



Scaling up of rooftop solar in the SME sector in India

Main report

April 2019

Table of Contents

About Climate Investment Funds (CIF)	02
Acknowledgements	03
Executive summary	04
1 Background	13
1.1 Context	13
1.2 Objectives of the study	14
2 Methodology	15
2.1 Methodology	15
2.2 Market survey	17
2.3 Stakeholder consultations	23
3 Current context	26
3.1 MSME sector in India	26
3.2 Rooftop solar financing in India	29
4 Barriers to scaling rooftop solar in the MSME sector	30
4.1 Technical barriers	30
4.2 Financing barriers	31
4.3 Commercial barriers	32
4.4 Operational barriers	32
4.5 Knowledge barriers	32
5 Financing instruments for rooftop solar in the MSME sector	33
5.1 Context	33
5.2 Financing instruments for rooftop solar	33
5.3 Proposed financial instruments	36
5.4 Interest subvention	38
5.5 Concessional loan to support the OPEX model	41
5.6 PRGF	45
6 Way forward	49
7 Bibliography	56

About Climate Investment Funds (CIF)

The US\$8B CIF accelerates climate action by empowering transformation in clean technology, energy access, climate resilience, and sustainable forests in 72 developing and middle-income countries. The CIF's large-scale, low-cost, long-term financing lowers the risk and cost of climate financing. It tests new business models, builds track records in unproven markets, and boosts investor confidence to unlock additional sources of finance. The CIF business model, which is based on the programmatic approach as its primary model of delivery, leverages the expertise, standards, and global reach of multilateral development banks (MDBs) to drive climate action at scale through both advisory and investments (at both the strategic planning and project implementation phases). The CIF encompasses four different programmes: the clean technology fund (CTF), the scaling-up for renewable energy programme in low-income countries (SREP), the pilot programme for climate resilience (PPCR), and the forest investment programme (FIP).

The CTF was established under the CIF to provide scaled-up financing to developing countries for the demonstration, deployment, and transfer of low-carbon technologies with a significant potential for long-term greenhouse gas emissions savings. The objectives of the CTF are to finance transformation through large-scale financing of low-carbon technologies and innovative business models in energy efficiency, renewable energy, and sustainable transport while providing experience and lessons in responding to the challenge of climate change through learning-by-doing.

During the past 10 years, the US\$5.5B CTF has financed the development and implementation of low-carbon investment plans in 15 middle-income countries, a regional programme on concentrated solar power (CSP) in the Middle East and North Africa, and three phases of dedicated private sector programmes. The CTF portfolio

encompasses large-scale investments in energy efficiency in the industrial, commercial, and residential sectors; renewable energy technologies ranging from solar and geothermal to wind and biomass; and sustainable urban transport for public transit, hybrid buses, and green logistics.



Acknowledgements

The study was carried out by Deloitte Touche Tohmatsu India, LLP (“DTTILLP” or “Deloitte”), in collaboration with the CIF.

The overall project team was led by Tushar Sud (Partner - DTTILLP, Task Team Leader) and Abhishek Bhaskar (Energy Specialist - CIF, Co-task Team Leader). The renewable energy team from Deloitte conducted an analysis and drafted the report. The team comprises Shubhranshu Patnaik, Rajneesh Sharma, Abhishek Kaustabh, Sagun Tripathi, and Radhika Udgirkar.

The team benefited from the timely and strategic guidance offered by colleagues from World Bank (Simon Stolp, Amit Jain, and Mani Khurana), Asian Development Bank (Jiwan Acharya and Jigar Bhatt), the CIF (Zhihong Zhang, Joseph Dickman, Christopher Head, Rafael Ben, Neha Sharma, and Erin Baldwin), among others.

The Deloitte team would also like to thank key stakeholders, particularly from government bodies; implementation agencies; utilities; solar developers and engineering, procurement, and construction (EPC) companies; industry associations; and financing institutions, for sharing their views on critical issues and possible remedial actions that need to be undertaken with regard to the proliferation of rooftop solar in the micro, small and medium enterprises (MSME) sector in India.

Please send any questions or comments about this report to Abhishek Bhaskar (abhaskar@worldbank.org) or Tushar Sud (tsud@deloitte.com).



Executive summary

India's substantial and sustained economic growth has led to an increase in demand for energy resources. In such a scenario, using alternate energy options, particularly renewable energy sources, is one of the most desirable ways to address demand increase in the short term, while diversifying energy infrastructure and improving energy security.

The MSME¹ sector is one of the key pillars of the Indian economy. The sector has witnessed steady growth over the past few years. It accounted for 29% of the country's gross domestic product (GDP) and created 111 million jobs, according to Annual Report 2017-18 of the Ministry of MSME. This sector is also one of the largest consumers of energy in the economy, accounting for about 25% of the total energy consumed in the industrial sector². However, volatile market conditions and increasing energy expenses are among the key factors affecting the long-term profitability, competitiveness, and sustainability of the MSME sector.

The Indian government has acknowledged this need and implemented several policies that encourage MSMEs to adopt energy-efficient processes, less-polluting practices, and alternative energy solutions. To achieve its ambitious target of 100 GW of solar energy

capacity by 2022 set under the National Solar Mission, the Ministry of New and Renewable Energy (MNRE) has allocated 40 GW for rooftop solar, which has seen early adoption among C&I consumers³. More than 20 states have put in place dedicated solar policies and net/gross metering regulations to enable scaling up and adoption of grid connected rooftop solar systems (RTS) across different consumer categories. The MSME sector has a crucial role to play in reducing greenhouse gas emissions and contributing to the country's clean energy goals. However, the adoption and growth of rooftop solar applications in the MSME sector in India is yet to pick up.

This study attempts to know the reasons for slow growth and low investments in the solar rooftop space by MSMEs in India by, inter-alia, a) assessing key barriers for scaling-up rooftop solar in the MSME sector; b) identifying possible mitigants for the associated barriers; and c) identifying and evaluating appropriate financial instruments that can be considered to balance lenders' concerns with MSMEs' needs.

MSME market survey results

Familiarity with barriers to the adoption of rooftop solar across the MSME sector is of great significance in the context of this study. To develop a deep understanding of these barriers, 150

MSMEs were surveyed as a part of this study across six clusters identified on the basis of pre-defined quantitative and qualitative criteria. These included average electricity consumption, concentration and composition of MSMEs, scale and volume of operations, profitability, and geographical spread.

The survey was conducted in MSME clusters based in Hyderabad (rubber and plastic products), Ahmedabad (pharmaceuticals), Gurugram (auto components), Chennai (paper and paper products), Jaipur (food products and beverages), and Thane (textiles). The survey sample was distributed across the three categories (micro, small, and medium) of the MSME sector.

During the survey, one-on-one consultations with MSME units' management across the identified clusters were undertaken. The survey's key findings are mentioned below:

- a) **Ownership:** More than 90% of the MSMEs shared that they were the owners of the properties/buildings from where they run their companies. Therefore, ownership issues are not expected to pose any significant barrier to the implementation of rooftop solar in the surveyed cluster.
- b) **Electrical load:** Almost 50% of the MSMEs had connected load in the

¹ Micro, Small and Medium Enterprises

Enterprises	New definition
Micro	Annual turnover does not exceed INR5 crore
Small	Annual turnover is more than INR5 crore but does not exceed INR75 crore
Medium	Annual turnover is more than INR75 crore but does not exceed INR250 crore

* Additionally, the central government may, by notification, vary turnover limits, which shall not exceed three times the limits specified in Section 7 of the MSME Act

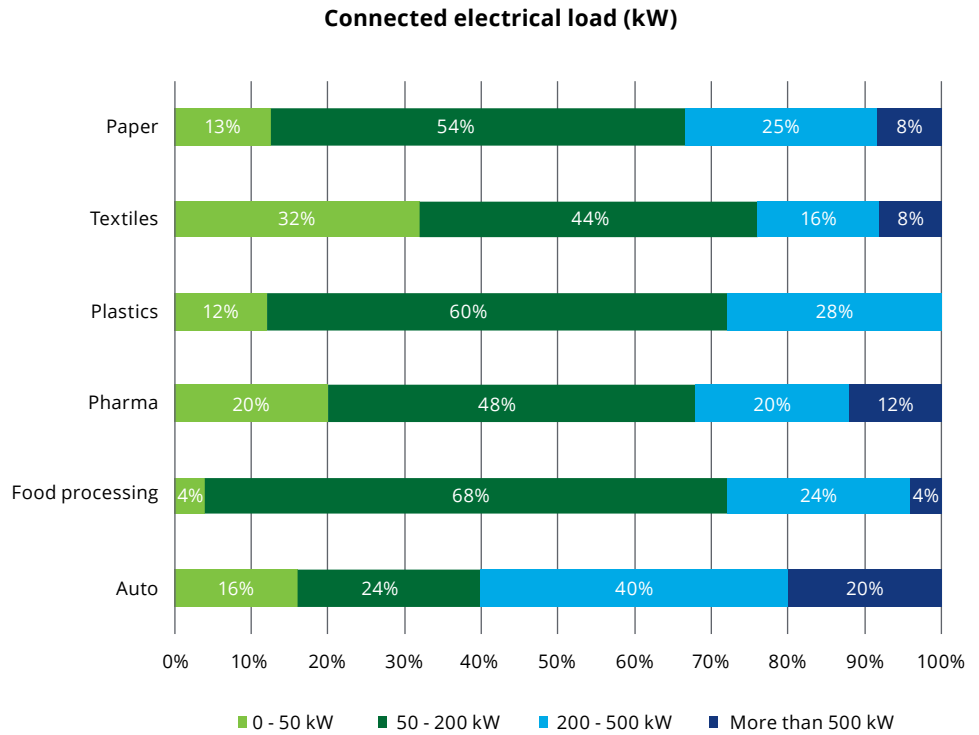
² Source : BEE website

³ Source : MNRE website

range of 50–200 kW, while in most cases (~54%), the rooftop solar potential was less than 50% of the connected load. This implies that entire solar generation can be fully absorbed at such MSMEs. The auto components and pharmaceuticals clusters had the maximum number of units with connected load of more than 500 kW. This is primarily because these are well-developed clusters with a higher proportion of small- and mid-size units.

c) Electricity cost as a percentage of operating expenses:

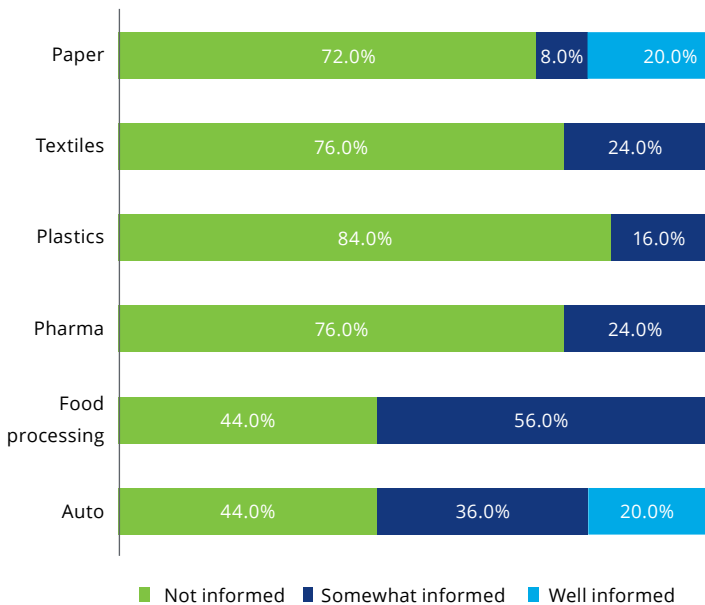
Most SMEs spent either between 5% and 10% or between 10% and 20% of their operating income on electricity. The share of electricity in the overall operating expenses varied with the nature of industry and cost composition of other raw materials.



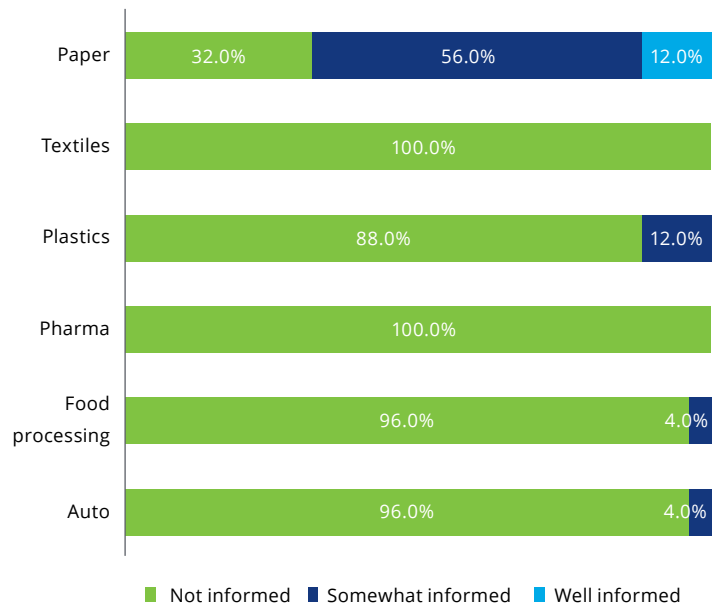
d) Awareness:

The level of awareness about rooftop solar was quite low among the sample surveyed. Many high power-consuming SMEs were hesitant to install rooftop solar because of the perceived performance risks.

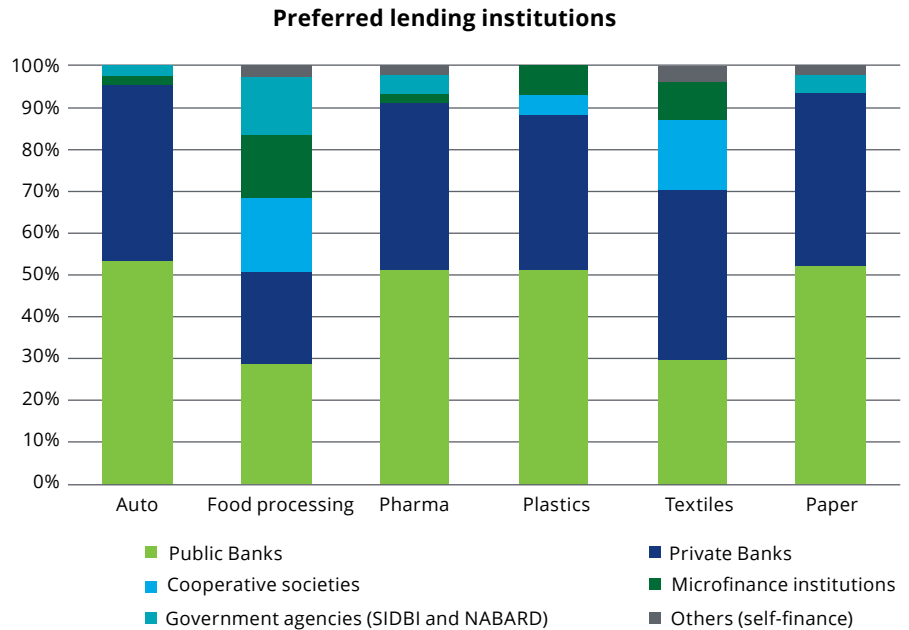
Awareness about rooftop schemes



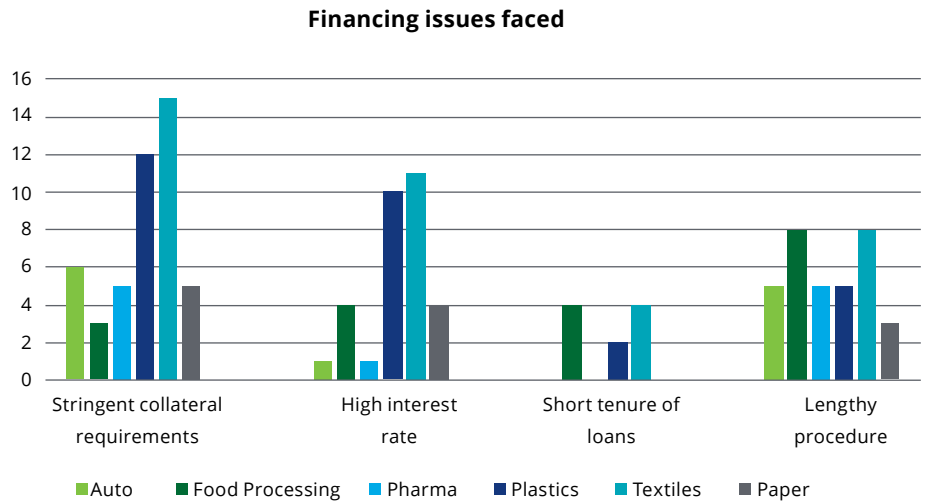
Awareness about financing options



e) **Borrowing preferences:** The surveyed MSMEs reported that public and private commercial banks were their most preferred financial institutions for taking loans. A few MSMEs in the auto components and pharmaceuticals clusters shared a preference for working with other institutions because of faster processing and better interest rates. Micro enterprises mainly prefer cooperative banks. A few MSMEs, especially in the textiles and plastics clusters, were self-financing their business investments. However, in most cases, respondents expressed a willingness to work with any institution that could offer the most attractive terms on a financial product.



f) **Financing challenges:** In many cases, MSMEs found it difficult to meet collateral requirements as their plant and machinery were already committed to other term loans. Most of these MSMEs were from the fragmented textiles and plastics clusters. However, most mid-size MSMEs reported facing no major challenges in obtaining loans.



Barriers to scaling up of rooftop solar in the MSME sector

Technical challenges, lack of long-term business visibility⁴, and lack of awareness emerged as the key barriers impeding growth of rooftop solar among the surveyed MSMEs. MSMEs (especially micro and small) face challenges such as stringent collateral requirements, cumbersome documentation, and time-consuming loan processing procedures while raising funds to support capex. Other barriers include reluctance to invest in non-core business activities and non-streamlined internal processes leading to hectic day-to-day operations.

The aforementioned barriers were discussed with other key stakeholders, particularly: a) scheduled commercial banks (SCBs) and non-banking financial companies (NBFCs), such as Indian Renewable Energy Development Agency (IREDA), Small Industries Development Bank of India (SIDBI), and private lending institutions; and

b) policymakers such as the MNRE and Solar Energy Corporation of India (SECI), to obtain their views on the survey's outputs. The discussions and deliberations with aforementioned stakeholders provided a greater perspective on existing issues affecting the proliferation of rooftop solar in the MSME sector.

⁴ Select MSMEs do not foresee long-term business operations of their existing set up due to uncertain market conditions. Lack of long-term visibility for MSME units inhibits them from taking any strategic investment decision for business operations. Therefore, investment for rooftop solar takes a backseat.

Operational barriers

- SMEs lack the capacity and knowledge to maintain the equipment installed on their premises.
- SMEs are reluctant to invest in training staff or maintenance people or engaging a third party for the maintenance of a RTS.
- Distribution utilities are reluctant to promote rooftop solar systems as they fear losing their high-revenue generating consumers.

Technical barriers

- Some SMEs have inadequate rooftop space.
- SMEs are mainly located in congested industrial areas where a useable roof area is greatly reduced because of shadows of nearby objects.
- SME units use tin shed roofs that need to be replaced at regular intervals, resulting in lesser interest in rooftop solar applications.

Financing barriers

- SME units' creditworthiness is inadequate.
- A large number of SME units do not have any credit history/profile.
- The installation of rooftop solar systems requires high upfront investment.
- Transaction cost for FIs is high due to their smaller size.
- SMEs face difficulty in meeting their collateral requirements as existing plant/machinery are already pledged as collateral for existing loans.

Commercial barriers

- SMEs face business uncertainty
- RESCOs are not active in the MSME segment
- SMEs face risk of payment delays/default.
- SMEs' business planning horizon is limited (6–7 years), which makes them apprehensive to commit to long-term projects, such as installing a rooftop solar system.

Awareness barriers

- Awareness of rooftop solar schemes and incentives for its adoption is low among SMEs.
- There are perceived technical limitations of rooftop solar systems.

The key takeaway from these discussions is that a customised approach is required to promote rooftop solar in the MSME sector. The nature of customisation shall involve tailoring business models and financial instruments according to the needs of the targeted SMEs. Our key recommendations on such financing instruments and implementation frameworks are presented below.

Solar rooftop business models and financing instruments

In the CAPEX model, entire investment comes from power consumers. Consumers usually hire a solar EPC company providing the turnkey













installation service for entire solar power system and handing over assets to consumers. However, in the OPEX model, renewable energy service company (RESCO) incurs capital expenditure and consumers pay for energy consumed/supplied by the solar power project. Both the consumers and the developer sign a long-term power purchase agreement (PPA) for an agreed tenure and tariff. In the context of MSMEs, the choice between the CAPEX model and the OPEX model depends mainly on MSME units' willingness to invest capital in RTS, which is not their core business. During the primary survey, a majority still viewed rooftop solar

as costly, especially in terms of initial capital expenditure. As the use of the OPEX model is not widespread and limited developers focus on the MSME segment, MSMEs either end up installing RTS under the CAPEX model or not adopting it at all.

As observed during the primary survey, MSMEs have different lending preferences and face varied challenges in financing their investments. Therefore, the design of financing instruments must take into consideration requirements of different MSME segments, facilitating optimisation in terms of the utilisation of available resources and efficacy. In



the light of these observations, the following financial instruments⁵ are proposed for different MSME segments under the CAPEX and OPEX business models.

Business model	Type of SMEs	Issues/difficulties	Supporting financial framework
 CAPEX	 Micro/Small enterprises that are willing to do CAPEX	 High project cost	 Interest subvention
 OPEX	 Micro, small, and medium-size enterprises with average creditworthiness	 Project bankability Payment default/ risk of NPA	 PRGF
 OPEX	 Micro, small, and medium-size enterprises with good creditworthiness	 Incentivising SMEs to adopt rooftop solar systems	 Concessional loan

⁵. PRGF means partial risk guarantee fund



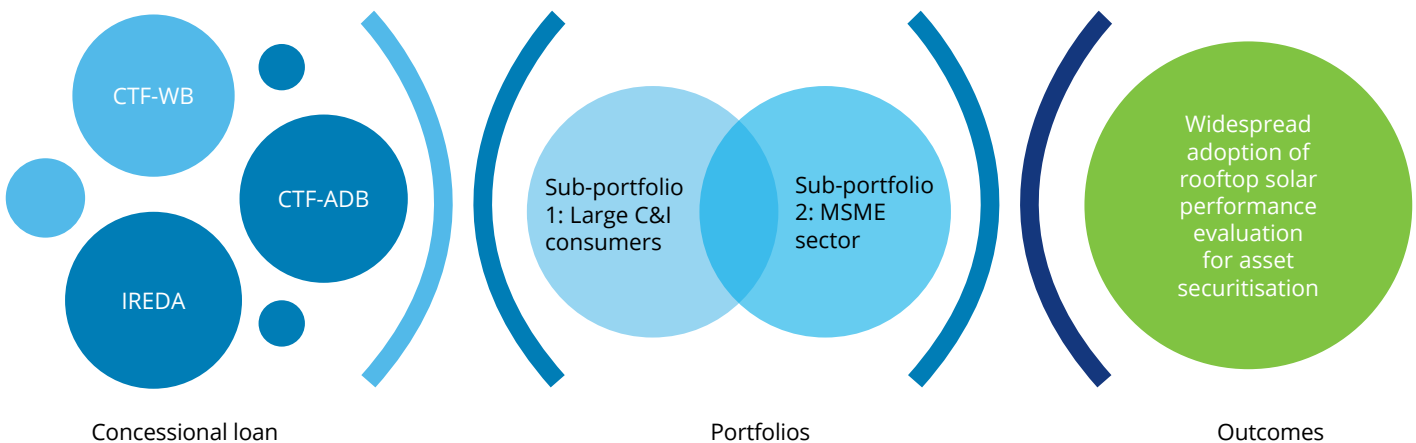
An interest subvention scheme for micro- and small-scale enterprises willing to invest in rooftop solar has been proposed⁶ under the CAPEX model, as these enterprises are likely to face challenges in attracting RESCOs under the OPEX model in the short term. Being the line ministry for the MSME sector in India, the Ministry of MSME can provide this support through a budgetary allocation. As MSMEs held an important place in the Indian economy and take the lead in extending such assistance, the use of public finance to support the sector has become imperative. Further, as observed during the primary survey, electricity constitutes a significant portion of MSMEs' operating expenses. Therefore, the competitiveness of Indian MSMEs can be enhanced by offering them incentives to adopt cost-saving measures, such as rooftop

solar. The Ministry of MSME can play an instrumental role in catalysing this transition.

In case of the OPEX model, concessional loans can be provided to RESCOs implementing projects at small and medium-scale establishments with good creditworthiness to improve the attractiveness of rooftop solar for such MSMEs. For other MSMEs with average creditworthiness, providing the partial risk guarantee facility (PRGF) to lenders may be a suitable option to enhance bankability and risk perception. In both the instances, RESCOs can aggregate demand within a particular cluster to bring about benefits of economies of scale and make the portfolio lucrative for lenders. The local utility could also be incentivised to play a role in demand aggregation and collection/billing.

Further, the portfolio of rooftop projects should comprise a mix of small and mid-sized enterprises for risk mitigation purposes.

Funds for these support mechanisms can be obtained from the new or existing lines of credit for rooftop solar available (such as CTF-World Bank and CTF-ADB). As these credit facilities have mostly been used to implement projects at large commercial and industrial (C&I) establishments, a dedicated portfolio for the MSME sector is proposed to be created. It is recommended that eligibility criteria and evaluation frameworks for obtaining financing through these facilities under a dedicated portfolio should be tailored for the MSME sector. An indicative overview for the same is provided below:



⁶ Given the unwillingness of policymakers to extend capital subsidy support for rooftop solar to the MSME sector, capital subsidy was not considered.

The performance of projects financed under this stream can be monitored for a pre-defined period on the basis of which other instruments, such as asset securitisation, can be considered. In the long term, an arrangement known as ‘fund of funds’ can be created to support the wider participation of other financial institutions (FIs) through which ‘lines of credit’ could be established. A “fund of funds” is an interim fund mechanism created to overcome any restrictions that prevent the parent fund from providing funds to private-sector banks. An additional benefit is that multiple MDBs and development agencies can also contribute to ‘parent fund’, provide support, and extend concessional loans through the same interim fund mechanism.

Way forward

The installed rooftop solar capacity in India remained at 1.44 GW⁷, as of December 2018. Thus, interventions at multiple levels would be required to achieve a target of 40 GW in the long term (by 2022). Under the OPEX model, PPAs drive the Indian rooftop solar market with large C&I entities.

Achieving the 40 GW target will require bringing segments such as MSME and residential consumers to the forefront. While the MNRE has continued to support residential consumers through capital subsidy, the MSME sector has to compete with large C&I entities characterised by larger scales of operation and superior credit profiles. With a limited bandwidth of existing rooftop solar players (due to financing and operational constraints), large-scale adoption of rooftop solar by the MSME segment is likely to take much longer time under the business-as-usual scenario. Based on the market survey and stakeholder consultations, the study proposed that the following interventions should be considered to help overcome key barriers impeding the proliferation of rooftop solar in the MSME segment.

Target attractive clusters in short term

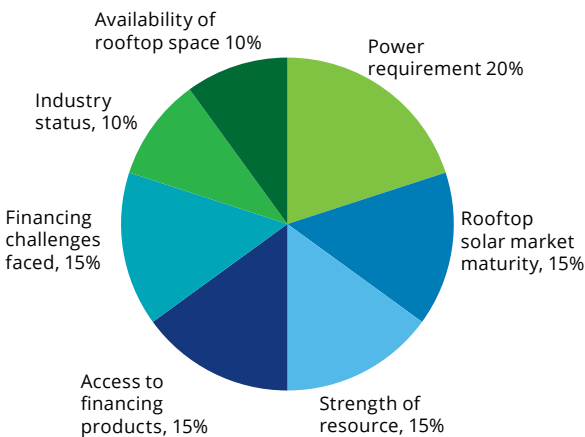
The primary survey results indicated significant differences among various MSME clusters in terms of their composition, market outlook, level of awareness, energy consumption

patterns, financing requirements, etc. Therefore, MSME clusters must be evaluated and compared to identify the clusters where the likelihood of the proposed interventions achieving intended outcomes is higher.

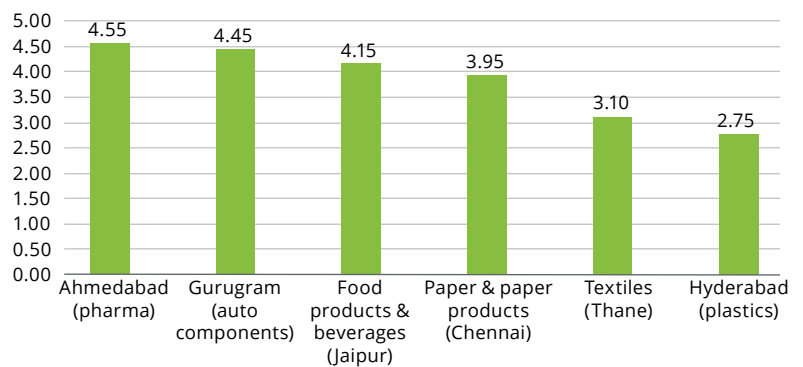
Accordingly, a framework for evaluating attractiveness of MSME clusters has also been developed that takes into consideration seven parameters covering market, technical, and financing-related aspects. Each parameter has been assigned a weight according to its relative significance and impact on the intervention design approach⁸.

After applying the framework to the current survey sample, the auto components and pharmaceutical clusters emerged as the most suited clusters for piloting a targeted strategy for the proliferation of rooftop solar. This is largely attributed to high electricity requirements, long-term business visibility, higher level of awareness, and plenty of rooftop space available for system installation in these clusters.

Attractiveness index - parameters



Cluster indices



⁷ Source : MNRE website

⁸ Refer Page 45 for detailed evaluation



Aggregation vehicle

In the short term, we propose that pilot projects across shortlisted MSME clusters under the OPEX model can be undertaken. About 4-6 clusters can be selected across different industries and states for pilot projects. Based on the preliminary assessment of the survey data, the surveyed clusters currently have a minimum capacity requirement of 25 MW that can potentially be developed under a pilot. Technical surveys shall be conducted and FIs' existing relationship with MSMEs needs to be leveraged to identify MSMEs for pilot projects.

The Indian rooftop solar market currently does not seem to be geared to implement large-scale rooftop solar

projects under the OPEX model in the MSME sector without institutional or financial interventions. Hence, it is proposed that a dedicated aggregation vehicle should be developed to support the implementation of rooftop solar projects across the targeted MSME clusters. The MNRE needs to play an important role in supporting the formation of this aggregation vehicle and can consider designing a dedicated scheme for this purpose. An implementing agency [such as SECI (Solar Energy Corporation of India)/EESL (Energy Efficiency Services Limited)] can also be appointed for the formation of such an aggregation vehicle. The vehicle shall develop different sub-portfolios of rooftop solar projects based on the

targeted cluster, scale of capacity, MSME profile, etc., and use these sub-portfolios to mobilise additional financing in the market.

As MNRE is already providing performance-based incentives to utilities to promote rooftop solar within their jurisdictions, it can also provide them incentives to participate in such aggregation projects as collection/billing agents.

Supporting MSME-based portfolios within existing/new lines of concessional credit

As MSMEs are not the first preference of solar project developers (unlike large C&I entities) for implementing

RTS under the OPEX model, it may be important for concessional lines of credit to target dedicated portfolios supporting rooftop solar projects in the MSME sector. Concessional lines of credit would reduce the borrowing cost of project developers yielding to lower tariff under the OPEX model. These portfolio projects can be further categorised into sub-portfolios based on their credit rating, project size, customer profile, etc. Creating dedicated RTS portfolios catering to MSMEs within larger credit lines is expected to help understand the performance of these portfolios, and identify MSME sector-specific issues and their solutions in the mid-to-long term.

Initially, funding can be targeted towards any dedicated aggregation vehicle created for supporting rooftop solar implementation in MSME units. In the longer term, the vehicle may also assist in undertaking the securitisation of such dedicated portfolios. These sub-portfolios can be treated as risk tranches and securities linked to these tranches can be issued. The investors shall receive returns based on their securities and respective sub-portfolios.

Dedicated scheme supported by the Ministry of MSME

It is proposed that the Ministry of MSME may support financial interventions, such as interest subvention and PRGF through budgetary allocations to support the implementation of pilot projects across target clusters during the initial stages of a project. This can have a strong demonstration effect on the clusters and lead to the wider adoption of RTS in subsequent phases without subsidies. Interest subvention support can be targeted for the CAPEX model, whereas the PRGF facility can

be offered to lenders for financing RTS projects in MSMEs under the OPEX model.

Regulatory changes to support aggregation

Unlike large C&I entities, MSME units have smaller rooftops and pose high transaction costs to lenders. While aggregation-based models can address some of these barriers, new regulatory frameworks such as group and virtual net metering could assist in implementing aggregation models in the MSME clusters and overcoming issues related to scale, diverse customer profile, and financing. Regulatory provisions should extend this benefit to MSMEs while adopting group and virtual net metering.

Creating awareness and capacity building

According to the survey, an overwhelming majority of the MSMEs had little to no knowledge of various aspects of rooftop solar. These aspects include cost and benefits, government schemes and policies, sources of concessional funding, business models, prevalent market technologies/brands, and performance guarantee contracts.

This indicates that the MSME sector suffers from a significant knowledge gap. As the MSME segment has enormous untapped rooftop solar potential, it should be supported through dedicated initiatives to bridge the knowledge gaps. Some of these initiatives are discussed below:

- Conducting workshops and seminars across targeted clusters in association with respective MSME associations
- Preparing collaterals for increasing awareness such as toolkits on solar technology, project benefits, and financing

- Developing tools to access information and streamline the process of installing rooftop solar projects

Creating robust contracting ecosystem

The survey revealed that MSMEs perceive solar rooftop projects as a non-core activity. It also highlighted that MSMEs were not aware of the aspects pertaining to technical performance of an RTS. In this regard, putting in place a robust contracting mechanism with EPC providers, and project developers under both the CAPEX and OPEX models is of great significance. Therefore, a contracting framework should be put in place to ensure the proper functioning of the RTS. Standard contracts could be put in place for different operational service-related activities to safeguard the interest of MSMEs. To ensure the smooth operation of solar rooftop projects under any selected business model, the following contracting features need to be in place:

- Signing a mandatory O&M contract for the following contractor services and obligations:
 - Plant monitoring requirements
 - Scheduled maintenance requirements
 - Unscheduled maintenance requirements
 - Agreed targets and/or guarantees (for example, response time or system availability figure)
 - Contractual obligation for the contractor to optimise plant performance
- Securing EPC guarantee to cover technological risks of the rooftop solar plant; such a guarantee can assure both the lender and the off-taker about the project's performance, and ensure the superior quality of equipment delivered to the off-taker.

1. Background

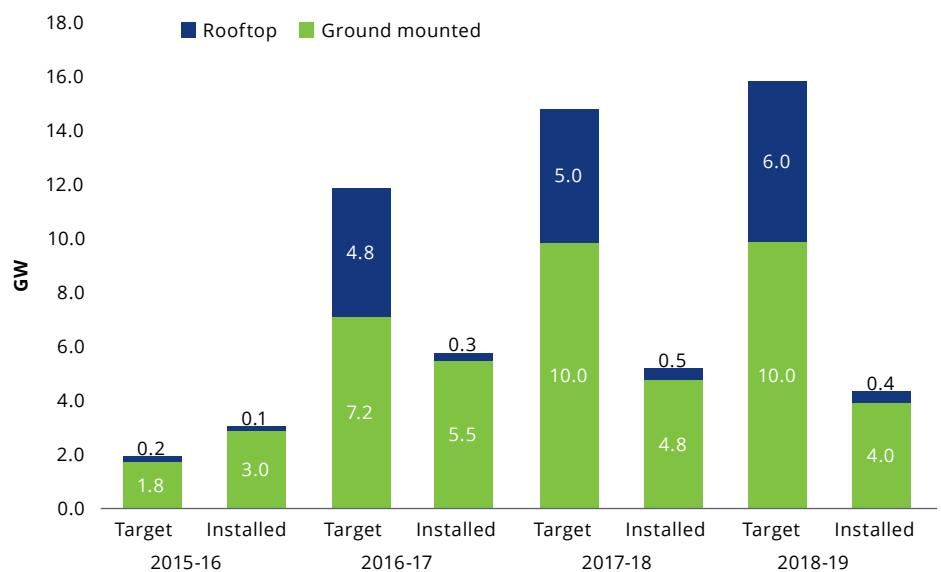
1.1 Context

Under a target of 175 GW of renewable energy capacity by 2022 set by the government of India, 40 GW is slated to come from rooftop solar installations. The graph below presents the roadmap of the federal the MNRE for achieving the 40 GW target by 2022:

Several policy and regulatory initiatives have been undertaken to promote rooftop solar. These initiatives include the provision of subsidies for specific consumer categories and net metering regulations. About 20 states have introduced dedicated solar policies and net metering regulations to facilitate the scaling up and adoption of grid connected RTS across different consumer categories. As a result, the grid interactive rooftop solar segment has witnessed robust growth over the past few years. It reached 1.44 GW¹⁰ of the installed capacity, as of December 2018. This growth has been largely driven by declining solar installation costs, which have led to a decrease in solar tariffs in comparison with other utility tariffs for C&I consumers.

The MSME sector constitutes a significant share of the industrial consumer category and is a large target market for rooftop solar. Recent studies have estimated the potential of the MSME segment to be about 16 GW (about 40% of the rooftop solar capacity target of 40 GW¹¹). The MSME sector in India accounts for about 25% of the annual energy consumption of the industrial sector¹². Energy is often

Figure 1: Solar capacity addition targets (in GW)⁹



Source: MNRE

the largest operating cost element. Hence, it is a key factor in determining the competitiveness of the industry. However, the proliferation of rooftop solar in the MSME sector faces several barriers, which need to be suitably addressed through appropriate business models, policy and regulatory interventions, etc.

The MSME sector has witnessed steady growth over the years. It accounted for 29% of India's GDP and created 111 million jobs, according to Annual Report 2017-18 of the Ministry of MSME. Per the 2014-15 census report of the MSME sector, energy requirement of about 32% of the MSMEs is met through electricity¹³. MSME clusters have historically faced

long hours of unscheduled power cuts on account of electricity demand-supply imbalances prevailing across several states in India. This has led to either increased input cost due to dependence on diesel generation (DG) or loss of productivity.

Given the potential of the MSME sector, the right set of financial and policy instruments can help in transitioning these industries to cleaner sources of electricity and reducing carbon emissions. Such measures can simultaneously increase the uptake of rooftop solar in these industries and help achieve the target for the rooftop solar segment under the National Solar Mission.

⁷ FY 2018-19 is partial year data

⁸ Source : MNRE website

⁹ Source : 40GW rooftop target by year 2022 is as per MNRE

¹⁰ Source : BEE website

¹¹ Source : census report of MSME sector (2014-15)

1.2 Objectives of the study

The US\$8B CIF accelerates climate action by empowering transformations in clean technology, energy access, climate resilience, and sustainable forests in 72 developing and middle-income countries. The CIF's large-scale, low-cost, and long-term financing lowers the risk and cost of climate financing. It tests new business models, builds track records in unproven markets, and boosts investor confidence to unlock additional sources of finance. The CIF business model, which is based on the programmatic approach as its primary model of delivery, uses the expertise, standards, and global reach of MDBs to drive climate action at scale through both advisory and investments at both the strategic planning and project implementation phases. The CIF encompasses four different programmes: CTF, SREP, PPCR, and FIP.

The CTF was established to provide scaled-up financing to developing countries for the demonstration, deployment, and transfer of low-carbon technologies with a significant potential to reduce greenhouse gas emissions in the long term. During the past 10 years, the US\$5.5B CTF has financed the development and implementation of low-carbon investment plans in 15 middle-income countries. The CTF portfolio encompasses large-scale investments in energy efficiency in the industrial, commercial, and residential sectors; renewable energy technologies ranging from solar and geothermal to wind and biomass; and sustainable urban transport for public transit, hybrid buses, and green logistics.

Being the only mitigation-focused multilateral fund built around the operating model of MDBs, the

MDB-collective model of CTF is designed to take the full advantage of MDBs' key strengths, and their ability to use capital to attract large volumes of finance from both public and private sources. Some of its key features include its ability to provide resources at scale, and emphasis on private-sector engagement, innovative financial instruments, and a flexible programmatic approach.

The importance of the learning objectives of the CIF has been widely acknowledged, and a number of activities aimed at generating and applying learning have been undertaken or are underway at CIF under the Evaluation and Learning (E&L)¹⁴ Special Initiative. CIF has made an important contribution to the rooftop solar sector in India through its US\$300M investments in the two projects by Asian Development Bank and the World Bank. Building on experience and realising the potential of SMEs in the deployment of the technology, the CIF has initiated a study, "Scaling up rooftop solar in the MSME sector in India", to explore the key barriers hindering the acceptance of rooftop solar among SMEs in India.

This study is funded using the CIF E&L Calls for Proposals (CFP), which sought ideas from CIF-implementing institutions and stakeholder community for strategic, demand-driven evaluation, and learning work that addresses the topic of transformational change, as part of the CIF E&L special initiative.

This study's objective is to explore questions such as:

- What is the current policy/regulatory and financing landscape for MSMEs in India? What support mechanisms already exist for MSMEs to improve their access to financing for energy efficiency/clean energy projects?

Why have they not been able to propel rooftop solar capacity deployment in the MSME sector?

- What are the key barriers to scaling up rooftop solar in the MSME sector in India?
- What are the potential mitigants to addressing the identified barriers?
- What are the knowledge gaps?
- What are the appropriate financial instruments that balance the concerns of lenders with the needs of MSMEs (with a limited credit history)? What could be the implementation modalities of such financial instruments?
- What kind of implementation roadmap is needed to promote the uptake of rooftop solar in the MSME sector? Is a tailored approach aimed at specific MSME segments and clusters likely to yield the desired results?

As mentioned earlier, the MSME sector is a major contributor to the country's GDP. An energy-intensive sector faces severe access to finance issues due to lack of a credit worthy profile. While solar energy offers a cleaner alternative, its high upfront costs, among other factors discourage its wider uptake in the sector. It does not help that solar power is not the core business of MSME units. This pushes it further down the priority list of prospective investments among MSMEs.

In this context, the study's main objective is to ultimately identify the key interventions required to promote investments in the rooftop solar segment across a high-impact MSME sector in India. Additionally, the study intends to inform/update relevant stakeholders about various aspects of rooftop solar, such as technology, business models, support mechanisms, and implementation frameworks.

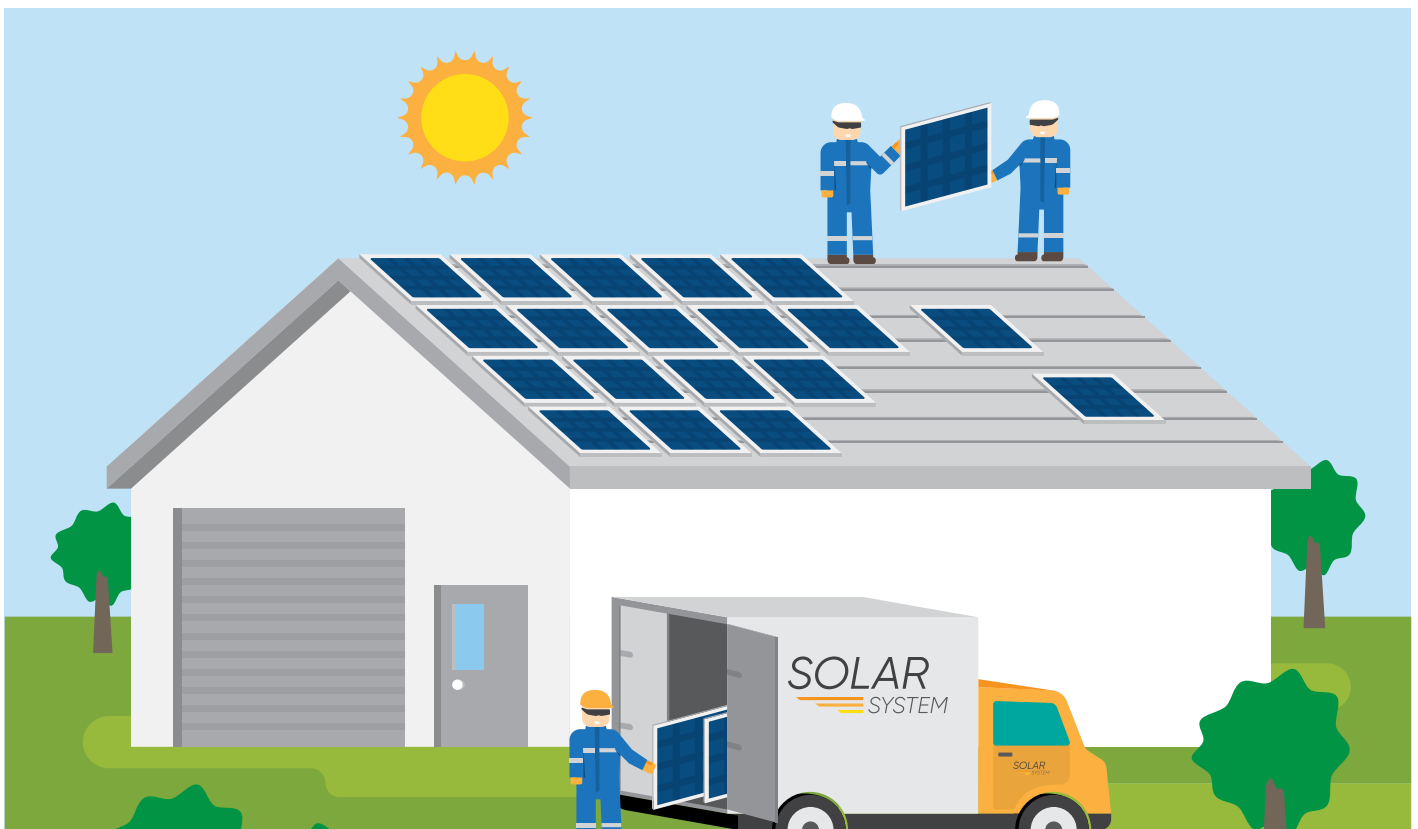
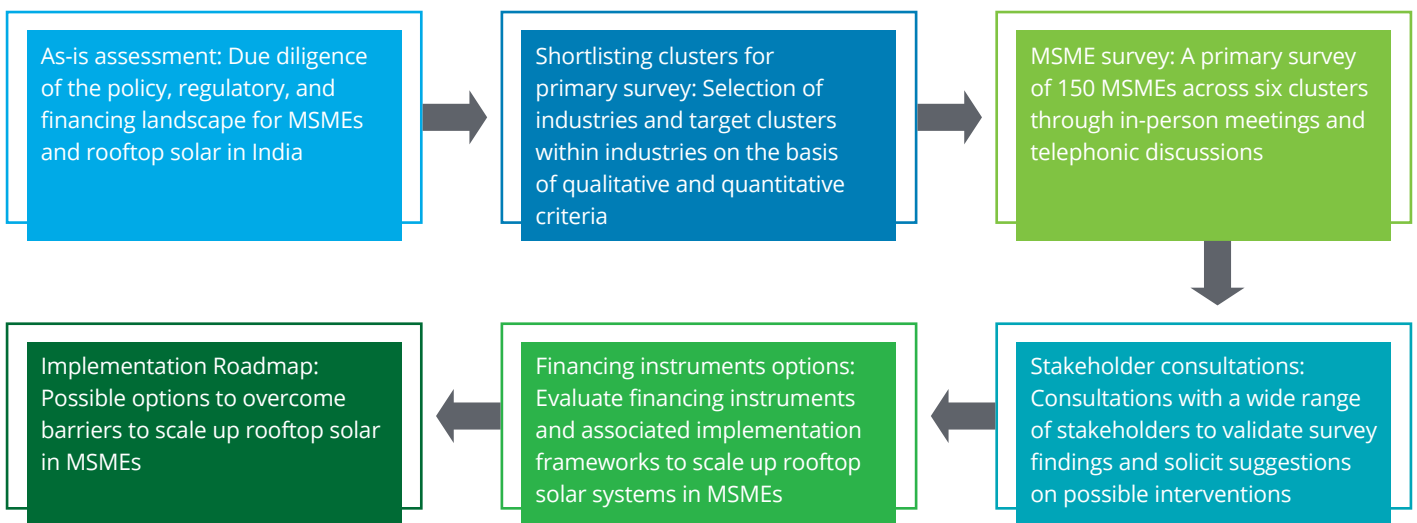
¹⁴ The CIF E&L Initiative is delivering over 30 studies and activities that cover some of the most important and pressing challenges facing climate finance funders and practitioners

2. Methodology

2.1 Overall approach

The overall approach adopted for undertaking different activities for this study is summarised in the figure below:

Figure 2: Overall approach for the study



A diagnostic assessment of the MSME and rooftop solar sectors was carried out to understand the policy, regulatory, and financing landscapes in these sectors, and identify potential barriers in scaling up rooftop solar. Subsequently, a primary survey covering 150 MSME units across six clusters was carried out to identify key barriers. The survey findings were subsequently analysed and the key findings were discussed with stakeholders across the spectrum of the rooftop solar ecosystem. These

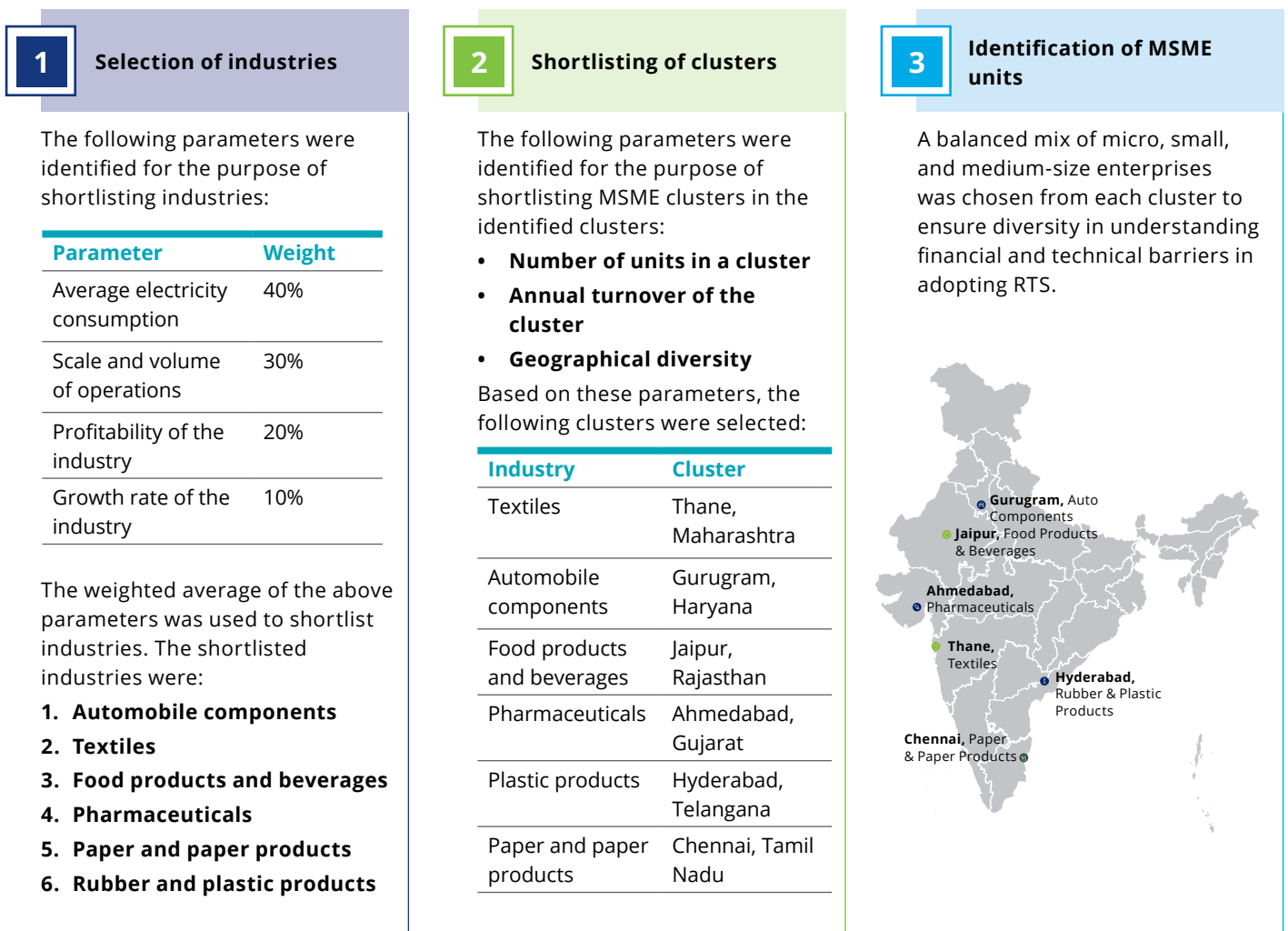
consultations helped validate the key barriers impeding the growth of rooftop solar in the MSME sector and provided inputs on the design of financial instruments and their implementation frameworks to address some of the key challenges.

The methodology adopted for identifying MSME units for the primary survey had the following three steps: (i) selection of industries; (ii) shortlisting of clusters within target industries; and (iii)

identification of MSME units. Parameters such as the concentration of MSMEs in the industry, scale of operations, annual turnover, profitability and growth rate, electricity consumption, and geographical diversity were identified. To maintain sufficient diversity in the survey sample, a balanced mix of MSMEs were shortlisted.

The methodology used for shortlisting MSME clusters for the survey is captured in the infographic below:

Figure 3 : Methodology for shortlisting MSME clusters



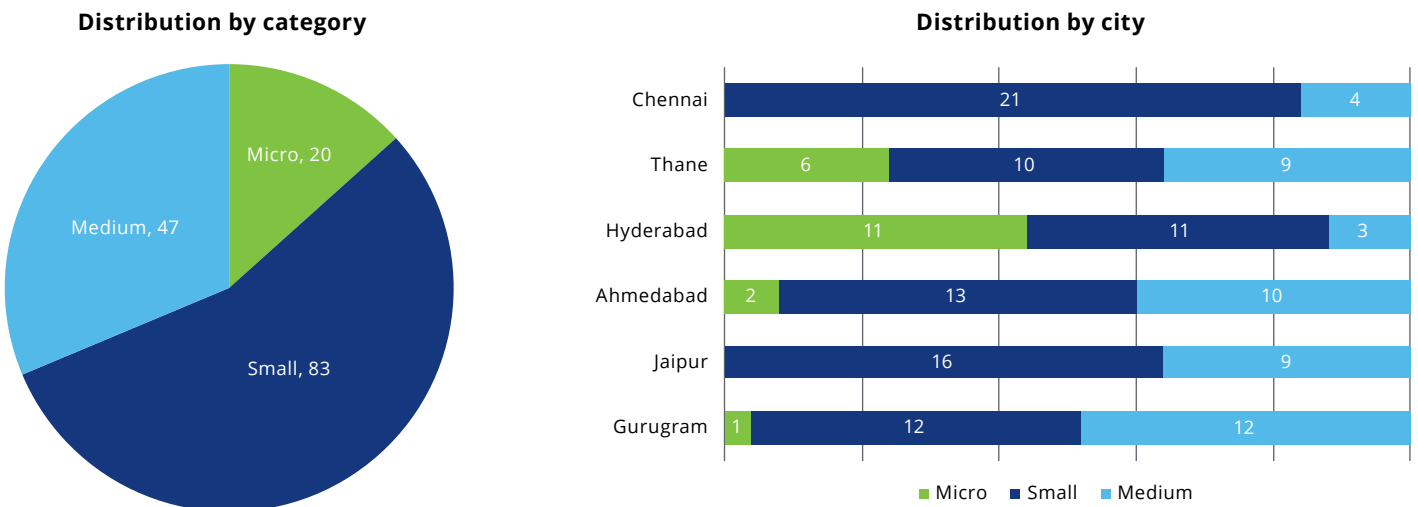
2.2 Market survey

A detailed questionnaire was developed to cover critical financial, commercial, technical, and policy and regulatory aspects relevant from the perspective of the MSME and rooftop solar sectors. The key findings from the primary survey of the six clusters are discussed below.

2.2.1 General sample profile

A total of 150 MSMEs were surveyed across the six clusters. The sample surveyed was distributed across the three categories (micro, small, and medium) of the MSME sector as shown in the figure below:

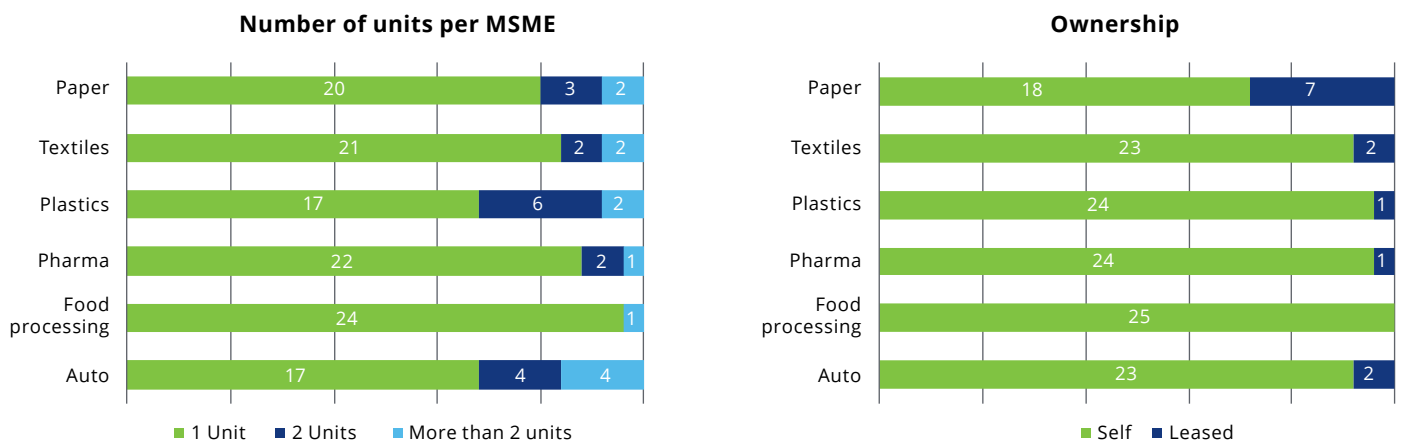
Figure 4: Survey sample distribution



The pharmaceuticals (Ahmedabad), textile (Thane), and auto components (Gurugram) clusters had the maximum number of mid-size industries. This is attributed to the presence of a large and well-established ecosystem for their industries. The plastics cluster in Hyderabad was more fragmented due to the presence of a large number of small and micro players. The paper cluster in Chennai was characterised by a large number of small-scale industries.

The majority of the MSMEs (~81%) reported to have the possession of only one unit. The maximum number of MSMEs from the auto components cluster in Gurugram reported to have more than two units as it is one of the well-developed clusters among those surveyed. More than 91% of the MSMEs surveyed reported that they were the owners of the properties/buildings from where they run their companies. The majority of the MSMEs (~54%) that were operating from leased premises were found in the paper products (Chennai) cluster (see figure below).

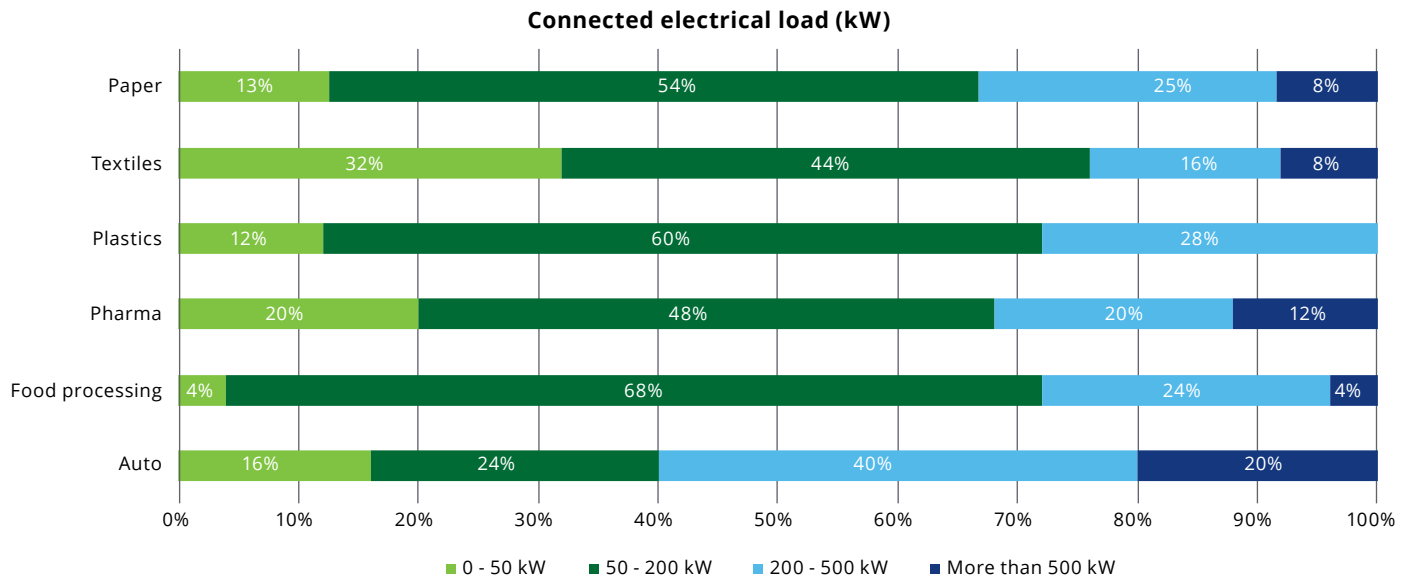
Figure 5: Number of units per MSME and ownership status



2.2.2 Connected electrical load and rooftop solar potential

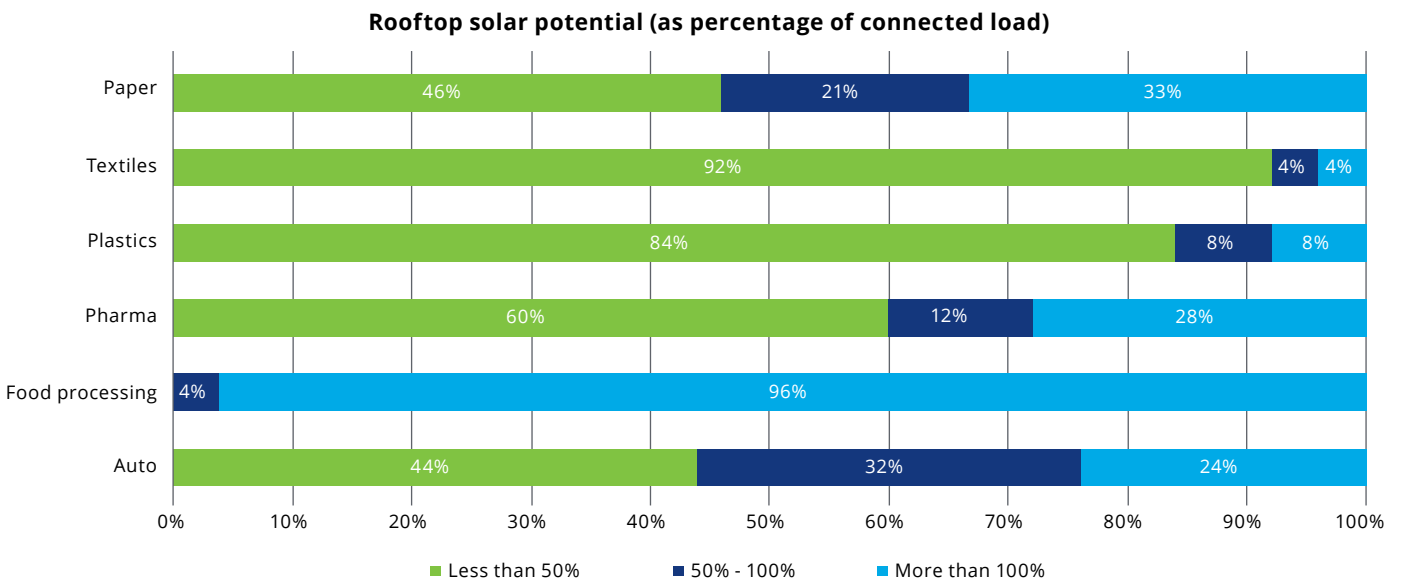
Almost half of the surveyed MSMEs had connected load in the range of 50–200 kW. The textile cluster (Thane) had the maximum number of MSMEs with connected load of less than 50 kW. MSMEs in the auto components (Gurugram) and pharmaceuticals (Ahmedabad) clusters accounted for a higher proportion of mid-size industries. Hence, these clusters had the maximum number of MSMEs with connected load exceeding 500 kW. The following figure shows the connected electrical load of the sample surveyed:

Figure 6: Connected electrical load



About 54% of the MSMEs surveyed had rooftops that yielded lower potential compared to connected electrical load requirement. This also implies that the entire rooftop solar capacity of these MSMEs can be used to meet their electricity requirements. In case of food products and beverages cluster (Jaipur), more than 90% of the MSMEs surveyed had a rooftop solar potential that exceeded electrical load. This was primarily because these MSMEs had multiple buildings within the same premises (with some buildings being used for purposes needing lower electricity such as storage, trading, and packaging). The following figure shows the rooftop solar potential as a percentage of the connected load of the surveyed industries:

Figure 7: Rooftop solar potential as a percentage of the connected load

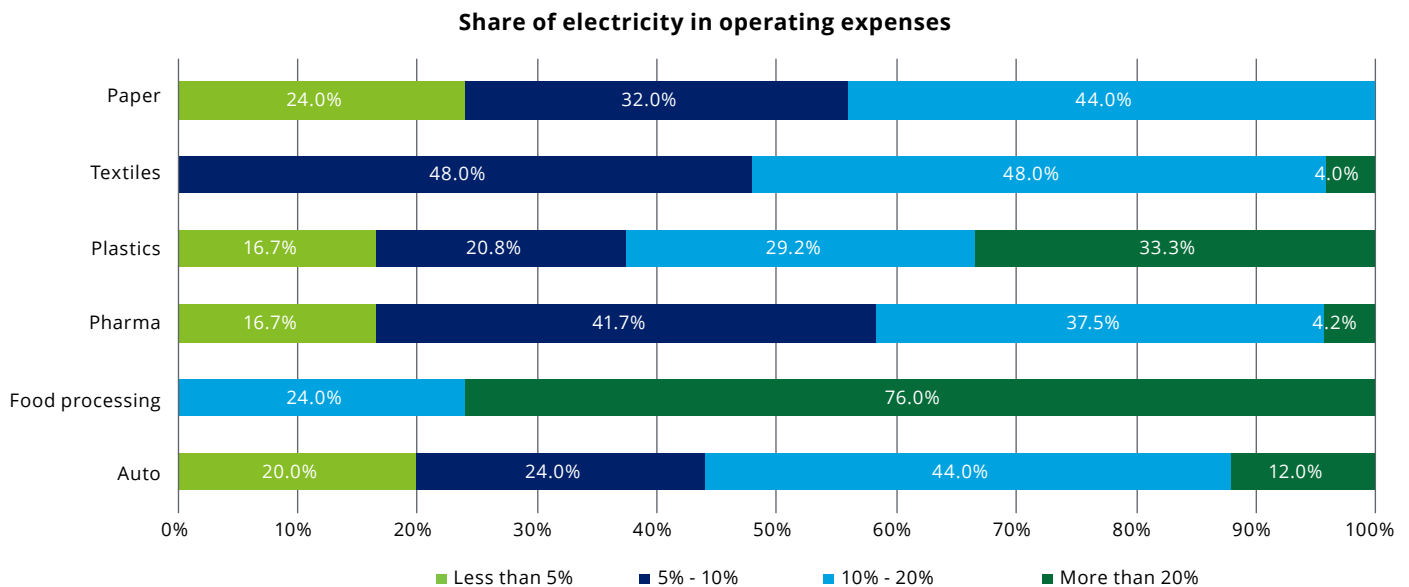


A lower rooftop solar potential as a proportion of the connected electrical load may not necessarily mean a lower capacity, especially for MSMEs with high-power consumption. For instance, the aggregate rooftop solar potential of the surveyed MSMEs in the auto components and pharmaceuticals clusters was about 5.5 MW and 2.7 MW, respectively.

2.2.3 Electricity requirement for MSMEs

The share of the electricity cost in operating expenses is determined by the nature of the industry to a large extent. The cost of raw materials in one industry (for example, auto components) can be significantly higher than another (such as food processing). Therefore, a higher percentage may not necessarily imply a higher quantum of expenditure on electricity. The following figure shows the share of electricity in overall operating expenses for the sample surveyed:

Figure 8: Share of electricity charges in operating expenses for the sample responses



For about 40% of the surveyed MSMEs, the share of electricity cost in overall operational expenses was less than 20%. The plastics and food processing clusters had the maximum number of MSMEs whose electricity expenses were more than 20% of their operating expenses.

2.2.4 Adoption of rooftop solar by MSMEs

The adoption of rooftop solar by MSMEs is influenced by the level of awareness about its technical, commercial, financial, and regulatory aspects to a large extent. The survey findings

show that awareness is affected by the presence of a solar supply chain, including solar companies, EPC players, and distributors, in the region.

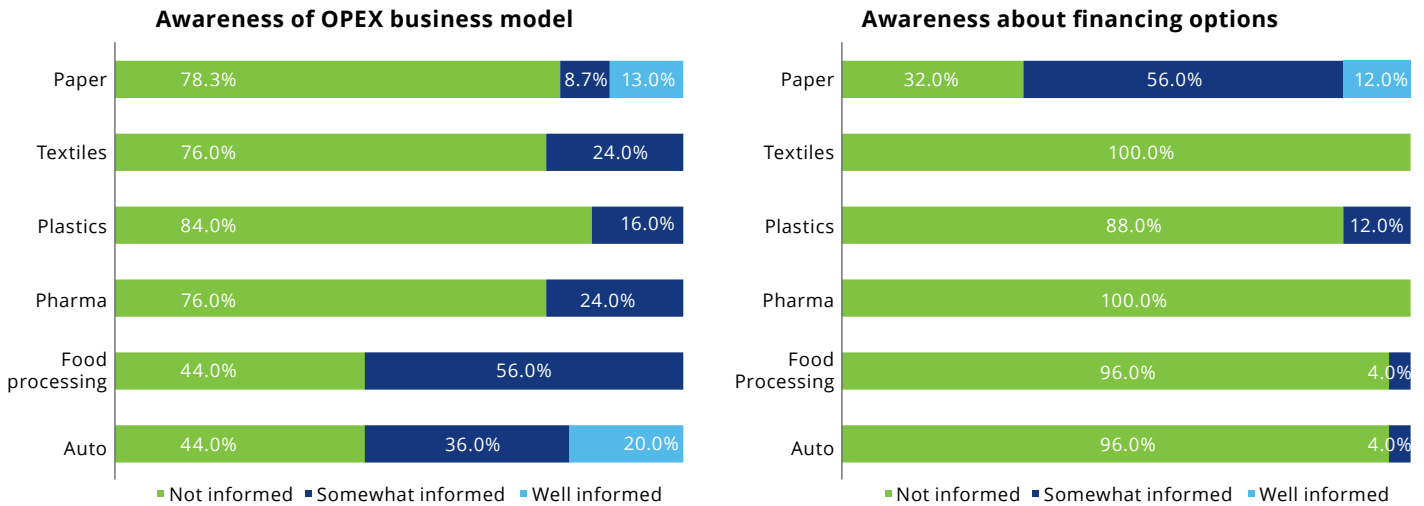
2.2.4.1 Awareness of rooftop solar schemes and financing options

The level of awareness about various government schemes, such as capital subsidy and net metering, for promoting rooftop solar was low among the surveyed companies. A similar trend was also seen for financing options available



for the rooftop solar sector in India. These options include financing schemes of Punjab National Bank, State Bank of India, and IREDA, as shown in the figure below:

Figure 9: Awareness about rooftop solar schemes and financing options



A few MSMEs in the auto components and paper clusters were aware of such schemes and policies. Most of the others were not aware or had limited understanding of the sector.

The level of awareness also depends on the extent of growth in the rooftop solar market in the MSME cluster and the specific region in which the cluster is located. Therefore, a phased approach targeting specific clusters (initially targeting regions where the

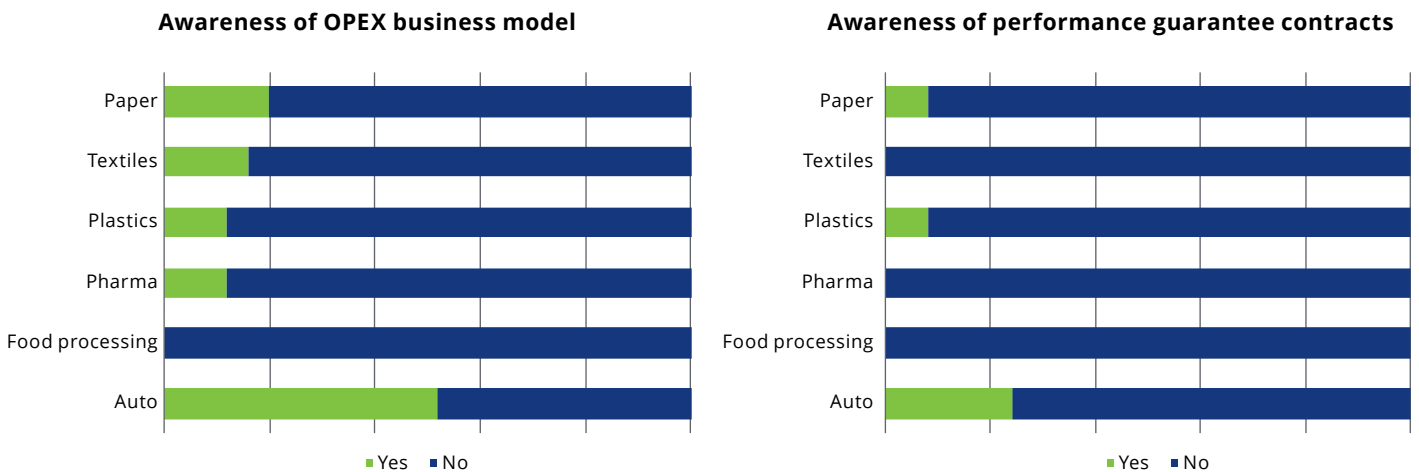
rooftop solar market is more evolved) could be more effective in proliferating rooftop solar in the MSME sector.

2.2.4.2 Awareness of business models and commercial aspects

The majority of the MSMEs (more than 80%) considered the CAPEX model (requiring upfront capital investment by the owner) as the only mode of implementing a project. Awareness about various commercial aspects of

rooftop solar, including performance guarantee contracts with solar developers, was even lower. MSMEs were also not aware of the available manufacturers/brands of the key components of a rooftop solar system. The understanding of various aspects was high for those that had already installed a rooftop solar system at their premises or were in discussions with developers for this purpose (see figure below).

Figure 10: Awareness about business models and commercial aspects



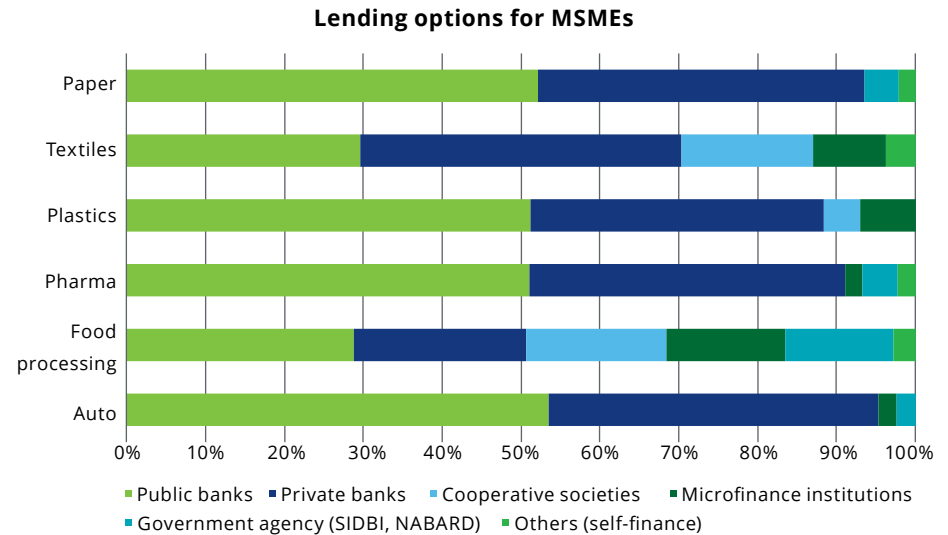
Due to lack of awareness about business models, many MSMEs were less inclined to implement rooftop solar at their premises. This underscores the importance of the involvement of industry associations in promoting rooftop solar through conferences, webinars, seminars, pamphlets, flyers, etc. The awareness can be enhanced by conducting marketing campaigns and **implementing pilot projects in select clusters.**

2.2.5 Project financing for MSMEs
2.2.5.1 Preferred lending options for MSMEs

The surveyed MSMEs reported that public and private banks are their most preferred financial institutions for borrowing. In many cases, the reason for this preference was either an existing relationship or hypothecation with a bank. However, in most cases, respondents expressed a willingness to work with any institution that could offer the most attractive terms on a loan. The figure below shows lending options for MSMEs:

A few MSMEs in auto components (Gurugram) and pharmaceuticals (Ahmedabad) clusters prefer working with microfinance institutions and government institutions, such as

Figure 11: Lending options for MSMEs

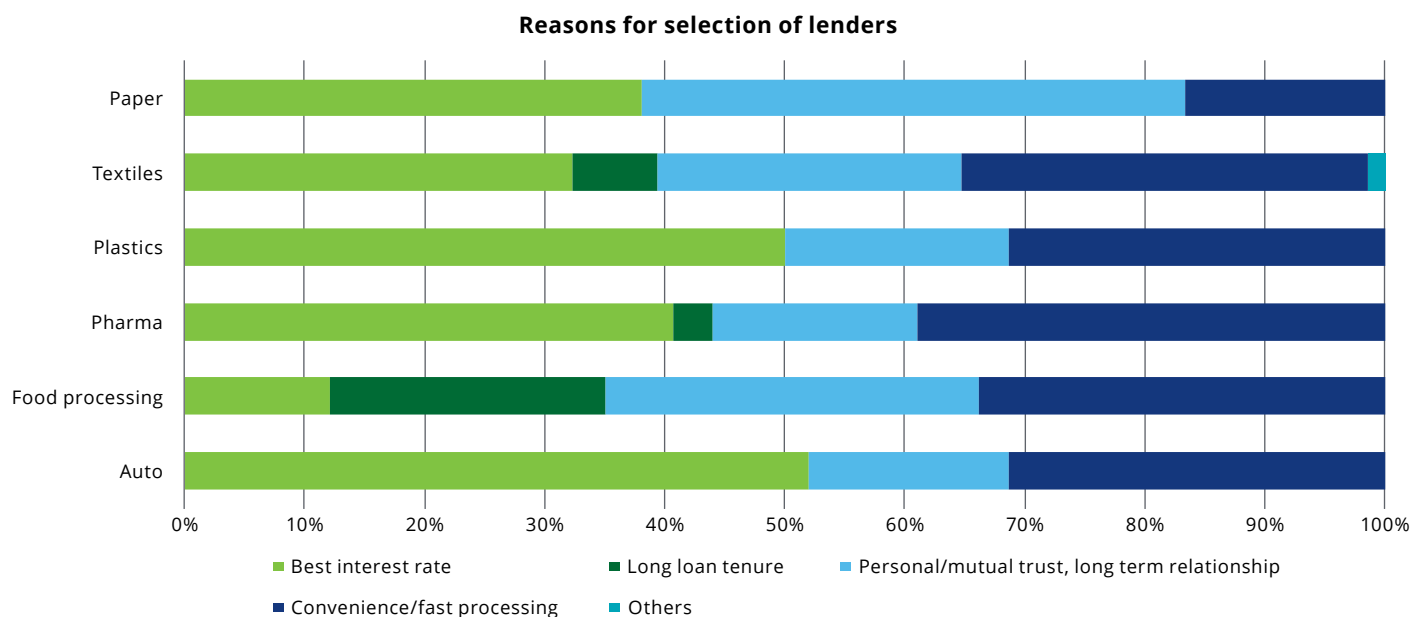


SIDBI, offering faster processing and better interest rates. Most of the micro enterprises prefer cooperative banks. However, a number of MSMEs, especially in the textile (Thane), and rubber and plastic products (Hyderabad) clusters were not dependent on loans and self-financing their business investments. To evaluate the creditworthiness of unregistered MSMEs or those that had not undergone a formal credit assessment, banks typically referred to metrics such as CIBIL¹⁵ score.

2.2.5.2 Selection of Lenders by MSMEs

Different enterprises reported different borrowing preferences. However, the key deciding factor was the rate of interest, and other terms and conditions of the financial product. Therefore, acceptability among MSMEs for working with a new financing institution is high if right incentives are provided. The figure below shows the reasons considered while selecting lenders:

Figure 12: Selection of lenders by MSMEs



¹⁵. Established in 2000, TransUnion CIBIL Limited (formerly known as Credit Information Bureau (India) Limited) is India's first Credit Information Company.

2.2.5.3 Financing challenges faced by MSMEs

The findings from the survey showed that many MSMEs found it difficult to meet collateral requirements as their plant and machinery were already committed to other term loans. Other reported issues included high interest rates, lengthy processing times for loans, and extensive documentation. Most of these MSMEs were from the fragmented textiles and plastics

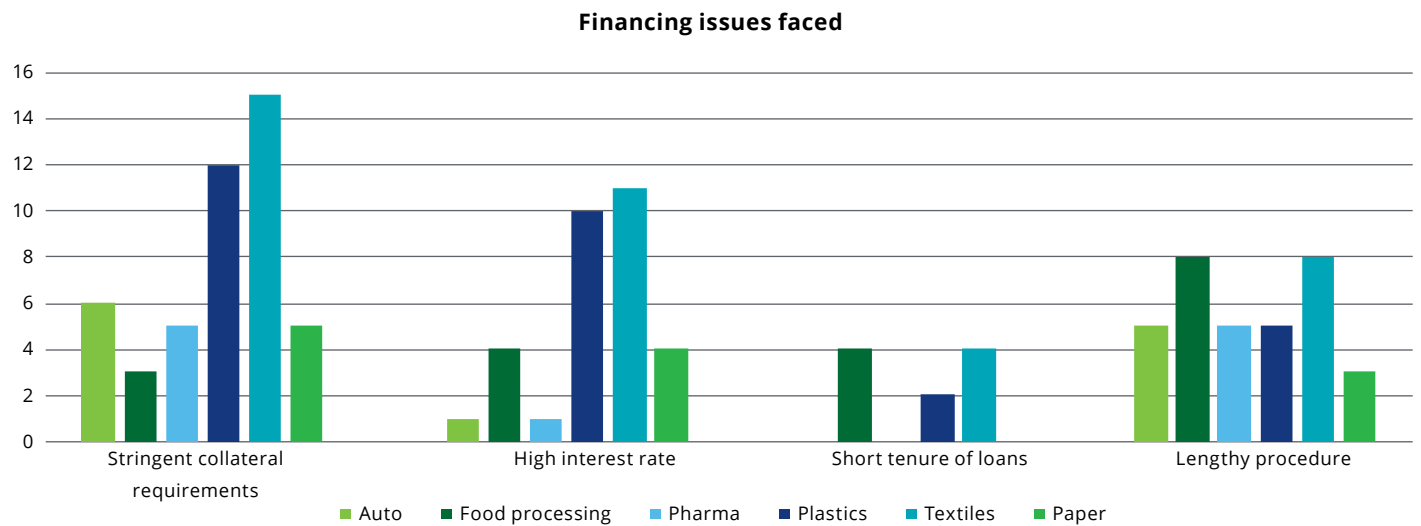
clusters that had a higher number of micro- and small-scale enterprises. However, mid-size MSMEs reported facing no major challenges in obtaining loans. In their case, either the business was well-established or banks were already aware of their creditworthiness.

The servicing of debt could prove to be a challenge for industries that face cyclical downturns and an uncertain

business environment. A targeted approach with dedicated business models and financial frameworks for different segments of the MSME sector may thus be better suited as opposed to a one-solution-fits-all approach for proliferating rooftop solar in the MSME sector.

Different financing challenges facing MSMEs are shown in the figure below:

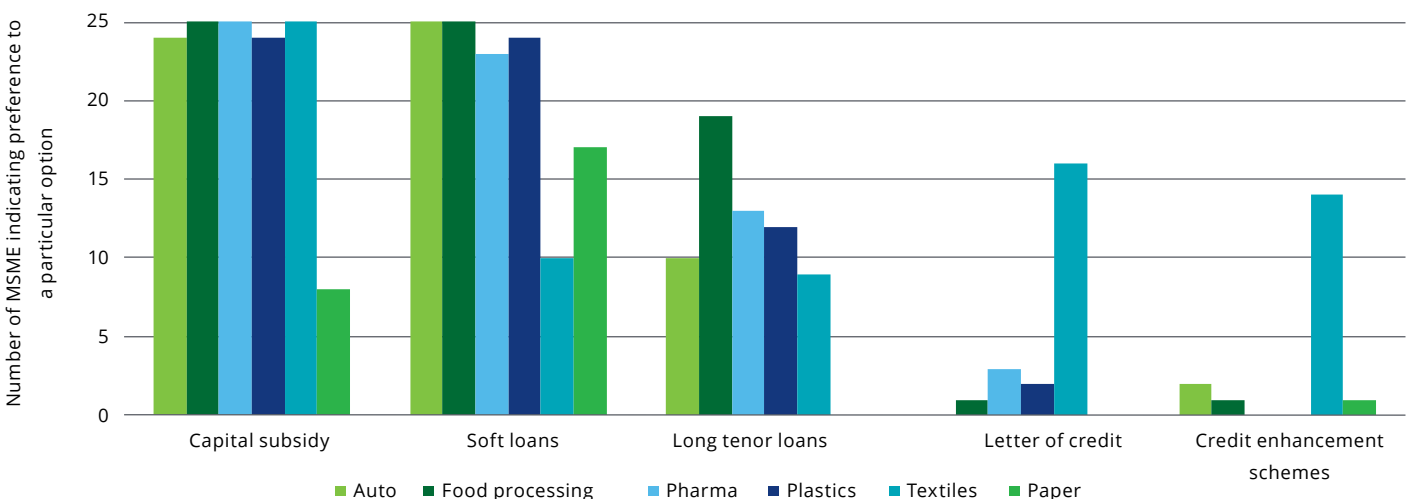
Figure 13: Financing challenges faced by MSMEs



2.2.5.4 Choice of financing instruments for rooftop solar

The majority of the MSMEs were in favour of a capital subsidy for rooftop solar as it was perceived to be a capital-intensive investment. There was also considerable interest for concessional loans, especially among mid-size MSMEs. Many micro- and small-scale MSMEs were interested in other support mechanisms, such as credit enhancement schemes and letter of credit, to improve their debt servicing capabilities. The figure below shows financial instruments that MSMEs prefer:

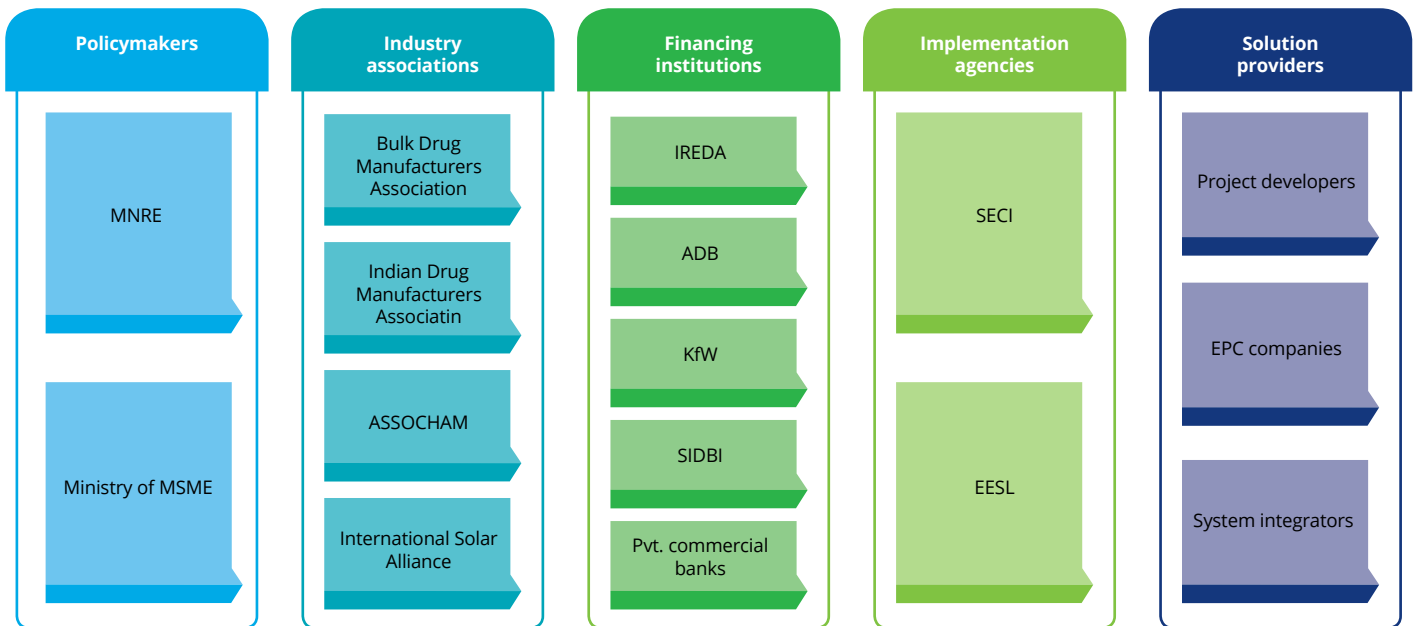
Figure 14: Preferred financial instruments by MSMEs



2.3 Stakeholder consultations

Stakeholder consultations formed an integral part of our approach towards this study. The process of gathering diverse viewpoints enabled the validation of the primary survey's findings, and provided relevant inputs for the design of the proposed business models and financial instruments. A sample of the stakeholders consulted as part of the study is shown in the graphic below:

Figure 15: Sample of the stakeholders consulted



Knowledge sharing sessions were also instrumental in meeting the stated E&L indicators and enhancing the study's efficacy. Two stakeholder consultation workshops were conducted to bridge knowledge gaps by disseminating the study's findings and deliberate on possible solutions.

A summary of the discussions is given in the following sub-sections.

2.3.1 Policymakers

Policymakers were consulted to understand their perspective on the issues faced by MSMEs in adopting rooftop solar and solicit their views on the proposed financial frameworks. The key outcomes of these discussions are summarised below.

- The general consensus was that **lack of awareness among MSMEs was the biggest barrier** to the proliferation of rooftop solar. Therefore, the need for executing awareness campaigns to raise awareness was strongly recognised. As part of the awareness campaigns, it was suggested that toolkits (to assess rooftop solar potential, project cost, benefits, etc. for consumers and lending institutions) could also be developed. The need for implementing demonstration projects to create awareness among clusters with abundant rooftop solar potential was also emphasised.
- Capital subsidy provided to MSMEs was not favoured as solar power is perceived to be cheaper than grid power for C&I consumers. Therefore, subsidy is not needed.
- The need to devise *innovative solutions to tackle some of the technical challenges* (such as easily removable support structures that allow quick dismantling and reinstallation of solar panels) faced in implementing rooftop solar was also discussed.

2.3.2 Financing institutions

Financing institutions were consulted to learn about their experiences of

rooftop solar project financing in the MSME sector and solicit their views and perspectives on the interventions needed to overcome the identified barriers. The key outcomes of these discussions are summarised below.

- The lines of credit of ADB and WB are currently available only to public-sector banks. The stakeholders were of the opinion that such lines of credit should be accessible to all banks. A **fund of funds** can also be created to cater to the needs of the MSME sector. Further, one institution suggested that all funds currently available for financing clean energy projects could be channelised under one agency to improve efficiency.
- Most of the financing institutions were of the view that a **demand-aggregator based RESCO business model** (with the aggregator being a party to the PPA) would be most effective in proliferating rooftop solar in the MSME sector. This is because individual projects are typically less than 50 kW in size that makes them unattractive for lenders from the perspective of return on investment and transaction cost. The role of aggregation could be played by a designated government entity (such as SECI or EESL) with the distribution company (DISCOM) acting as the billing/collection agent. The stakeholders expected demand aggregation to bring about benefits of economies of scale to the recipient MSMEs and also lower rooftop solar tariff for them in the process. While implementing a project via the CAPEX mode, most financing institutions agreed to contractually bind the EPC contractor to ensure optimum system performance.
- A **cluster-based approach** was recommended by most stakeholders due to the heterogeneous nature of the MSME sector. In their opinion, there could be some clusters that can benefit more from interventions compared

with others. In this regard, the stakeholders suggested *that lessons learnt from energy efficiency projects should be incorporated* into the cluster-specific strategies.

- Many financing institutions also highlighted the *importance of having rigorous technical standards*, not just for the key equipment but also for various stages of the project development process (such as installation, construction, and commissioning). They focused on the importance of making adherence to such standards mandatory for projects seeking financial support.
- In terms of their views on proposed business models and financial support mechanisms, most respondents were of the view that instruments such as payment security mechanism and partial risk guarantees could be effective in enhancing rooftop solar deployment in the MSME sector. One financing institution suggested that any partial risk guarantee facility should be cost neutral for the government. Some of the stakeholders were of the opinion that the *CAPEX model would be more effective in MSMEs due to lack of long-term business certainty in the sector*. This would discourage many MSMEs from signing long-term contracts. Further, they felt that MSMEs with a robust credit profile and access to capital would be more likely to invest in the CAPEX mode instead of the OPEX mode.
- From an awareness perspective, some financing institutions suggested building **banks' capacity** to improve their ability to review bidding documents, project contracts, etc., and ease the appraisal process, thereby bringing about scalability. The need for pilot projects was also emphasised. Banks can target their existing MSME customers for supporting rooftop solar financing.



2.3.3 Implementing agencies

Potential implementing agencies, such as SECI and EESL, were also consulted to solicit their views on the proposed business models and implementation frameworks. The key outcomes of these discussions are summarised below.

- The implementing agencies agreed with the suggestion that a *demand-aggregator based RESCO business model could boost the uptake of rooftop solar in the MSME sector*. In this regard, they stressed on the importance of the role of the distribution utilities as they can assist the implementing agency in identifying suitable consumers and act as the billing and collection agent for a nominal fee. Therefore, *the need for incentivising DISCOMs to participate in such projects was emphasised*.
- One implementing agency suggested that MSMEs undergoing energy audits could also be advised on the techno-commercial feasibility of rooftop solar at their premises as part of the process.
- Most of the stakeholders agreed that some form of payment security mechanism (PSM) was important from the perspective of the banks to enhance projects' bankability. They stated that PSM is present even in mature markets, such as the housing

market. Therefore, it was important to have a similar mechanism in place in a developing market, such as rooftop solar. This is because there is limited availability of equity financing in the rooftop solar market and significant volume of debt financing is necessary for scaling up the market. To mitigate these challenges and provide risk diversification for investors (debt and equity), the need for PSM was emphasised.

- Respondents also highlighted the important role to be played by industry associations in creating awareness, building capacity, and aggregating demand for RESCOs.

2.3.4 Solar solution providers

Solution providers, such as solar project developers, EPC companies, and system integrators, were also consulted to know their experiences of implementing rooftop solar projects in the MSME sector, and solicit their views on the proposed business models and implementation frameworks. The key outcomes of these discussions are summarised below.

- There was general consensus among stakeholders that long-term PPAs continue to remain a challenge, especially for industries facing business uncertainties. Therefore, offering *customised and flexible*

PPAs with a reduced tenor (5-10 years) for the MSME sector is important.

- Developing a secondary market for solar projects is important as this will help solar developers in forging short-term PPAs with MSMEs and give a sense of security to financial institutions funding such solar rooftop projects in the MSME sector.
- Stakeholders expressed that it was often challenging to finance rooftop solar projects in the MSME sector due to complications arising on account of lack of credit history and banking relationship of consumers. The need for *developing standardised risk assessment products was also highlighted*. In this regard, it was suggested that MSME credit analysis should be undertaken by commercial banks with the support of multilateral development agencies.
- Stakeholders stated that a payment security mechanism was essential to give a sense of security to lenders.
- Some respondents suggested that the *auto components and pharmaceuticals MSMEs would be better suited for early interventions* as they have strong balance sheets and superior business practices, and are suppliers to large industries.

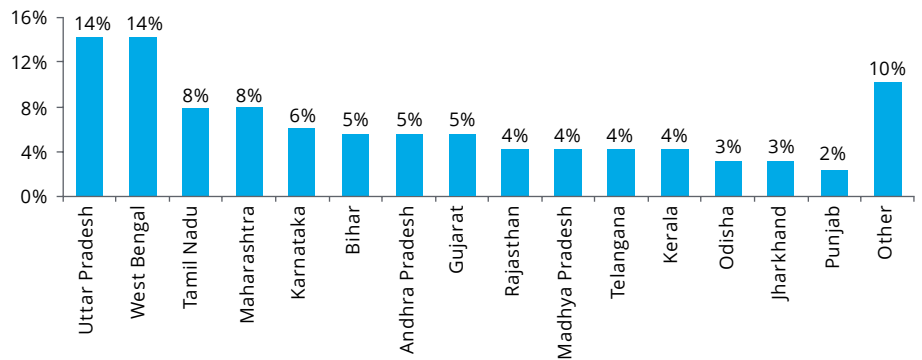
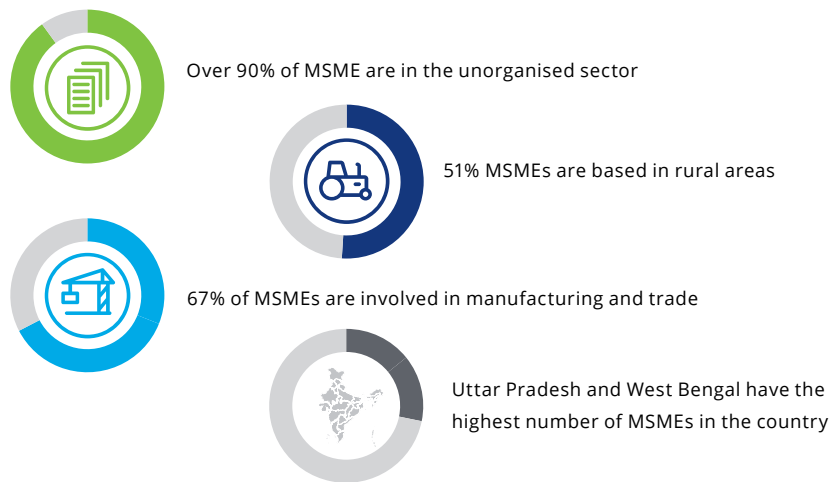
3. Current context

3.1 MSME sector in India

The MSME sector is an important constituent of the Indian economy, contributing significantly to GDP, manufacturing output, employment, and exports. According to the 73rd National Sample Survey (NSS) conducted by the National Sample Survey Office (NSSO) and the Ministry of Statistics and Programme Implementation (MoSPI) (2015-16), there were 633.88 lakh (~63 million) unincorporated non-agricultural MSMEs providing employment to about 110 million in the country. Of the total estimated MSMEs, the micro sector accounts for 99.47%, with 0.52% (~ 0.33 million) and 0.01% (~5,000) being small and medium-scale establishments, respectively. About 95.98% MSMEs were proprietary enterprises¹⁶.

Since February 2018, MSMEs have been reclassified on the basis of annual turnover against investment in plant and machinery/equipment. Per the amendment to the Section 7 of the Micro, Small and Medium Enterprises Development (MSMED) Act, 2006, revised classification in terms of annual turnover is as follows:

Figure 16: Key statistics of MSME sector in India



Source: Annual Report FY 2017-18, Ministry of MSME, GoI

Table 1: Revised classification of MSMEs in India

Enterprises	New Definition
Micro	Annual turnover does not exceed INR 5 crore
Small	Annual turnover is more than INR5 crore but does not exceed INR75 crore
Medium	Annual turnover is more than INR75 crore but does not exceed INR250 crore

¹⁶. Annual Report of Ministry of MSME 2017-18

Further, the central government can notify different turnover limits within the abovementioned limits. These changes have been done to align the classification norms with the new goods and services tax (GST) regime.

3.1.1 Institutional Framework

The Ministry of MSME is responsible for implementing various schemes aimed at providing financial assistance; technology assistance and upgrading; skill development and training; enhancing competitiveness; and market assistance to MSMEs. The Office of the Development Commissioner implements policies and various programmes/

schemes for providing infrastructure and support services to MSMEs. It functions through a network of MSME-development Institutes (MSME-DIs), regional testing centres, production centres, field testing stations, and specialised institutes.

MSMEs in India are also supported and assisted by a number of other government institutions. SIDBI is an apex financial institution that provides financial assistance to MSMEs in the country. SIDBI provides financial support by refinancing eligible lending institutes such as banks, state financial corporations, & micro-finance

institutions, and directly lending to MSMEs. National Agricultural and Rural Development Bank (NABARD) promotes sustainable and equitable agricultural and rural development. Regional rural banks and co-operative banks, under the supervision of NABARD, help disburse funds to MSMEs in the semi-urban and rural areas.

3.1.2 Policy and regulatory framework for MSMEs

The Office of Development Commissioner (MSME) operates a number of schemes for the MSME sector. Some of these schemes and their objectives are explained in the table below:

Table 2: Key schemes implemented by the ministry of MSME

Sr. No.	Name of the scheme	Description
1	National Manufacturing Competitiveness Programme (NMCP)	Comprises various schemes, such as the zero defect zero effect scheme, technology and quality upgrading support (provides financial assistance in the form of 25% of the project cost to implement energy-efficient technologies), and the design clinic scheme.
2	Micro and Small Enterprises Cluster Development Programme (MSE-CDP)	The scheme is aimed at promoting cluster development approach to enhance productivity, competitiveness, and capacity of MSMEs and their collectives in the country.
3	Credit Linked Capital Subsidy Scheme for Technology Upgradation (CLCSS)	The scheme aims at facilitating technology upgrading of micro and small enterprises by providing 15% capital subsidy (12% capital subsidy before 2005) on institutional finance obtained by them for the induction of well-established and improved technology in approved sub-sectors/products.
4	Credit Guarantee Scheme for MSMEs (CGT-MSE)	The government of India and SIDBI contribute to a trust (CGTMSE) in a ratio of 4:1 to extend collateral-free credit to micro and small industries.
5	Scheme of Micro Finance Programme	The scheme is operated in underserved states/pockets to provide for security deposits that MFIs/NGOs require to get a loan from SIDBI.
6	MSME Market Development Assistance (MDA)	The scheme is aimed at encouraging small and micro exporters in their efforts at tapping the overseas market and promoting participation at international exhibitions, trade fairs, etc.

Source: Ministry of MSME, SIDBI website

3.1.3 Financing landscape for the MSME sector

The government of India has identified the MSME sector as a priority lending sector, given the sector's contribution to the economy, to improve the formal financial sector's outreach to MSMEs. The total on-balance sheet commercial lending exposure in India stood at US\$ 779B, as of January 2018 (MSME loans accounting for US\$127.8B). Loans in the MSME segment have continued to increase since 2016 with a year-on-year growth rate of 14.1%. New-to-credit borrowers have consistently increased over the past two years. The category has seen a 21% increase from 400,000 new additions in 2017 to 520,000 in H1 2018¹⁷.

The financial ecosystem of the MSME sector consists of government agencies, such as SIDBI and NABARD, regional rural banks, and commercial banks (including public-sector banks, private-sector banks, non-banking financial companies, and co-operative banks). Financial institutions offer a number of products such as general and open-term loans. MSMEs use these products to undertake fixed-asset acquisition, capacity expansion, modernisation and technology upgrading, and meet their working capital requirements. Financing institutions also offer trade and export-specific financing. In addition to debt financing, MSMEs can also obtain products such as letters of credit and bank guarantees.

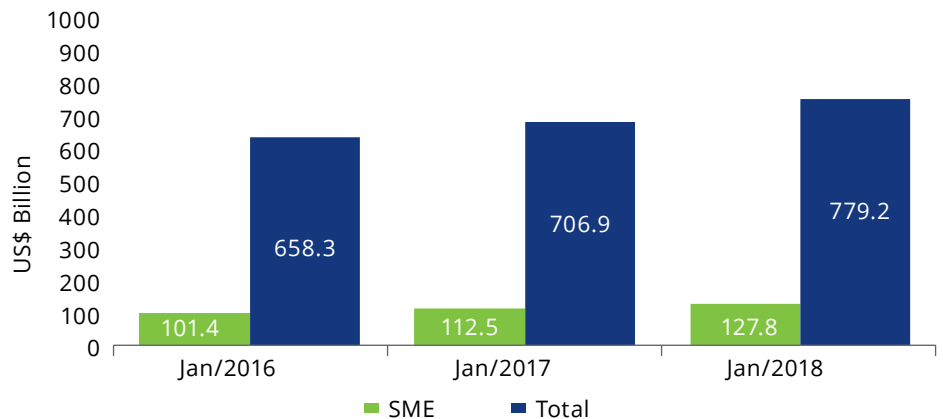
Public-sector banks have traditionally been dominant lenders to the MSME sector with a market share of about 50% in 2018. However, in the past few years, they have lost some of their share to private-sector banks and NBFCs.

3.1.3.1 Role of SIDBI¹⁸

From the perspective of the MSME sector, SIDBI is responsible for providing financial and technical

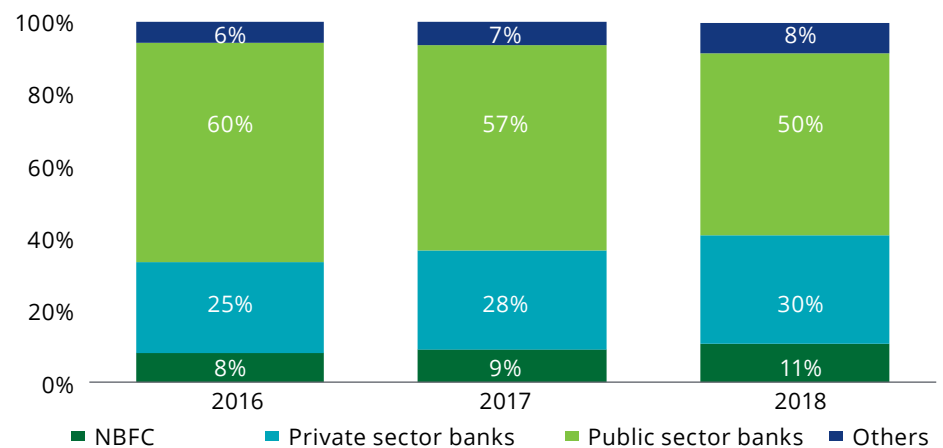


Figure 18 : Commercial lending to MSME sector in India



Source: SIDBI MSME Pulse Report September 2018

Figure 17 : Lenders' share in the MSME segment



Source: SIDBI MSME Pulse Report June 2018

¹⁷. Source : SIDBI MSME Pulse Report September 2018

¹⁸. Source : SIDBI Website



assistance to the MSME sector. It provides financial assistance to MSMEs by way of:

- Refinance and resource support through eligible primary lending institutions (PLIs) such as banks and State Financial Corporations (SFCs) for onward lending to MSMEs
- Direct assistance to MSMEs, with a focus on niche areas such as risk capital/equity, sustainable finance for promoting energy efficiency and cleaner production, receivable financing, and service sector financing
- Microfinance through MFIs

SIDBI also offers a range of financial products and assistance to MSMEs. These products include secured business loans, working capital assistance, inland letter of credit, and general purpose term loans. In addition to providing financial and non-financial assistance to the MSME sector, SIDBI is the implementation agency for a number of government subsidy schemes, such as such as CLCSS, Technology Upgradation Fund Scheme for the Textile Sector

(TUFS), and Technology and Quality Upgradation Scheme (TEQUP).

3.2 Rooftop solar financing in India

Lending in the rooftop solar sector is majorly driven by public-sector and private-sector commercial banks and non-banking financial companies. Public-sector banks, such as State Bank of India and Punjab National Bank, are prominent financiers of rooftop solar projects. They are able to provide lending at affordable terms and conditions due to their access to lines of credit from CTF-World Bank, CTF-Asian Development Bank, and GCF-NABARD. These three lines of credit have access to a funding worth US\$1.3B and are expected to boost lending to the sector. In 2018, the Green Climate Fund has also channelised a US\$250M fund via Tata Cleantech Capital and NABARD targeting rooftop solar¹⁹.

State Bank of India obtained a US\$625M line of credit from CTF-World Bank in 2016 for lending to grid-connected rooftop solar programmes in the commercial, industrial, and institutional sectors. The financing can be obtained

by both aggregators and end-users. This is expected to support 600 MW of additional rooftop solar capacity in the country by making long-term financing of up to 15 years available at an affordable cost. The project sizes under the programme range from 25 kWp to 16 MWp with access to multiple business models, such as third-party ownership, rooftop rental, leasing, and direct end-user ownership. According to an Implementation Status report published in June 2018, State Bank of India has sanctioned projects with aggregate credit facilities of US\$315M²⁰.

Under the Rooftop Solar Investment Programme, Punjab National Bank sought US\$500M sovereign backed multi-tranched financing facility from CTF-Asian Development Bank in 2016. The facility intends to finance large solar rooftop solar projects in the C&I sectors on a standalone or aggregated basis²¹.

IREDA has lines of credit with several bilateral and multilateral agencies, such as KfW, JICA, ADB, EIB, and AfD for financing renewable energy projects. For rooftop solar projects, IREDA has a specific loan scheme for financing rooftop solar PV grid-connected projects for commercial, industrial, and institutional consumers. Through this scheme, IREDA provides financing for projects ranging from 1,000 kWp for standalone projects and aggregated projects with each sub-project having a capacity of 20 kWp. The loan under the scheme can be obtained for a period of nine years²².

Among private sector banks, Yes Bank and Axis Bank have a strong presence in the rooftop solar market. NBFC such as IREDA, PFC, REC, and L&T Financial Services also have a prominent presence in the solar lending space.

¹⁹. Source : <https://www.greenclimate.fund/news/agreement-set-to-increase-india-s-rooftop-solar-reach>

²⁰. Source : The World Bank website

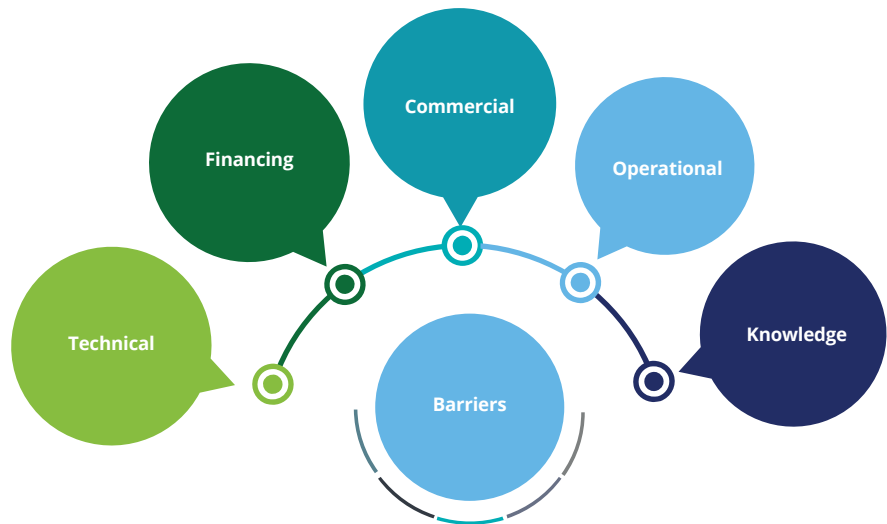
²¹. Source : Asian Development Bank website

²². Source : IREDA Annual report (2017-18), IREDA Financing Norms & Scheme

4. Barriers to scaling rooftop solar in the MSME sector

Despite various initiatives, presence of a conducive policy/regulatory regime, a strong economical driver (falling solar tariffs vis-à-vis typically high grid power tariffs for industrial consumers), dedicated financing schemes, and a robustly growing market, the uptake of rooftop solar has been largely limited to large-scale industries and the institutional sector. The vast potential in the MSME and residential segments remains mostly untapped. One of the key objectives of the study was to develop an in-depth understanding of various challenges that MSMEs face while adopting rooftop solar. The following figure shows the key barriers identified in the survey undertaken as a part of this study:

Figure 19: Barriers to scaling up of rooftop solar in the MSME sector



A detailed description of these barriers is provided in the following sub-sections.

4.1 Technical barriers

Some of the technical barriers observed during the survey are mentioned below.

4.1.1 Inadequate rooftop space in some units

A number of MSME units across the sectors were located in congested industrial estates. In these estates, the actual useable rooftop area was far less than their land footprint on account of factors such as improper building alignment, shadow from nearby objects, and utilisation of the roof for other purposes (such as storage and packaging). Furthermore, many MSMEs were operating from premises made of tin-shed structures, which typically need to be replaced after a few years. MSMEs were reluctant to commit to

long-term projects, such as rooftop solar. Inadequate rooftop area resulted in a lower solar PV potential available in comparison with electrical demand of the MSMEs. MSMEs' thought process that rooftop solar is worth considering only if it can meet their full requirement, has proved to be a major hindrance to the adoption of RTS.

4.1.2 Technological limitations of rooftop solar PV

Many small and mid-size MSMEs have round-the-clock operations with a high power requirement. Moreover, the plastics industry witnesses

sudden and high injections of power requirements because of its processes (such as extrusion, blow moulding, and injection moulding). The rooftop area at MSMEs available for solar installation was quite limited, which would lead to the realisation of smaller capacity. Therefore, such MSMEs did not see any significant financial benefit in implementing rooftop solar projects. MSME units from the pharmaceuticals sector also required 24x7 supply of high-quality power. Such units had considerable doubt about the ability of rooftop solar to provide power with the desired specifications.

"...MSMEs undergoing energy audits could also be advised on the techno-commercial feasibility of rooftop solar at their premises as part of the process.." Implementing agency of Ministry

4.2 Financing barriers

Some of the financing-related barriers observed during the survey are mentioned below.

4.2.1 High initial investment requirement

The survey findings revealed that high investment involved in rooftop solar was perceived one of the biggest barriers impeding growth of rooftop solar in the MSME sector. The high payback period also discouraged MSMEs from locking-in capital; commercial/industrial establishments were typically reluctant to divert capital to non-business and non-core activities.

4.2.2 Absence of credit ratings of MSMEs

The RBI guidelines encourage MSME units to undergo credit assessment by reputed credit rating agencies to facilitate credit access and enhance the comfort level of lending institutions. In contrast, the majority of the surveyed MSME units across the identified sectors reported that they had not undergone any credit assessment by RBI-approved credit rating agencies, such as CRISIL, ICRA, and CARE. Therefore, MSMEs were perceived to be lacking sufficient creditworthiness due to absence of credit information/ratings. This hinders access to finance for RESCOs and MSMEs for capital-intensive projects, such as rooftop solar.

4.2.3 Availability of loans for capital projects

Banks are usually risk averse and often have stringent lending guidelines that require collateral (an asset such as land, building, or machinery/plant equipment). They usually

provide recourse loans for renewable energy projects based on existing relationships with customers. The survey revealed that MSMEs, especially the micro- and small-size ones, faced challenges such as stringent collateral requirements, while seeking credit from banks. This was due to the fact that they had already pledged their plant and machinery for existing term loans. Therefore, it was difficult for them to provide additional assets as collateral, especially for capital-intensive projects, such as rooftop solar.

4.2.4 High transaction costs for financing institutions

Lending institutions did not perceive loans for rooftop solar projects lucrative enough as these loans involve high transaction costs compared to loan amount. Banks often lack institutional capacity to perform a rigorous techno-commercial due diligence of rooftop solar loan applications. Thus, evaluating such applications, some of which may be



for smaller projects, becomes inefficient in terms of cost and time. Standardised financial products, such as rooftop solar loans with a set of defined evaluation criteria, could potentially lower transaction costs for FIs.

"Cluster-based approach for financing SME sector is required owing to the heterogeneous nature of the SME sector... rigorous technical standards need to be adopted for solar rooftop projects to be developed in SME sector" – Leading Financing Institution

4.3 Commercial barriers

4.3.1 Business uncertainty

A large number of MSMEs were discouraged from committing to long-term projects, such as rooftop solar, because of uncertainty with respect to the longevity of their business. During the survey, they reported that their business was susceptible to changing government policies, regulatory requirements, and political regimes. Only mid-size industries reported that they were not significantly affected by such developments. Some industries (such as plastics) faced a risk of obsolescence due to growing environmental concerns regarding the end use of their products. In addition, a typical business planning horizon of the surveyed MSMEs was in the range of 4-5 years. This resulted in lenders being reluctant to extend long-term credit to these enterprises for implementing rooftop solar projects. It also pointed to the need for evolving solar PPAs with a reduced tenor (5-10 years) and robust provisions for early termination, termination compensation, transfer of ownership, salvage value, etc., for the MSME sector.

4.3.2 Risk of payment delay/default

Banks were also apprehensive of payment delays and default by MSME units (due to the uncertain nature of these units' operations) and thus were hesitant to sanction loans for rooftop solar projects. Therefore, instruments such as a letter of credit and partial risk guarantee should be made available to improve the bankability of rooftop solar projects and provide a sense of security to lenders.

4.4 Operational barriers

4.4.1 Lack of institutional capacity in MSMEs

MSMEs often lack the capacity and knowledge to maintain the equipment installed on their premises. A rooftop solar system's components, including panels, mounting structures, inverters, batteries, cables, and junction boxes, need maintenance. If a user does not know which annual maintenance measures need to be taken, the equipment's life can reduce significantly. This will lead to a less-than-favourable rate of return. Undertaking operation and maintenance (O&M) activities may not be a core competency of MSMEs and thus, may require a further investment in training staff or maintenance personnel or engaging a third party to carry out maintenance activities.

4.4.2 Utility-related issues

Distribution utilities in India have not taken extensive initiatives to promote rooftop solar, despite regulatory mandates. The process of implementing net metering lacks consistency across states and still

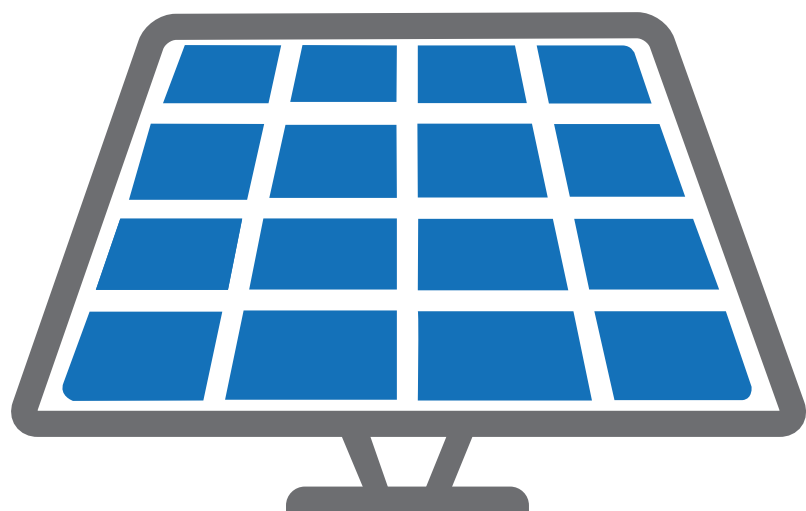
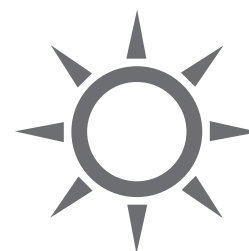
needs to be streamlined. Further, the participation of utilities in utility-driven models has been lukewarm. No specific incentives are provided to encourage MSMEs to implement rooftop solar projects. Without the active participation of distribution utilities, promoting rooftop solar among MSMEs is difficult.

4.5 Knowledge Barriers

4.5.1 Consumer awareness

An overwhelming majority of the MSMEs reported during the survey that they had little to no knowledge of various aspects of rooftop solar such as cost and benefits, government schemes and policies, sources of concessional funding, business models, prevalent market technologies/brands, and performance guarantee contracts. MSMEs perceive these aspects as one of the key barriers to the adoption of rooftop solar.

"Lack of awareness amongst MSMEs is one of the key barriers to proliferation of rooftop solar" Ministry of MSME



5. Financing instruments for rooftop solar in the MSME sector

5.1 Context

To address the financing barriers highlighted in the previous sections, suitable financing instruments and implementation frameworks need to be designed. Despite the presence of supportive federal and state policies for rooftop solar in India, financing challenges that MSMEs face for such projects are likely to continue. The reasons behind this are the lack of a formal credit history of MSMEs, business uncertainty, and unattractive project sizes for lenders and developers.

Dedicated lines of credit are available for financing rooftop solar projects. However, these financing instruments have been largely used by large and well-established developers. These developers have used these lines of credit to implement projects mostly at large C&I establishments. This was driven by robust credit profiles of the target customers and high rooftop solar capacities. The MSME and residential sectors remain untapped as they are perceived as undesirable market segments in terms of project size and creditworthiness. Thus, implementing the projects based on the OPEX model in these segments remains a challenge in the near future.

In this section, a combination of short- and long-term financing solutions has been explored. These solutions have been packaged with suitable rooftop solar business models, along with enabling implementation frameworks. The following sections detail and evaluate various financing instruments proposed for scaling up rooftop solar in the MSME sector.

5.2 Financing instruments for rooftop solar

5.2.1 Conventional instruments

In the CAPEX model, entire investment comes from power consumers. Consumers usually hire a solar EPC company that provides the turnkey installation service for entire solar power system and hands over assets to consumers. However, in the OPEX model, project developer-RESCO incurs capital expenditure and consumers pay for energy consumed/supplied by the solar power project. Both the consumer and developer sign a long-term power purchase agreement (PPA) for an agreed tenure and tariff.

In the context of MSMEs, the choice between the CAPEX model and the OPEX model depends mainly on MSME units' willingness to invest capital in RTS. During the primary survey, a majority

still viewed rooftop solar as costly, especially in terms of initial capital expenditure. As the use of the OPEX model is not widespread and limited developers focus on the MSME segment, MSMEs either end up installing RTS under the CAPEX model or not adopting it at all. The use of the OPEX model in the MSME sector is not widespread due to difficulties in obtaining financing for such RTS projects. This is because financing institutions consider lending to RESCOs (that sign PPAs with MSMEs) as risky investments. Thus, any intervention to promote the adoption of RTS by MSMEs needs to address the following key challenges:

- CAPEX: MSMEs perceive the system as costly
- OPEX: Lenders perceive the projects as risky; payment security concerns of RESCOs

Therefore, any existing or new supporting financial frameworks will need to be evaluated against these parameters to assess their suitability.

The evaluation of various support mechanisms available in the market under the CAPEX model is provided below:

"...Important to evolve customized and flexible PPAs with reduced tenor (5-10 years) of RESCO projects for the MSME sector." – Solar Power Developer

Table 3: Evaluation of supporting financing instruments for the CAPEX model

Sr. No.	Financial instrument	Ability to reduce costs	Overall suitability
1	Capital subsidy	↑ High	✓ Yes
2	Interest subsidy ²³ subvention	↑ High	✓ Yes
3	Partial risk guarantee fund	↓ Low	✓ No

²³. Interest subsidy has been considered as a supporting financing instrument under CAPEX mode as it is assumed that this benefit will be availed by financing institutions lending to the SME implementing the RTS system. Similarly, concessional loans are treated as a supporting financing instrument for the OPEX model as it is assumed that this facility will be made available to RESCOs who are approaching lending institutions to finance their RTS projects.

Financial instruments, such as capital subsidy and interest subvention, are likely to assist in reducing the overall cost of RTS installations for MSMEs. Therefore, these instruments can be considered suitable instruments for supporting the growth of RTS. In comparison, instruments such as payment risk guarantees are expected to have a lower impact under the CAPEX model, as lending decision primarily depends on a borrower’s creditworthiness, strength of balance sheet, and collaterals.

The evaluation of various support mechanisms available in the market under the OPEX model is provided below:

Table 4: Evaluation of supporting financing instruments for the OPEX model

Financial instrument	Ability to reduce risk perception of lenders	Ability to invite more players in RESCO business	Overall suitability
Partial risk guarantee fund (PRGF)	↑ High	⇔ Medium	✓ Yes
Payment security mechanism	⇔ Medium	⇔ Medium	✗ Limited
Concessional loan	⇔ Medium	↑ High	✓ Yes

Partial risk guarantee funds provide a partial guarantee to lenders to cover their losses in case of a default by the borrowing RESCOs. Such funds typically provide coverage for first loss and overall loss. Lending institutions perceive the availability of PRGF as a positive factor in their lending decision. The lowering of risk perception is also expected to enable the entry of more players in the RESCO business, thereby adding choice and competition in the sector.

In comparison with the guarantee that PRGF offers, a short-term payment security mechanism provides only a minor level of comfort to lenders. Therefore, this instrument may not be effective for promoting RTS under the OPEX model at this stage (as PPAs under the OPEX model are typically of a duration of 20-25 years).

Concessional loans are another instrument that could promote the

growth of RTS. They improve project bankability and reduce lenders’ risk perception. These loans also have the potential to attract more players in the RESCO business that is expected to result in the greater proliferation of RTS under the OPEX model.

5.2.2 Alternative instruments

Some of the alternate rooftop solar financing instruments, such as municipal solar bonds and asset securitisation, were also analysed from the perspective of their applicability to the Indian rooftop solar segment. A brief description of these instruments, along with an analysis conducted, is presented below.

5.2.2.1 Municipal solar bonds

The municipal bond model for rooftop solar combines public debt-based finance with an existing OPEX model. Under this mechanism, a public entity, which could be a special purpose vehicle (SPV) owned by a municipality, issues a bond that is supported with cash flows from rooftop solar project(s). The SPV then issues a request for proposal (RFP) seeking solar developer(s) to build, operate, and own solar rooftop projects or a portfolio of projects on municipal buildings and other consumer segments. The bond proceeds are used to finance/refinance projects of private developers/RESCO.

Currently, the municipal corporations in India play a limited role in promoting rooftop solar. Moreover, India’s debt capital market is not fully developed to support such initiatives, as it fails to attract enough investors if the credit rating of a bond is below the investment grade rating. Hence, getting high credit ratings would be difficult for municipal



" Lines of credit should be accessible to all banks. Fund of funds could be created to cater to the needs of the SME sector" Leading Financing Institution

bonds. Another potential issue of the proposed model is that transaction costs could be higher than either self-ownership or third-party financing models, mainly due to the novelty of the approach.

In the MSME sector, the adoption of rooftop solar has been low and therefore, the portfolio of such projects has not reached a sufficient scale to instil confidence in their performance. Only when such projects stabilise and start generating regular revenues, initial debt can be refinanced through municipal bonds.

5.2.2.2 Asset securitisation

Securitisation is a process in which illiquid assets are pooled and processed into financial vehicles (securities), which are then sold to investors. The process confers liquidity by providing investors a standardised, tradable product, and reduces various risks associated with an individual asset. In case of rooftop solar, loans extended to RESCOs/consumers can

be bundled into a pool (“portfolio”), which could then be sold to capital market investors through an SPV. Payment streams from a PPA, lease, or loan agreement for solar systems provide the cash flows underlying security. Rating agencies may subsequently assess (rate) the pooled assets according to the probability of payment default. These assets can then be categorised to match risk/return expectations of different types of investors.

Securitisation requires a diligent assessment and pricing of the risks associated with a particular pool of assets. This may be currently difficult in case of rooftop solar in India because the risks are not entirely understood (due to insufficient track-record and data availability) and a few metrics are yet to be evaluated. The majority of the MSMEs are not rated, which makes it difficult to categorise portfolios in terms of their credit rating. The cost of securitisation can also be high.

5.2.2.3 Supply chain financing (SCF)

The key concept behind SCF is to enhance access to financing facilities for a supplier using its buyer’s stronger credit rating. SCF requires the development of an SCF platform and an external finance provider who settles supplier invoices in advance of the invoice maturity date at a lower cost than the buyer. However, the benefit for the supplier is that the funds are received immediately after raising the invoice as opposed to on the invoice due date. The buyer approves the supplier’s invoice and pays the financial institution on the maturity of the invoice.

SCF has not been used in the rooftop solar sector primarily because of the short-term nature of the invoices raised. Further, SCF can only be implemented in select cash-rich sectors with a well-established supply chain. Most MSME sectors, such as textiles and food processing, are characterised by low cash liquidity and unorganised supply chains. Moreover, bringing large buyers on-board for such complex



arrangements and convincing them to be a part to any tripartite agreements is expected to be quite challenging.

5.3 Proposed financial instruments

As observed during the primary survey, different MSMEs have different lending preferences and face varied challenges in financing their investments. Therefore, the design of appropriate financing instruments should take into consideration the requirements of different MSME segments, thereby bringing optimisation in terms of utilisation of available resources and efficacy.

5.3.1 CAPEX model

In case of the CAPEX model, both capital subsidy and interest subvention use government funding. Given the unwillingness of policymakers (MNRE) to extend any form of capital subsidy support to the industrial and commercial sectors to implement rooftop solar projects, capital subsidy has not been considered for evaluation.

Considering the limited budgetary support, interest subvention may be extended to only those micro and small industries that are willing to invest in an RTS system and likely to face challenges in attracting RESCOs under

the OPEX model in the short term. It is proposed that this support can be provided by the Ministry of MSME as it is the line ministry for the MSME sector in India. As MSMEs hold an important place in the Indian economy, the use of public finance to support the sector has become imperative. Further, as observed during the primary survey, electricity constitutes a significant portion of the operating expenses of MSMEs. Therefore, the competitiveness of Indian MSMEs can be enhanced by offering them incentives to adopt cost-saving measures, such as rooftop solar. The Ministry of MSME can play an instrumental role in catalysing this transition.

5.3.2 OPEX model

In case of the OPEX model, concessional loans can be provided to RESCOs implementing projects at small and medium-scale establishments with good creditworthiness to improve the attractiveness of rooftop solar for such MSMEs. For other MSMEs with average creditworthiness, providing the partial risk guarantee facility (PRGF) to lenders may be a suitable option to enhance bankability and risk perception. In both the instances, RESCOs can aggregate demand within a particular cluster to bring about benefits of economies of

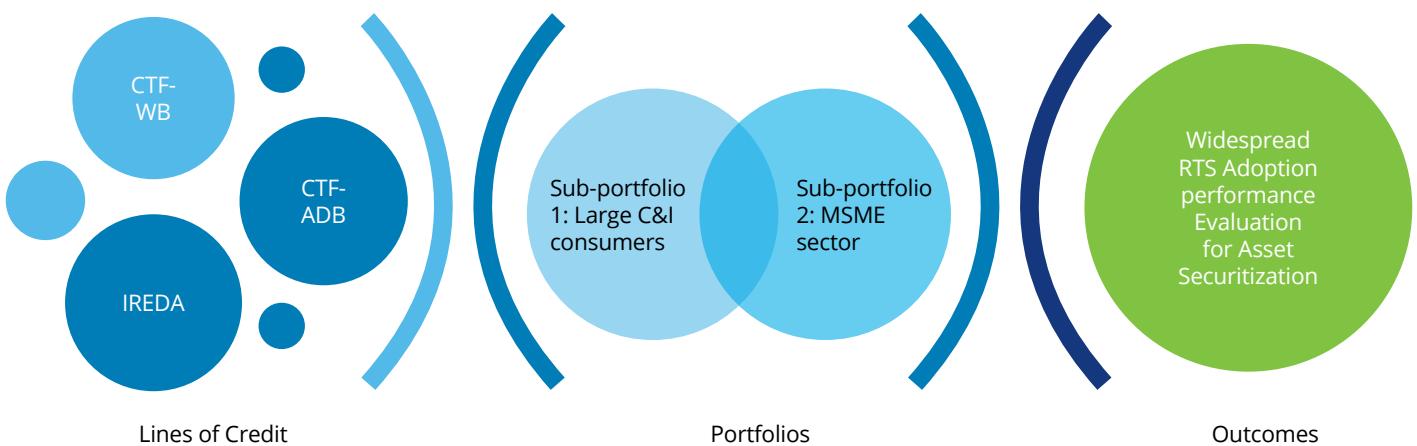
scale and make the portfolio lucrative for lenders. The local utility could also be incentivised to play a role in demand aggregation and collection/billing. Further, the portfolio of rooftop projects should be comprised of a mix of small and mid-sized enterprises for risk mitigation purposes.

Funds for these support mechanisms can be sourced from new or existing lines of credit for rooftop solar available (such as CTF–World Bank and CTF–ADB). As these credit facilities have mostly been used to implement projects at large commercial and industrial (C&I) establishments, a dedicated portfolio for the MSME sector is proposed to be created. It is recommended that eligibility criteria and evaluation frameworks for obtaining financing through these facilities under a dedicated portfolio should be tailored for the MSME sector.

The performance of projects financed under this stream can be monitored for a pre-defined period based on which other instruments, such as asset securitisation, can be considered.

The figure below shows the financing framework that is proposed for the OPEX model:

Figure 20: Proposed financing framework for the OPEX model



²⁴. As per a recent order of the Cabinet Committee on Economic Affairs (CCEA) issued on 19 February 2019, subsidy to all sectors other than residential has been discontinued.



In the long term, an arrangement known as ‘fund of funds’ can be created to support the wider participation of other financial institutions (FIs) through which ‘lines of credit’ could be established. A “fund of funds” is an interim fund mechanism constituted to overcome any restrictions that prevent the parent fund from providing funds to private-sector banks. An additional benefit is

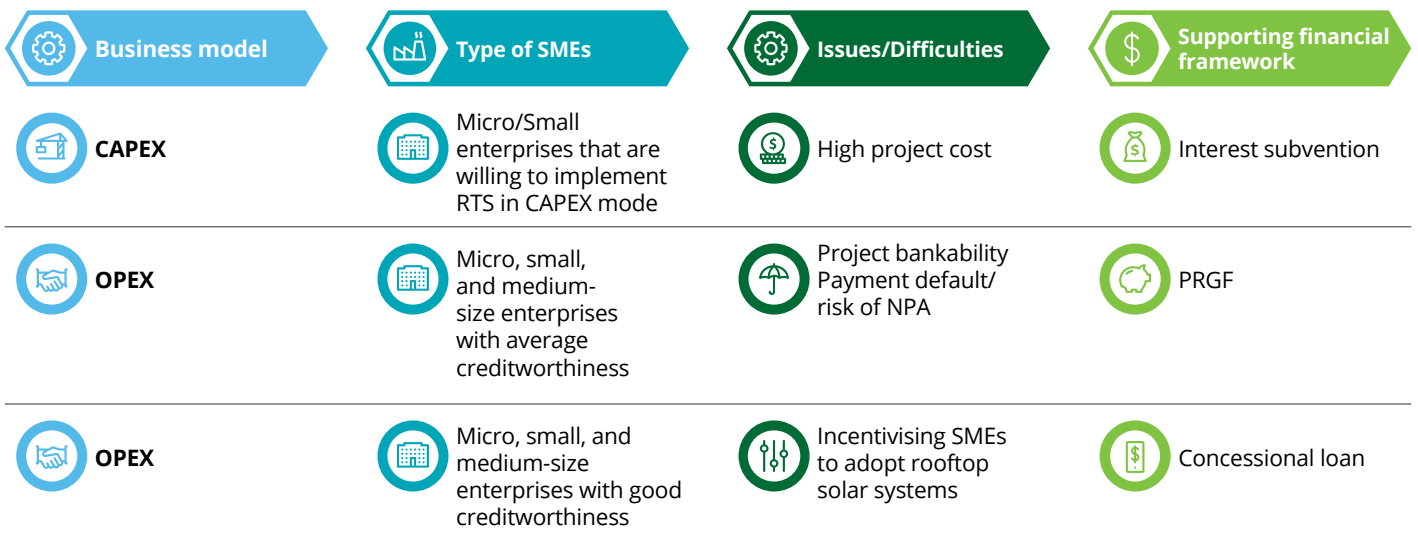
that multiple MDBs and development agencies can also contribute to ‘parent fund’, and provide support and extend concessional loans through the same interim fund mechanism. With this arrangement in place, scheduled commercial banks may be allowed to access the concessional loan mechanism for funding RESCO-based RTS projects under PPAs with MSME consumers

(either directly or through aggregators). Managing the ‘fund of funds’ could be handed over to an entity such as SIDBI, IREDA, or PFC.

5.3.3 Recommendations

In conclusion, the financial instruments proposed for different MSME segments under the CAPEX and OPEX business models are as follows:

Figure 21: Proposed business models and financial instruments to promote RTS adoption by MSMEs



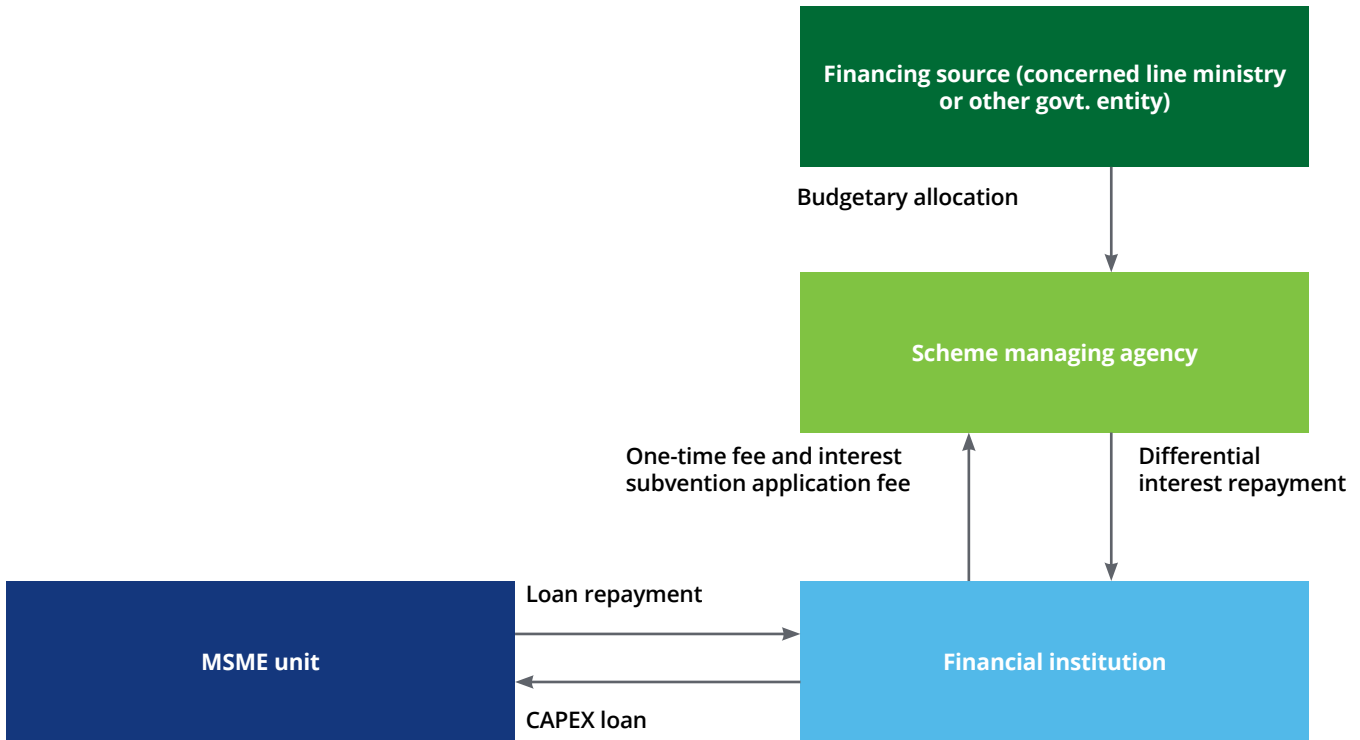
The subsequent sections describe in detail the proposed financing instruments, along with the associated implementation frameworks, pros and cons, and risks and mitigation strategies.

5.4 Interest subvention

5.4.1 Description

Interest subvention has been proposed for the self-owned model. The lower rate of financing will reduce the debt servicing burden for MSMEs. The typical structure of the fund flow in case of interest subvention is demonstrated in the figure below:

Figure 22: Typical interest subvention framework for rooftop solar



5.4.2 Current scenario

In India, interest subvention/subsidy schemes are typically supported by funds and lines of credit from development banks and through budgetary allocations of concerned line ministries.

5.4.3 Proposed implementation framework

Interest subvention support provided under the CAPEX model could offer MSMEs access to low-cost financing for RTS projects. This is a form of interest subsidy, wherein a portion of the interest is paid from a financing source (proposed to be the Ministry of MSME) through a budgetary allocation, and the remaining by the MSME consumer.

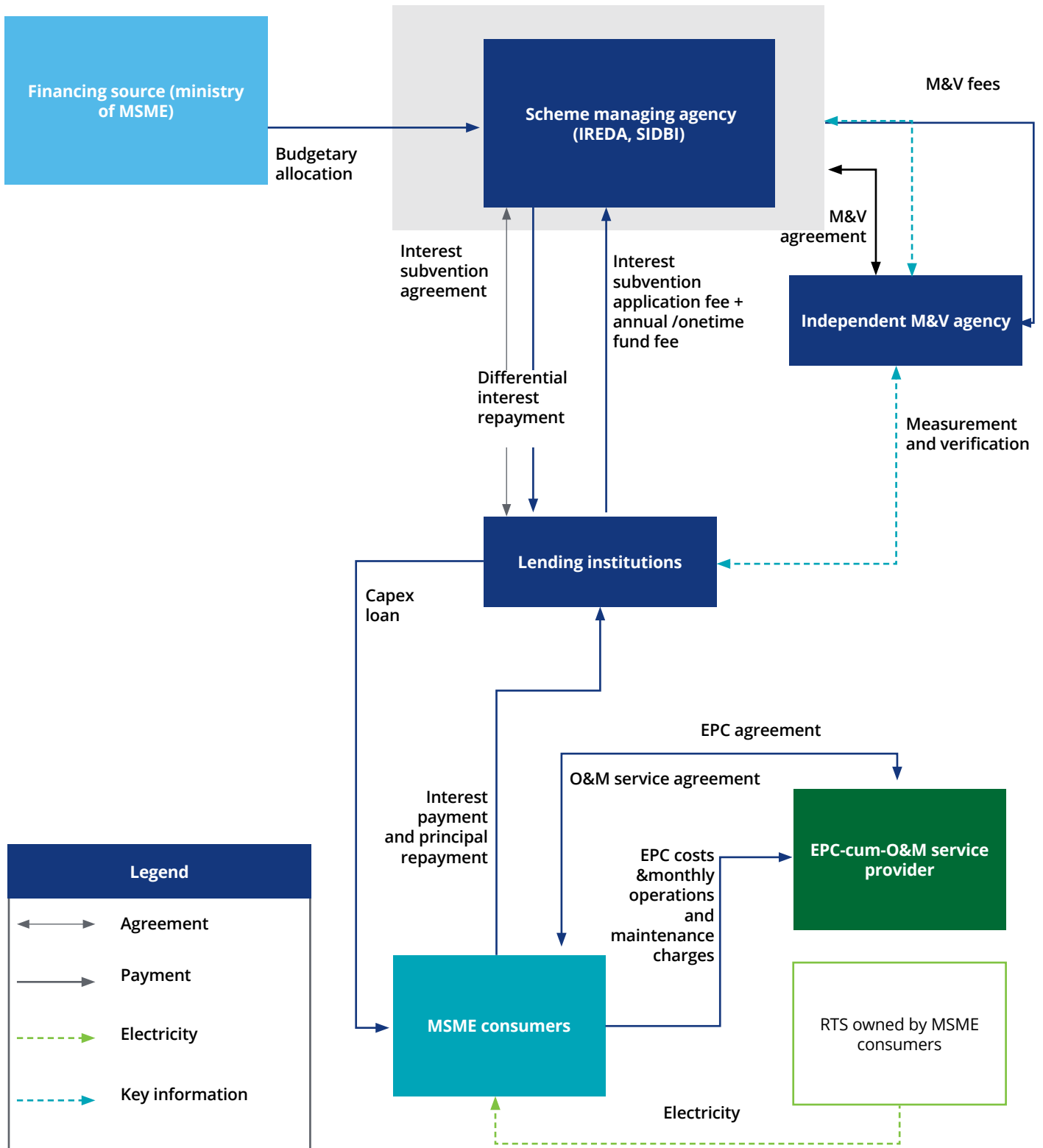
An instituted scheme management agency (SMA) manages the entire scheme. The lending institution participating in the scheme lends out to the MSME(s) developing projects under the CAPEX mode at a reduced/subsidised interest. The SMA provides differential interest support to the lending institution under a 'interest subvention' agreement. Moreover, the lending institution shall pay a one-time fund fee and an annual application fee for participating in the scheme. To ensure visibility to investors and encourage MSMEs to participate in the scheme, a time trajectory for the scheme should be defined. Such operational guidelines for the scheme can be finalised by the SMA in

coordination with the Ministry of MSME. A monitoring and verification (M&V) agency could also be designated to report the operation of the participating lending institutions under the scheme to the SMA. Initially, interest subvention of 1% may be considered.

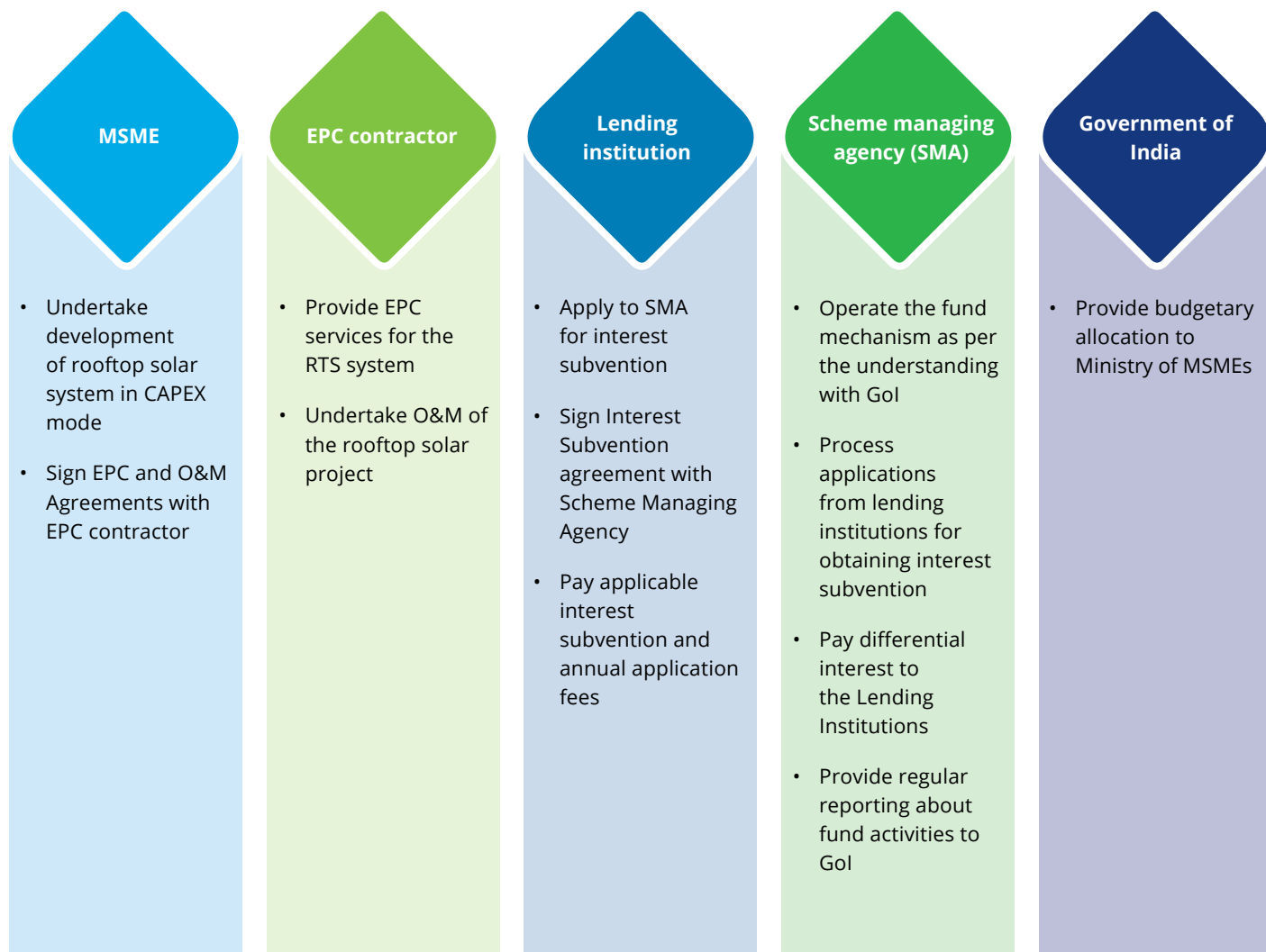
The quality of project O&M is important for the success of the scheme, as savings from the RTS will enable the MSME consumer to repay loan. Lending institutions may stipulate that only those projects will be considered eligible under the said scheme wherein the solar solution provider agrees to provide O&M for at least five years with defined technical and performance requirements.

The details of the interest subvention scheme, in coherence with the CAPEX model, are given in the figure below:

Figure 23: Proposed implementation framework - interest subvention



In the framework shown above, the role of engaged stakeholders becomes crucial and instrumental. The following illustration depicts the role of the stakeholders engaged in the framework:



5.4.4 Pros and cons

The following table summarises the key advantages and limitations of interest subvention as an instrument to promote rooftop solar:

Table 4: Evaluation of supporting financing instruments for the OPEX model

Advantages	Disadvantages
<ul style="list-style-type: none"> Lowers interest cost for consumers, thereby allowing more consumers to adopt RTS 	<ul style="list-style-type: none"> Use of the government’s budgetary resources, which are usually limited Consumers are usually more concerned with high initial capital expenditure, which is not addressed under the interest subvention scheme

5.4.5 Risks and mitigation strategies

Interest subvention carries the risks similar to those faced by other subsidy mechanisms. These risks are mentioned below:

- Risk of subsidy benefits not reaching intended beneficiaries:** There is a risk that lending institutions may not pass on the full benefits of interest subsidy to MSMEs by quoting a higher rate of interest excluding subsidy. This risk can be mitigated through disseminating market information about lending rates on a wider scale and allowing MSMEs to get access to multiple lending institutions, preferably through an online portal.

- Risk of slow delivery mechanisms:** In case of interest subvention, delay in disbursing subsidy affects the liquidity of lending institutions. This risk can be mitigated by building capacity, strengthening SMA, and adopting single-window management portals for the scheme.
- Low quality equipment affecting system performance:** This risk can be mitigated by adopting BIS standards and mandating the solar solution provider to offer O&M services for a minimum period of 5-10 years.
- The government’s policy requirements (if applicable) to promote domestically manufactured solar power

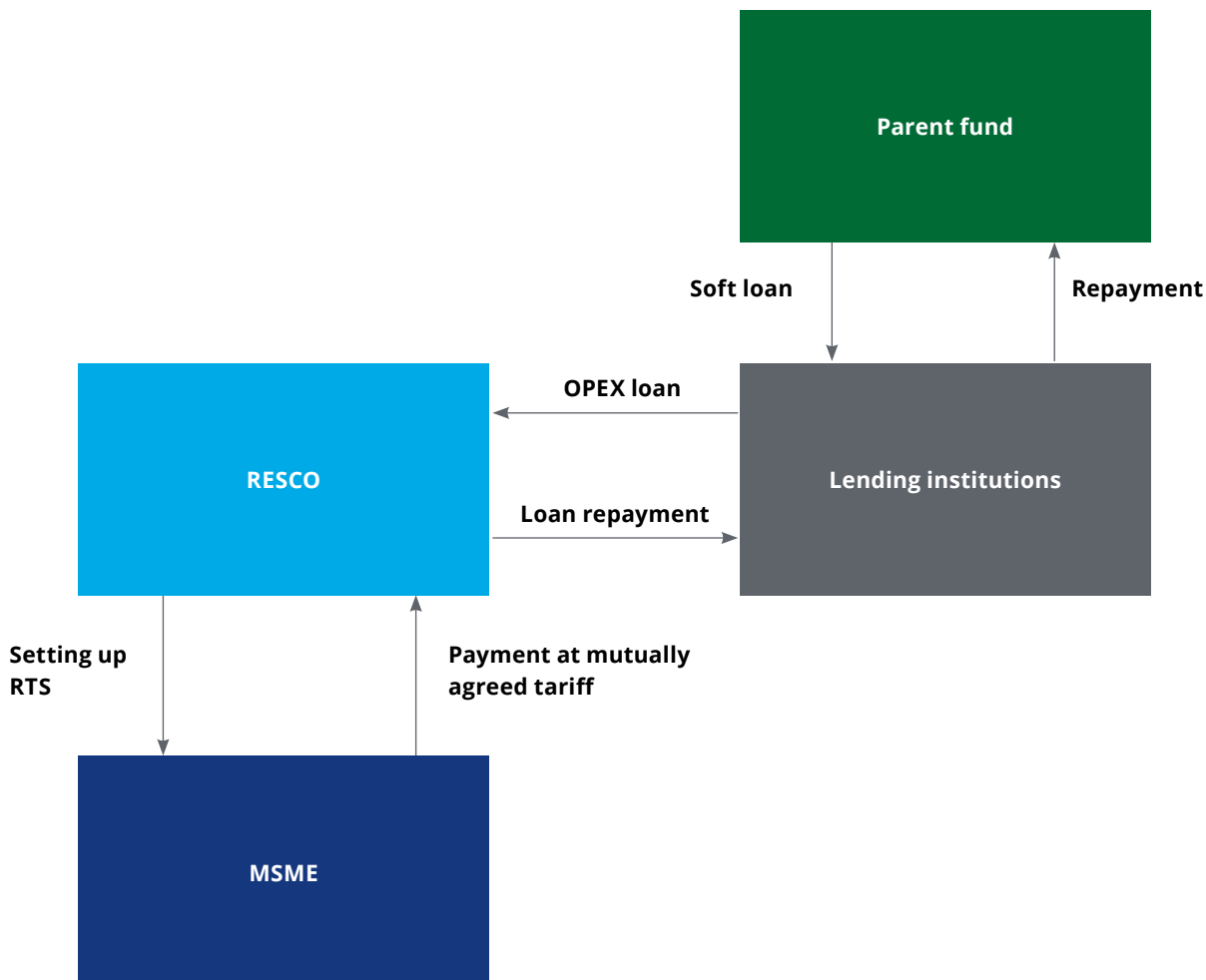
equipment, as a prerequisite for subsidy disbursement, may increase the overall cost of an RTS. This may offset the benefits of subsidy.

5.5 Concessional loan to support OPEX model

5.5.1 Description

Under this model, concessional/soft loans are made available for lending institutions from a ‘global parent fund’ through an ‘interim fund mechanism’. These concessional loans shall result in lower interest costs for RESCOs, thereby improving project attractiveness for both RESCOs and MSMEs. The typical structure of a concessional financing fund is demonstrated in the figure below:

Figure 24: Typical concessional financing framework for rooftop solar



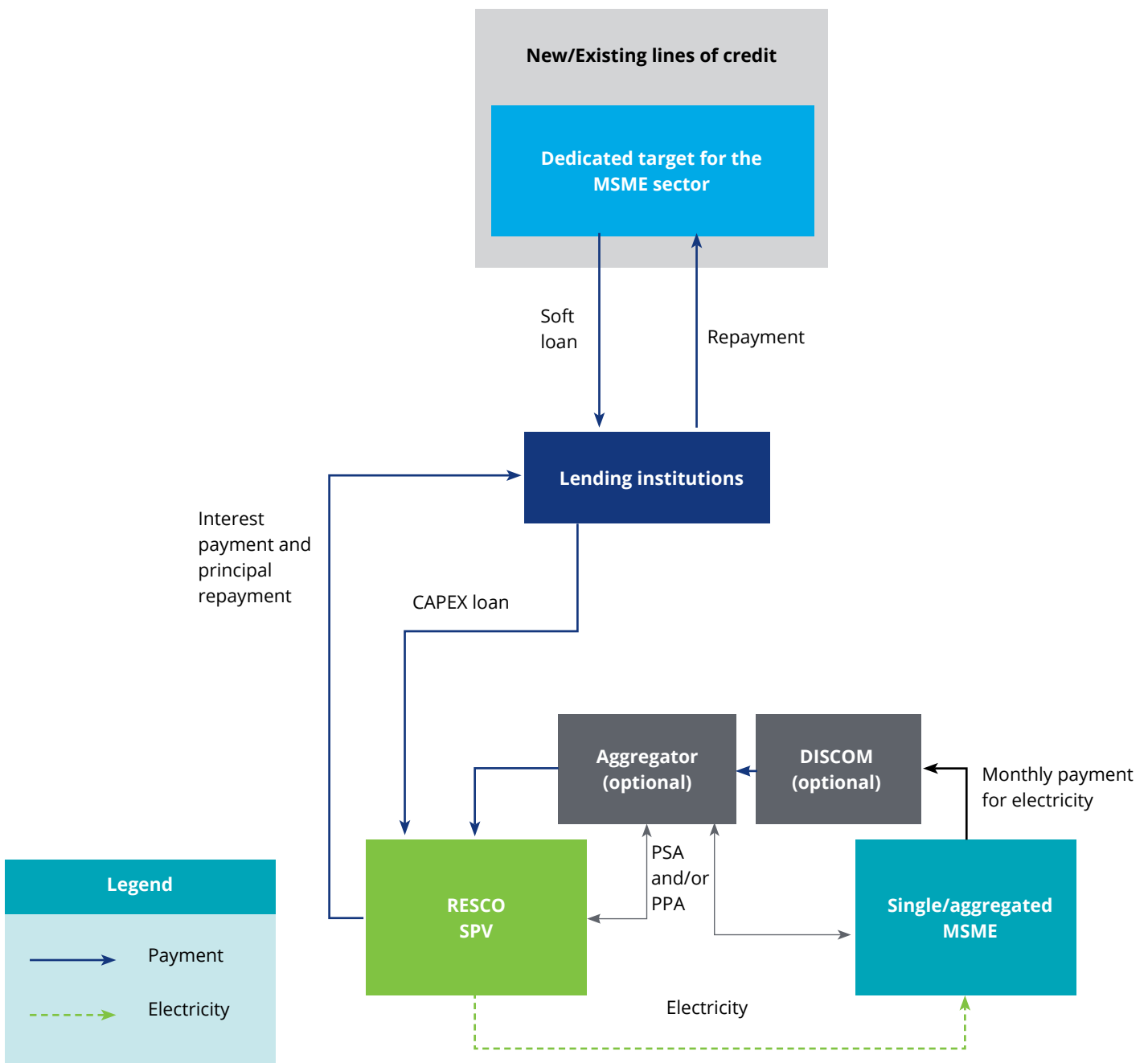
5.5.2 Current scenario

As described earlier, concessional loans for rooftop solar are currently available only from public-sector banks.

5.5.3 Proposed implementation framework

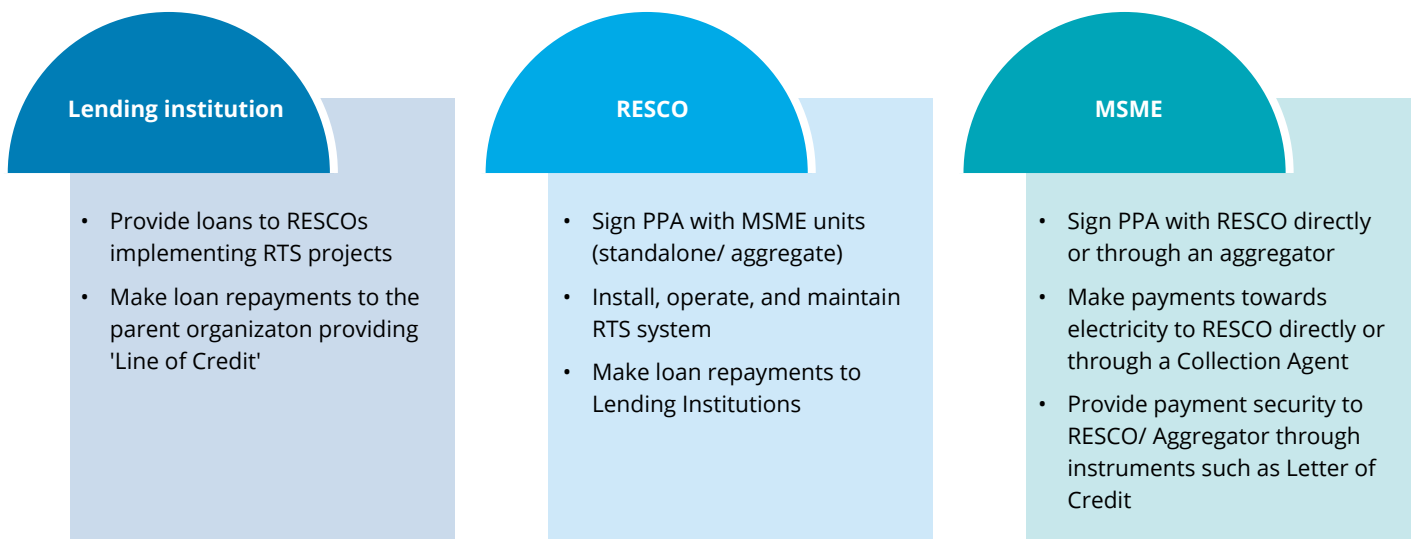
In the short term, the creation of a dedicated portfolio within the new or existing lines of credit, such as CTF–World Bank and CTF–ADB, is proposed to support OPEX models for the MSME sector.

A developer, utility, or a designated agency (such as EESL/SECI) can aggregate the capacity of such projects. For example, SECI could act as an intermediary procurer to further enhance the bankability of PPAs. In such an instance, the RESCO would sign a power sale agreement with SECI, which in turn will sign PPAs with MSMEs. The schematic of the framework is given below:





The role of the key stakeholders involved in the framework is indicated below:



Concessional lines of credit can also be used to provide *dedicated* support to segments such as MSMEs that typically face challenges in raising commercial finance under the OPEX model. The idea is to ensure that the MSME sector does not compete with other segments (such as large C&I PPAs) for raising commercial financing. In the short term,

financing dedicated MSME projects under concessional lines of credit (resulting in developing a sub-portfolio with adequate capacity within a larger portfolio of rooftop solar projects funded) is important.

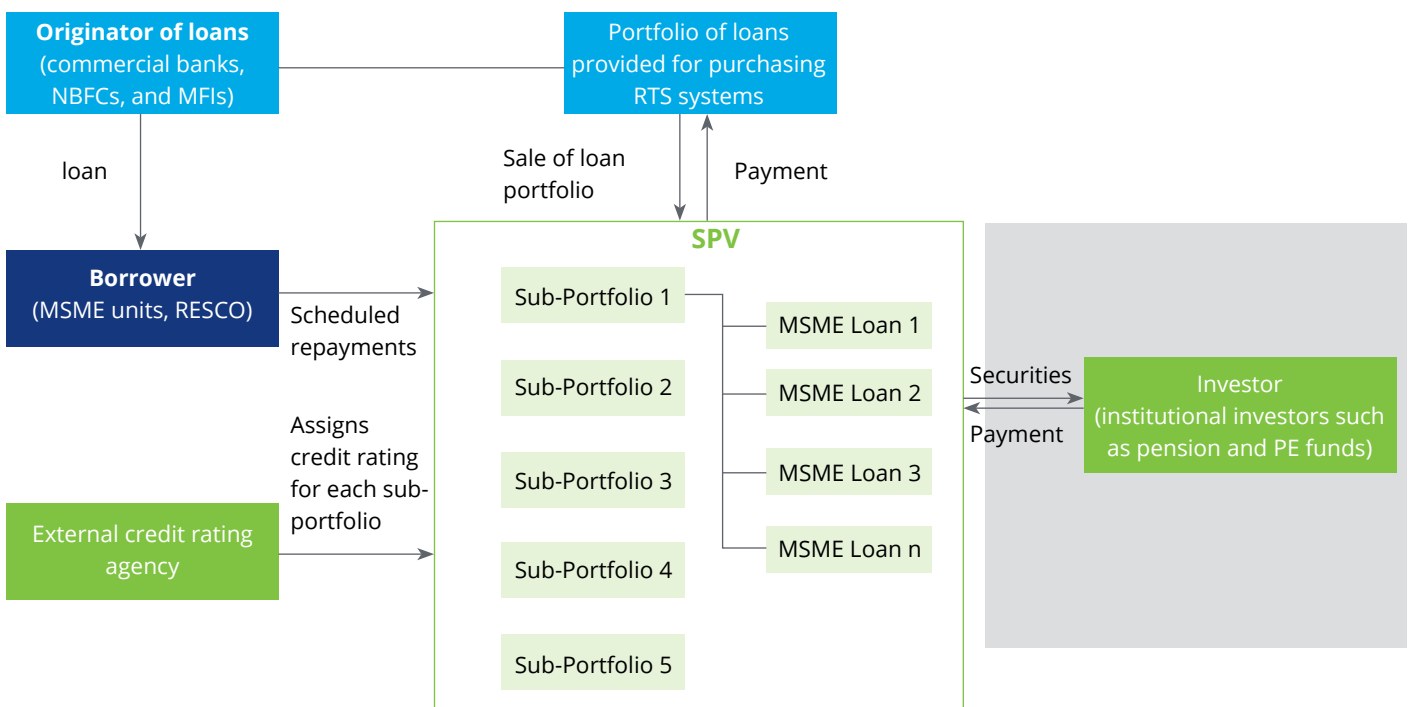
Thus, rooftop solar projects financed under concessional lines of credit can

be categorised into sub-portfolios on the basis of their credit rating, project size, customer profile, etc. This can provide adequate information on the performance of such sub-portfolios. These sub-portfolios can be treated as risk tranches and securities linked to these tranches can be issued.



In the long term, adequate information on performance will also help initiate the securitisation of such portfolios. Investors can receive their returns based on the sub-portfolio their securities are linked with. The figure below provides an overview of the proposed securitisation structure for rooftop solar sub-portfolios:

Figure 25: Developing dedicated sub-portfolios of RTS financing for MSME sector



5.5.4 Pros and Cons

The following table summarises the key advantages and limitations of concessional loans as an instrument to promote rooftop solar:

Table 6: Key advantages and disadvantages of concessional loans

Advantages	Disadvantages
<ul style="list-style-type: none"> • Improves the bankability of projects by providing comfort to lenders • Availability of concessional loans can incentivise more players to enter the RESCO business 	<ul style="list-style-type: none"> • At present, concessional loans can only be provided by public-sector banks



5.5.5 Risks and mitigation strategies

In case of concessional loans, the key risk is the absence of additional safety measures or coping mechanisms used against payment defaults by either the lending institution or RESCOs. Thus, if a portion of the concessional loans turns into non-performing assets, the parent organisation providing the line of credit also faces a risk of the corresponding loan not getting repaid in full.

The involvement of DISCOMs and aggregators (say SECI or EESL) can help mitigate the risk related to non-payment and reduce project cost to enhance project attractiveness for MSMEs.

" Demand-aggregator based RESCO business model, with the aggregator being a party to the PPA, would be most effective in proliferating rooftop solar in the SME sector.....The role of aggregation could be played by SECI or EESL with the DISCOM acting as the billing/collection agent." – Financial Institution

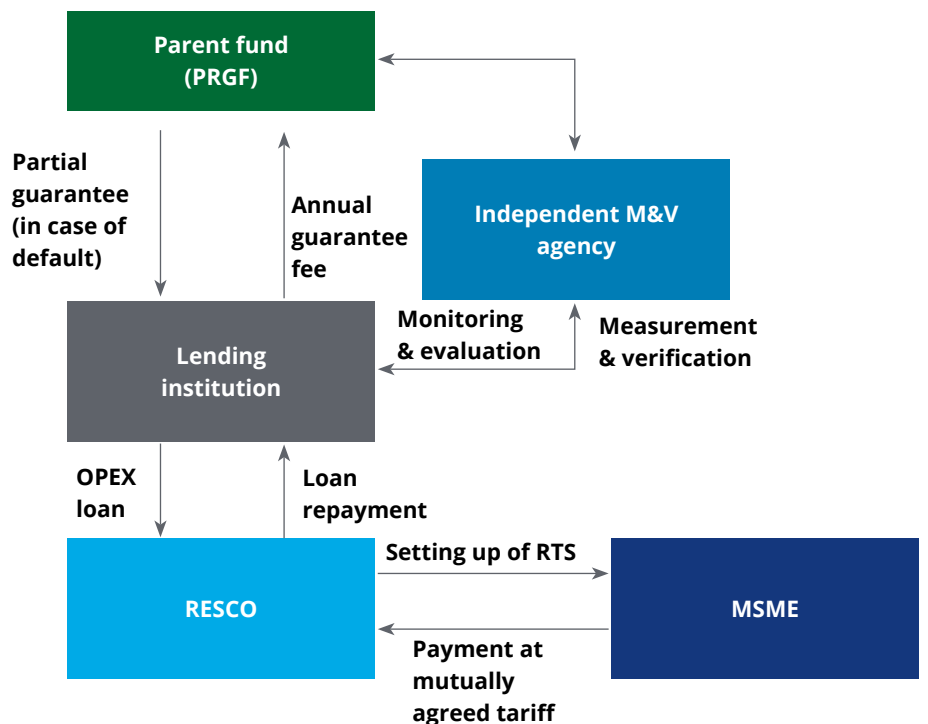
5.6 PRGF

5.6.1 Description

A PRGF provides coverage for first loss and overall default, thereby enhancing the bankability of projects and providing a sense of security to lenders. It is typically run by an implementing agency with requisite experience in the relevant

sector and an independent M&V agency that verifies the guarantee claims filed by participating financial institutions. The guarantee fund can be accessed by projects on a standalone or aggregated basis. The typical structure of a PRGF facility is demonstrated in the figure below:

Figure 26: Partial risk guarantee fund framework for rooftop solar



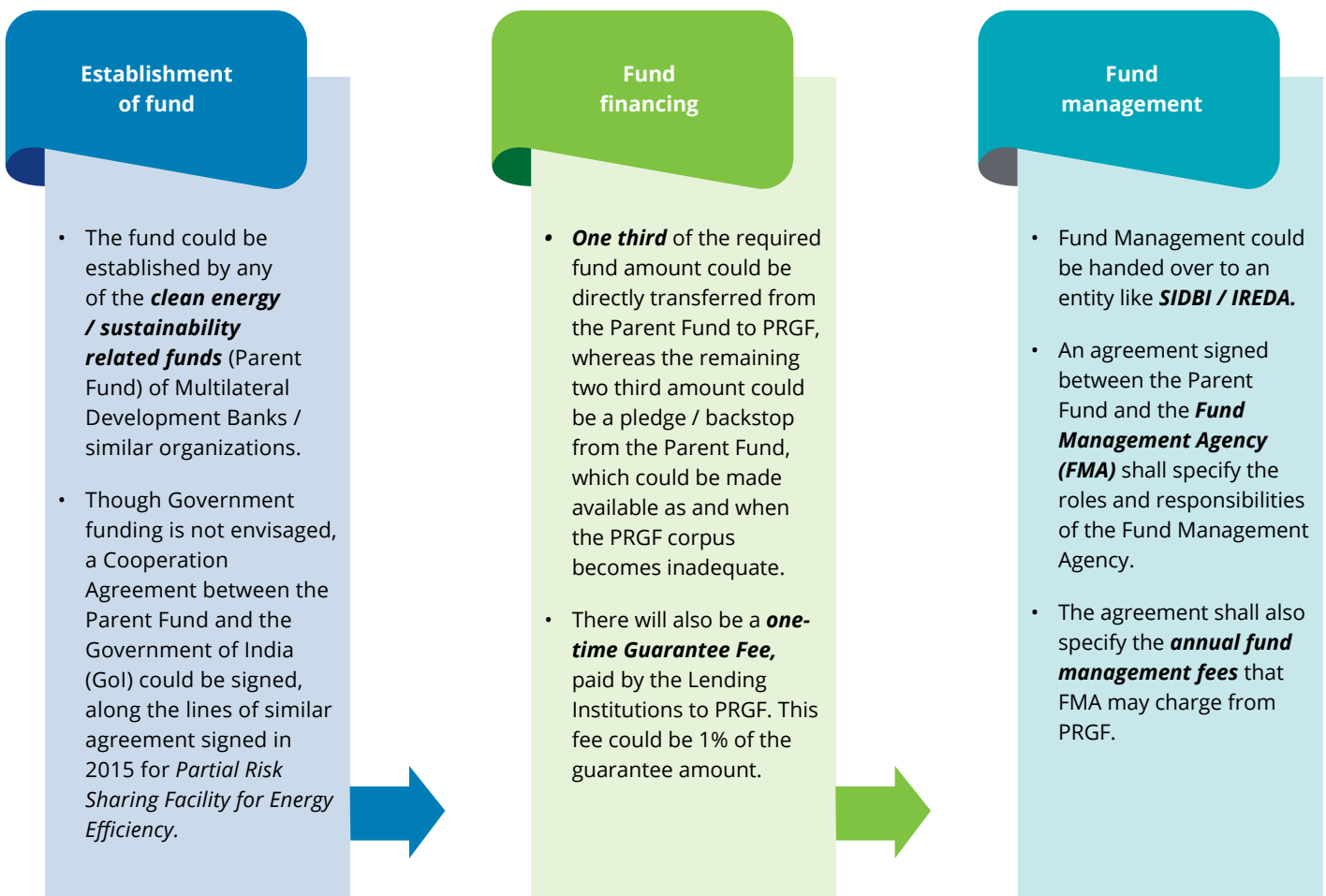
5.6.2 Current Scenario

While there is no PRGF facility for renewable energy projects in India, two funds have been set up to promote energy efficiency projects. These are the Partial Risk Guarantee Fund for Energy Efficiency (PRGFEE) by the Bureau of Energy Efficiency (BEE) and Partial Risk Guarantee Fund in Energy Efficiency by the World Bank. These funds provide guarantees to financing institutions lending to energy service companies (ESCOs) that work with MSMEs. Both the schemes have an implementing agency, and an M&V agency.

5.6.3 Proposed implementation framework

A PRGF can be constituted to provide risk guarantee to lending institutions against payment default by RESCOs. The guarantee could be provided for 50% of the loan amount for a period of 10 years. It can include the first loss coverage, which could be up to 10%²⁵ of the guarantee amount. Thus, a one-time payment default can be covered through the first loss coverage. The participating financial institutions will have to pay an annual fee to participate in the guarantee scheme.

In case of sustained default, full guarantee claim can be raised by lending institutions. In the event of the complete default, the fund managing agency (FMA) can release 75%²⁶ of the remaining guarantee amount after verification. The verification should be completed within 60 days of filing an application by an independent M&V agency. The remaining 25% of the guarantee amount could be released after the lending institution completes the recovery process. The overall structuring of the PRGF for the OPEX model can be as follows:

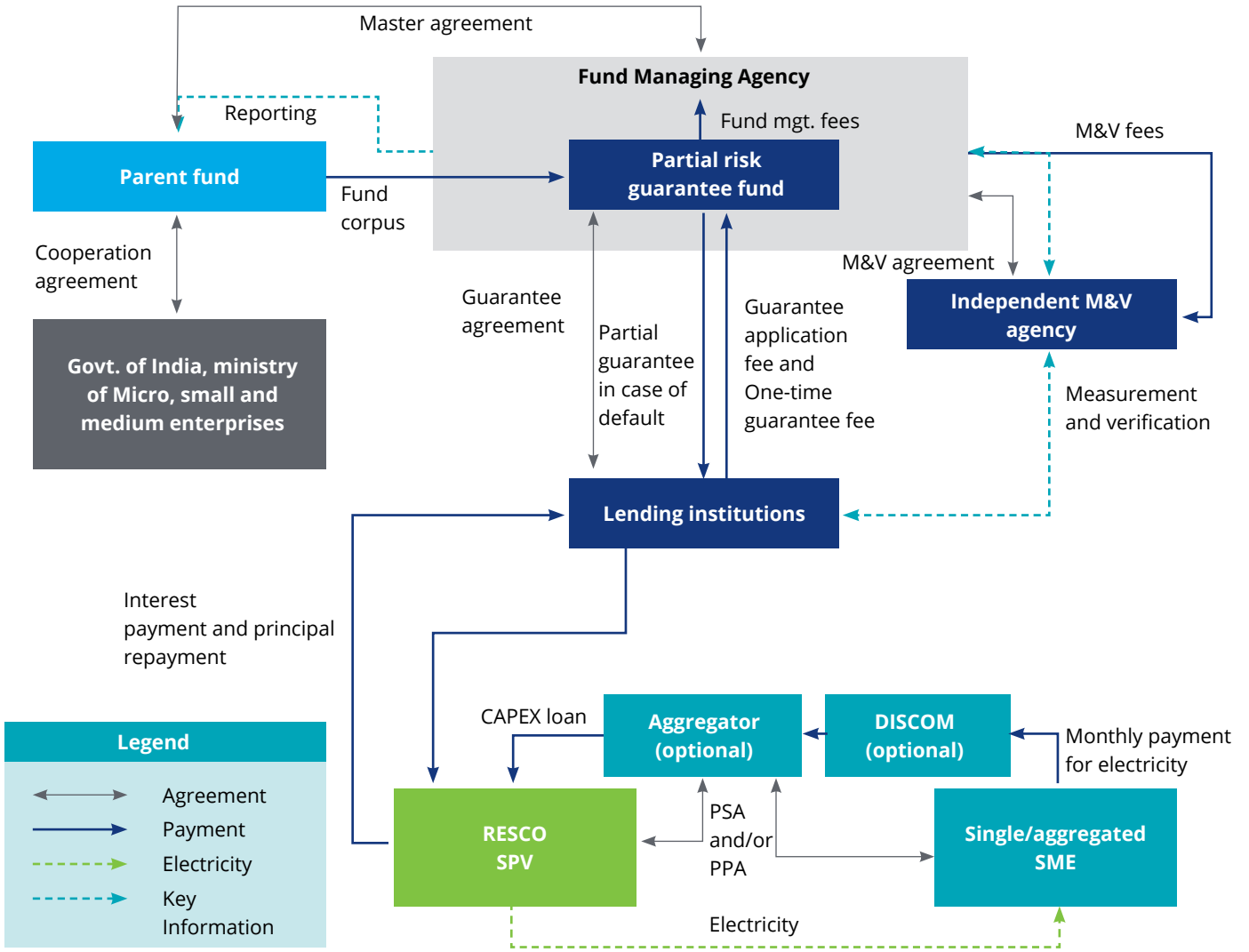


²⁵. In line with BEE PRGF scheme

²⁶. In line with BEE PRGF scheme

As specified, the PRGF scheme can work for different variants of the OPEX model. The schematic of the framework with the inclusion of the OPEX business model is shown below:

Figure 27: PRGF framework for rooftop solar



Further, the role of the key stakeholders involved in the framework is explained below:

Lending institution	<ul style="list-style-type: none"> Apply and pay fees to FMA for registration under PRGF Work with M&V agency in case of default
Fund Management Agency	<ul style="list-style-type: none"> Operate the PRGF as agreement signed with the parent fund Process applications from lending institutions for registration under PRGF Disburse guarantee based on M&V agency's report Disburse guaranteed amount to lending institutions in case of a default by RESCO in making payments
M&V Agency	<ul style="list-style-type: none"> Verify the legitimacy of guarantee claims filed by lending institutions Verify that due process is being followed by lending institutions in managing default
RESCO	<ul style="list-style-type: none"> Sign PPA with MSME units (standalone/aggregate) Install, operate, and maintain RTS system Make loan repayments to lending institutions
MSME	<ul style="list-style-type: none"> Sign PPA with RESCO (standalone/aggregator) Make payments towards electricity directly or through a Collection Agent Provide payment security to RESCO/ aggregator through instruments such as Letter of Credit

5.6.4 Pros and cons

The following table summarises the key advantages and limitations of a PRGF as an instrument to promote rooftop solar:

Table 7: Key advantages and disadvantages of PRGF

Advantages	Disadvantages
<ul style="list-style-type: none"> PRGF improves the bankability of projects by changing lenders' risk perception of RESCO PPAs. The fund may not be fully used, and the same fund corpus could later be used for alternate purposes. 	<ul style="list-style-type: none"> PRGF provides protection only to lenders, and not to RESCOs. The definition of default needs to be clearly stated – will non-repayment during one credit cycle or after NPA declaration be considered default?

5.6.5 Risks and mitigation strategies

The key risk with PRGF is the possibility of the fund becoming inadequate for managing payment defaults. PRGF typically assumes that only a proportion of the investments that it supports will fail. A failure/default rate is assumed to eliminate the need to maintain a large fund corpus, which otherwise would sit idle. However, if the actual default rate rises above

the assumed default rate, the fund runs the risk of being inadequate. The risk can be mitigated through actions such as:

- Periodic review of project default and fund adequacy, and adjustment of fund size
- Backstop support for additional funds from the parent fund

6. Way forward

The government of India is targeting achieving a capacity of 40 GW rooftop solar by 2022. To achieve the target, policymakers and regulatory commissions have undertaken initiatives to kick-start rooftop solar growth in the country. A number of dedicated lines of credit have also been established for rooftop solar projects.

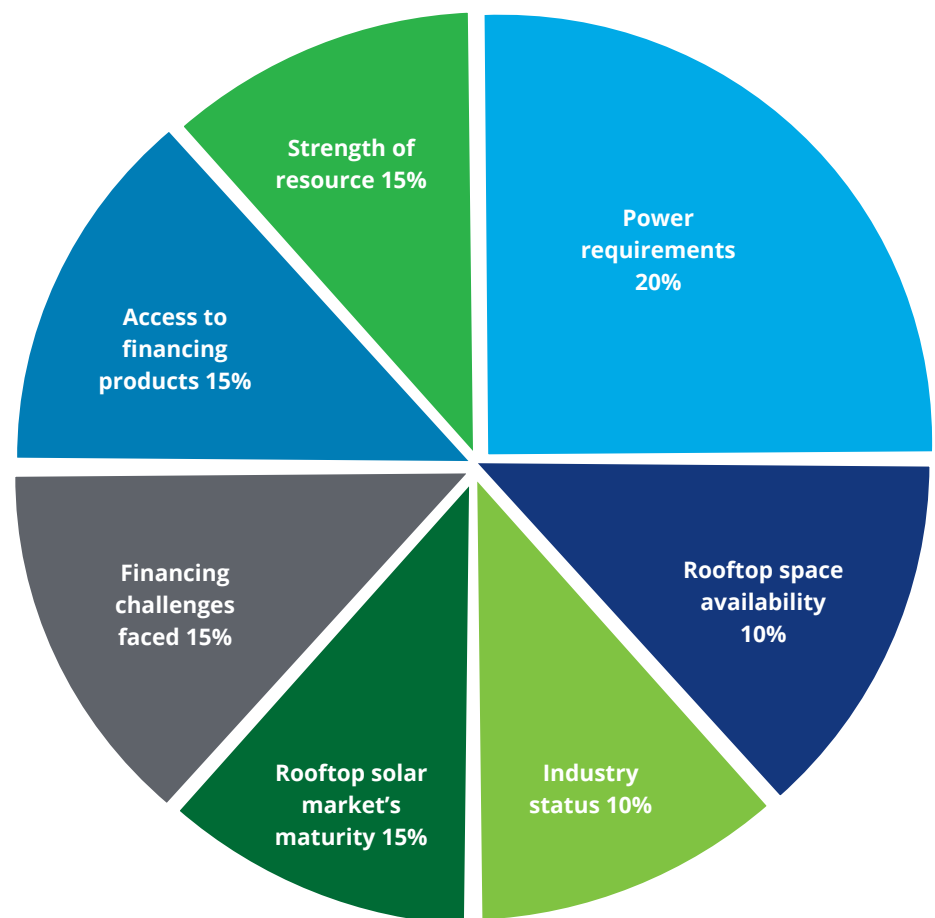
The current installed capacity of rooftop solar stood at 1.44 GW, as of December 2018, and will require interventions at multiple levels to achieve the 40 GW target by 2022. The Indian rooftop solar market under the OPEX model is mainly driven by PPAs with large industrial and commercial entities. Achieving the 40 GW target will require bringing segments such as MSME and residential consumers to the forefront. While the MNRE has continued to support residential consumers by way of capital subsidy, the MSME sector has to compete with large C&I entities with robust credit profiles offering high-capacity projects. With limited bandwidth of existing rooftop solar players (due to financing and operational constraints), the large-scale adoption of rooftop solar in the MSME segment will take much longer under the business-as-usual scenario.

Based on a market survey and stakeholder consultations, the study proposes the following interventions that will help overcome some key barriers impeding the proliferation of rooftop solar in the MSME segment.

6.1 Target attractive clusters in short term

The primary survey results indicated that there are significant differences among various MSME clusters in terms of their composition, market outlook, level of awareness, energy consumption

Figure 28: Cluster attractiveness evaluation parameters



patterns, financing requirements, etc. Therefore, evaluating and comparing MSME clusters (to help identify clusters where the likelihood of the proposed interventions achieving their intended outcomes could be higher) have become imperative.

MSME attractiveness evaluation framework

Accordingly, a framework for evaluating attractiveness of MSME clusters has been developed that takes into

consideration seven parameters covering market, technical, and financing-related aspects.

Each parameter has been assigned a weight according to its relative significance and impact on the overall intervention design approach. Further, for each evaluation parameter, a score on a scale 1 to 5 (with 5 being the best) has been assigned.

The table below presents the scores assigned to the surveyed clusters on different parameters and their overall attractiveness indices:

Parameter	Weight	Pharma	Auto components	Food products & beverages	Paper & paper products	Textiles	Plastics
Power requirement	20%	4	3	5	4	3	2
Rooftop solar market maturity	15%	5	5	2	4	3	2
Strength of resource	15%	5	4	5	5	5	5
Access to financing products	15%	5	5	4	4	2	3
Financing challenges faced	15%	4	5	4	4	2	3
Industry status	10%	4	5	4	3	4	2
Availability of rooftop space	10%	5	5	5	3	3	2
Weighted average score		4.55	4.45	4.15	3.95	3.10	2.75

The rationale for the scores assigned to these clusters is explained below:

- Power requirements** – MSMEs in the plastics and auto component clusters have high power requirements and face higher perceived performance risks for rooftop solar. As a result, they are assigned lower ratings. The food products and beverages cluster is assigned the highest rating on account of lower energy demand in comparison with the land footprint of its constituent MSMEs. Some of the pharmaceuticals MSMEs operate for only 8–10 hours a day and have moderate power requirements. Thus, the pharmaceuticals cluster is rated higher than the auto components cluster on this parameter.
- Rooftop solar maturity** - As mentioned earlier, an indicator of the maturity of the rooftop solar market is the level of awareness of the MSMEs about various aspects of rooftop solar. These aspects include government schemes and policies, technology, and business models. The survey results indicated that most pharmaceuticals and auto components MSMEs were well-informed of these aspects. Therefore, these clusters have been assigned a higher rating compared with other clusters.
- Industry status** – MSMEs in the auto components cluster serve the auto industry, which has

been experiencing rapid and consistent growth in India over the past decade. The growth was attributed to increasing income and standards of living. Therefore, the auto components cluster has been assigned the highest rating among the surveyed clusters. The plastics cluster, due to uncertainty surrounding long-term longevity of many of its SMEs, was assigned the lowest rating.

- Strength of resource** – Apart from the auto components cluster, other clusters are located in zones that receive the highest average daily solar irradiation in India. Therefore, the auto components cluster has been assigned a rating of 4, while others are assigned a rating of 5.
- Availability of rooftop space** – The survey findings indicated that food processing and beverages SMEs had a rooftop solar potential, which was more than their electrical demand. Therefore, the food processing and beverages cluster is assigned the highest rating on this parameter. The pharmaceuticals and auto components clusters are also highly rated due to the availability of abundant rooftop area at the premises of their constituent SMEs.
- Lending preferences** – Almost all of the SMEs surveyed expressed a willingness to work with different financing institutions. The key

selection criteria were the interest rate and other terms and conditions of the financing instrument. However, some SMEs in the plastics and textiles clusters reported that they were self-financing their business investments as they faced challenges in raising loans. Therefore, the plastics and textiles clusters have been assigned lower ratings compared with the other surveyed clusters.

- Financing challenges faced** – The survey revealed that many SMEs in the textiles and plastics clusters were facing financing-related challenges and thus, were self-financing their business investments. On the other hand, SMEs in the other clusters did not report any major challenges. Thus, the textiles and plastics clusters are assigned the lowest rating among the surveyed clusters. The pharmaceuticals cluster was assigned a lower rating than the auto components cluster as a few pharma SMEs in Ahmedabad reported facing financing challenges.

In conclusion, the **auto components and pharmaceutical clusters emerged the most suited clusters to rollout a pilot project/scheme for proliferation of rooftop solar**. This is largely attributed to the presence of a large number of medium-scale industries in these clusters that have robust credit profiles,

long-term business visibility, higher level of awareness, and plenty of rooftop space available for system installation.

6.2. Aggregation vehicle

In the short term, we propose that pilot projects across shortlisted MSME clusters under the OPEX model can be undertaken. About 4-6 clusters can be selected across different industries and states for pilot projects. Based on the preliminary assessment of the survey data, the surveyed clusters currently has a minimum capacity requirement of 25 MW and that can potentially be developed under such a pilot. Technical surveys shall be conducted and FIs' existing relationship with MSMEs needs to be leveraged to identify MSMEs for pilot projects.

Some handholding would be necessary initially to promote the implementation of large-scale rooftop solar projects under the OPEX model in the MSME sector. Hence, a dedicated aggregation vehicle should be developed to support the implementation of rooftop solar projects across target MSME clusters. The MNRE would have to play an important role in supporting the

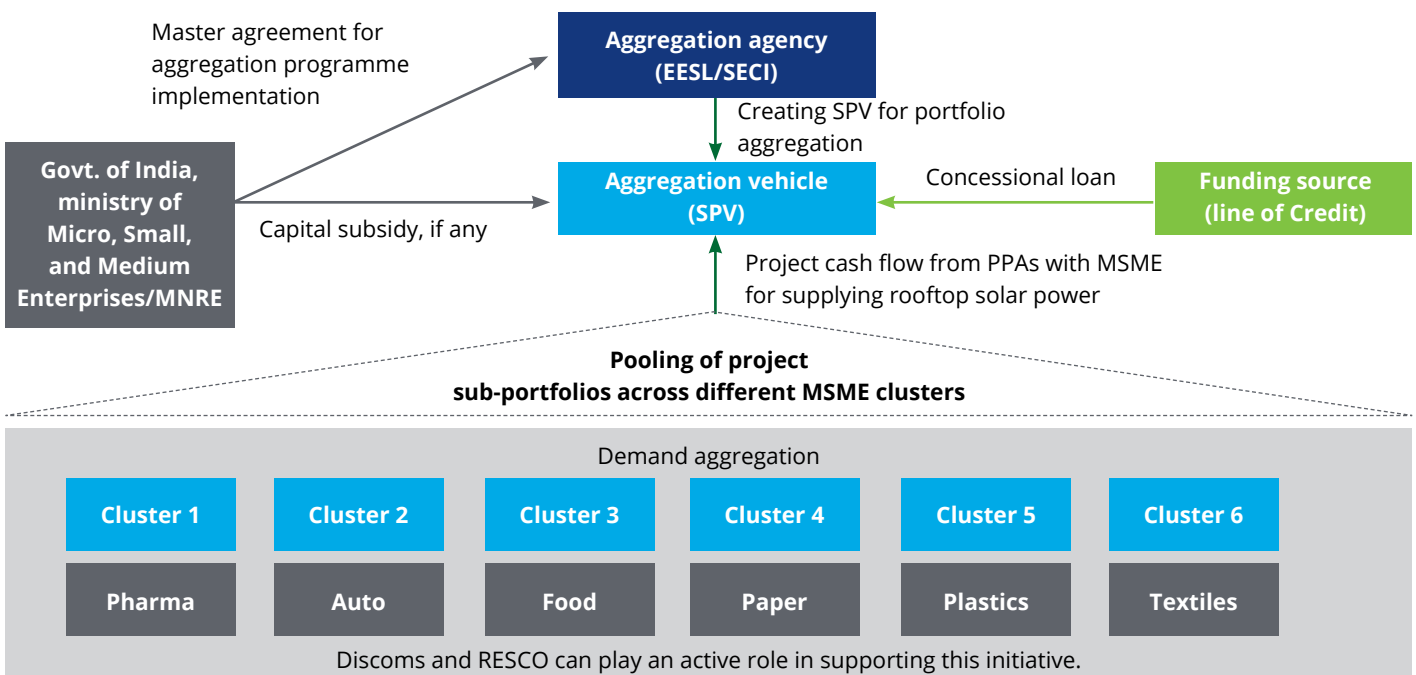
formation of this aggregation vehicle. It could also consider designing a dedicated scheme for this purpose. An implementing agency (such as SECI/EESL) can also be identified for the formation of such an aggregation vehicle.

The figure below gives an overview of possible arrangement to establish an aggregation vehicle:

The implementing agency can structure the aggregation vehicle to implement pilot projects considering the below mentioned elements:

- An aggregator can be identified to mitigate the risk of RESCOs. SECI or EESL can act as an aggregator and operate the aggregation vehicle.
- The aggregation vehicle can be set up as an SPV as limited liability company. The SPV can aggregate demand across different MSME clusters and enter into PPAs with different MSMEs. The PPA-related cash flow from MSMEs can flow to the aggregation vehicle.
- A concessional line of credit available for rooftop solar could support the financing of such an aggregation vehicle initiative.
- In the initial phase, such a vehicle may require support from the government of India in the form of a grant.
- The aggregation vehicle can develop different sub-portfolios of rooftop solar projects based on the targeted cluster, scale of capacity, MSME profile, etc. The diversity and larger pools of the sub-portfolios across different clusters could assist in risk diversification. It would also help reduce the concentration of default risk and performance issues.
- RESCOs can partner with aggregation agency in such an initiative by being a part of the overall arrangement. They may act as equity partners in the aggregation vehicle or support as an EPC-cum-O&M operator.
- *The involvement of a DISCOM as a billing/collection agent (with a provision of billing fee to DISCOM) can be promoted. MNRE is already providing performance-based incentives to DISCOMs based on RTS capacity achieved in a financial*

Figure 29: Overview of aggregation vehicle design



year. Further incentivising DISCOMs to support aggregation projects in MSMEs will be important.

- MSME units were identified on the basis of a technical survey and consultations with financial institutions. FIs' existing relationship with MSMEs is leveraged to identify the MSMEs for pilot projects.

6.3 Supporting MSME-based portfolios within existing/new lines of concessional credit

India has a vast rooftop solar potential. Given the pace of installation and availability in other attractive segments, it may take much longer to achieve large-scale rooftop solar installations in MSME units under the OPEX model. A number of lines of credit, such as CTF-WB and CTF-ADB, have been initiated to support the proliferation of rooftop solar. These lines have been quite helpful in addressing the initial barriers faced by rooftop solar developers in India. These lines, if targeted effectively, could be used further to support the scale up of RTS.

As MSMEs are less attractive than large C&I entities for implementing RTS under the OPEX model, concessional lines should target dedicated portfolios supporting rooftop solar implementation in the MSME sector. This approach can help address a number of barriers, with some being related to the existing processes and capabilities of MSMEs, developers, and financial institutions in dealing with the implementation of rooftop solar projects in the MSME segment.

During the initial stages, the funding can be targeted towards any dedicated aggregation vehicle created for supporting rooftop solar implementation in MSME units. Having dedicated RTS portfolios catering to MSMEs within larger credit lines will also assist in understanding the performance of these portfolios in the mid-to-long term and identifying MSME



sector-specific issues and their possible solutions. Over the long term, this may also assist in adopting the securitisation of such dedicated portfolios.

6.4 Dedicated scheme supported by the Ministry of MSME

On a pure commercial basis, rooftop solar tariff may be lower than utility tariffs that MSME units pay to DISCOMs. However, given MSMEs' sector-specific characteristics and credit profiles, the adoption of rooftop solar under the OPEX model is likely to take longer than expected. The role of the Ministry of MSME shall be crucial in addressing MSME sector-specific issues hindering the adoption of rooftop solar.

It is proposed that the Ministry of MSME may support financial interventions, such as interest subvention and the PRGF mechanism, to support the implementation of pilot projects across target clusters during the initial phase.

Interest subvention support provided under the CAPEX model could offer MSMEs access to low-cost financing for RTS projects. This is a form of interest subsidy, wherein a portion of the interest is paid from a financing source (proposed to be the Ministry of MSME) through a budgetary allocation, and the remaining by the MSME consumer.

While there is no PRGF facility for renewable energy projects in India, two funds have been set up to promote energy efficiency projects²⁷. A PRGF can provide risk guarantee to lending institutions against payment defaults by RESCOs. The Ministry of MSME can play an active role in setting up this facility.

6.5 Regulatory changes to support aggregation

Unlike large C&I entities, MSME units have smaller rooftops and pose high transaction costs to financing institutions. It is well accepted that

²⁷. These are the Partial Risk Guarantee Fund for Energy Efficiency (PRGFEE) by Bureau of Energy Efficiency (BEE) and Partial Risk Guarantee Fund in Energy Efficiency by the World Bank. These funds provide guarantees to financing institutions who are lending to ESCOs that work with MSMEs.



aggregation-based models are the best suited for segments with low capacities and diverse customer profiles. However, the implementation of aggregation models to facilitate rooftop solar implementation in MSME clusters in India faces regulatory hurdles.

Delhi has recently initiated discussions around the implementation of group and virtual net metering. The adoption of group and virtual net metering is likely to assist in the implementation of aggregation models in MSME clusters and overcoming issues related to scale, diverse customer profile, and financing to a large extent. Regulatory provisions must extend provisions of group and virtual net metering to MSME units.

6.6 Creating awareness and capacity building

According to the survey, an overwhelming majority of the MSMEs had little to no knowledge of various aspects of rooftop solar. These

aspects include cost and benefits, government schemes and policies, sources of concessional funding, business models, prevalent market technologies/brands, and performance guarantee contracts.

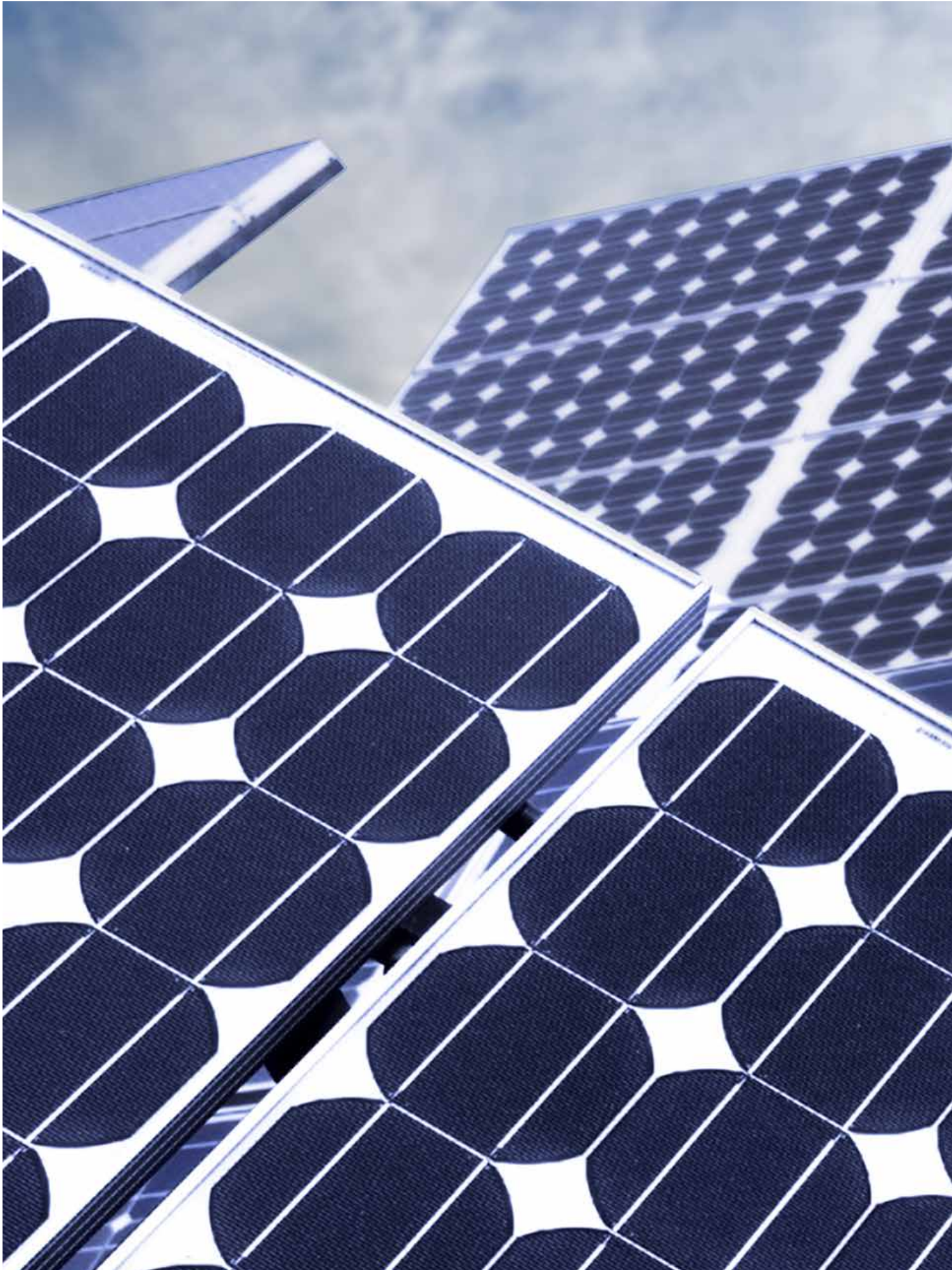
This indicates that the MSME sector suffers from a significant knowledge gap. As the MSME segment has enormous untapped rooftop solar potential, it should be supported through dedicated initiatives to bridge the knowledge gaps. Some of these initiatives are discussed below:

- Conducting workshops and seminars across targeted clusters in association with respective MSME associations
- Preparing collaterals for increasing awareness such as toolkits on solar technology, project benefits, and financing
- Developing tools to access information and streamline the

process of installing rooftop solar projects

6.7 Creating robust contracting ecosystem for MSMEs

The survey revealed that MSMEs perceive solar rooftop projects as a non-core activity. It also highlighted that MSMEs were not aware of the aspects pertaining to technical performance of a RTS. In this regard, putting in place a robust contracting mechanism with engineering, procurement, and construction (EPC) providers, and project developers under both the CAPEX and OPEX models is of great significance. Therefore, a contracting framework should be put in place to ensure the proper functioning of the RTS. Standard contracts could be put in place for different operational service-related activities to safeguard the interest of MSMEs.





7. Bibliography

Ministry of Micro, Small, and Medium Enterprises – Annual Report 2017-18

Ministry of Micro, Small, and Medium Enterprises – Annual Report 2013-14

MNRE (Ministry of New and Renewable Energy) – Annual Report 2017-18

MoSPI (Ministry of Statistics and Programme Implementation) Energy Statistics 2015-16, 2016-17, and 2017-18

MSME (Ministry of Micro, Small, and Medium Enterprises) – Report of The Working Group on Micro, Small, and Medium Enterprises (MSMEs) Growth for 12th Five Year Plan (2012-2017)

BTI (Bridge to India) – Solar Map of India 2017-18

SIDBI (Small Industries Development Bank of India) – Annual Report 2016-17 and 2017-18

IREDA (Indian Renewable Energy Development Agency) – Annual Report 2017-18

CPI (Climate Policy Initiative) Report – Drivers and Challenges for Rooftop Solar Loans to Small and Medium Enterprises in India

CEEW (The Council on Energy Environment and Water) Report – Scaling Rooftop Solar-Powering India's Energy Transition with Households and DISCOMs

SWITCH-Asia – Enabling SME Access to Finance for Sustainable Consumption and Production in Asia

Ministry of Finance, Economic Survey 2016-17, Statistical Appendix, Government of India.

Ministry of Finance, Economic Survey 2017-18, Statistical Appendix, Government of India.



Deloitte refers to one or more of Deloitte Touche Tohmatsu Limited, a UK private company limited by guarantee (“DTTL”), its network of member firms, and their related entities. DTTL and each of its member firms are legally separate and independent entities. DTTL (also referred to as “Deloitte Global”) does not provide services to clients. Please see www.deloitte.com/about for a more detailed description of DTTL and its member firms.

This material is prepared by Deloitte Touche Tohmatsu India LLP (DTTILLP). This material (including any information contained in it) is intended to provide general information on a particular subject(s) and is not an exhaustive treatment of such subject(s) or a substitute to obtaining professional services or advice. This material may contain information sourced from publicly available information or other third party sources. DTTILLP does not independently verify any such sources and is not responsible for any loss whatsoever caused due to reliance placed on information sourced from such sources. None of DTTILLP, Deloitte Touche Tohmatsu Limited, its member firms, or their related entities (collectively, the “Deloitte Network”) is, by means of this material, rendering any kind of investment, legal or other professional advice or services. You should seek specific advice of the relevant professional(s) for these kind of services. This material or information is not intended to be relied upon as the sole basis for any decision which may affect you or your business. Before making any decision or taking any action that might affect your personal finances or business, you should consult a qualified professional adviser.

No entity in the Deloitte Network shall be responsible for any loss whatsoever sustained by any person or entity by reason of access to, use of or reliance on, this material. By using this material or any information contained in it, the user accepts this entire notice and terms of use.