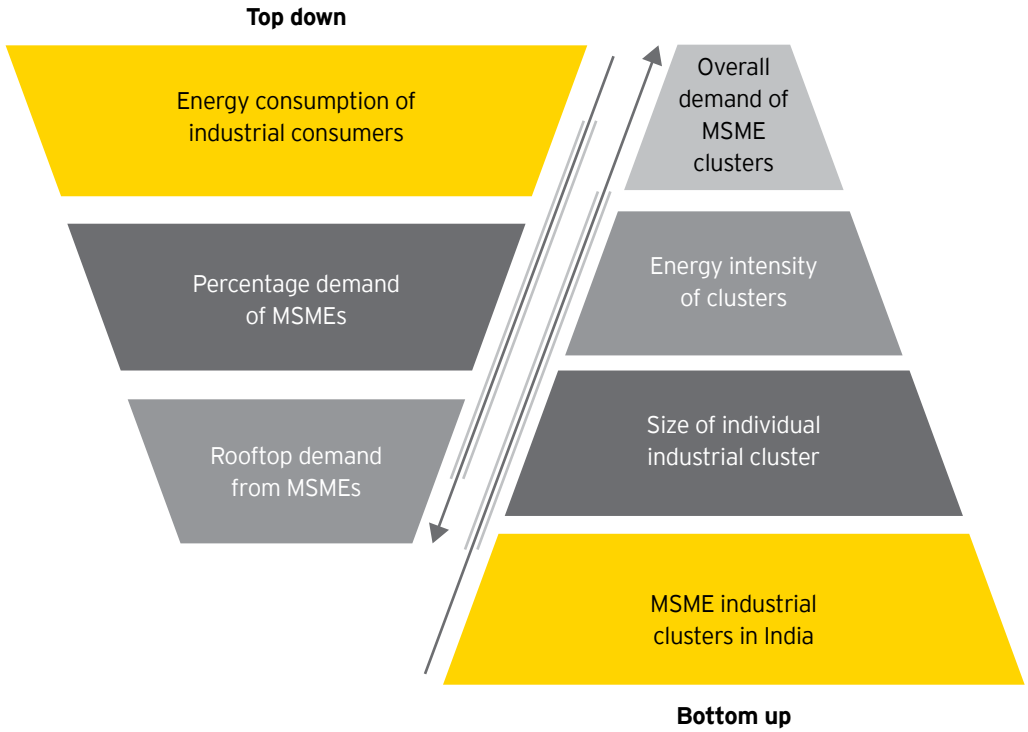
2.1 Analysis through top-down approach

Based on Energy Statistics 2017, the total demand from industrial consumers in India in 2016 was 424 billion electricity units (BUs or TWh), out of which total energy demand from utilities was 286 billion electricity units. The rest of the 138 billion electricity units of energy consumption was met through captive power generation. Maharashtra, Gujarat, Tamil Nadu, Uttar Pradesh, Punjab, Karnataka, Andhra Pradesh, Rajasthan, Telangana, Haryana, Madhya Pradesh and West Bengal are the top 12 states in terms of energy consumption in the industrial sector..

As per a study undertaken by SIDBI [5], 48% of the energy demand in the industrial sector comes from MSMEs.

The calculation below shows the energy demand from MSMEs is estimated at 204 BU (TWh) annually:

Figure 3. Approach for computation of rooftop potential available in MSMEs in India



Source: EY analysis

Energy demand of industrial MSMEs X % demand from MSMEs = demand from MSMEs

424 BU X 48% = 204 BUs

5 http://sameeeksha.org/pdf/presentation/SIDBI_Energy-Efficiency-Initiatives-for-MSMEs.pdf

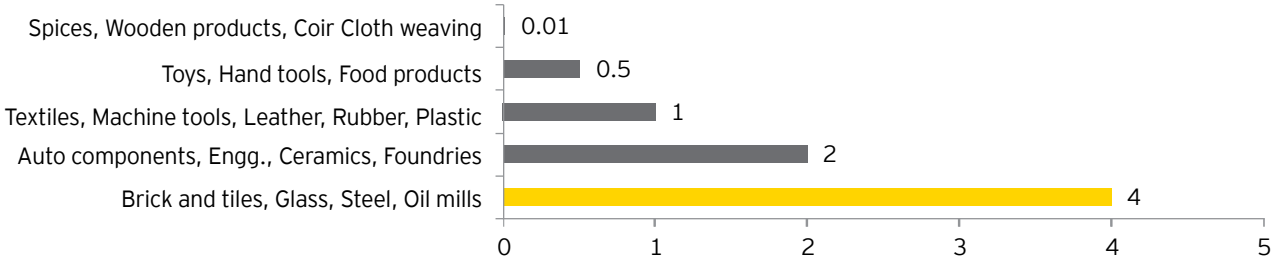
2.2 Analysis through bottom-up approach

The number of clusters has been taken from the development commissioner MSME cluster list, which provides details of 388 clusters in the country. As these clusters are of varying sizes, they have been split into four categories.

For each cluster, the number of registered units that have been considered are the lower limit of the range for conservative estimates. For example, the number of units considered in the range 500¬-1000 units is 500 units.

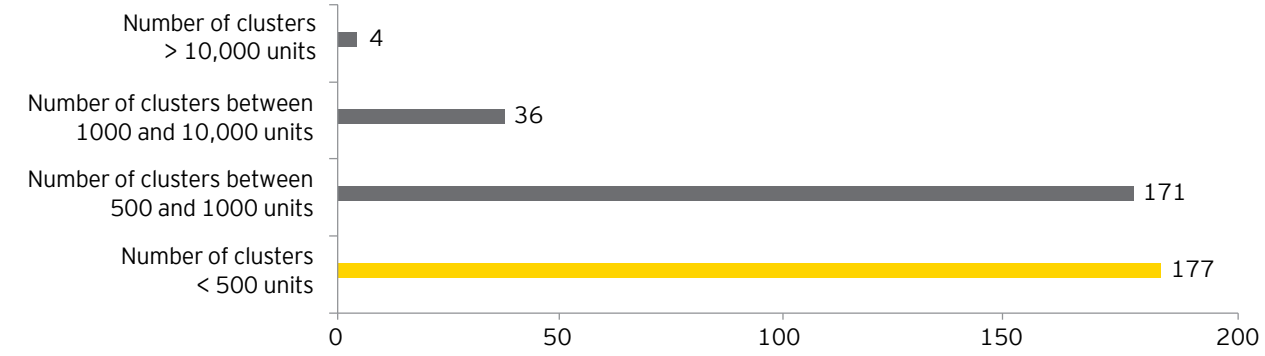
These units have been further categorized on the basis of their energy consumption profile (energy intensity) depending on the type of industry based on discussions with industry experts and other secondary data. The number of units classified as per the average energy consumption is given in figures 5 and 6:

Figure 4a. Average energy consumption based on type of industry Energy consumption (MU/annum)



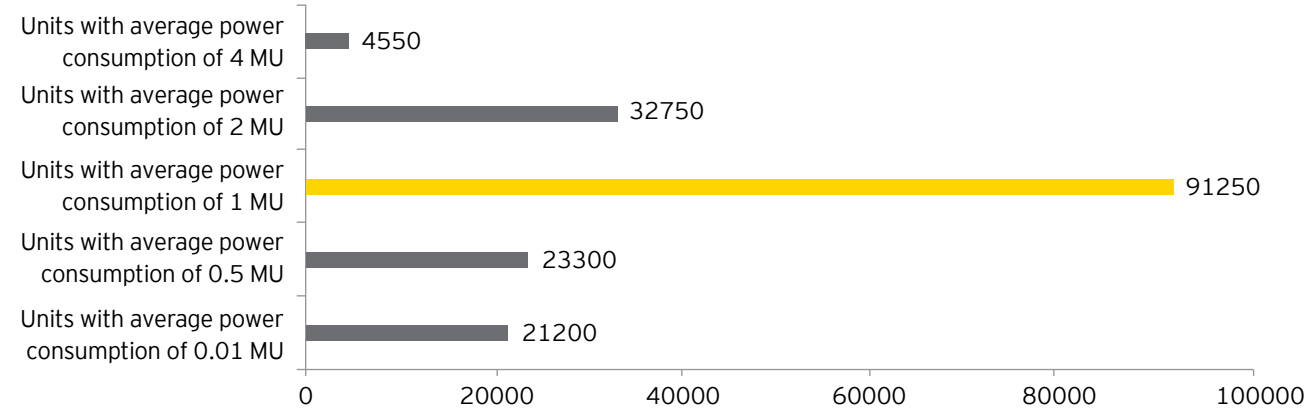
Source: Energy Intensity Report by BEE

Figure 4b. Split of industrial clusters in terms of number of units per cluster



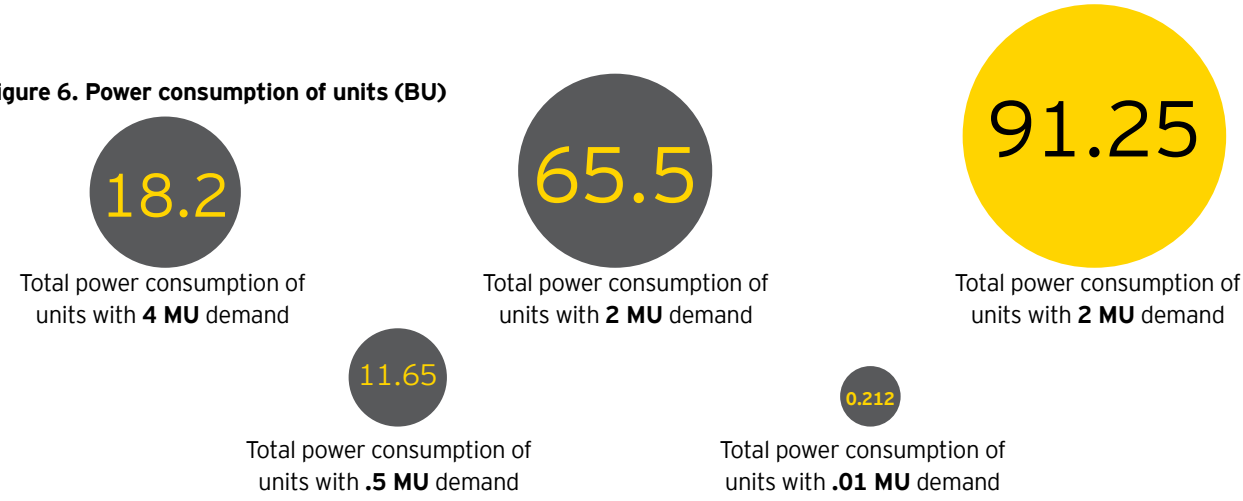
Source: Energy Intensity Report by BEE

Figure 5. Number of units as per average energy consumption



Source: Energy Intensity Report by BEE supplemented by EY analysis

Figure 6. Power consumption of units (BU)



Source: Energy Intensity Report by BEE supplemented by EY analysis

An addition of these energy demand figures in BU gives the energy demand in MSMEs, which estimates to 186.81 BU.

The following formula has been used, wherein the data from the previous graphs has been incorporated:

MSME industrial clusters X size of individual clusters X energy intensity of clusters based on the type of industry = overall demand of industrial MSMEs

Source: EY analysis

From this energy demand, the rooftop potential of MSMEs can be estimated. The following factors have been considered to evaluate the demand of rooftop solar installation in MSMEs:

- Overall energy demand from industrial MSMEs (from top-down and bottom-up approaches)
- Likely percentage of consumers owning their roof: 60% (based on primary estimates by EY)
- Likely percentage of consumption met from solar rooftop: 15% (based on primary estimates by EY)

Following are the calculations that have been carried out based on the aforementioned two approaches in Table 2 below.

The estimated rooftop solar potential from the top-down approach gives us a figure of 17.9 GW, whereas the bottom-up approach brings us to a figure of 16.4 GW.

So, it is observed that both the approaches converge to rooftop solar potential figure of ~16.5 GW to ~18 GW in the MSME segment. This is clearly a huge potential, which if properly tapped, can go a long way towards meeting half of the rooftop solar target of 40 GW by 2022.

Table 2. Estimated rooftop solar potential in MSME segment by FY22

Demand category	Top-down approach	Bottom-up approach
Energy demand by MSMEs (TWh or BU)	204	187
Growth estimate for FY 16-22	6.50%	6.50%
Energy demand in FY 22 (BU) (A)	298	273
Likely % of consumers owning their roof (B)	60%	60%
Likely % of consumption met from solar rooftop (C)	15%	15%
Overall contribution from solar rooftop (BU) (D=A*B*C)	27	25
Potential capacity in MW @ 17% CUF by FY22	17,989	16,490

Source: EY analysis

3 Barriers to rooftop solar adoption in MSMEs

Rooftop solar in sectors such as residential, PSU and large C&I have their own unique incentives to adopt rooftop solar. However, for the MSME segment, the situation is different and difficult, though the potential is substantial.

There are several issues impeding the drive towards rooftop solar by MSMEs. These issues broadly range from financial issues such as lack of good financing options for MSMEs, requirement of collateral, poor credit rating, etc. to operational issues such as lack of uniform policies, lack of awareness, lack of suitable rooftop structure, etc. Some of these barriers are listed out in the subsequent section.

3.1 Financial barriers

Rooftop solar projects are moderately long-term projects which need high upfront capital. Lack of access to finance significantly impedes the uptake of rooftop solar by MSMEs. Out of a total outstanding credit of INR26,041b as in November 2017, according to the Economics Survey 2017-18, 17.4% went to MSMEs. The share is disproportionately small given the fact that the share of MSME sector in the country's Gross Value Added (GVA) is approximately 32%[6]. Thus, more than being an issue related only to rooftop solar, the lack of offtake of rooftop solar is due to the inherent issues associated with MSMEs.

Due to the higher tariffs in the commercial and industrial sector, rooftop solar is self-sustainable. However, MSMEs have their unique challenges due to the operational and financial barriers in these segments.

Some of the financial barriers faced by MSMEs in installing rooftop solar systems are:

- **Credit worthiness:** RBI guidelines encourage reputed credit rating agencies to do credit rating of MSME units to facilitate credit flow to the MSME sector and enhance the comfort level of lending institutions. Banks are advised to consider these ratings as per the availability and wherever appropriate, to structure their rates of interest depending on the ratings assigned to the borrowing MSME units[7]. However, as per an external study[8] conducted, it is estimated that close to 94% of the MSMEs are unregistered, without any credit ratings. Their financial transactions are conducted in cash and they do not have financial records. This makes it very difficult for the banks and other financial institutions to assess their credit-worthiness. As a result, MSMEs find it challenging to access external finance, let alone green finance.

  Industry sources state that many MSME units, which have received some credit limit, neither have an external credit rating nor have managed to get investment grade ratings. Investment grade rating would typically mean a rating of BBB or higher by RBI-approved credit rating agencies such as CRISIL, ICRA and CARE[9].

  Also, MSMEs in some sectors have high NPA rates (ranging from 14% to 17%) and also low credit growth rate (less than 2% in steel and metal products, etc.). There are traditional risks associated with these sectors and thus an increased risk aversion of banks in lending to these sectors.

- **Insufficient financing options:** after RBI issued guidelines categorizing the renewable energy sector under priority lending status[10], it was expected that credit availability to MSMEs would be enhanced, especially for clean energy related requirements. While there are quite a few financing schemes targeting energy efficiency programs in MSMEs, these do not cater specifically to the installation of rooftop solar systems.

  As per EY analysis, out of the 27 public sector banks providing financing to MSMEs, only five have specific energy efficiency financing products and none of them have loans for pollution control

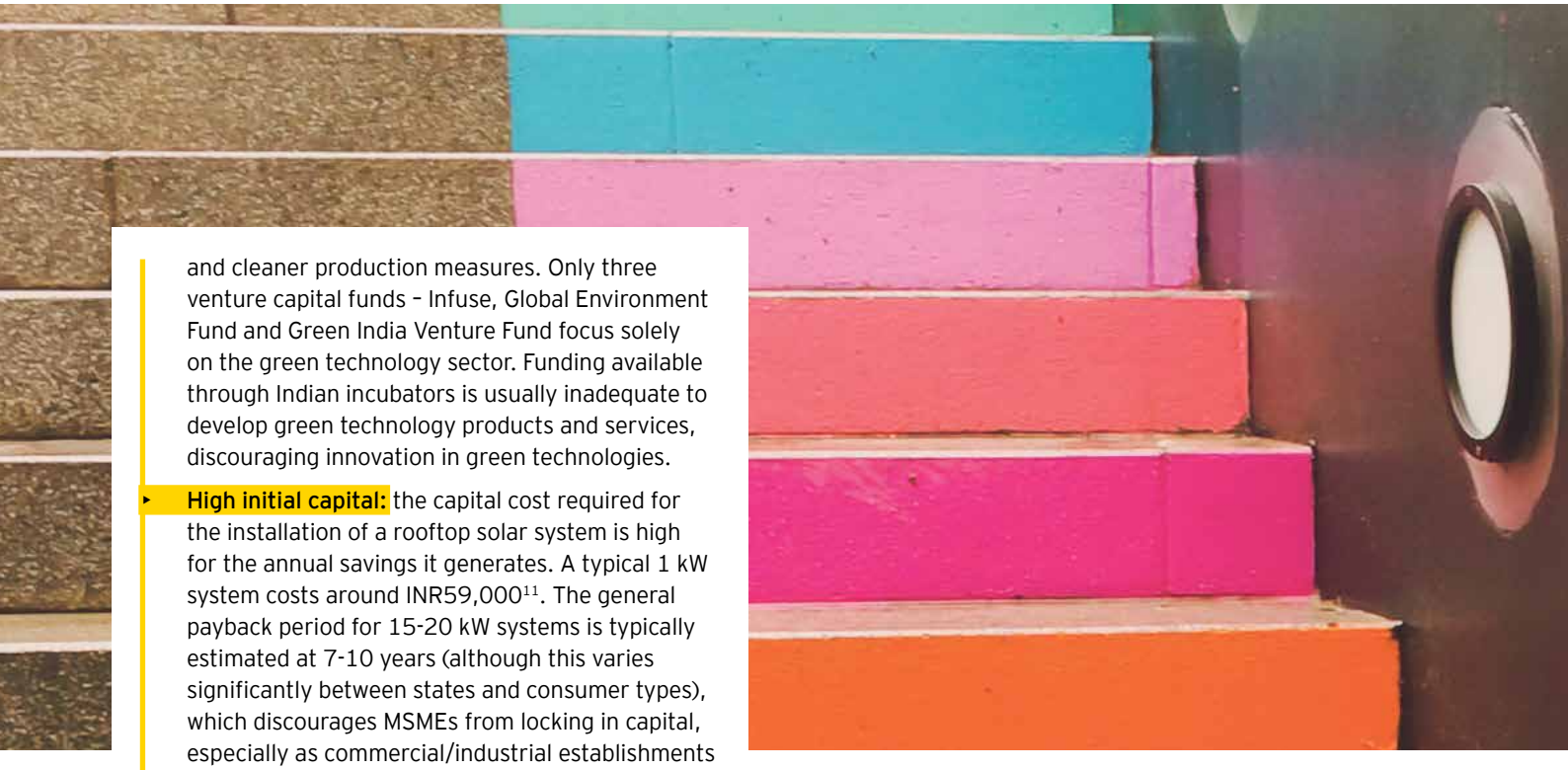
6 https://economictimes.indiatimes.com/small-biz/sme-sector/economic-survey-large-businesses-corner-82-6-of-credit-MSMEs-get-a-paltry-17-4-/articleshow/62693254.cms

7 https://www.rbi.org.in/commonman/english/scripts/FAQs.aspx?Id=966

8 http://www.switch-asia.eu/fileadmin/user_upload/Publications/2016/Green_Finance_Study_-_2016_-_India.pdf

9 http://www.thehindu.com/todays-paper/tp-business/SBI-diktat-to-affect-credit-to-small-medium-sized-firms/article14986586.ece

10 https://www.rbi.org.in/Scripts/FAQView.aspx?Id=87



and cleaner production measures. Only three venture capital funds – Infuse, Global Environment Fund and Green India Venture Fund focus solely on the green technology sector. Funding available through Indian incubators is usually inadequate to develop green technology products and services, discouraging innovation in green technologies.

- **High initial capital:** the capital cost required for the installation of a rooftop solar system is high for the annual savings it generates. A typical 1 kW system costs around INR59,000[11]. The general payback period for 15-20 kW systems is typically estimated at 7-10 years (although this varies significantly between states and consumer types), which discourages MSMEs from locking in capital, especially as commercial/industrial establishments typically don't want to divert the capital to non-business and non-core activities[12]. Therefore, the high initial capital required for installing rooftop solar proves to be deterrent for MSMEs.
- **RESCO issues:** the reluctance of RESCOs due to concerns regarding the ability of MSMEs to honor power purchase agreements (PPAs) and lack of protection mechanisms poses a big problem in implementing rooftop systems. While banking institutions have the right to assets of the borrower in the event of default, there is no such power given to RESCOs who work with the help of borrowing from banks. Therefore, they may not be willing to take the risk of entering into long-term agreements with MSMEs. Policies can provide backings from central or state governments or states to PPAs, and local DISCOMs may be legally made a party to these contracts to improve compliance.
- **Long-term business viability:** a large number of MSMEs are often unregistered and may not be fully working within the purview of company laws and banking systems. These MSMEs conduct financial transactions primarily in cash and do not have adequate financial records[13]. There is also no clarity on the long-term operational existence of many industries. This effect is amplified in the case of MSMEs because in the event of non-availability of adequate credit, there is a higher chance of these enterprises to wind up. This results in financial institutions becoming reluctant to extend long-term credit to these enterprises for implementation of rooftop solar systems.
- **Collateral requirement:** banks are usually risk averse and often have stringent lending guidelines which require collaterals, usually a property – either land or buildings. They usually provide recourse loans for renewable energy projects based on existing relationships with customers. Often, MSMEs face difficulty in providing adequate property as collateral, especially if they plan to take up larger amounts of financing[14].

  According to an RBI circular, banks are mandated not to ask for collaterals in case loans upto INR1m extended to units in the MSME sector[15]. Further, banks may, on the basis of a good track record and financial position of the MSME units, increase the limit of dispensation of collateral requirement for loans up to INR2.5m with the approval of an appropriate authority.

  However, more often than not, the initial investment required for the establishment of rooftop solar systems exceeds the threshold amount specified by RBI and hence collaterals become necessary.

11 https://mnre.gov.in/sites/default/files/uploads/benchmark%20cost%202019-20%20%281%29.pdf
12 https://amplussolar.com/blogs/?p=486
13 http://www.switch-asia.eu/fileadmin/user_upload/Publications/2016/Green_Finance_Study_-_2016_-_India.pdf
14 https://www.rbi.org.in/commonman/english/scripts/FAQs.aspx?Id=966
15 https://www.rbi.org.in/commonman/english/scripts/FAQs.aspx?Id=966

3.2 Operational barriers

The following are some of the major operational barriers faced by MSMEs while implementing rooftop solar systems:

- **Non-existent quality control parameters:** there is a low entry barrier for system integrators as well as concerns about equipment quality, raising concerns over long-term rooftop system operations. The efficiency and quality of solar panels produced by the Indian players is not at par with its global counterparts because of the lack of technical expertise and intellectual property[16].
- **Consumer awareness:** as per EY's secondary research, there is a lack of consumer awareness in benefits of a rooftop solar system, equipment standards, financial instruments in the market, etc. In a recent survey, 71% of MSMEs reported that they were unaware of the Credit Guarantee Fund Trust for Micro and Small Enterprises (CGTMSE) program. Out of the 29% of MSMEs that were aware, 99% found difficulty in obtaining information from banks. Bank officers often lack knowledge on green technologies and business models as well as risk assessment tools for green finance products[17].They also lack the awareness of benefits to be accrued out of rooftop solar systems along with ways to utilize them in the best possible manner. Therefore, the rate of uptake is slow. Providing information about quality, cost and benefits of adopting solar, clearing confusions regarding interconnecting with the grid or metering, etc. can help MSMEs to choose the right rooftop solar solutions. Although, National Solar Energy Federation of India (NSEFI) and MNRE are putting efforts to raise awareness through television and radio media, other significant steps are required to be taken in spreading awareness on the benefits of rooftop solar[18].
- **Regulatory issues:** non-uniform regulatory procedures in different states make it difficult for MSMEs to refer to the set procedures. Policies like net-metering and gross-metering for solar rooftops have been announced by almost all states. But the implementation of these policies has been quite slow[19]. One of the reasons behind this is the takers' lack of clarity on procedures for applying for a new rooftop solar connection. Lack of clarity in kW unit scaling, and non-availability of skilled professionals in handling or explaining net-metering model have created problems in the uptake of rooftop solar on a large scale.
- **DISCOM apathy:** lack of DISCOM initiatives in (a) executing net metering regulations, (b) streamlining processes and (c) in being part of payment security mechanisms are barriers in the uptake of rooftop solar systems. In some states, it takes almost three to six months to receive a net-metering connection. However under Phase-II Programme of MNRE, the focus has been centered on DISCOMs, with performance based incentives being provided to DISCOMs based on the RTS capacity achieved. Unless DISCOMs have a stake in the rooftop solar implementation, it is difficult to witness a boom in the rooftop solar market.
- **Non-availability of rooftop space:** available rooftop space in industries are limited by structural issues, piping layouts, congested industrial areas and placement of other equipment. In addition to this, shade and angle of inclination of the roof becomes an important factor to be considered while installing rooftop systems. Even with the availability of appropriate rooftops, consumers may not want to allocate their rooftops for solar system as they may use it for various alternate purposes of different and enhanced value. As a solution to this, a superstructure on the top of rooftops for installation of solar panels can be considered.
- **Maintenance issues:** MSMEs lack the capacity and knowledge to maintain the installed equipment on their premises. Various components, including the solar panels, mounting structures, inverters, batteries, cables, junction boxes, etc. need to be maintained. This technical maintenance may not be a core competency for the MSMEs and thus may require a further investment in training the staff or maintenance personnel or even an engagement of third party for the maintenance.

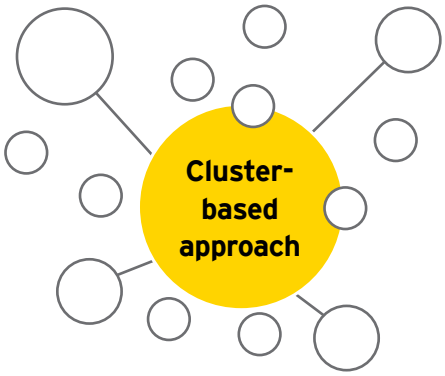
16 https://amplussolar.com/blogs/?p=486
17 http://www.switch-asia.eu/fileadmin/user_upload/Publications/2016/Green_Finance_Study_-_2016_-_India.pdf
18 https://www.vikramsolar.com/rooftop-solar-in-india-undeniable-growth-yet-challenges-exist/
19 https://www.businesstoday.in/magazine/features/the-sun-has-never-shone-brighter-for-the-rooftop-solar-market-in-india/story/242977.html

4 Methodology adopted for this study

The study has taken a cluster-based approach to review and analyze rooftop solar adoption by MSMEs and devise solutions for increasing the uptake of rooftop solar. A cluster is a geographical area where firms from the same industry typically are located together in a close proximity. It enables small companies to enjoy the same benefits as big firms through economies of scale. By being together, firms are able to reap benefits from neighborhoods' pool of expertise, focused approach and skilled workers[20].

The cluster-based approach towards increasing rooftop solar uptake in MSME is feasible, owing to similar characteristics among units in a cluster such as geographical location, markets, products, technology deployed and similar development issues, the collection of data and understanding of issues turns out to be more resource efficient and effective. As a result, more conclusive takeaways can be expected from such an approach.

At the outset, the study has focused on identifying the sectors/clusters, which are best suited for undertaking this study.

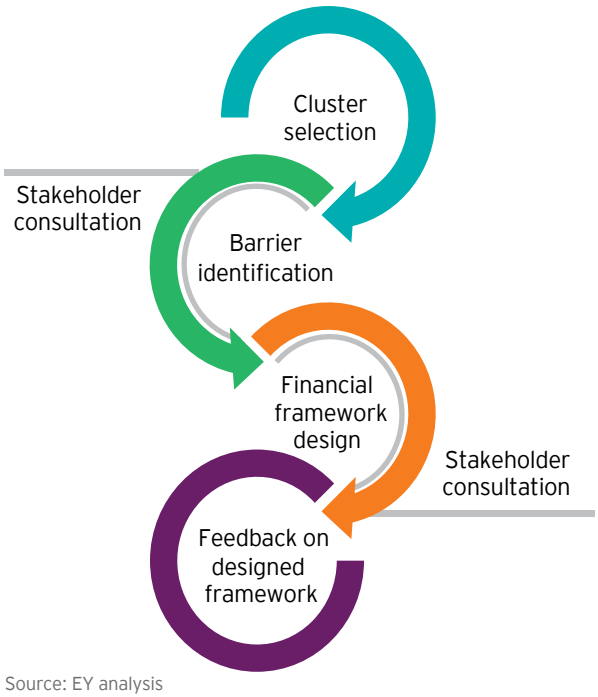


This has been carried out by ranking the sectors based on different logical parameters such as macro parameters, financial parameters and technology (energy-related) parameters. Based on a detailed analysis and after consulting with stakeholders, the top sectors have been shortlisted that can best leverage the results out of this study.

The next step of this process involves studying the barriers that are plaguing these sectors and preventing them from adopting rooftop solar to the extent possible as per their available potential.

As laid out, the barriers are mostly on the financial and the operational aspects. For understanding specific barriers in these sectors, detailed consultations have been conducted with stakeholders such as MSMEs, developers serving these sectors, as well as financial institutions responsible for lending to these companies. Each has its own specific reasons for not supporting or adopting rooftop solar in MSMEs. A study of financial instruments that already exist in the market has also been carried out to study their suitability to the purpose of rooftop solar offtake, and also the demerits in these instruments, which can be plugged in to better serve the MSME sector for offtake of rooftop solar.

Figure 7. Cluster-based approach towards rooftop solar uptake



Source: EY analysis

Finally, the findings made on the basis of the previously mentioned studies and stakeholder consultations have been analyzed, and used to design a financial framework that suits the offtake of rooftop solar in MSMEs.

This financial framework is envisaged to be based on risk profiling of different MSME sectors and is focused on addressing the concerns of both the lenders and the borrowers (MSMEs or developers).

20 https://www.economist.com/node/14292202

The study considered the government published list of MSME clusters available on the Development Commissioner (DC) MSME website. This list of 388 clusters was further clubbed into a list of 21 broad sectors, on which initial filters were applied.

Initial filters were used to eliminate the sectors which are not suitable for rooftop solar offtake, by considering the electricity consumption and dependency of these sectors and removing the ones for which electricity does not form a significant component of its energy demand.

The remaining sectors were then ranked on their suitability to the adoption of rooftop solar on the basis of multiple factors categorized under macro, technical and financial to finally arrive at those sectors, which are best suited to the adoption of rooftop solar.

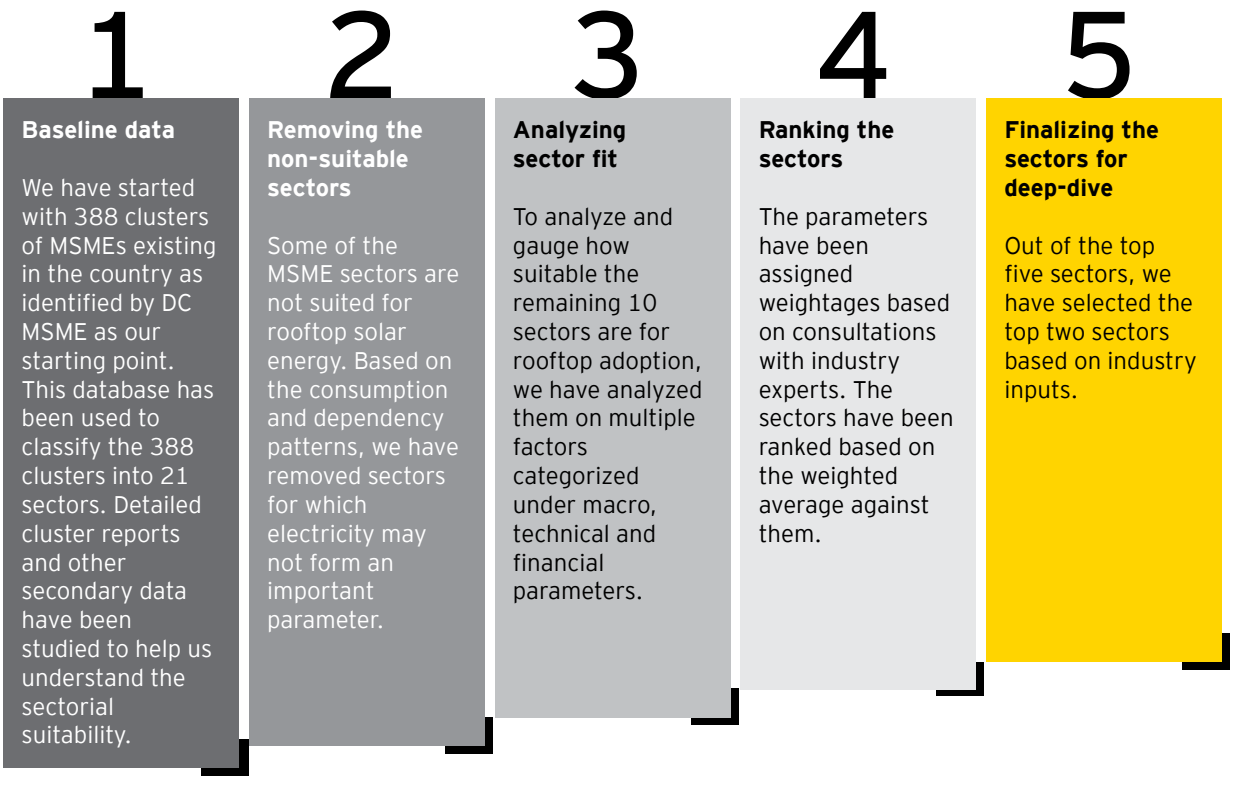
Following key steps were taken in this study to arrive at the sectors to assess rooftop uptake:

4.1 Initial filtering of sectors

To arrive at a trickled-down list, the MSME sectors were subjected to the filters illustrated below, thus enabling the selection of sectors on which further analysis can be conducted. The following two filters have been initially considered to understand rooftop suitability in the sectors:

The electricity consumption of the sectors: this factor reflects the average volume of electricity used by a single unit of the studied clusters. This is an important parameter to consider because it represents the potential that rooftop solar systems have in these units in reducing the expenses incurred in meeting their electricity demand.

Figure 8. Approach to selection of sectors to be studied



Source: EY analysis

Sectors ranked

This study has considered the unit-wise electricity consumption (in kWh/annum), which has been estimated by dividing the total electricity consumption in all the clusters studied under a sector by the number of units in these clusters.

The dependency on electricity in meeting energy demands: this factor is a reflection of the significance electricity holds in comparison to energy from other fuel sources, in meeting the energy demands of the individual units/clusters/sectors. It is important to consider this parameter as a filter because the percentage of electricity dependence is a direct reflection on the level of inclination of units towards moving for rooftop solar.

This study has found out, or in cases, calculated, the electricity dependency as a percentage of the total energy consumptions of the clusters from the reports analysed in secondary research, and has averaged them out to get a picture of energy dependency of the entire sector.

Based on their prominence against these two parameters, the sectors were ranked. This helped in arriving at the final selection of sectors most suited for targeting offtake of rooftop solar. Accordingly, six sectors were found to be highest in ranks when considering their prominence under both these parameters. These sectors are cold chain, plastic, pharma, leather, rice mills and foundry. Apart from this,

Table 3. Factors for the selection of sectors for further studies

Industries	Electricity consumption (Mwh/per annum)	Number of units in the cluster	Weighted average electricity (Mwh) per unit	Weighted average electricity % of the total energy consumption	Industries selected
Cold chain warehousing	2,44,238.63	244	1,321.57	93%	✓
Plastic	1,42,072.08	440	428.04	86%	✓
Auto and engineering products	14,96,735.86	17,965	150.02	80%	✓
Machine tools	20,468.80	400	51.17	74%	
Pharma	59,615.38	52	1,146.45	64%	✓
Leather	58,580.31	205	285.75	58%	✓
Iron	33,517.66	457	47.88	52%	
Food processing (rice mills)	9,90,259.61	1,020	1,455.10	47%	✓
Foundry	42,59,132.70	7,361	1,251.46	41%	✓
Agricultural mills (oil mills)	6,512.80	30	217.09	36%	
Hand tools	1,15,416.12	1,005	76.98	32%	
Paper	1,77,939.00	29	6,135.82	15%	✓
Food processing/ warehousing	1,42,047.41	1,225	290.90	14%	
Chemicals	11,99,129.29	1,788	669.53	13%	✓
Textiles	19,09,153.87	22,765	383.65	12%	✓
Cement	14,188.60	75	189.18	6%	
Glass and ceramics	10,69,576.21	1,690	309.88	5%	
Wooden products	71,187.23	696	102.28	4%	
Coir	2,317.51	451	5.13	3%	
Mixed minerals	19,922.19	381	65.96	3%	
Brick	30,249.63	1,58,550	21.60	0%	
Grand total	**1,20,62,260.90**	**2,16,829**	**663.10**		

A Top 11 based on the weighted average electricity consumption (Mwh/pa) per unit

B Top 11 Weighted average electricity % of the total energy consumption

C ✓ 6 industries common to both (A &B)

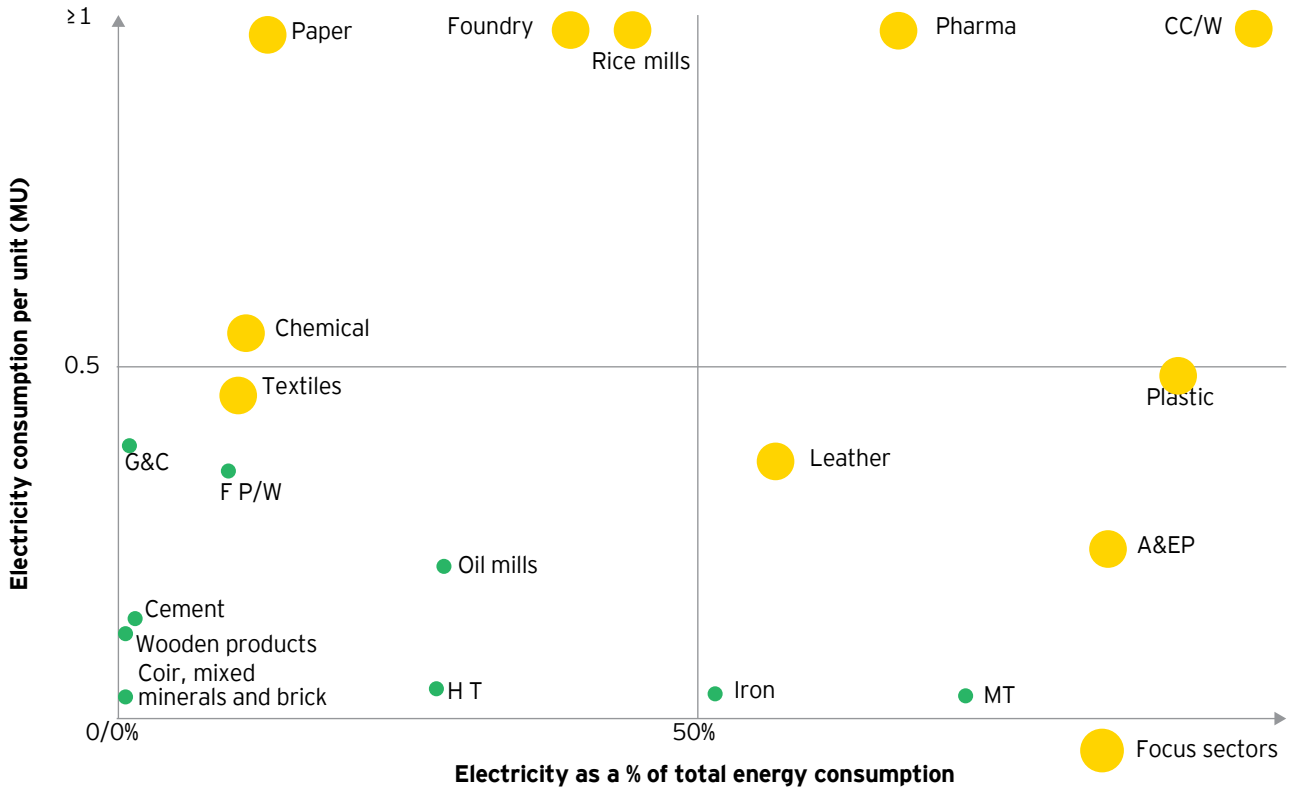
D ✓ Other 4 potential industries

Source: Energy Intensity Report by BEE supplemented by EY analysis

auto and engineering products also scored very high against the electricity dependency filter. Three other sectors which scored moderately high against these two filters are paper, chemicals and textiles. The following working table shows how the comparisons were done on the basis of these two parameters, which led to the sectors on which further detailed analysis has been done.

As a comparative representation, the sectors have been stacked against each other, and have been projected taking both the parameters into consideration. As seen from the graph below, most of the chosen sectors appear in the 1st, 2nd or 3rd quadrants, which is a fair reflection of their high electricity consumption as well as dependence, as has been pointed out in this section.

Figure 9. Matrix to ascertain sector dependence on electricity



Source: EY analysis