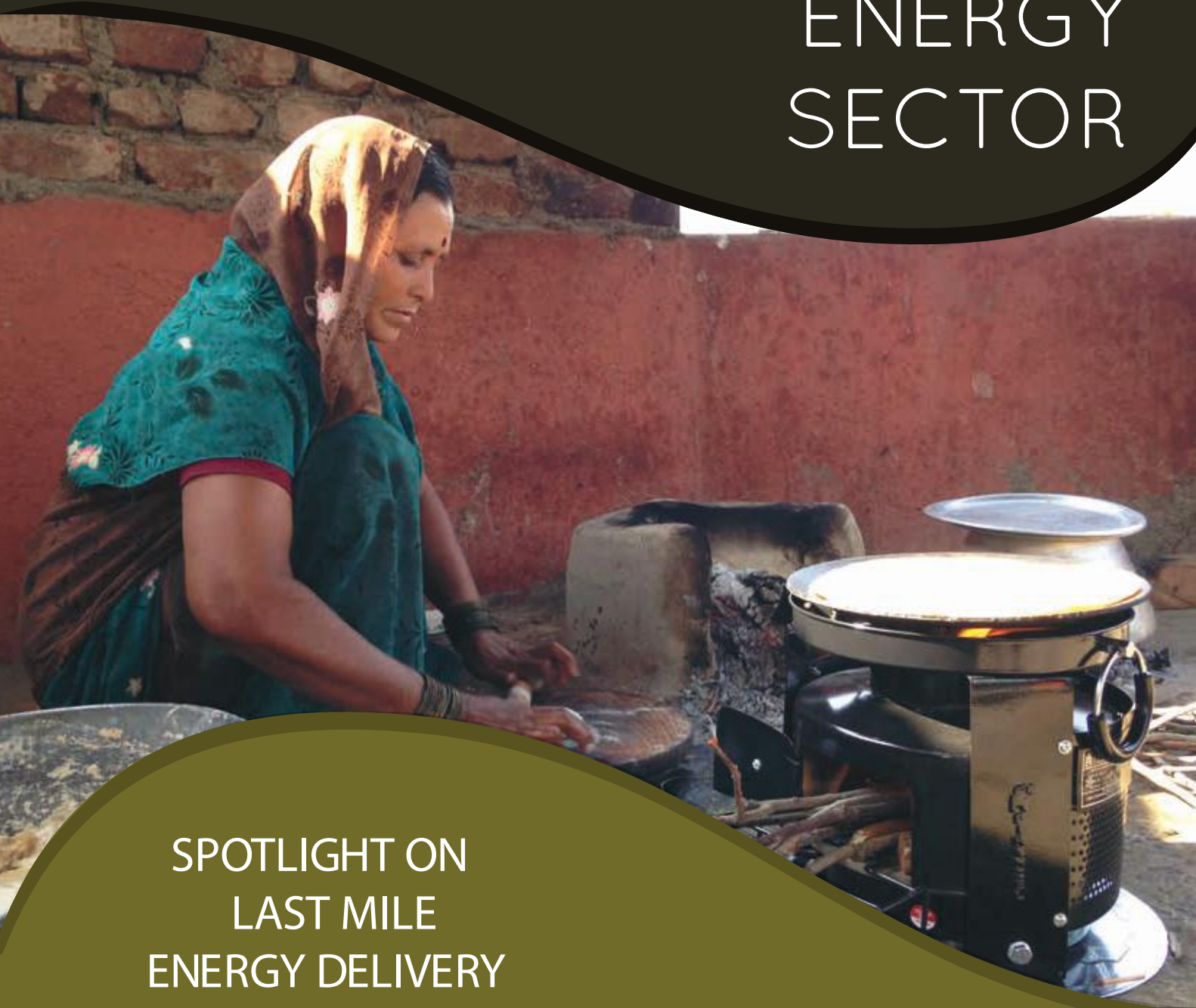


# STATE OF THE INDIAN DECENTRALIZED RENEWABLE ENERGY SECTOR



SPOTLIGHT ON  
LAST MILE  
ENERGY DELIVERY

2016-17



Energy off the  
Grid and of  
the People



# State of the Decentralized Renewable Energy sector in India: Spotlight on last-mile energy delivery (2016-17)

Acknowledgements  
List of abbreviations  
Glossary  
List of figures and tables  
About CLEAN  
Executive Summary

## Contents

<b>Chapter 1: Introduction</b> .....	14
1. 1 Background	
1. 2 Methodology	
<b>Chapter 2: Sector Highlights</b> .....	19
2. 1 Member Highlights	
2. 2 Access To Finance	
2. 3 Policy and Regulation	
2.4 Technology needs and Skill development	
<b>Chapter 3: Takeaways and Conclusion</b> .....	50
3.1 Key challenges for the sector	
3.2 Takeaways and Recommendations	
3.3 Conclusion	

References  
Appendix: List of CLEAN members

**Disclaimer:**

*The views/analysis expressed in this report/document do not necessarily reflect the views of Shakti Sustainable Energy Foundation. The Foundation also does not guarantee the accuracy of any data included in this publication nor does it accept any responsibility for the consequences of its use.*

*CLEAN's efforts are also made possible by the support of the United States Agency for International Development (USAID) under Award Number AID-386-A-14-00013. The contents of this report are the sole responsibility of the Clean Energy Access Network (CLEAN) and Small Scale Infrastructure Development Fund (S3IDF) and do not necessarily reflect the views of USAID or the United States Government.*

## Acknowledgements

CLEAN would like to thank the following members who shared information on operations, system deployment and financial needs.

Barefoot Power India	Grassroots Energy	Pollinate Energy	SELCO India
d.light Energy	Greenlight planet	Prakti	SIMPA Networks
Ecosense Appliances Pvt Ltd	Greenway Grameen Infra	Puhor	Supernova Technologies
Ecozen Solutions Pvt. Ltd	MeraGao Power	Pushan Renewable Energy	SustainEarth Energy Solutions
E-Hands Energy (India) Pvt Ltd.	MLinda	RAL Consumer Products Ltd	Sustaintech India
Emsys Electronics	Non-conventional Energy and Rural Development Society (ie.NERD Society)	Renewable Energy Applications and Products	Udyama
Envo Business Solutions	OMC Power	Riya Solar	VolksEnergie Pvt. Ltd.
Frontier Markets	ONergy Solar	Rural Spark	
Dharma Life / Gajan India Pvt Ltd	Oorja Development Solutions India	S.G.Foundation	
Gram Oorja Solutions	Phoenix Products	Samuchit Enviro Tech	

We would also like to thank the following financial institutions that shared information and insights on the access to credit in the DRE sector- TATA Cleantech, Oiko Credit, RMGB, Yes Bank and cKers Finance.

We are thankful to the Shakti Sustainable Energy Foundation for financially supporting this project and their support to the Network.

We would like to thank Bhaskar Deol, Rajeev Palakshappa and Amartya Awasthi for undertaking the research on Access to Debt and for their timely inputs and comments on sections of the report. We are extremely thankful to William Brent and the Power for All team, the GOGLA team, Rekha Krishnan and Abhishek Jain for reviewing the various sections of the report and providing their valuable feedback. We are grateful for the information shared by Smart Power India, SELCO Foundation and Sasmita Patnaik at CEEW. We would like to also acknowledge the efforts of Hari Natarajan, Asha Jyothi, Thomas Pullenkav, Ashis Sahu and Santosh Singh who helped frame the original research. Thanks to Vivek Sashty and Gursimran Kaur for their final review and edits, and to Vibhav Sinha and Sudarshan Gopalan for contributing to the design and graphics of the report.

We thank USAID for their constant support to the Network. Finally, we would like to thank the CLEAN Board and other members of the CLEAN team- Harihara Mohapatra, Mohit Bhatia, Anand R M (Intern)- for providing inputs and support at various stages of the project.

### Project team:

Surabhi Rajagopal, Madhuri Negi, Nitin Akhade

## List of abbreviations

- BP: Bharat Petroleum corporation
- BPL: Below the Poverty Line
- Capex: Capital Expenditure
- CBO: Community Based Organization
- CFA: Central Financial Assistance
- CGST: Central Goods and Services Tax
- DDUGJY: Deen Dayal Upadhyaya Gram Jyoti Yojana
- DISCOM: Distribution company
- DRE: Decentralized Renewable Energy
- FY: Financial Year
- GST: Goods and Services Tax
- HP: Hindustan Petroleum corporation
- IOC: Indian Oil Corporation
- IGST: Integrated Goods and Services Tax
- INDC: Intended Nationally Determined Contributions
- INR: Indian National Rupee
- IREDA: Indian Renewable Energy Development Agency
- IRRs: Internal Rate of Return
- KW: Kilo Watt
- LPG: Liquefied Petroleum Gas
- MNRE: Ministry of New and Renewable Energy
- MoP: Ministry of Power
- MoPNG: Ministry of Petroleum and Natural Gas
- MSME: Micro, Small and Medium Enterprises
- NABARD: National Bank for Agriculture and Rural Development
- NCEEF: National Clean Environment and Energy Fund
- NEP: National Energy Policy
- NGO: Non-Government Organizations
- NITI (Aayog): National Institution for Transforming India
- NPA: Non Performing Assets
- NSM: National Solar Mission
- PDS: Public Distribution System
- PMUY: Pradhan Mantri Ujjwala Yojana
- PSL: Priority Sector Lending
- PSU: Public Sector Undertaking
- RE: Renewable Energy
- REC: Rural Electrification Corporation
- RESPs: Rural Energy Service Providers
- RGGVY: Rajiv Gandhi Grameen Viduyutikaran Yojana
- RRB: Regional Rural Banks
- SCGJ: Sector Council for Green Jobs
- SDGs: Sustainable Development Goals
- SHS: Solar Home Systems
- SGST: State Goods and Services Tax
- SNA: State Nodal Agencies
- VAT: Value Added Tax

## Photo Credits:

Ravi Engineering and Chemical works

CLEAN and AIREC

Envo Business Solutions

MLinda Foundation

SELCO Foundation

Claro Energy

The Batti Ghar Foundation

Samuchit Envirotech

Simpa Networks

## Glossary:

- **1 USD = ~ INR 64**
- **2016-17- Year of assessment:** The year is defined in terms of the Financial Year in India, which begins in April and ends in March. Year 2016-17 refers to the period April 2016 -March 2017.
- **Clean cooking solution providers:** Entities that manufacture, sell, install, service improved biomass cookstoves, biogas units and solar cooking solutions
- **Distribution agencies:** Entities that distribute clean energy products for cooking and/or electricity, by developing local networks.
- **Last mile energy delivery entities/ enterprises/ practitioners:** Primarily for-profit, but also includes the few not-for-profit organizations that are directly involved in on-ground delivery of clean energy solutions through standalone systems, clean cooking solutions, micro and mini grid solutions or distribution of portable or standalone products
- **Micro- and Mini-grid system providers:** Entities that design, install, maintain and in most cases operate pico-, micro and mini-grids that provide electricity to households and/or commercial establishments in an area
- **Micro, Small and Medium-Sized Enterprises (MSMEs):** The enterprises follow the definitions as provided in the MSMED Act, 2006 of India
- **Pico, Micro and Mini grids:** Pico and micro-grids cover installations of 300W to 9KW; Mini-grids cover installations between 10KW and 60KW
- **Productive loads:** Applications beyond lighting that directly affect the productivity of the livelihood or enterprise powered by decentralized clean energy- usually solar energy; Ideally using, efficient appliances
- **Solar powered water pumps:** Typically used for irrigation, these pumps could be AC or DC, and powered using solar energy; with reference to the end users served by Decentralized Renewable Energy (DRE) enterprises, typically pump sizes range from 1-2HP to 10HP, with most of the demand being 2HP, 3HP, 5HP pumps.
- **Stacking (in cooking):** Stacking is the use of multiple stoves and cooking fuels by one household and allows for a range of options to be available to the household depending on the type of cooking to be done.
- **Standalone electricity system providers:** Entities that manufacture, sell, install, service pico-products and lanterns, home systems and standalone systems for lighting and electricity generation.

## List of figures and tables

- *Figure 1: Representation of the Ecosystem to support DRE interventions and solutions*
- *Figure 2: CLEAN's area of specialization*
- *Figure 3: Categorization of CLEAN membership*
- *Figure 4: Number of systems deployed during 2016-17*
- *Figure 5: India map of household electrification rates in each state*
- *Figure 6: Map with state level operations of last mile delivery entities*
- *Figure 7: Availability and Need for debt and equity per annum*
- *Figure 8: Access to debt survey respondents, by category*
- *Figure 9 a: Finance raised so far and expected needs over the next 3 years (2017-2020)- by category and type of finance*
- *Figure 9 b: Finance raised and expected needs over the next 3 years (2017-2020)- Debt, Equity, Grant*
- *Figure 10: Current and planned uses of Debt*
- *Figure 11: Interest rates and tenures on debt accessed by enterprise respondents*
- *Figure 12: Debt terms that enterprises most prefer to amend*
- *Figure 13: Timeline on National level policies in the sector*
  
- *Table 1: Summary of types of financing and their characteristics*
- *Table 2: Overview of the main credit lines and funds available*
- *Table 3: Key characteristics of surveyed companies*
- *Table 4: List of financial institutions that provided debt to respondents*
- *Table 5: Number of enterprises reporting access to various debt sources and expected end uses*
- *Table 6: Compilation of various Central and State taxes being subsumed under GST*
- *Table 7: Summary of key takeaways from the DRE sector*

## About CLEAN:

The Clean Energy Access Network is an all India representative organization launched in 2014 with a clear mandate to support, unify and grow the decentralized clean energy sector in India. With a membership of 104 enterprises and organizations, it particularly aims to bring together diverse stakeholders across India working to improve energy access for the rural and urban poor and create an inspiring model for countries around the world to follow.

CLEAN is technology agnostic. Technologies include solar, wind, bioenergy, pico-hydro. The scale of its members' operation ranges from pico solutions to larger, decentralized solutions and they are mostly small and medium enterprises. CLEAN recognizes that decentralized energy solutions move beyond bridging the energy gap by addressing lighting, cooking, pumping needs and so on to positively affect outcomes in education, health and agriculture and enhances livelihood opportunities. Decentralized clean energy has an impact on the overall quality of life.

## Executive summary

### Background:

The Sustainable Development Goals (SDGs) were adopted by the United Nations General Assembly in 2015, with the aim of alleviating the challenges of poverty, hunger, health care, education, livelihoods, gender equality among others by 2030. SDG7 outlines the need to provide access to affordable, reliable, sustainable, and modern energy services for all. This goal is particularly relevant in the Indian context as the world's second most populous country with 1.2 billion people. Of this total, more than 304 million people lack access to grid-based electricity and more than 500 million people still depend on solid biomass for cooking.

The Government of India (GoI) in September 2017 put forward the "Saubhagya" initiative, with a goal of achieving universal household electrification by December 2018 (i.e. over the next 15 months). Yet based on current government data, approximately 300,000 households are being connected to the grid on a monthly basis. Even if the rate of electrification is doubled, it could take more than 10 years to electrify the remaining 40 million households.

Existing centralized approaches are just one way to address the energy access challenge. Decentralized Renewable Energy (DRE) solutions - with a range of energy sources and using a number of business models- offer an option to address these challenges while also enabling customization of design, operational models, collections, payments to the local context. Their deployment through increased Public- Private Partnership can help achieve the shared objectives of powering rural India's development.

For a sector with a growing number of stakeholders involved in energy provision across regions, an alliance was essential to align efforts and ensure a stronger representation. Thus, with the aim of building an enabling ecosystem and creating a voice for multiple actors in this sector to institutionalize DRE in rural and urban energy provision, the Clean Energy Access Network (CLEAN) was established in September 2014. The network is technology and scale agnostic. By working across the verticals of Technology, Skills, Access to Finance, Policy and Information and Networking, CLEAN seeks to not only provide common services that benefit members, but also provide stronger representation for the interests of its members amongst external stakeholders such as Government agencies and financiers. Last mile energy providers have a pivotal role to play, and the sector seeks to continue to work with the Government of India to achieve full integration of DRE solutions for a 21<sup>st</sup> century energy system.

The CLEAN membership includes 104 members in total, as of July 2017. Of these, approximately 69 are organizations and enterprises involved in the last-mile delivery of energy access solutions, which includes one or more of the following- design, manufacture, sale, distribution, installation, maintenance of DRE systems. The remaining 35 organizations are facilitators working on various aspects of DRE and energy access including research, innovation, training, consultancy, financial linkage, policy advocacy and so on. In addition, there are 13 founding members of the Network broadly consisting of practitioners, field-based organizations, research think tanks, existing networks and facilitators.

As the inaugural version of CLEAN's State of the Sector report, the focus for this year is on CLEAN's core membership base- organizations involved in last-mile energy delivery. Much of the representation is from solar

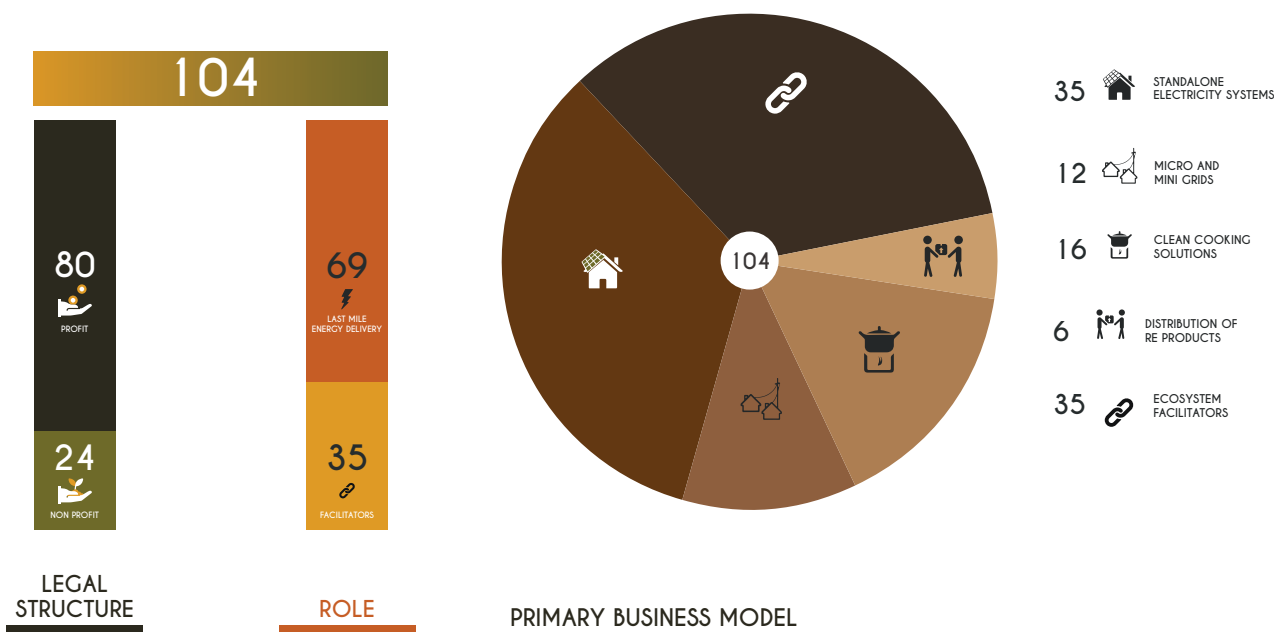


and biomass enterprises engaged in the deployment of pico-products, standalone systems (for electricity and cooking) and micro/mini-grids.

While CLEAN aspires to provide a holistic and all-inclusive assessment of the sector, this year's report has only captured the work and challenges of the Network's own member-base. The paucity of time prevented the identification, engagement and assessment of other companies engaged in last mile delivery of energy access solutions in India, who are not part of the CLEAN membership base<sup>1</sup>. The Network seeks to address this in next year's report and have a better representation of the efforts of energy access practitioners and ecosystem facilitators.

### Member Highlights:

The figure below provides an overview of the CLEAN membership, broken up by legal structure, role and primary business model.



### Categorization of CLEAN membership

Source: Self-reported information and CLEAN analysis

For the purposes of the report and analysis of findings, enterprises are broadly categorized based on their primary model for deployment, including the product/service being provided and their role in the process. The various possibilities in terms of roles and products offered for each category are outlined below:

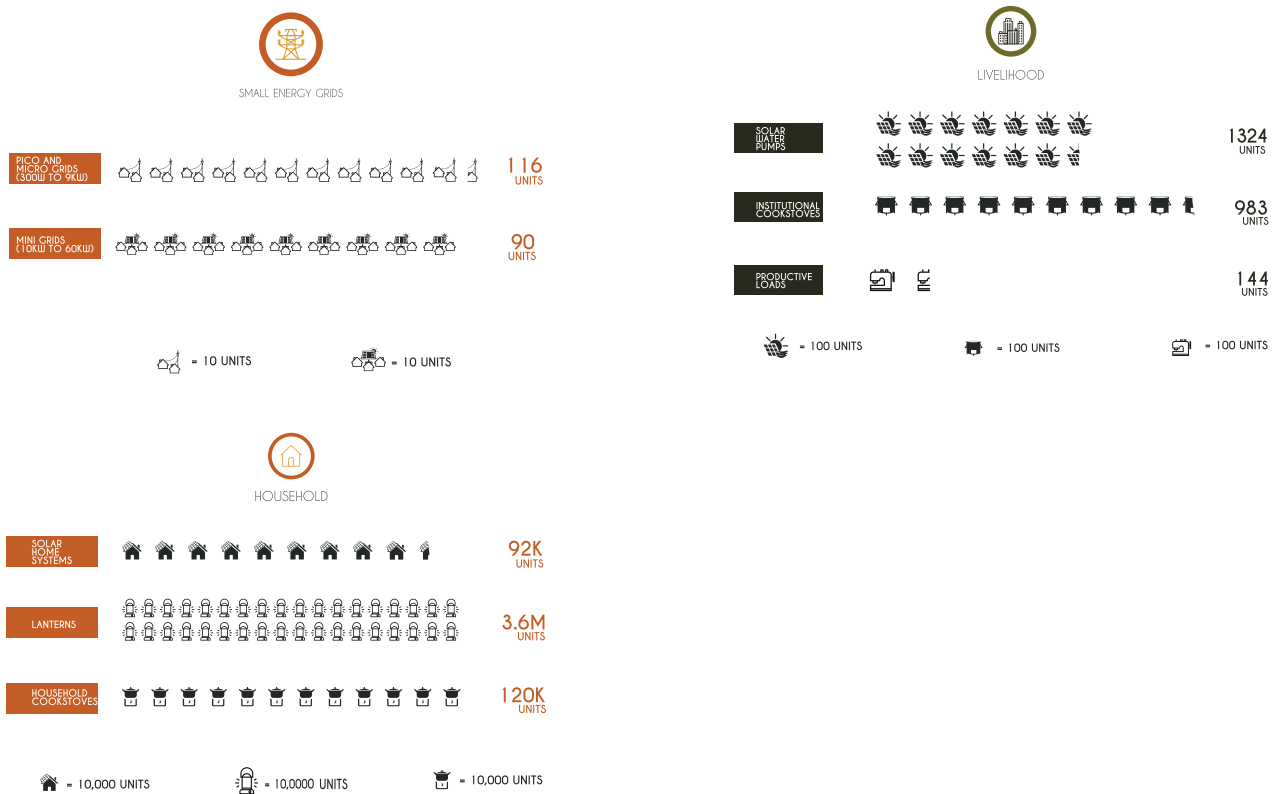
- **Standalone electricity system providers:** manufacture, sell, install, service pico-products and lanterns, home systems and standalone systems for lighting and electricity generation
- **Clean cooking solution providers:** manufacture, sell, install, service improved biomass cookstoves, biogas units and solar cooking solutions

<sup>1</sup> Based on previous studies (CEEW, 2013), this would be roughly 180 enterprises who are non-CLEAN members and mainly those featured in the MNRE off grid solar channel partner list where there is limited overlap with the CLEAN membership base

- **Micro- and Mini-grid system providers:** design, install, maintain and in most cases operate pico, micro and mini-grids that provide electricity to households and/or commercial establishments in an area

**Distribution agencies:** distribute and replace clean energy products for cooking and/or electricity, by developing local networks.

Based on the responses of 32 members, the number of systems deployed on the field over the 2016-17 period is summarized in the figures below.

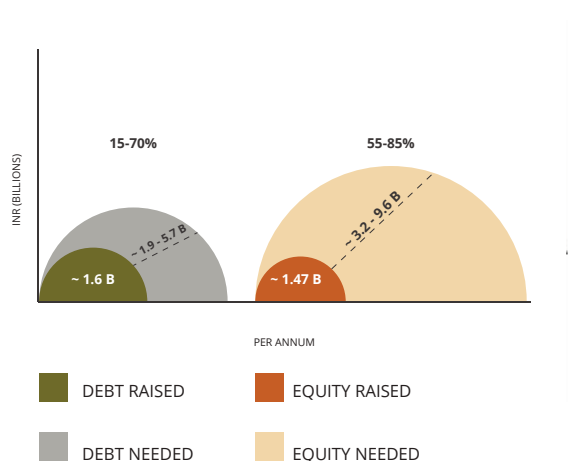


*Number of systems deployed during 2016-17*

Source: CLEAN survey and analysis; Insights from Smart Power India

**Access to finance:**

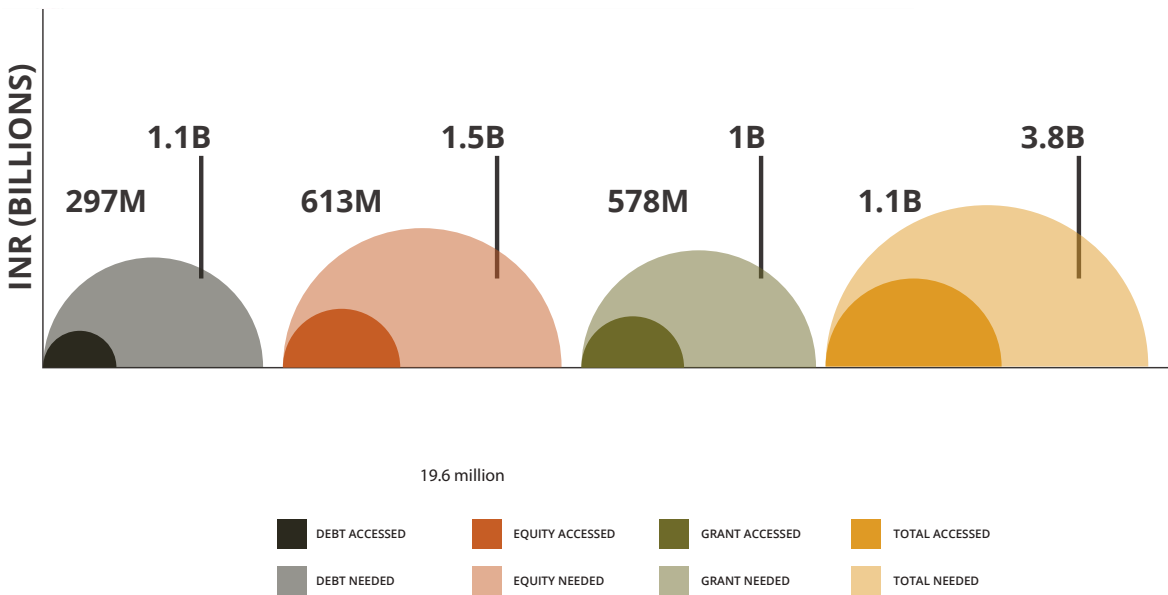
Despite their role in filling an essential gap in energy access provision to communities, last mile energy enterprises and organizations often find it difficult to raise capital for their own operations and expansion. Funds and credit lines have been created in recent time for renewable energy projects and enterprise financing ( discussed later in section 2.2). The Reserve Bank of India (RBI) has also included Renewable Energy under the ambit of priority sector lending. However, accessing these funds for DRE solutions and energy entrepreneurship has been limited. Based on estimates from previous studies, the debt mismatch for the sector on an annual basis in India could be as high as INR 4.1 billion (USD 64 million), while the equity gap ranges from INR 1.7 billion (USD 26 million) to INR 8.13 billion (USD 127 million) per annum as shown in the figure attached (GIZ 2016; BNEF 2016).



*Availability and Need for debt, equity per annum*  
Source: Adapted from GIZ (2016), BNEF (2016)

With the aim of improving access to credit for CLEAN’s members and ensuring a better understanding of their financing needs, CLEAN conducted a survey focusing on Access to Debt. Of the 60+ last-mile delivery entities, 28 responded to the survey. It is important to note that the finance requirements provided here are not a complete snapshot of the sector and are merely based on the responses of 28 last-mile energy delivery entities. However, it is instructive in understanding the needs of small and medium enterprises, which are currently the predominant group within CLEAN’s membership.

Overall the respondents are no strangers to accessing debt, with 68% companies taking on debt in the last three years, and 88% expecting to take on debt over the next three years (2017-2020). Of the reported debt, 35% companies noted that they had taken bank loans, shareholder loans and overdrafts. In general, there was limited reporting of access to cheaper long-term debt and a greater prevalence of the use of high-interest rate lending from sources such as NBFCs and overdrafts. The figure below provides an overview of the collective debt, equity and grants accessed by the respondents. Over the next three years, respondents sought to raise ~INR 3.8 Billion from debt, equity and grants - tripling current levels.



*Finance raised and expected needs over the next 3 years (2017-2020)- Debt, Equity, Grant*  
 Source: CLEAN Analysis; Note: The responses of 1 member were excluded from this analysis owing to very high figures that would skew the overall picture; the attempt has been to capture more representative insights.

Short-term working capital and consumer finance were the most frequently reported end uses of debt. Some enterprises reported raising long-term debt from expensive sources like NBFCs and crowdfunding, contradictory to the interests of such small and medium enterprises. Interest rates and demand for collateral came up as terms that enterprises would most prefer amending, and appear to be barriers for accessing debt.

Financiers on the other end spoke of a strong track record as key to eligibility of enterprises for debt financing. Greater understanding of track record is essential to enabling better finance access, and would require face to face interactions between enterprises and financiers.

One financier highlighted the need for “companies to build partnerships with DISCOMs”, which links back to the need for DRE to complement the grid. This in turn requires policymakers to play a more proactive role in being inclusive in rural electrification planning and allowing for stronger linkages with local DISCOMs that can enable

DRE solutions to complement grid availability on the ground. This would provide greater confidence to financiers on the utility, viability and sustainability of these business models.

### Policy and Regulation:

With the provision of electricity and clean cooking viewed as key to the role of the nation state, support from policies and the government buy-in on DRE solutions is essential to strengthening the sector. While successive governments have supported clean energy deployment for electricity, most of this has been to power the centralized grid.

There are two overarching issues in the current policy scenario and its incentives that favor certain energy alternatives over others.

- Emphasis solely on grid expansion and LPG connections
- Subsidies for kerosene and fossil fuels for the grid

Across policies for DRE, there is a need to address the lack of a level-playing field and design incentives and support mechanisms that provide better choices to the end user. The key policies that affect the DRE sector at the National level include regulatory and financial policies as well as those specific to energy schemes.

2010	2011	2012	2013	2014	2015	2016	2017
Launch of National Solar Mission (with off-grid scheme)		Solar off-grid included in Priority Sector Lending	Launch of Unnat Chulha Abhiyan		RE included in Priority Sector Lending  Launch of DDUGY to promote grid expansion for rural electrification  Launch of PMUY- to promote LPG connections	June: Draft Mini Grid Policy shared for public comments	GST introduced; Draft National Energy Policy shared for public comments  Discontinuation of NABARD off-grid scheme under National Solar Mission  Close of the Unnat Chulha Abhiyan program

With a presence across the country, the sector provides a tremendous opportunity to address the diverse energy needs for various regions in the country while meeting other goals of increased solar energy deployment. Through entities like the International Solar Alliance, India can also play a leadership role in ensuring DRE is used to meet the energy needs of other developing countries as well. A summary of the takeaways from the DRE sector, with a focus on Information, Access to Finance and Policy, is provided below. The relevant stakeholders for specific recommendations are also referred to.

KEY CHALLENGE	RECOMMENDATION	RELEVANT STAKEHOLDERS
<b>INFORMATION:</b>		
<ul style="list-style-type: none"> <li>Lack of data availability</li> <li>Limited internal capacity of enterprises to record and share data</li> <li>Limited metrics on energy access provision</li> </ul>	<ul style="list-style-type: none"> <li>Improve engagement processes with enterprises</li> <li>Adopt best practices on data collection to ease effort from enterprises</li> <li>Present value-proposition to respondents on the data shared, including visibility, increased finance flows, engagements with policymakers and financiers.</li> <li>Improve the set of indicators used to measure household electrification, clean cooking access, energy availability for livelihood, health and education.</li> </ul>	<p>Last mile energy enterprises and DRE practitioners, CLEAN, GOGLA, Policymakers (particularly on metrics for energy access provision)</p>
<b>ACCESS TO FINANCE:</b>		
Demand side:		
<ul style="list-style-type: none"> <li>High interest rates and collateral requirements</li> <li>Limited access to long term debt</li> </ul>	<ul style="list-style-type: none"> <li>Use of philanthropic capital and existing credit lines to unlock commercial capital while addressing demand side challenges</li> <li>Engage with policymakers and advocate for greater policy certainty and inclusion of DRE in Energy access plans to enable operational stability for projects and increase confidence of financiers.</li> </ul>	<p>Philanthropic organizations, select Banks and NBFCs, Last mile energy enterprises, Financing facilitators, Incubation centers, CLEAN</p>
Supply side:		
<ul style="list-style-type: none"> <li>Need for more detailed, well-structured business plans and loan applications</li> <li>Limited utilization of schemes and credit lines</li> </ul>	<ul style="list-style-type: none"> <li>Undertake capacity building with enterprises based on feedback of financiers- such as better documentation of track record and stronger plans and financial processes</li> <li>Facilitate platforms and interactions to clarify terms of existing credit lines, reasons for limited utilization and ways to address the barriers and enable deal flow</li> </ul>	

KEY CHALLENGE	RECOMMENDATION	RELEVANT STAKEHOLDERS
<b>POLICY:</b>		
<ul style="list-style-type: none"> <li>Near-exclusive focus on schemes and approaches to rural energy access with little or no recognition of the role of DRE</li> </ul>	<ul style="list-style-type: none"> <li>Promote DRE as a complement to current energy access programmes; On electricity- enabling linkages between DISCOMs and DRE enterprises to better address rural segment needs in a more cost effective manner On cooking- providing similar incentives to various clean energy options to allow for clean cooking fuel and stoves choices based on consumer needs</li> </ul>	Ministries such as MNRE, MoP, MoRD, MoPNG and their SNAs, DISCOMs, Ecosystem facilitators working on Policy issues, CLEAN
<ul style="list-style-type: none"> <li>Continued subsidies for kerosene with limited incentives to DRE</li> </ul>	<ul style="list-style-type: none"> <li>Create a level playing field for subsidies and incentives across energy options- with a view to promote cleaner alternatives as part of India's commitment to local development and environmental sustainability</li> </ul>	
<ul style="list-style-type: none"> <li>Challenges occurring on account of GST introduction- operations and diversion of funds</li> </ul>	<ul style="list-style-type: none"> <li>Support DRE enterprises in understanding and navigating the GST regime to help stabilize their businesses</li> <li>Allocate a certain percentage of NCEEF to the continued R&amp;D for clean energy (as opposed to complete diversion of resources to compensate States for GST losses)</li> </ul>	

Table 7: Summary of key takeaways from the DRE sector  
Source: CLEAN Analysis

# CHAPTER 1 INTRODUCTION



## 1.1 BACKGROUND

## 1.2 METHODOLOGY:

# Chapter 1: Introduction:

## 1.1. BACKGROUND

The Sustainable Development Goals (SDGs) were adopted by the United Nations General Assembly in 2015, with the aim of alleviating the challenges of poverty, hunger, health care, education, livelihoods, gender equality among others by 2030. SDG7 outlines the need to provide access to affordable, reliable, sustainable, and modern energy services for all. The framing of this goal is important both in terms of acknowledging energy services as a catalyst for improvements in human well-being and income generation, and in the recognition of sustainable energy as the solution to enable a win-win opportunity for socio-economic development and environmental sustainability.

This goal is particularly relevant in the Indian context as the world's second most populous country with 1.2 billion people. Of this total, more than 304 million people lack access to electricity and more than 500 million people still depend on solid biomass for cooking (NITI Aayog 2017). Even among those who are connected to the grid, unreliability of power and frequent power outages are a reality (CEEW 2015, SELCO Foundation 2016).

In terms of households, more than 43 million households are unconnected to the grid and 2/3 of all households in the country rely on firewood and biomass-based fuel for their cooking energy needs. It is worth noting that at the current rate of approximately 300,000 households being connected to the grid on a monthly basis, it could take more than 10 years to electrify the remaining 40

million households (adapted from Jain 2017). The concentration of energy poor households in rural and remote parts of the country makes them harder to reach through a centralized approach. The centralized approach also comes with a number of challenges, the key ones are listed below (Brookings India 2015; CEEW, 2015)

1. Higher demand on fossil fuels with associated implications for carbon emissions and / or import bill
2. High costs of building transmission and distribution infrastructure for electricity in far-flung areas, difficult terrain and scattered hamlets
3. Transmission and distribution losses and power thefts plaguing the existing centralized grid system
4. Operational difficulties that also increase costs such as tariff collections, operations, maintenance and management of the grid
5. Peak power demand affecting Distribution Company (DISCOM) incentives and their ability to provide reliable electricity supply to rural areas between 9am and 6pm, especially 3 phase supply for productive applications.
6. Affordability of Liquefied Petroleum Gas (LPG) for cooking energy and reliability of LPG refills
7. Rural households engage in stacking of fuels requiring multiple clean cooking alternatives to be made available that can meet a variety of local cooking and food habits



Decentralized Renewable Energy (DRE) solutions offer an option to address these challenges while also enabling customization of design, operational models, collections, payments to the local context. DRE encompasses a range of energy sources that are electricity and non-electricity based, including solar, pico-hydro, biomass and micro wind. A variety of business models across each of these technologies and scales of operation- be they sales, leasing or rental models of portable systems for lighting and cooking, home energy systems, community-based products or mini-grids with productive anchor base loads- are part of the DRE sector.

**Ecosystem for Energy Access and CLEAN:**

Over the last decade, a number of organizations, both for-profit and not-for-profit, sprung up to address the gap in energy access through last-mile delivery using DRE solutions.

A number of these operate as Micro, Small and Medium-Sized Enterprises (MSMEs) with a focus on energy service provision while others operate as facilitators working on aspects of community mobilization, finance, technology development, research, policy engagement and so on.

However, a key barrier to the effective functioning and scale up of such energy access enterprises and organizations has been the absence of an enabling environment or a supportive ecosystem including lack of clarity on policies and regulations, limited availability of skilled human resources, high cost of capital and apathetic financiers, and unsupportive existing policy environments.

A representation of the supportive ecosystem to enable implementation and long term sustainability of DRE solutions is provided in the figure below.

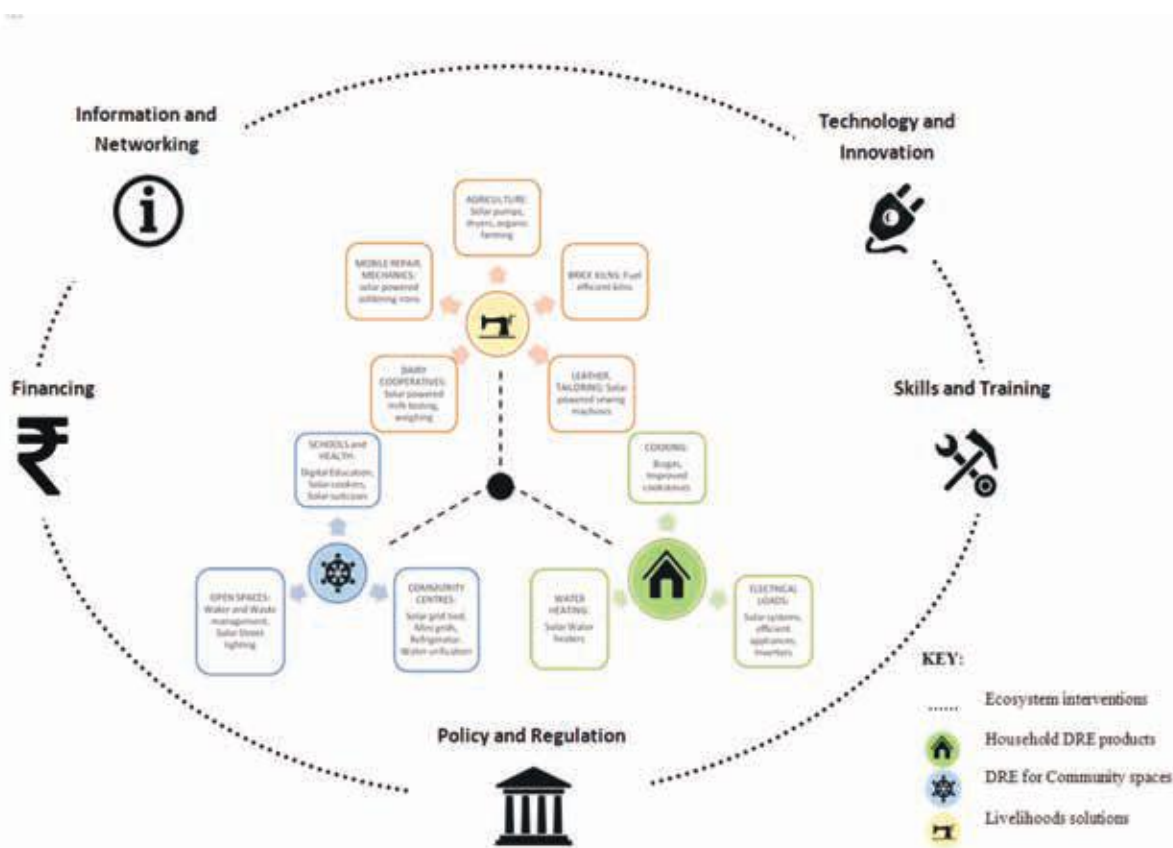


Figure 1: Representation of the Ecosystem to support DRE interventions and solutions  
Source: Adapted from WWF and SELCO Foundation, 2015.

For a sector with a growing number of stakeholders involved in energy provision across regions, an alliance was essential to align efforts and ensure a stronger representation. Thus, with the aim of building an enabling ecosystem and creating a voice for multiple actors in this sector to institutionalize DRE in rural and urban energy provision, the Clean Energy Access Network (CLEAN) was established in September 2014. The network is technology and scale agnostic. By working across the verticals of Technology, Skills, Access to Finance, Policy and Information and Networking, CLEAN seeks to not only provide common services that benefit members, but also provide stronger representation for the interests of its members amongst external stakeholders such as Government agencies and financiers.

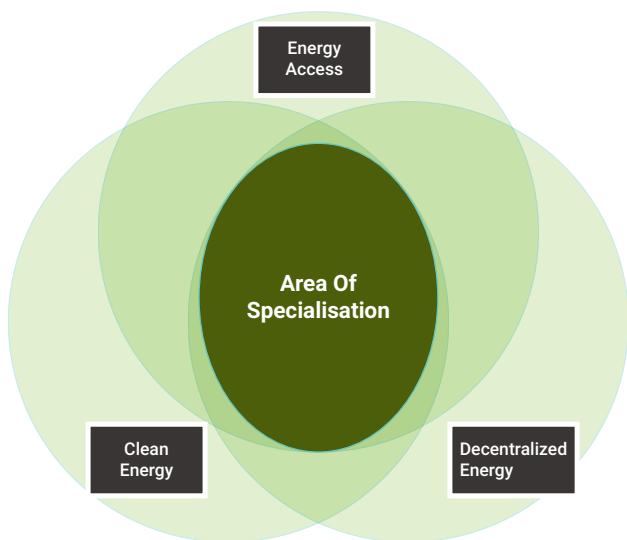


Figure 2: CLEAN's area of specialization  
Source: CLEAN

The CLEAN membership includes 104 members in total, as of July 2017. Of these, approximately 69 are organizations and enterprises involved in the last-mile delivery of energy access solutions, which includes one or more of the following- design, manufacture, sale, distribution, installation, maintenance of DRE systems.

The remaining 35 organizations are facilitators working on various aspects of DRE and energy access

including research, innovation, training, consultancy, financial linkage, policy advocacy and so on.

In addition, there are 13 founding members of the Network broadly consisting of practitioners, field-based organizations, research think tanks, existing networks and facilitators.

**Structure of the report:**

As the inaugural version of CLEAN's State of the Sector report, the focus for this year is on CLEAN's core membership base- organizations involved in last-mile energy delivery. Much of the representation is from solar and biomass players engaged in the deployment of pico-products, standalone systems (for electricity and cooking) and micro/mini-grids.

While CLEAN aspires to provide a holistic and all-inclusive assessment of the sector, this year's report has only captured the work and challenges of the Network's own membership base. The paucity of time prevented the identification, engagement and assessment of other businesses engaged in last mile delivery of energy access solutions in India, who are not part of the CLEAN membership base<sup>2</sup>. The Network seeks to address this in next year's report and ensure a better representation of energy access practitioner efforts.

The report begins with a background on energy access, the relevance of DRE in plugging the gaps and the role of CLEAN in enabling the same. A short overview of the methodology behind data collection and analysis is also provided.

<sup>2</sup> Based on previous studies (CEEW, 2013), this would be roughly 180 enterprises who are non-CLEAN members and mainly those featured in the MNRE Off-grid solar Channel partner list where there is limited overlap with the CLEAN membership base

Chapter 2 explores the highlights in the sector with the first section providing a greater understanding of CLEAN's membership, including geographical spread, diversity in business models, product offerings and a glimpse of the sale and installation of a subset of decentralized clean energy systems over the 2016-17 period (FY 2016-17).

Section 2.2 delves into the access to finance for these energy enterprises, the challenges faced, the possible mechanisms to mitigate these challenges and the need for end-user financing. An outline of the Policy scenario and the extent to which key policies and guidelines aid or hamper the efforts of the DRE sector is discussed in Section 2.3. The next section summarizes some Technology and Skill development- related updates.

Finally, the report discusses the key challenges within the sector and CLEAN lays down a set of recommendations that could ensure better integration of the DRE sector as part of plans of Government (National and State levels) and Non-Government Organizations (NGOs) to address energy access issues- both clean cooking and electricity.

## **1.2 METHODOLOGY:**

### **DATA COLLECTION AND AGGREGATION:**

A combination of primary information from members and key stakeholders and secondary sources of information has been used for this report. On issues of policy and larger-level challenges and takeaways from the sector, CLEAN's own experiences and those of its members and partners have shaped some of the key takeaways and recommendations in this report. In the paragraphs below, the methodology used to compile information for specific sections is outlined.

For the purposes of the report and analysis of findings, enterprises are broadly categorized based

on their primary model for deployment, including the product/service being provided and their role in the process. The various possibilities in terms of roles and products offered for each category are outlined below:

- **Standalone electricity system providers:** manufacture, sell, install, service pico-products and lanterns, home systems and standalone systems for lighting and electricity generation
- **Clean cooking solution providers:** manufacture, sell, install, service improved biomass cookstoves, biogas units and solar cooking solutions
- **Micro- and Mini-grid system providers:** design, install, maintain and in most cases operate pico-, micro and mini-grids that provide electricity to households and/or commercial establishments in an area
- **Distribution agencies:** distribute and replace clean energy products for cooking and/or electricity, by developing local networks.

### **Section-wise data sources:**

Section 2.1 provides an overview of the CLEAN membership using self-reported information for the year 2016-17 and background details from membership application forms. The sub-section on Deployment of DRE solutions focuses on a subset of the energy enterprise members and captures self-reported information from 32 entities on the number of systems sold and/or installed during 2016-17. This is supplemented by information from certain secondary sources to provide a more holistic picture of the deployment figures.

Section 2.2 focuses on Access to finance- primarily for the needs of the enterprise. Here, a combination of literature review, secondary information and a survey of a subset of CLEAN membership are used. Of the set of 68 enterprises, 28 members responded to a survey providing more information on their

access to finance, the challenges faced and their additional needs on debt, equity and grants with a greater focus on debt needs. Interviews were also undertaken with a set of financier stakeholders to capture the financial institution perspective.

The information gathered through survey responses in Sections 2.1 and 2.2 does not cover the entire CLEAN membership. However, the data is being reported if the market leaders in each category (from the membership base) have provided information.

Section 2.3 summarizes the policy scenario with reference to energy access and highlights policies, guidelines and programmes at the national level that are directly related to or affect the deployment of DRE in some way. This section uses secondary information about the policy, guideline or programme, supplemented by CLEAN's understanding of the key impacts and aspects to be mindful of while evaluating a certain policy.

#### **Assumptions and Limitations:**

- It is assumed that the information provided by members is accurate and reflects the reality of their operations and finances. Any primary data referred to is self-reported and its validity is dependent on honest inputs. No triangulation on the data reported could be undertaken in this instance owing to time limitations and the geographically spread membership base.
- Care was taken to prevent double counting on deployment of systems in 2016-17, especially in the case of both manufacturers and distributors reporting on sales information. CLEAN has used its sectoral insight and understanding of the supply chains scenario to include information only from manufacturer sales.
- The set of respondents is relatively small when looking at the entire DRE sector 'population' in the country. As mentioned earlier, while CLEAN aspires to provide a holistic and all-inclusive assessment of the sector, the paucity of time prevented a more extensive assessment and analysis. The responses from the entire CLEAN membership have been elicited for certain sections. In other sections, the responses accounted for nearly 70% of the enterprise membership base (DRE deployment) and 40% of the similar membership base when it comes to finance and debt needs. There has been no extrapolation of this data to the larger CLEAN membership base or the population of the DRE sector.
- The respondents for various sections of primary data are representative of enterprises using solar or biomass as the main energy source, as this is also reflective of the CLEAN member base. Additional efforts will be made in the future to actively involve pico-hydro, small wind players and solicit inputs from them.
- The categorization of energy enterprises that is used across the report is based on a combination of the product/service being provided and their role in the process (operational model on the ground). While there could be questions on whether this is the ideal mechanism for categorization, it was a clear way to avoid overlap of entities or double counting of enterprises. The categorization process used information from the CLEAN membership form, responses on surveys and CLEAN's own understanding of the changes in the business model of the enterprise.

# CHAPTER 2

# SECTOR HIGHLIGHTS

**2. 1 MEMBER HIGHLIGHTS:**

**2. 2 ACCESS TO FINANCE:**

**2. 3 POLICY AND REGULATION:**

**2.4 TECHNOLOGY NEEDS AND SKILL DEVELOPMENT:**

## Chapter 2: Sector highlights:

This section provides an overview of the CLEAN membership and categorization including a glimpse of the DRE solution deployment in 2016-17 by a subset of members and the geographies of their operations. It delves deeper into the financing scenario in the sector-specific aspects of member operations and fund flow. It also throws light on the key policies that affect the sector.

### 2.1 MEMBER HIGHLIGHTS

Over the last 3 years, CLEAN has grown to a membership of 104 members. Most of these members are engaged in last-mile delivery of energy access using a variety of technologies and business

models that rely on sustainable energy sources. As is the trend in the sector, a majority of CLEAN's membership is focused on solutions based on solar energy and biomass, with a much larger segment focused on electricity access in comparison to clean cooking solutions.

A categorization of the membership base is provided below; by legal structure- profit or not-for-profit; by role- last-mile energy delivery or facilitation; by focus area or primary business model- standalone electricity, micro and mini-grids, clean cooking, distribution of DRE products and facilitators. Their representation within the membership base is reflected in Figure 3.

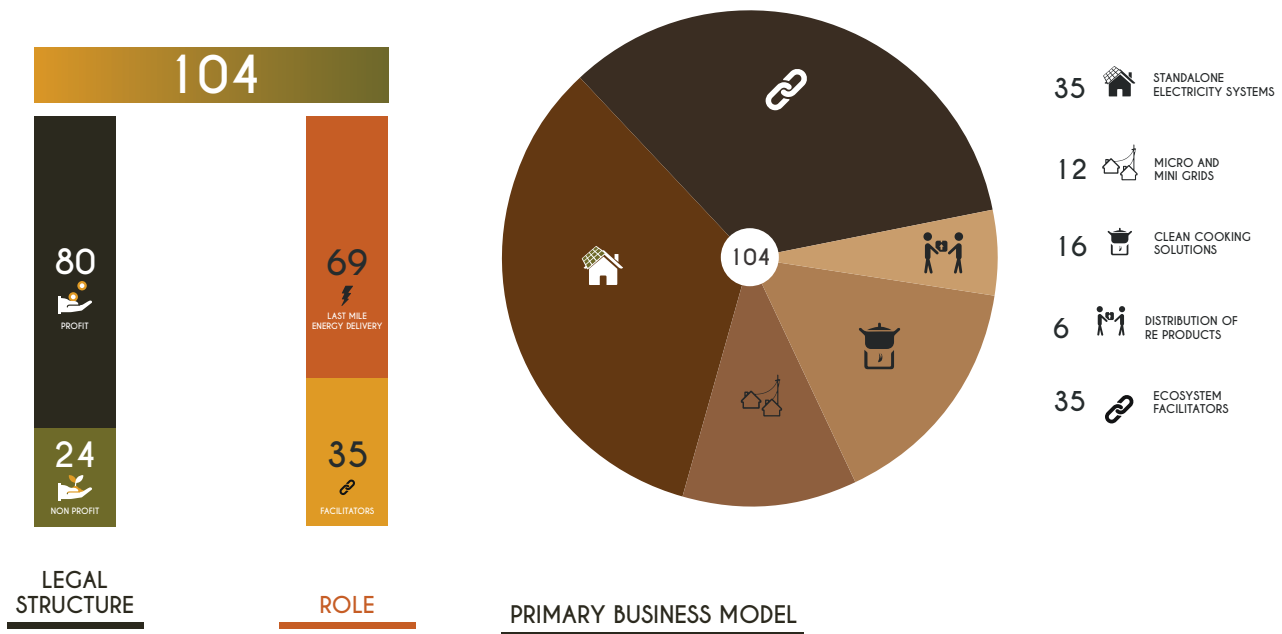


Figure 3: Categorization of CLEAN membership

Source: Self-reported information and CLEAN analysis

Of the total membership of CLEAN, a little more than 80% are registered as for profit organizations. When categorized in terms of organizations engaged in last-mile delivery of energy access versus those that can be considered ecosystem facilitators, last-mile delivery entities form more than 65% of the member base.

Within this, more than 50% are engaged in the delivery of standalone solutions for lighting and electricity generation, including solar Lanterns, solar home systems (SHS), solar water pumps and other productive loads.

The few entities involved in standalone pico-hydro solutions also come under this category, while pico-grid, micro- and mini-grid solution providers comprise 17% of the last-mile delivery group. Clean cooking solution providers contribute to 23% of this sub-member base and distributors of renewable energy products comprise 8%.

While it would be useful to provide a more nuanced picture of exactly what Tier of service each category is able to deliver- on the Multi-tier framework for lighting and cooking (World Bank, SE4All 2015), there are challenges in doing so as each category is capable of providing higher tiers of service but the likelihood differs based on other factors such as demand and cost implications. These enterprises are currently categorized on the basis of their operational model on the ground and the primary source of revenue which affects their cash flows, repayment from customers, types of financing required and incentives under specific policies.

The ecosystem facilitators form 34% of the total member base and include capacity building institutions, Community Based Organizations (CBOs), Finance facilitators, Associations, R&D and Consultancy organizations, and component manufacturers.



## Deployment of DRE solutions:

Based on reporting from 32 last-mile energy delivery entities, comprising 40% of the sub-member base, the number of systems sold and installed under various product categories has been compiled. This is illustrated in Figure 4. The respondents accounted for approximately 50% of the members from each of the following categories- standalone, clean cooking, micro- and mini-grids and distributors. Broadly, the solutions deployed by the last-mile delivery entities include:

- Solar lanterns, solar home systems, improved biomass cookstoves at the household level.
- Solar water pumps for irrigation, other productive loads powered by solar systems and biomass based cookstoves for institutions and commercial establishments
- Small energy grid solutions including pico and micro grids as well as mini grids.

It is worth noting that for each of the solutions, the sales tended to be concentrated in a handful of leading enterprises. This raises questions around the type of support that other enterprises may need in order to increase their reach, including access to finance which is discussed in the next section.

At the level of household solutions, more than 92,000 solar home systems have been deployed over the course of the year. These include a combination of DC systems and AC systems as well as Plug-and-Play, customized and installed units.

3.6 million pico-solar and portable products were sold this year, including lanterns, study lamps, headlamps and torches, while approximately 120,000 units of improved biomass cookstoves were manufactured and distributed across the country.

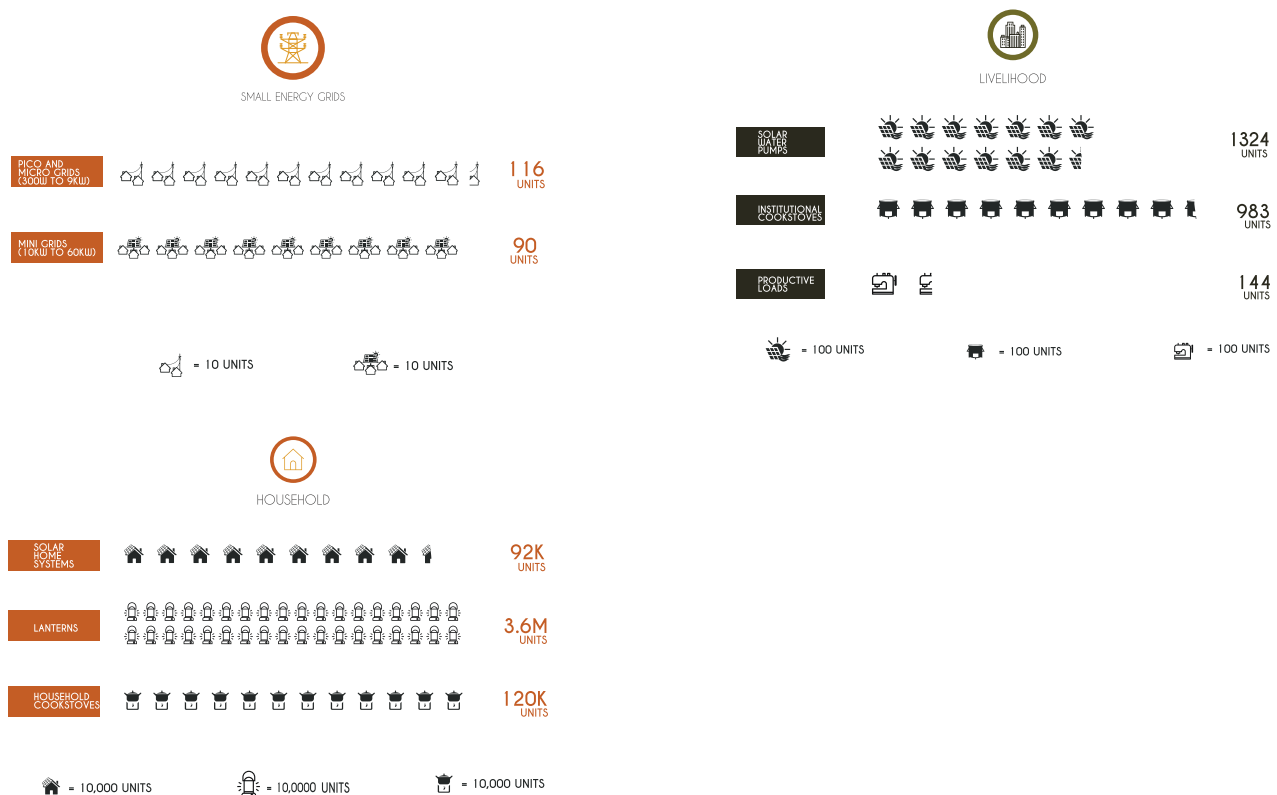


Figure 4: Number of systems deployed during 2016-17

Source: CLEAN survey and analysis; Insights from Smart Power India; Note: All productive loads and solar water pumps reported (powered by standalone systems as well as micro/mini grids) have been included under livelihood.



In the case of livelihood solutions, they broadly include solar-powered water pumps (primarily for irrigation), clean cookstoves for small restaurants and other institutions, and productive loads powered by solar for agro processing, dairy, textiles, food processing and information services.

Over the course of the year, 1,324 solar water pumps were installed. Given the push from entities like MNRE and NABARD on the promotion of solar water pumps, this number seems relatively low. However, the main reason for this is linked to the fact that most CLEAN members are not empanelled with MNRE owing to stringent criteria and issues within the scheme. In the case of institutional cookstoves, 980 units were deployed on the ground.

In addition to pumps for irrigation, approximately 144 productive loads have been powered in 2016-17. These include poultry incubators, rice hullers, milk testing and weighing machines, roti-rolling machines for home-based workers, textile-related livelihood equipment such as looms and sewing machines, air-blowers for blacksmiths and laptop-printers for ICT-related businesses in villages.

The small energy grid solutions are classified into pico- and micro-grids covering installations of 300W to 9KW and mini-grids covering installations between 10KW and 60KW. Here, approximately 116 units in the first category and 100 units in the larger mini-grid category have been deployed in 2016-17.

### Geographic spread

While CLEAN's members operate in states across the country, there is a concentration of members in certain states- based primarily on the electrification and cooking access scenario in these states. As indicated in Figure 5, household electrification is less than 50% in the northern and eastern states of Uttar Pradesh (UP), Bihar, Jharkhand and north-eastern state of Nagaland. Other states that fall below the

national average of 71% in terms of household electrification include Odisha in the east, Madhya Pradesh in the center, Maharashtra in the west and the North-Eastern states of Assam and Meghalaya.

In the case of cooking, studies have indicated that nearly 95% of rural homes across the energy-deficient states of Bihar, Jharkhand, Madhya Pradesh, Odisha, Uttar Pradesh and West Bengal still use traditional fuel, such as firewood, dung cakes and agricultural waste for cooking (CEEW 2015).

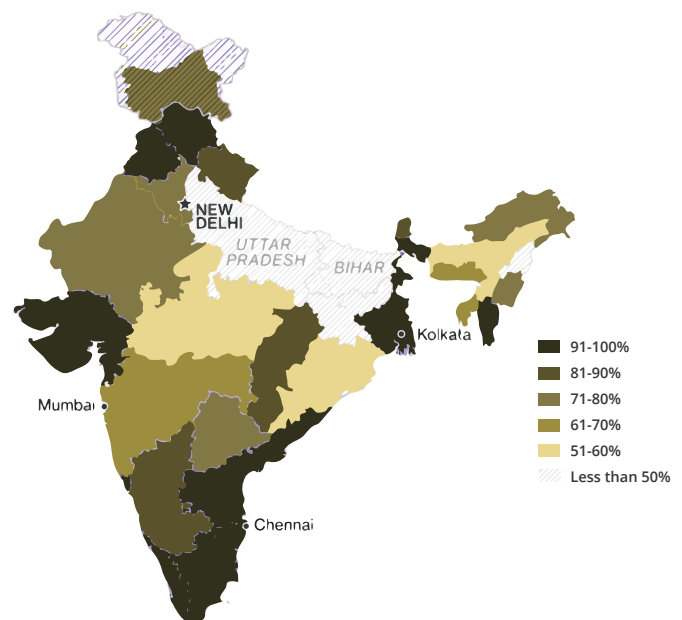


Figure 5: India map of household level electrification in each state

Source: Adapted from Bloomberg (2017) & GARV platform

The map in Figure 6 represents the state level concentration of each category of last mile delivery enterprises. This covers all states that a particular enterprise has operations in and is therefore reflective of the potential to saturate specific regions in terms of DRE solutions. Whether or not this potential is realized will be dependent on a variety of other factors including access to capital, state level policies, district level concentration and so on.

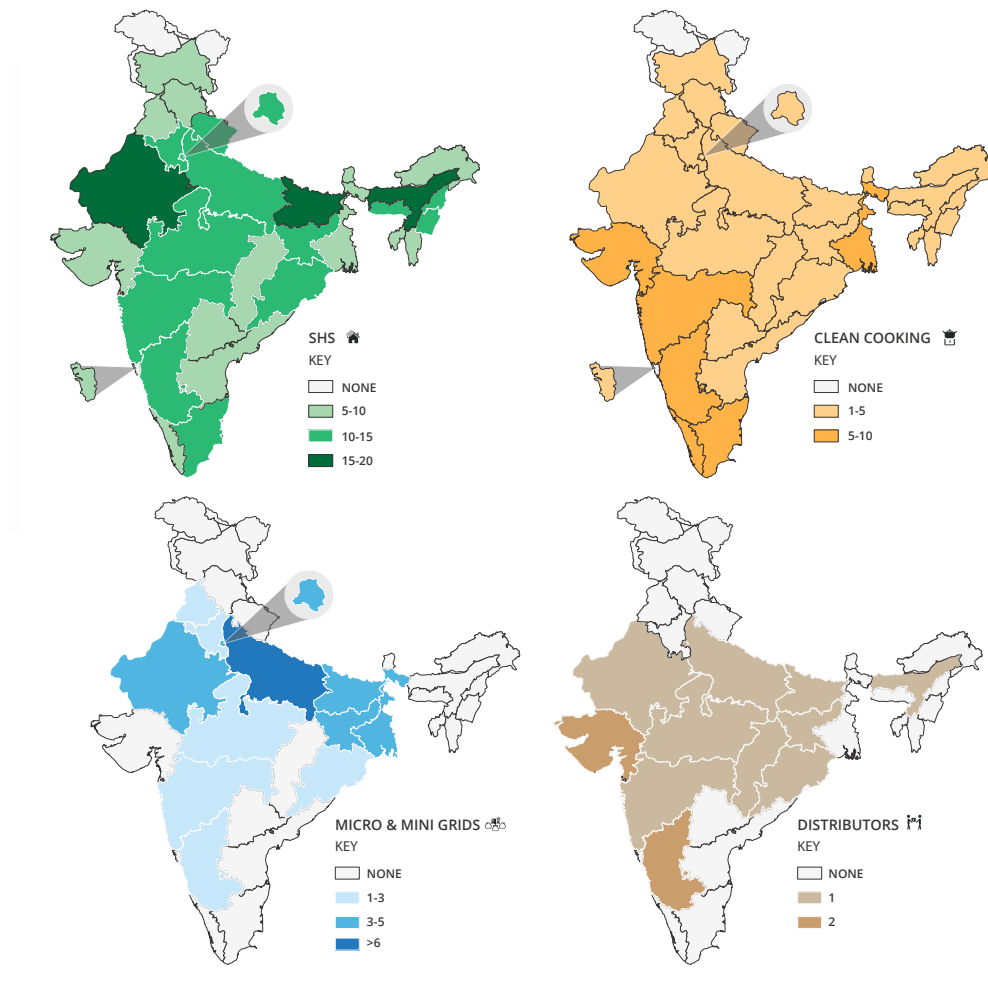


Figure 6: State level operations of last mile delivery entities, by category  
 Source: CLEAN Survey and Analysis

It can be observed that the states of Rajasthan, North East, Bihar, Jharkhand, Odisha have a higher concentration of standalone electricity providers. However, it is worth noting that states with good electricity access such as Karnataka, Maharashtra, Tamil Nadu and so on also have a high concentration of standalone systems. This is also linked to the fact that these are solutions that are typically purchased and owned at an individual household level to reduce electricity bills and complement the unreliable electricity supply from the grid.

Given the low levels of household electrification, a state like Uttar Pradesh (UP) has the highest concentration of micro- and mini-grid providers while Bihar, Jharkhand and West Bengal (WB) are the other states with more than 1 micro- and mini-grid operator. UP and Bihar have also been some of the first states to bring out policies on mini-grids (independently or under the State RE policy).

Entities like Smart Power India have also focused their efforts on supportive policies and enabling environments for micro and mini grid players in this region. Despite biomass based cooking being predominant across rural households in energy-deficient states, there are a very small number of clean cooking solution providers in these regions. The highest numbers of clean cooking solution providers operate in the states of Maharashtra, Tamil Nadu, Gujarat, Karnataka and Kerala.

This geographical representation of the membership base and its operations is useful in understanding the current reach of DRE practitioners. It helps determine the states where more active efforts can be undertaken on the ground while also providing a clearer picture of regions that would require more enterprises or expansion of current enterprises to meet all under-served needs.

## 2.2 ACCESS TO FINANCE:

Despite their role in filling an essential gap in energy access provision to communities, last mile energy enterprises and organizations often find it difficult to raise capital for their own operations and expansion. Funds and credit lines have been created in recent time for renewable energy projects and enterprise financing (discussed later in the section). The Reserve Bank of India (RBI) has also included Renewable Energy under the ambit of priority sector lending. However, accessing these funds and the schemes for solutions and energy entrepreneurship has been limited. The main reasons for reluctance amongst banks and traditional financial institutions include the following<sup>3</sup>:

- Lack of familiarity and limited information about the technology and scepticism about the existence of strong, local maintenance and after-sales networks.
- Fear of Non Performing Assets (NPAs) due to challenges involved in repayments, collections; Customer segments being served by the enterprises are perceived to be risky
- Lack of confidence since enterprises are themselves relatively early stage and may lack the necessary scale or margin; Promoters may lack significant credit history or individual net worth
- Inability of enterprises to offer any collateral beyond the project's assets, which may be deemed insufficient by bankers to meet the banks' security requirement
- Limited familiarity with risk mitigation techniques specifically for credit within this sector (particularly with regard to end user financing for clean energy loans)

- Lack of targets, mandates for lending to this sector from monitoring authorities within the Government (despite the existence of relevant lending schemes)

The reasons mentioned above, particularly risk perception and lack of confidence, in turn affect interest rates, collateral requirements and other conditions linked to debt.

In addition to debt, another concern is the difficulty in availing 'patient' investment capital on account of high expectations of growth and Internal Rate of Return (IRRs). Some suggest that this results "*from an under appreciation of investors to recognize the challenges in setting up a social enterprise and hesitation of entrepreneurs to effectively communicate ground realities further drives the imbalance*" (SELCO Foundation 2015). This may result in investors resorting to traditional modes of assessing businesses and decision patterns that do not match the contextual requirements of last mile energy enterprises. While this report does not explore the equity investment side in detail, it is worth taking note of the concerns.

Despite these challenges, enterprises in this sector have been able to access different forms of capital- debt, equity, grant- from a variety of sources, albeit in relatively smaller volumes compared to demand. This section summarizes existing literature on the types of finance available for last-mile energy delivery, while also exploring the current and future capital needs of a subset of CLEAN members and the terms and conditions that would be ideal. The section is primarily devoted to looking at enterprise-level access to finance while end-user finance is discussed but with more information from secondary sources.

---

<sup>3</sup> Based on the interactions of CLEAN, and its partners with financial institutions over the last 3 years

## Overview of existing information:

Reports over the last 2-3 years on DRE financing have developed estimates of the market size and arrived at some indication of the financing need and availability. The market size between FY 2013 and FY 2016 has been reported as INR 1.73 billion (\$27 million) for DRE utilities and INR 12.6 billion (USD 196 million) for SHS and Lanterns (BNEF 2016), based on a combination of estimates for asset financing, investments made and estimated revenues.

The financing is estimated to have resulted in 2.9MW of DRE on the ground and 7.3 million SHS and lantern units deployed. The range of financing needed per annum in comparison to the availability is outlined in figure 7. According to this estimate, the debt mismatch on an annual basis in India could be as high as INR 4.1 billion (USD 64 million), while the equity gap ranges from INR 1.7 billion (USD 26 million) to INR 8.13 billion (USD 127 million) per annum

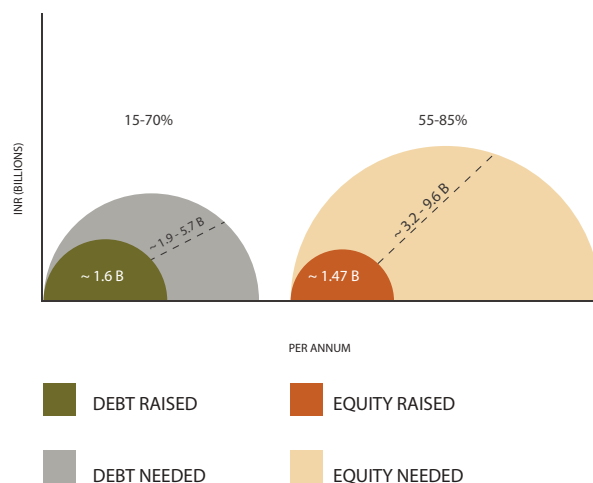


Figure 7: Availability and Need for debt and equity per annum

Source: Adapted from GIZ (2016), BNEF (2016)

Based on information from secondary sources, summarized below are the types of financing and the characteristics of each type including the main end users, the typical sources, tenure and criteria for funding.

	Debt		Equity & Quasi-Equity		Grants
Instruments	Short Term Debt	Long Term Debt	Commercial Equity	Impact Capital	Grants/ Subsidies/ Technical Assistance/ Guarantees
Sources of Capital	RRBs, NBFCs, Equipment Financiers, Indian DFIs, MFIs	Commercial Banks, EXIM Banks, International DFIs, Indian DFIs	PE & VC Funds, HNIs	Impact Investors, International DFIs, HNIs, Blended Finance Facilities	Government, Foundations, Donors, CSR Funds
End Uses	<ul style="list-style-type: none"> <li>End Consumer Finance</li> <li>Working Capital</li> <li>Equipment Finance</li> <li>Capital Expenditures</li> </ul>	<ul style="list-style-type: none"> <li>Equipment Finance</li> <li>Capital Expenditures</li> </ul>	<ul style="list-style-type: none"> <li>Capital Expenditure</li> <li>Working Capital</li> </ul>	<ul style="list-style-type: none"> <li>Capital Expenditure</li> <li>Working Capital</li> <li>End Consumer Finance</li> </ul>	<ul style="list-style-type: none"> <li>Capital Expenditure</li> <li>Working Capital</li> <li>End Consumer Finance</li> </ul>
Criteria for Financing	Balance Sheet, Profitability, Track Record, Collaterals, Personal Guarantee	Balance Sheet, Profitability, Track Record, Collaterals, Guarantee	Business Model, Track Record, Promoters, Balance Sheet, Technology	Impact Potential, Business Model, Promoters, Technology	Impact Potential, Nascent Sector needing support
Tenure	6 months - 5 years	7 - 18 years	> 5 years	4-10 years	N/A
Risk Appetite	Low	Low	Medium	Medium & High	High
Return Expectation	12%-20%	4%-16%	15%-35%	5%-35%	Nil

Table 1: Summary of types of financing and their characteristics

Sources: Adapted using information in the following sources: cKinetics (2013); The Climate Group (2015), GIZ (2016), CLEAN interviews and analysis

The key insights worth noting are as follows:

- Barring long term debt, all other types of financing are being used for working capital, indicative of the high demand for such capital
- Track record comes up as a key criterion for financing, particularly in the case of debt. This is also highlighted in the financier insights from the CLEAN study, where track record was referred to in terms of implementation experience of the enterprise and the existence of a substantial number of operational systems on the ground.
- Enterprises find accessing long term debt to be a challenge, even for capital expenses for long lived assets, microgrids for example.

Given the lower and more uncertain commercial returns in DRE businesses, return expectations are extremely high for short term debt as well as equity. As concerns around high interest rates and rates of return expectations affect enterprise ability to take on capital, there are related questions that come up. There is a need for debate about whether the focus of facilitators, philanthropic organizations and patient investors should be on addressing the return expectations at the equity level, or on providing interest subventions

Many of these points are in line with the findings of the survey on access to debt that CLEAN conducted, whose results are presented later on in this section.

Over the last few years, a number of credit lines and funds have been created to address the additional financing needs in the sector to enable DRE deployment. However, many of them are targeted towards financing solar rooftop projects, raising concerns around the real availability of soft or patient funding for decentralized renewable energy deployment to alleviate energy access. The main channels of funding and credit lines are summarized in table 2.

There is limited information on the accessibility and utilization of many of these credit lines and it appears few deals have gone through with only certain channels having been active over the last year. This could be on account of a mismatch between the expectations of host organizations (of the credit facility/ fund) and the enterprises, on aspects such as ticket size, time frames for processing loans, eligibility of projects and enterprise track record and past revenues.

Organization	Sectors of Focus	Description	Off-grid Focus / Size
KfW-IREDA credit line	Solar Rooftop <sup>1</sup>	Debt	USD 28 Million
USICEF	Solar Mini/Micro-Grids, Solar Rooftop, Off-grid solar, Smaller-scale grid connected solar projects <sup>2</sup>	Grant (Driving Market Growth)	USD 20 Million
GCF (NABARD, SIDBI)	Energy, Energy Efficiency (among others)	Grant	
MIA (Microgrid Investment Accelerator)	Microgrids <sup>3</sup>	Blended (Debt & Equity)	USD 50 Million (Across Geographies)
ADB-PNB line	Solar Rooftop	Debt	USD 500 Million
World Bank-SBI line	Solar Rooftop	Debt	USD 625 Million
ADB loan	Distributed Energy Efficiency <sup>4</sup>	Debt (Technical Assistance)	USD 200 Million
Smart Power India	Minigrids	Debt	USD 75 Million
cKers Finance	Energy, Energy Efficiency	NBFC	

Table 2: Overview of the main credit lines and funds available

Source: Adapted using information in the following sources: Shakti Foundation (2014), OPIC Press release (2016), Micro grid invest.

## Financing Needs of CLEAN members- Overview

With the aim of improving access to credit for CLEAN’s members and ensuring a better understanding of their financing needs, CLEAN conducted a survey focusing on Access to Debt. Of the 60+ last-mile delivery entities, 28 responded to the survey and as mentioned in the previous section and survey results substantiate certain findings from other studies. In terms of data validity, not all 28 enterprises responded to all questions, but the results were included in this report if a minimum of 50% of the respondents answered a certain question. In addition, 5 financial institutions with ongoing or previous deals with DRE enterprises were interviewed.

The survey focused on access to debt with a basic understanding of the equity and grant scenarios as well. The challenges in accessing debt, the ideal terms and conditions for the enterprise as well as the opinions and perceptions of financiers were explored.

The key characteristics of the enterprises surveyed are provided below.

Majority of respondents (66%) had annual revenues of less than INR 50 million, and were in operation for 5 years or more (60%). The median revenue was INR 50 million per annum, and the range is from INR 500,000 to INR 400 million per annum.

The respondents represented a range of technologies and business models, but standalone electricity providers (particularly solar pico products and SHS) and micro- and mini-grid enterprises dominated.

It is important to note that the finance requirements provided here are not a complete snapshot of the sector and are merely based on the responses of 28 last-mile energy delivery entities. The findings and takeaways, however, are instructive in understanding the needs of small and medium enterprises, which are currently the predominant group within CLEAN’s membership.

**Key characteristics of surveyed companies**

	Range	Median Value
Year of inception	1995 - 2016	2011
Revenue (IN INR)	500,000 – 400 million	50 million
Debt Raised (IN INR)	0 – 55 million	12.3 million
Debt Need* (IN INR)	2 million – 320 million	40 million
Equity Raised (IN INR)	4.5 million– 100 million	35 million
Equity Need* (IN INR)	5 million– 400 million	100 million
Grant Raised (IN INR)	0 – 320 million	10 million
Grant Need (IN INR)	0 – 640 million	19.6 million

*\*over a 3 year period (2017-2020); 1 USD = ~INR 64*

*Table 3: Key characteristics of surveyed companies*

*Source: CLEAN Analysis*



Overall the respondents are no strangers to accessing debt, with 68% companies taking on debt in the last three years, and 88% expecting to take on debt over the next three years (2017-2020).

Of the reported debt, 35% companies noted that they had taken bank loans, shareholder loans and overdrafts. In general, there was limited reporting of access to cheaper long-term debt and a greater prevalence of the use of high-interest rate lending from sources such as NBFCs and overdrafts.

Over the next three years, respondents sought to raise ~INR 3.8 Billion (USD 59 million) from debt, equity and grants- tripling current levels. The figure below illustrates category-wise, amounts raised and future needs across debt, equity and grant.

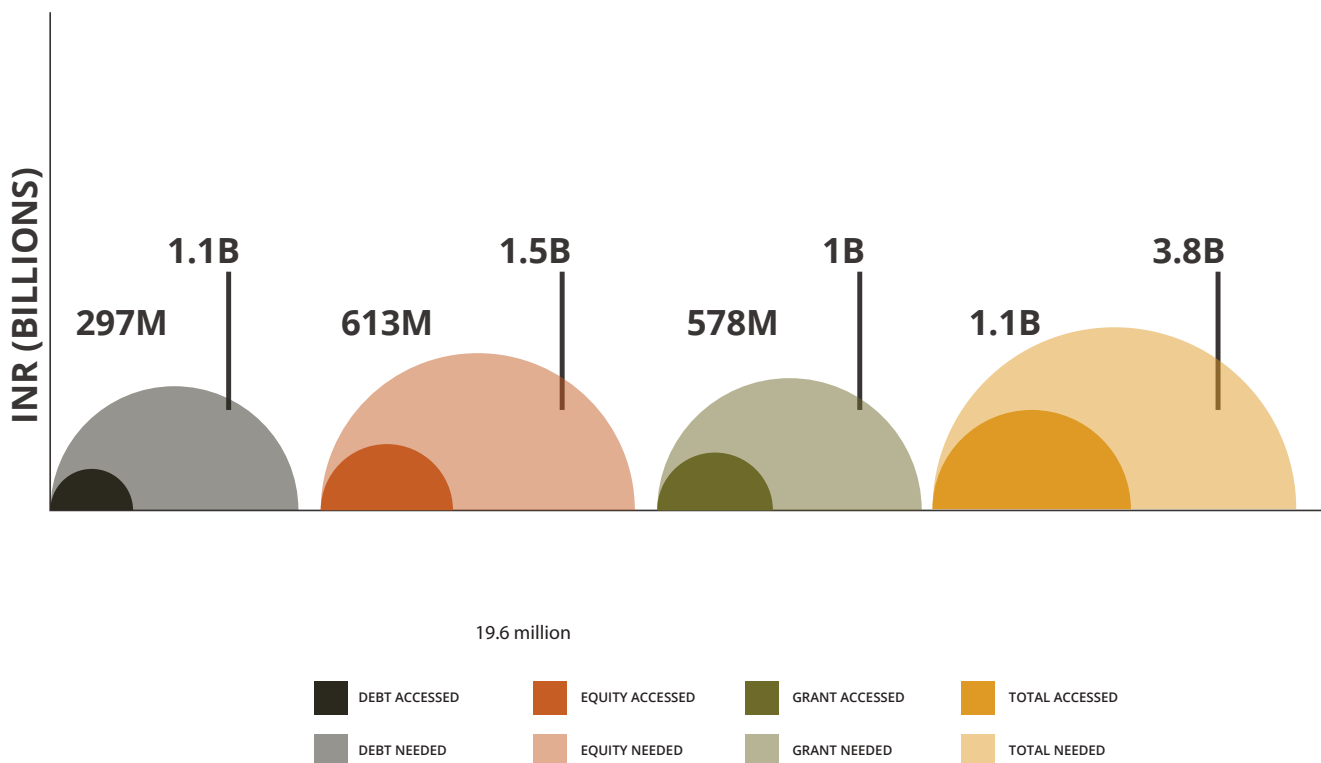


Figure 9 a: Finance raised so far and expected needs over the next 3 years (2017-2020)- by category and type of finance

Source: CLEAN Analysis

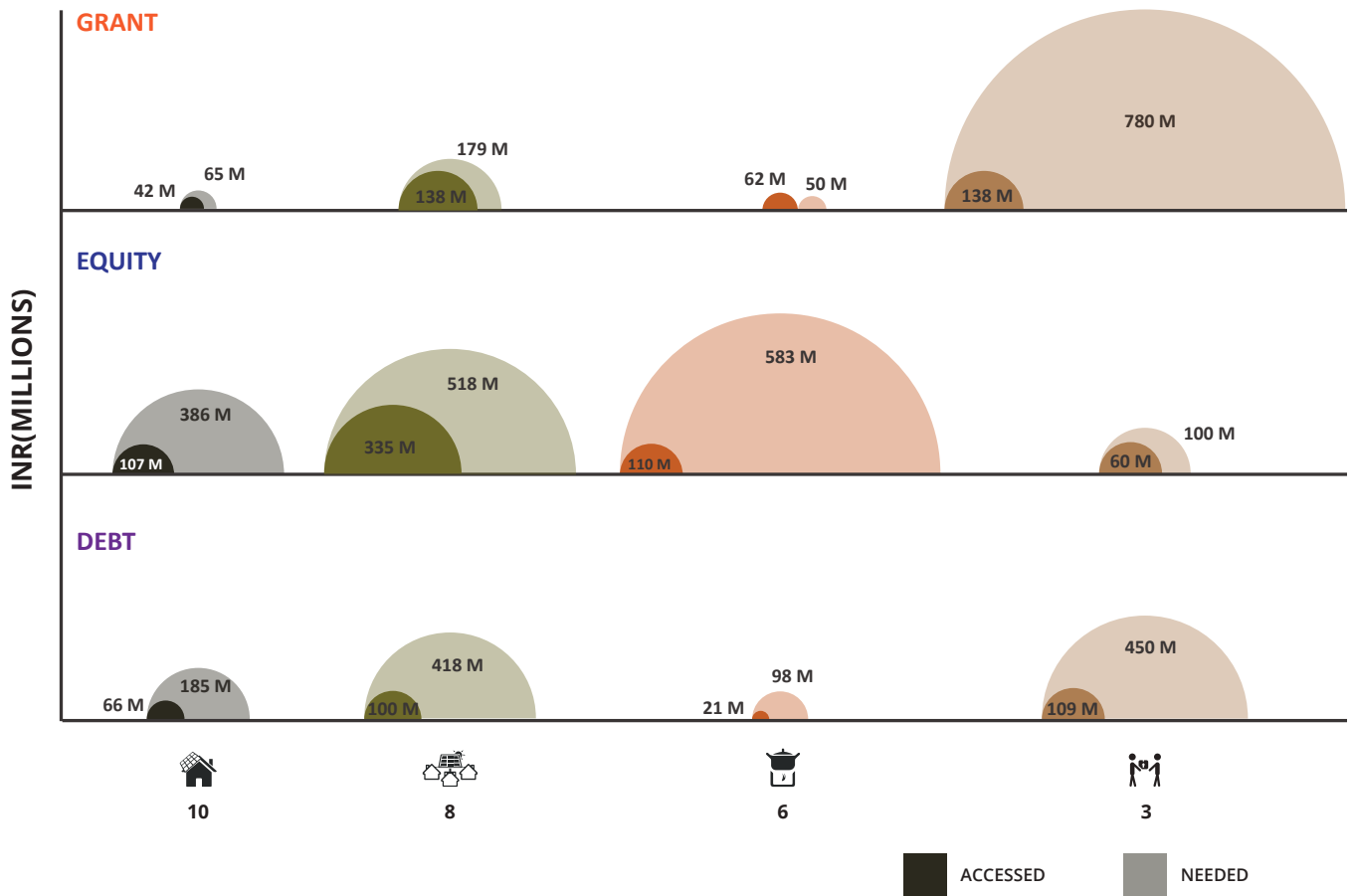


Figure 9 b: Finance raised and expected needs over the next 3 years (2017-2020)- Debt, Equity, Grant

Source: CLEAN Analysis

Note: The responses of 1 member were excluded from this analysis owing to very high figures that would skew the overall picture; the attempt has been to capture more representative insights.

The median debt reported was INR 11 million (USD 171,875). One survey respondent provided very high figures for debt and equity needs. For the purposes of analysis, their response was excluded in order to avoid skewing the overall picture, and capture more representative insights.

Enterprises reported largely being driven on owners' equity with only 45% of the respondents having raised external equity. Those having raised external equity were primarily enterprises that have been around for a minimum of 5-10 years. None of the 3 companies surveyed, with less than 3 years' operational experience had raised any external equity. In the case of grant, 73% of the enterprises

had raised such funding, with Foundations being the largest source. 79% expected to raise grants in the future, indicating that grants will continue to play an important role as a source of financing in the DRE space. This is important to acknowledge as it requires us to qualify the conditions under which we emphasize the operation of a market-driven environment for the DRE sector.

In terms of future financing, the need for these enterprises is likely to grow 3 times over the next 3 years with the growth being highest in terms of debt and equity and a significantly large share of the need coming from micro- and mini-grid companies given the Capex heavy business models.



## Debt- Sources, End Use, Terms and Conditions:

While discussing debt sources used so far, the instruments and the names of entities that provided this debt are worth noting as it sheds light on the costs of capital for energy enterprises and the accessibility of finance. Overdrafts and loans from NBFCs were widely reported used, indicating poor accessibility to cheaper, longer-term sources of financing and reliance on channels with higher interest rates.

While International lenders such as export credit agencies and development banks are large potential funding sources, their stringent due diligence requirements prevent less “sophisticated” enterprises from accessing these sources. Only one enterprise reported accessing these sources and was responsible for 40% of the total debt reported, indicating that only a small number of enterprises are successful in raising larger amounts of debt.

The table below presents the list the financial institutions that enterprises successfully accessed debt from.

The largest category of financial institutions providing debt to energy enterprises were public sector banks within the country. While these institutions are willing to lend (against aspects of track record and business plan which are discussed later), it is mainly overdrafts and loans with higher interest rates making this capital relatively expensive.

While considering the uses of debt, it is clear that long-term financing is a challenge. While several companies reported using bank loans for short-term working capital needs, few respondents used bank debt for equipment financing, which indicates a challenge in finding debt to meet long-term capital needs from low cost sources.

TYPE OF FINANCIERS	NAMES OF FINANCIAL INSTITUTIONS
Impact Investors	Oiko Credit, ICCO Investments
Development Finance Institutions	ADB, OPIC
Public Sector Banks	Syndicate Bank, Punjab National Bank, Bank of India, Central Bank of India, Union Bank of India, Odisha Grameen Bank
Public Sector DFI	NABARD, IDBI
Foundation	DOEN Foundation, ELEA Foundation
PE/ VC Investor	IIFL,
Private Sector Bank	Axis Bank, HDFC Bank, ICICI Bank, CITI bank, RBL
Foreign Bank	Deutsche Bank
Private NBFC	Tata Capital, Maanaveeya Development and Finance private limited, Capital first limited, IntelleGrow, Sriram City

Table 4: List of financial institutions that provided debt to respondents

Source: CLEAN Analysis

It could also be reflective of the higher representation of standalone system providers in the survey since some business models may have lower requirements for long term capital than others. This is summarized below.

Sources	Short Term Working Capital	Long Term Financing	End Consumer Financing
Bank Loan	9		3
Other Loans	5	1	
Shareholder Loan	5		1
Bank Overdraft	5		
NBFCs	4	1	3
Vendors Finance	1	1	1
Bilateral		1	1
Crowdsourcing		1	1
Multilateral organization			1
Export Credit Agency			1

*Table 5: Number of enterprises reporting access to various debt sources and expected end uses*

Source: CLEAN Analysis

Short-term working capital and consumer finance were the most frequently reported end uses of debt. Some enterprises reported raising long-term debt from expensive sources like NBFCs and crowdfunding, contradictory to the interests of such small and medium enterprises. Enterprises reported utilizing the entire spectrum of debt instruments to aid end consumers' finance needs.

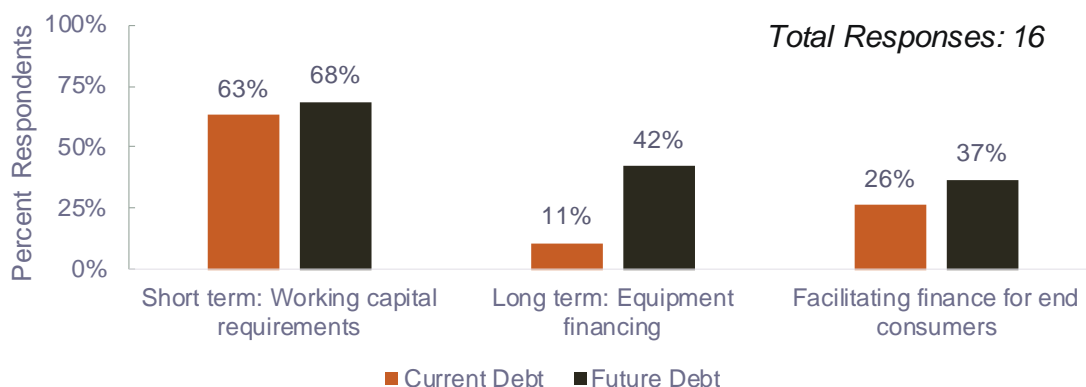
In terms of the use of future debt, the highest need was for short-term working capital and long-term equipment financing.

When analyzed by category, the micro- and mini-grid players and clean cooking solution providers had a greater preference for long-term equipment financing in comparison to short-term working capital, while the standalone electricity system providers and distributors of RE products were more interested in debt from the perspective of short-term working capital and facilitating end user financing.

With the aim of using this exercise to improve access to debt in the future, the assessment sought to understand the current interest rates, tenures at which these enterprises had accessed debt. It also probed into the main challenges faced by enterprises and financiers in facilitating deals.

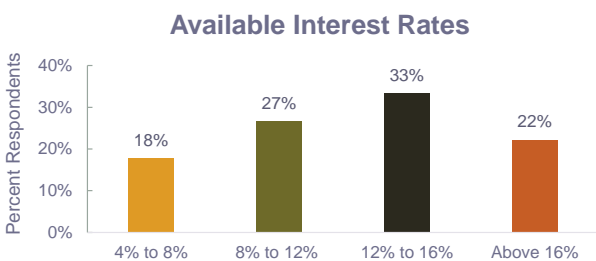
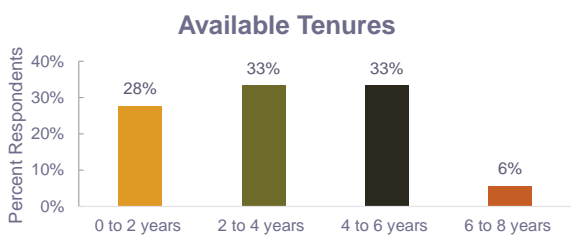
To determine if there was a financing instrument or mechanism that could be introduced to alleviate enterprise level issues, enterprise insights on the terms that they would most prefer changing were also solicited.

### Current and Planned Uses of Debt



As represented in Figure 11 below, the highest percentage of respondents accessed debt at between 12% and 16% interest while tenures for most respondents were between 2-4 years or between 4-6 years. There was a significant drop off in the number of respondents reporting available tenures greater than 6 years. This indicates that long-tenure debt is difficult to access and enterprises are having to rely on expensive, short-term debt. For example, nearly 30% of enterprise respondents are focused on mini-grid and micro-grid technologies with long asset lives. However, debt with comparable tenures is not easily available. This reflects a complete lack of long-term financing that is required and otherwise available for any rural infrastructure project.

Enterprises that borrowed at less than commercial bank lending rates (4-8%) indicate a reliance on international lenders or other cheaper sources that are only available to a handful of enterprises with more sophisticated models- that are able to exhibit stronger business plans, better financial processes and in-house expertise to manage accounting and finances.



In terms of the challenges and the preferred terms, over 70% of respondents indicated that high interest rates and demand for collateral were the key challenges in accessing debt. Time for loan approval and inadequacy of balance sheets were also mentioned as challenges by respondents.

With reference to Figure 12 below, 71% indicated a strong preference for lower interest rates, and 41% preferred less onerous collateral requirements. This validates the point that interest rates continue to be one of the most critical challenges for enterprises.

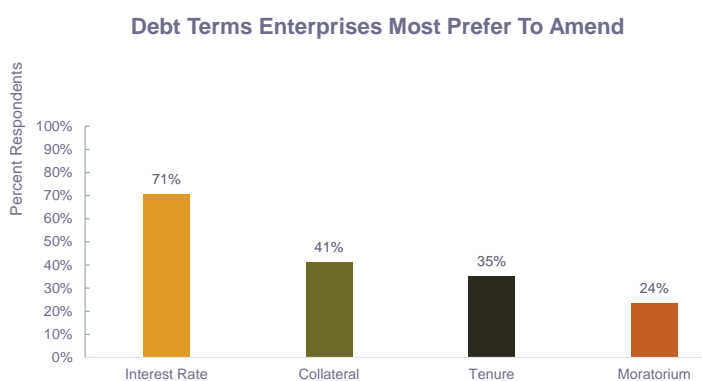


Figure 12: Debt terms that enterprises most prefer to amend.

Source: CLEAN analysis

Note: Respondents had the option of choosing more than 1 debt term that they preferred to amend

In interviews with financiers and the assessment of their insights, inadequate balance sheet size and insufficient company track record were cited most frequently as criteria upon which enterprises' applications were rejected. Interestingly, entrepreneurs did not raise these as challenges, reflecting the lack of communication between the two groups or a mismatch in the understanding of evaluation criteria.

Lenders indicated that newer companies could also be eligible, if they were able to show an order book and a convincing track record, albeit over a limited time period. Given the frequency of its usage, there is a critical need to understand the issue of the 'lack of track record' better and determine the specific

criteria financiers would apply while determining an enterprise's 'track record'. During discussions, it was loosely defined in terms of implementation experience of the enterprise, revenue and the existence of a substantial number of operational systems on the ground. More detailed interactions between both sides are required to arrive at what this "substantial number" would be in the case of SHS, lanterns, cookstoves and micro and mini grids.

One financier highlighted the need for "companies to build partnerships with DISCOMs", which links back to the need for DRE to complement the grid. This in turn requires policymakers to play a more proactive role in being inclusive in rural electrification planning and allowing for stronger linkages with local DISCOMs that can enable DRE solutions to complement grid availability on the ground. This would provide greater confidence to financiers on the utility, viability and sustainability of these business models.

The access to credit issue is one that not only involves financial institutions and last mile enterprises, but also ecosystem facilitators and most importantly policymakers. The manner in which policymakers and the Government view the sector has a bearing on the access to debt, the terms and conditions of that debt which in turn affects the ability of enterprises to scale – both in terms of system deployment and geographical expansion.



## 2.3 POLICY AND REGULATION:

The provision of electricity and clean cooking are viewed as a critical role of the nation state, and hence support from policies and government buy-in on DRE solutions is essential to strengthening the sector. While successive governments have supported clean energy deployment, most of this has been to power the centralized grid.

The few schemes for DRE deployment in remote regions are often viewed as interim or stop-gap arrangements, with little recognition of DRE as a legitimate, sustainable solution to meeting the energy access goal. There are two overarching issues in the current policy scenario and its incentives that favor certain energy alternatives over others.

- **Emphasis on grid expansion and LPG connections:** The current government lays a strong emphasis on its flagship programmes for grid expansion and LPG connections, as the magic bullet to address the access to electricity and clean cooking challenge. While these policies are significant efforts in the right direction, there are a number of other parameters that determine whether or not energy is utilized for improvements in household well-being and income.

The availability and reliability of electricity once the grid has been extended, the ability of households to pay electricity bills and in the case of cooking, the frequency of refills on new LPG connections that reflect affordability also need to be tracked to determine real value-add on the ground. A number of reports and studies have questioned the efficacy of these flagship programmes in terms of sustainable access to

energy services beyond connections (CEEW 2015, SELCO Foundation 2016).

- **Subsidies for kerosene and fossil fuels for the grid:** In line with the centralized, 'one-size-fits-all' approach of the above-mentioned flagship programmes, the continued subsidies accruing to kerosene and coal power as a means of enabling rural energy access require further scrutiny. Kerosene is mainly used for lighting in rural areas and for cooking in urban areas. Research has shown that a significant amount of kerosene from the Public Distribution System (PDS) is lost to leakage including diversion to the black market and theft (IISD 2017). Eventually, the poorest 20% of households in rural India receive approximately 14% of the allocated kerosene share for rural areas.

Apart from not reaching the target population and affecting the state exchequer, kerosene subsidies also distort the market for energy alternatives. Similarly, grid electricity powered primarily by coal-powered plants enjoys a host of subsidies across the value chain from generation to transmission and distribution. In the case of cooking, the focus is on subsidizing a single fuel- LPG rather than assessing the viability of multiple fuels from a consumer-centric lens and determining support for a basket of options chosen by consumers.

DRE solutions on the other hand enjoy fewer government subsidies and MNRE has regularly reduced subsidies available on decentralized solar systems in an attempt to ensure long term phase-out of subsidies. In combination, the continued subsidies for kerosene and grid electricity alongside the annual reduction in the already low subsidies for DRE alternatives make the latter more expensive for the end user.

Across policies for DRE, there is a need to address the lack of a level-playing field and design incentives and support mechanisms that provide better choices to the end user.

This section reviews some of the most critical national-level policies that currently impact the DRE sector. A snapshot on each policy covers the key stakeholders, the primary mechanism/ instrument of support and the eligible set of products or solutions. This is followed by an overview of the policy and an update on where things stand as of date. Where relevant, recommendations are made to enable better deployment of DRE solutions.

The main actors in the policy-making environment for DRE at the national level include the Ministry of New and Renewable Energy (MNRE), the Ministry of Power (MoP), The Ministry of Petroleum and Natural Gas (MoPNG) and the NITI Aayog. At the state level, the state energy departments, DISCOMs and State Nodal Agencies (SNAs) of MNRE play an important role. The figure below outlines the timeline for the various policies covered in this section.

## OVERARCHING POLICIES RELEVANT TO THE SECTOR

### 1. DRAFT NATIONAL ENERGY POLICY:

#### Snapshot:

- Nodal Agency: NITI Aayog
- Launch: To be announced (likely FY 2017-18); Draft policy shared for comments in July 2017
- Primary incentive and instrument for support: Recognition of DRE solutions and biomass with efficient cookstoves as supplementary options to grid extension and LPG provision
- Target and solutions (relevant to DRE): 100% electrification by 2022, full clean cooking coverage by 2022

2010	2011	2012	2013	2014	2015	2016	2017
Launch of National Solar Mission (with off-grid scheme)		Solar off-grid included in Priority Sector Lending			RE included in Priority Sector Lending		GST introduced; Draft National Energy Policy shared for public comments
			Launch of Unnat Chulha Abhiyan		Launch of DDUGY to promote grid expansion for rural electrification	June: Draft Mini Grid Policy shared for public comments	Discontinuation of NABARD off-grid scheme under National Solar Mission
					Launch of PMUY- to promote LPG connections		Close of the Unnat Chulha Abhiyan program

Figure 13: Timeline on National level policies in the sector

Source: CLEAN analysis

## Policy Overview:

The key aspects of the policy relevant to DRE include electricity for all, clean cooking provision and overall development of an enabling ecosystem are outlined below:

### Electricity:

- Recognition that village electrification and household connections alone will not suffice—duration, quality and reliability are important
- Mention of the possibilities of dovetailing grid supply with off-grid solutions and the recognition of cost effectiveness of decentralized solutions with a specific mention of solar lanterns and micro grids in certain areas

### Clean cooking:

- Highlights that the end aim should be fuel substitution of firewood, dung cake, kerosene to cleaner sources such as LPG, Piped Natural Gas (PNG) and electricity
- Acknowledgement of ‘stacking’ of fuels and the need to incorporate biomass in the fuel options, given traditional cooking practices and the abundance of agriculture and forest-based biomass
- Launch of a National Mission on Clean Cooking to coordinate efforts on cooking fuels, efficient cookstoves and related R&D

### Enabling Ecosystem:

- Establishment of an ‘Energy Access Fund’ to convert capital subsidies into operational incentives to address the issues of service and system maintenance
- Development of the ecosystem for clean cooking by (1) supporting cookstoves, electric cooking appliances, bottled LPG and distribution; (2) ensuring maintenance of cookstoves by engaging closely with the Skill India Mission; (3) creating a database to track efforts

## Updates and Recommendations

The draft policy was shared for comments in July 2017 with a deadline of end July for receiving comments. No official announcement has been made since then on dates for notification of the policy.

The draft policy does well to acknowledge the value of DRE solutions, but adds in a condition of using these solutions in “exceptional circumstances”. The suggestions provided below could help create a more comprehensive and inclusive approach to meeting energy access needs:

- Recognize that DRE can play a critical and transformative role even in grid-connected areas by acting as a demand-side response, thereby, reducing the burden of peak demand on DISCOMs.
- Promote a mix of DRE options both in terms of electricity and clean cooking, rather than choosing a ‘one size fits all approach’ to DRE deployment. Based on the context and end user needs, portable pico-products, standalone systems for household and livelihood solutions, micro and mini grids for clusters can be implemented. Similarly with cooking, ensure that support is provided to a basket of options that are clean, affordable and relevant to the local cooking needs.
- Recognize the role of DRE in the provision of energy for Livelihoods, Health care and Education, combined with energy efficient appliances to allow for convergence with programmes of other development ministries.
- The setting up of the ‘energy access fund’ is a welcome move. Clearly outlining the objectives of such a fund is essential to achieve desired outcomes.
- Encourage R&D through field pilots and innovation particularly on storage technologies, efficient appliances, data monitoring, manufacture of improved stoves to meet Tier 4 service levels can improve quality of delivery and usage on the ground; Allow for a focused financial allocation for R & D in the DRE sector would also be critical to enable the above-possibly using resources from the proposed ‘Energy access fund’.
- Provide for greater integration of DRE and its ecosystem needs within the policy to ensure more comprehensive and inclusive approach to energy access in line with ground realities.

## 2. GOODS AND SERVICES TAX (GST)<sup>4</sup>:

### Snapshot:

- Nodal Ministry: Ministry of Finance
- Launched: July 2017
- Primary instrument: Unified tax regime that subsumes all other taxes on goods and services, and includes tax credits through the supply chain
- Relevant product/solutions: Renewable Energy Products at 5% GST, including solar panels, solar powered equipment; Improved cookstoves at 12% GST

### Policy overview:

The Goods and Services Tax (GST) was introduced in July 2017 with the aim of creating a unified tax regime across the country. It replaces the previous system of indirect taxation where multiple taxes were being levied by the centre and state and there was no uniformity in tax rates and structures across states.

The table below captures the various central and state taxes that have been subsumed under GST.

India has implemented a 'dual GST' regime. Under this regime, all transactions of goods and services for consideration would attract two levies i.e. CGST (Central GST) and SGST (State GST). In the case of inter-state sales, an Integrated Goods and Services Tax (IGST) has been created.

Renewable energy devices and spare parts are slotted in the 5% GST tax slab. These devices, including solar products, were previously taxed at 0%-5.5% Value Added Tax (VAT) under the VAT regime (differing across states). With the introduction of GST, RE devices are at 5% and include solar panels, solar lanterns and water heaters, solar power-based devices and power generating systems, biogas plants and so on. However, the individual input components including LED lights, electrical appliances and batteries are slotted under higher GST rates- 12% and 28% in most cases. The GST regime establishes a system of tax credits that flow through the supply chain.

TAXING AUTHORITY	PARTICULARS	APPLICABLE ON
<b>Central Government</b>	Customs Duty	Import or Export of goods
	Excise duty	Manufacture of goods in India
	CST	Inter-state sale of goods
	Service tax	Provision of services
	R&D cess	Import of technology into India under foreign collaboration
<b>State Government</b>	VAT	Sale of goods within the state
	Entry tax/OCTROI	Entry of goods into a local area for consumption / sale

Table 6: Compilation of various Central and State taxes being subsumed under GST

Source: CLEAN analysis

<sup>4</sup> Although the Goods and Services Tax (GST) came into effect after the reporting period (April 2016- March 2017), it was implemented prior to the writing of this report. Given the important implications it has on the cost of products and the operations of last mile energy delivery entities, it has been included here.



Subsequently, consumers will only pay the GST charged by the last dealer in the supply chain. In some cases this may mean a reduction in prices for products that have a lower GST rate (IFC 2017; CLEAN analysis).

Wood burning stoves are categorized under the 12% GST slab, despite the fact that 'Energy saving choolas' or 'Improved (wood burning) biomass stoves' have typically been categorized under 'Renewable Energy devices and spare parts' in the VAT act of most states, including Tamil Nadu, Karnataka, Rajasthan, Pondicherry, Andhra Pradesh, amongst others.

#### **Updates and Recommendations:**

Initial calculations have shown that the imposition of GST will not affect the cost of most decentralized solar-powered devices and systems (including DC home systems, solar water pumps, solar-powered micro- and mini-grids). Improved biomass based cookstoves (pellet or wood-based), on the other hand, would be negatively impacted with a 6%- 9.3% increase in costs (CLEAN analysis).

From the larger renewable energy perspective, it is worth noting, however, that GST on grid-connected, utility-scale solar would result in an increase of capital costs by around 4% (Bridge to India 2017). This combined with the decline in taxation on coal would make thermal power cheaper than its solar counterpart, resulting in a setback to some of the rapid advances made in recent times to close the price gap between the prices of solar power and thermal power, and disincentivizing the former (CEEW 2017).

Another concerning element in the implementation of GST is the indication that GST will directly affect the National Clean Environment and Energy Fund (NCEEF),

as all unutilized funds are likely to be transferred to cover state losses on account of GST (Scroll India 2017; India Climate Dialogue 2017). This amounts to more than INR 567 million. The purpose of the NCEEF, collected through a cess on coal, is to fund research and innovative projects in clean energy technologies.

The draft National Energy Policy calls for the creation of an Energy Access Fund given the importance of the sector and its need for resources. At a time when it is critical to alleviate energy poverty and address India's clean energy transition, funds that would contribute to R&D in renewable energy and could directly impact the transition to a clean energy future should not be diverted to other uses.

In light of the points mentioned above, CLEAN would propose the following recommendations:

- Categorize "Energy saving cook-stoves" under the same tax slab as renewable energy devices and spare parts in the GST tax regime, as it has been by most states under their respective VAT acts.
- Incentivize clean energy in line with the country's Intended Nationally Determined Contributions (INDC) and compensate for the reduced rates on coal by categorizing renewable energy devices and spare parts (including biomass-based electricity generation) under the lowest bracket of 'Nil rate' or 0% under the GST regime.

Retain an appropriate percentage of funding from the coal cess or NCEEF to facilitate clean energy development, on a continuing basis, thereby meeting the needs of energy poverty and energy security while also countering the intermittent challenge of GST losses.

### 3. RENEWABLE ENERGY IN PRIORITY SECTOR LENDING:

#### Snapshot:

- Nodal Agency: Reserve Bank of India
- Launched: 2015 [RE included in Priority Sector Lending (PSL); Solar off-grid was included under 'Other Indirect Agriculture loans' in 2012]
- Implementing institutions: Scheduled Commercial Banks (including select foreign banks), Regional Rural Banks (RRBs)
- Primary instrument: Ensuring advances to this sector (of the 75% PSL mandate to RRBs and the 40% PSL mandate to commercial banks)
- Eligible products/ solutions: All RE products and solutions (upto INR 1,000,000 for household systems; upto INR 150,000,000 for RE based utilities)

#### Policy Overview:

Priority Sector Lending (PSL) was first introduced for banks by the RBI in 1974, to ensure adequate credit flows to certain sectors and institutions that would otherwise not be attractive for banks, but would ensure socio-economic benefits for vulnerable sections of the economy. The categories include Agriculture, MSMEs, Education, Housing, Social Infrastructure, and advances to weaker sections of community, among others. Since July 2015, Renewable Energy is also one of the categories with the RBI circular stating:

*“Bank loans up to a limit of ₹ 15 crore to borrowers for purposes like solar based power generators, biomass based power generators, wind mills, micro-hydel plants and for non-conventional energy based public utilities viz. street lighting systems, and remote village electrification.*

*For individual households, the loan limit will be ₹ 10 lakh per borrower” (RBI 2015- Master circular: Priority Sector Lending)*

PSL forms 40% of the total advances within commercial banks while it is 75% of all advances in the case of RRBs. The RBI has also created targets for sub-sectors including Agriculture, Micro Entrepreneurship and Weaker Sections. However, no such target currently exists for RE.

#### Updates and recommendations:

While the annual report of the RBI (2016-17) speaks of PSL and makes a mention of renewable energy as one of the eligible categories, there is no mention of the amount of lending to RE. The report only provides aggregates for Agriculture and MSME lending (which have sub-targets). Discussions with individuals at NABARD and select public sector banks indicate the lack of any clear, uniform mechanism for all banks to track renewable energy lending as part of PSL.

Some suggest that RE is currently being categorized under a head termed 'Others', making it much harder to have a clear sense of the amount of credit flowing specifically to RE under PSL (which would include all financing for DRE).

The lack of information for categories that don't have a target prevents an analysis of the extent to which this directly impacts the DRE sector's access to finance. Towards addressing this, there is a need for greater understanding of the data collection process on PSL lending and the current challenges around recording RE-specific credit flow. Based on this understanding, a sub-target for RE or DRE within PSL could be explored

## ELECTRICITY-RELATED POLICIES:

### 1. DEENDAYAL UPADHYAYA GRAM JYOTI YOJANA (DDUGJY)

#### Snapshot:

- Nodal Agency and Ministry: Rural Electrification Corporation (REC), Ministry of Power
- Launched: 2015 (subsumes the previous rural electrification scheme- Rajiv Gandhi GrameenVidyutikaranYojana -RGGVY)
- Implementing institutions: DISCOMs, State Power Departments, SNAs (for DDG scheme)
- Primary incentive or instrument for support: Extension of grid to rural areas and subsidized electricity provision; Subsidized decentralized energy systems for villages that cannot be grid-connected
- Eligible products/ solutions: Grid-based electricity for un-electrified villages; Decentralized Distribution cum Generation for un-electrified villages and households

#### Policy Overview:

One of the flagship programmes of the current government, the DeendayalUpadhyaya Gram JyotiYojana (DDUGJY) with a budget of INR 760 billion aims to ensure 100% rural village electrification by 2019. This programme is implemented in conjunction with the Remote Village Electrification Programme (REVP) and the Decentralized Distributed Generation (DDG) schemes which are focused on villages that will be electrified through DRE and other decentralized solutions. A 90% subsidy is available from the central government through SNAs for the provision of DRE systems under DDG.

Provisioning of micro-grid and off-grid distribution networks find a mention in the guidelines of the DDUGJY, however there is very little beyond this mention. With an outlay of INR 5.4 billion, the DDG scheme is envisaged for villages where grid connectivity is either not feasible or not cost effective. The list of villages is to be compiled by states and shared with the REC for central financial assistance.

In addition to 100% village electrification, DDUGJY focuses on separation of agricultural and non-agricultural feeders to ensure regularity of supply for the latter, improved sub-transmission and distribution network to improve the quality and reliability of the supply and implementation of metering (Dalberg 2017). The scheme has also successfully created an online platform known as the 'Garv dashboard' to track progress on village (and more recently) household electrification.

#### Updates and Recommendations:

Out of the 597,464 census villages, 594,411 villages (99.4%) have been electrified as part of this program (last seen on 15<sup>th</sup> September 2017). Of the remaining 3053 villages, the largest numbers are in the states of Arunachal Pradesh, Assam, Odisha and Jharkhand (contributing to more than 2,000 un-electrified villages) (GARV platform). However, the more relevant indicator of progress on rural electrification is at the household level. 23% of all households, amounting to more than 40 million households remain unelectrified, and these are largely concentrated in the states of Odisha, Madhya Pradesh, Bihar and Uttar Pradesh (GARV platform).

There is little information available at the national level on the progress under the DDG scheme. Out of 4,604 DDG projects that have been sanctioned covering 240,911 households across various states, 2,224 projects are based on standalone systems and balance are mini/micro grids (MNRE 2016). So far, 518 mini/micro grids have been commissioned in the states of Andhra Pradesh, Chhattisgarh, Madhya Pradesh, Kerala, Uttar Pradesh, Karnataka and Uttarakhand. Given this scenario where a limited number of projects have been installed, it would be ideal to have a process for DRE entities to be accredited and enable implementation on the ground in conjunction with DISCOMs and through national and state mini-grid schemes. The scope of DDG could be expanded within DDUGJY to allow for areas that are unreliably electrified by the grid where DRE becomes a complement to the grid. This would enable DISCOMs to also address their peak power demands in a more efficient and effective way.

## 2. NATIONAL SOLAR MISSION- OFF GRID SCHEME

### Snapshot:

- Nodal Ministry: Ministry of New and Renewable Energy
- Launched: 2010
- Implementing institutions: State Nodal Agencies; NABARD through Regional Rural Banks, Commercial Banks, Cooperative banks (the NABARD channel has been discontinued since April 2017)
- Primary incentive and instrument for support: Subsidy for systems; End-user financing
- Eligible products: Solar Home Systems, Solar water heating systems (discontinued in 2014), Solar water pumps, solar street lights, Power packs, Micro and Mini grids

### Policy overview:

One of MNRE's flagship programmes has been the National Solar Mission (NSM) which was launched in 2010. Under the mission, the government seeks to increase the capacity of solar to 20000 MW by 2022, with 2000 MW in off-grid solar including 20million solar lighting systems (or solar lights). The main features of the policy are outlined below:

- **Products and Solutions:** The off-grid component of this mission promotes applications such as Solar Home Systems (SHS), solar water heating systems (discontinued in late 2014), solar water pumps for irrigation and drinking water, solar street lights and power packs
- **Subsidy:** Central Financial Assistance (CFA) in the form of a subsidy to end users is available from MNRE. The subsidy- between 30-40% against a benchmark cost- could flow directly to the Ministry's State Nodal Agencies (SNAs) in specific states or through the National Bank for Agriculture and Rural Development (NABARD). This benchmark cost is considered for revision on a yearly basis to take note of changes in market development and reduction in prices.

Through the SNA route, 30% subsidy from MNRE is combined with subsidies from the State Government and an end-user contribution of around 10%. Projects are then tendered out to the lowest bidder with conditions on installation, servicing, payment and so on.

- **End user financing:** Under the NABARD route, the 30% MNRE subsidy is combined with a loan from RRBs/Cooperative Banks/ Commercial banks for the remaining system cost. The subsidy is routed to the bank through regional offices of NABARD as a back-ended subsidy into the loan account of the end user, who chooses the specific solar energy system integrators to buy the system from.

In both cases, for the subsidy to accrue, the solar system integrator must be accredited under the NABARD off-grid scheme or directly with the MNRE-SNA scheme and the product must be certified against a set of criteria.

**Updates and recommendations:**

The achievements and number of systems deployed under the NSM specifically on Solar Home systems and solar water pumps are provided in the table below (MNRE 2016; MNRE 2017). This summarizes the cumulative numbers since the start of each of the schemes.

	Through States	Through NABARD	Grand Total
<b>Solar Home Systems (April 2010- Dec 2016)</b>	1,186,600	108,000	1,294,600
<b>Solar Water pumping systems (Apr 2014-Feb 2017)*</b>	124,739	2,833	127,572

\* CLEAN was informed that final numbers for NABARD are yet to be compiled

MNRE has indicated that a revamped version of the off-grid scheme will be introduced in the coming months. This scheme is likely to engage with banks directly through IREDA- the Indian Renewable Energy Development Agency- a financing arm of MNRE. So far, less than 10% of enterprises within the membership base of CLEAN have been able to engage with the scheme.

The constraints have mainly been in terms of empanelment/accreditation of enterprises with NABARD or the SNA, which requires a minimum 3 years of operation in addition to having the enterprise rated by a credit rating institution which can be expensive for a small enterprise. Additional issues cropped up with a new certification processes that made products being supplied by members no longer eligible for subsidies.

In order to address the challenges and ensure a more comprehensive approach, the following measures would be useful (based on recommendations from CLEAN and partners to MNRE)

- Addressing the dual subsidy scheme, particularly for solar water pumps for irrigation, as it creates a competition between the 2 routes for subsidy provision at the state level. The NABARD route included a bank loan for end users, while the State route includes a top up on the MNRE subsidy to cover as much as 80-90% of the total cost. This issue around duplication could be overcome by segregating the beneficiaries eligible for one or the other (based on pump capacity or based on farm size).
- Adding new products to the list of eligible solutions to include more livelihood based applications that can ensure higher return for end users and increase the possibility of repayment.
- Creating targets and incentives for banks operating in kerosene-dependent states to ensure greater deployment in regions that need it the most. This combined with well-thought out interest subsidy programmes can ensure the move towards more market-based mechanisms of DRE financing.
- Developing a strong monitoring platform to track performance of solutions deployed on the field using government support. This could include a grievance redressal mechanism and online tracking of deployment of systems and their status based on consumer feedback and enterprise action

### 3. DRAFT MINI-GRID POLICY:

#### Snapshot:

- Nodal Ministry: Ministry of New and Renewable Energy
- Launch: To be announced (likely FY 2017-18); Draft policy shared for comments in June 2016
- Implementing institutions: State Nodal Agencies, Rural Energy Service providers
- Primary incentive or instrument for support: Subsidy on systems installed, Accreditation of RESCOs
- Target solution: 500 MW capacity addition through deployment of at least 10,000 RE based Mini and Micro grids

#### Policy overview:

The objective of the policy is to promote the deployment of micro and mini grids powered by a range RE sources in un-served and underserved parts of the country through the development of state-level policies and regulations that enable participation of Energy Service Companies (ESCOs) (which include enterprises referred to in this report as last mile energy delivery entities or DRE practitioners).

Through the draft policy, the Ministry has set a target of deploying at least 10,000 RE based micro and mini grid projects across the country over a 5 year period, with a minimum installed capacity of 500 MW (assuming an average size of 50 kW per mini grid). The key features of the policy include:

- **Performance standards:** Each project should meet the basic needs of households, including lighting, fan and mobile charging with a minimum power supply of 8 hours; they should

strive to also meet productive loads and commercial needs of the local region and supply 24\*7 power.

- **Empanelment of ESCOs as RESPs:** To accelerate the process of deployment, the Ministry will empanel ESCOs as Rural Energy Service Providers (RESPs) to install, own, operate and service mini grid projects. Empanelled RESPs can directly identify and implement projects and claim the related benefits and incentives. The policy allows for provisional empanelment of early stage ESCOs and future accreditation conditional on the completion and validation of a certain number of projects, thereby creating a larger pool of operators in the interim.
- **State action:** States will be responsible for developing additional standards around safety, performance and technical design through their own policies or programmes. In addition to an open market approach in site selection and installation, it also provides for a state-led approach where the State identifies priority areas for mini grid projects for ESCOs to install projects and/or collaborate with the local DISCOM under a distribution franchisee.
- **Additional support and Exit options:** A 'potential ESCO' in this scheme could be an existing energy service provider, equipment manufacturer, supplier or an integrator. There is a focus on supporting RESPs in terms of research, innovation, pilots, capacity building and financial linkages for the projects. Multiple exit options for ESCOs operating mini grids are also outlined for areas where grid already exists as well as where the grid is yet to arrive. The policy will be reviewed 3 years after notification.

## Updates and Recommendations:

Following comments on the draft policy and a set of stakeholder consultations organized by the Ministry, the revised draft of the National Mini Grid policy is awaiting internal approvals at MNRE before being notified. There is some indication that it is likely to be notified over the next 3-6 months.

Despite delays in the notification of the policy at the national level, there has been progress at the state level with certain states notifying relevant policies and regulations. Over the last 6 months, the states of UP and Bihar have moved on notifying their Mini Grid Policy and RE policy respectively and are preparing the implementation framework for mini grids.

In Odisha, the Mini grid regulation is under preparation while the policy for DRE systems, including mini grids has been notified in Madhya Pradesh.

Notification of the National level policy would be critical in ensuring that other states develop their own DRE/ RE/ Micro and Mini grid policies. This will help provide the much-needed policy certainty to reduce risks involved in implementation and investment in micro and mini grids and could enable accelerated deployment to complement grid extension.



## CLEAN COOKING POLICIES:

### 1. PRADHAN MANTRI UJJWALA YOJANA (PMUY)

#### Snapshot:

- Nodal ministry: Ministry of Petroleum and Natural Gas (MoPNG)
- Launched: May 2015
- Implementing agencies: MoPNG and three Public Sector Undertakings (IOL,HP,BP)
- Primary incentive and instrument for support: Subsidized LPG connections to Below Poverty Line (BPL) households
- Eligible solutions and Target: LPG connections for 50million BPL households by 2019

#### Policy Overview:

The Pradhan Mantri Ujjwala Yojana is a joint effort of the ministry of petroleum and natural gas and the three public sector oil and natural gas companies, Indian Oil Corporation (IOC), Bharat Petroleum corporation (BP) and Hindustan Petroleum corporation (HP). Ujjwala seeks to expand access to LPG; the earlier approach of the government has been to provide LPG at subsidized rate to all domestic consumers. Ujjwala was preceded by Pahal (the direct bank transfer scheme to ensure better targeting of LPG subsidy), and 'Give it up' (to encourage customers to voluntarily give up LPG subsidies). Each LPG connection is provided with a financial support of INR 1600.

The scheme has thus far been restricted to BPL households listed in the Socio-Economic and Caste Census 2011. 5kg LPG cylinders are also covered under the Ujjwala scheme to tackle the problem of

high refill costs. To improve access to connections, the rural distribution network has been expanded, with a relaxation of financial criteria for distributors and a mandate to build infrastructure that enables home delivery of cylinders to reduce barriers to refills.

#### Updates and Recommendations:

Under the scheme, 50% of the target has reportedly been achieved. PMUY has helped LPG penetration to reach a national coverage of 70% as of 2017. There are certain gaps within the scheme that are worth noting and addressing.

- Preferred fuel choice of the end user and aspects of adoption, affordability and reductions in subsidy are not addressed under the policy
- Provision of LPG connections remains the focus. However, ensuring reliable and affordable LPG refills will be necessary to ensure that it is used and adopted effectively.

### 2. UNNAT CHULHA ABHIYAN

#### Snapshot:

- Nodal Ministry: Ministry of New and renewable Energy
- Duration of programme: 2013-2017
- Implementing agencies: MNRE, SNAs
- Primary incentive or instrument for support: CFA in the form of a 40%-50% subsidy against a benchmark cost; R&D support for more efficient design and test protocols and standards
- Eligible solution and Target: MNRE-approved stoves of both natural and forced draft; Installation and dissemination of 2.75 million improved biomass cookstoves- household and community levels



### Policy overview:

Unnat Chulha Abhiyan was an initiative by MNRE in continuation of the different schemes around improved biomass cook-stoves, most importantly, the National Biomass Cook-stove Initiative (NBCI). The initiative focussed on the setting up of state-of-the-art testing, certification and monitoring facilities and strengthening R&D programmes.

The aim was to design and develop an efficient, cost effective, durable and easy to use device. As a follow up of NBCI, Unnat Chulha Abhiyan Mission was launched during the 12th plan period with a budgetary cost of INR 2.9 billion. The objectives were:

- To develop and deploy improved biomass cook - stoves for providing cleaner cooking energy solutions in rural, semi - urban and urban areas using biomass as fuel for cooking.
- To mitigate drudgery of women and children, currently using traditional chulha for cooking.
- To mitigate climate change by reducing the black carbon and other emissions resulting from burning biomass for cooking.

The targeted groups for the scheme included:

- Individual households in rural areas who use biomass for cooking purposes.

- Kitchens of Mid-day Meal scheme, Anganwadis, forest rest houses, tribal hostels and small business establishments (roadside *dhabas*, small hotels and restaurants and a variety of cottage industries like textile dyeing, drying of spices and so on)

### Updates and recommendations:

Although the physical target was 2.75 million improved cookstoves to be disseminated, some suggest that less than 2% of that target was met by the time the scheme ended. It faced a setback with the launch of the PMUY. The absence of affordable Tier 3 and Tier 4 emission improved cookstoves in the market was also a major setback for the mission.

The dominance of traditional biomass cookstove in rural areas is primarily due to the affordability and availability of the fuel and fuel flexibility of the stove. Therefore it is important to appropriately integrate end user needs in the design and implementation of any improved cookstove scheme. Additional resources are also required to develop and innovate upon Tier 4 stoves (highest tier in terms of emissions and efficiency) through a co-ordinated and consistent R&D effort. Without addressing these challenges around end user preferences and R&D needs, many stoves are unable to fully replace the traditional chulhas.

## 2.4 TECHNOLOGY AND SKILL DEVELOPMENT

This section seeks to provide a glimpse into the current scenario on technology and skill development- with a focus on enterprise needs in terms of newer applications and tools. As this is not a primary focus area of the report, the technology section merely captures enterprise needs in terms of newer applications and tools and the skill development section provides a summary on the effectiveness of the Suryamitra programme the flagship programme on solar energy technician training.

### Technology needs of the DRE sector:

In order to better understand the need for innovation or interventions in DRE-powered consumer appliances and system performance enhancement tools for the sector, a survey was circulated amongst the 69 last-mile energy delivery entities within the CLEAN membership. Members were asked to rank solutions that they would want further testing, innovation and R&D on from a list of 16 electrical appliances (to meet household, livelihood, education and healthcare needs) and 4 system performance enhancement products. The factors that affected the ranking included: (1) demand from the ground, (2) high-volume expectations from manufacturers to provide at a reasonable rate per unit and (3) the existence of such a product in the market.

Based on the responses from members, 3 products from the consumer appliances category and 2 from the performance enhancement list were selected for technology incubation and field pilots to be undertaken by CLEAN over the course of 2017-18. In addition, a testing tool for clean cooking was also added to the list based on demand from relevant enterprises. The types of challenges and tools to address them provide insight into the needs of DRE practitioners.

### Consumer appliance needs:

1. Variable Frequency Drive (VFD) for domestic and livelihood applications (single phase to single phase); (Household and Livelihood): In order to address the challenge of high-power requirements for starting a small-capacity motor (upto 2 HP) for livelihood and domestic applications, there is a need for an appropriate VFD. Such a solution would also eliminate the issue of having to over-design the system with implications on costs, maintenance, financial repayment and so on.
2. DC mixer grinder with 30 minutes battery back-up (Household): DC operated appliances combined with DC producing DRE technologies can provide considerable energy savings compared to the current AC system. There is considerable opportunity to increase the efficiency of the universal motor that is being used in the household mixer-grinder appliance through collaboration with manufacturers and R&D centers.
3. Renewable energy powered energy-efficient milling machine (Agriculture): Solar energy can be used to power an electric AC motor that can overcome the current challenges of grain milling in rural areas- linked to fuel costs and electricity availability. The aim is to develop a solar powered system without batteries, but with an energy efficient 3-phase AC motor and the possibility of isolating the conveyor belt (currently a source of low efficiency due to friction losses).

### System performance enhancement and testing:

1. VFD with Remote Monitoring System for solar water pumping or irrigation load: Secondary research indicates that 70% of all electrical energy used in India operates flow loads such as pumps, fans, blowers and compressor, mostly powered by constant speed induction motors. When output flow requirements fluctuate in such systems, an external means of

adjustment is needed. The focus is on creating an effective solution for speed control and reduced power consumption, while also helping reduce resource-intensive maintenance activities post-installation.

2. Lithium Ion battery technology for mini-grids: Lithium Ion batteries provide a relatively maintenance-free alternative to lead acid batteries in decentralized solar energy systems — both standalone and micro- and mini-grids. The attempt will focus on understanding the ground level challenges of implementing and utilizing Lithium Ion batteries in DRE systems.
3. Portable Emission Measurement System for clean cooking: The system enables testing of improved cookstoves under actual field conditions, while providing emission data that

could add a layer to existing lab-level tests which are not able to provide a clear benchmark for performance. The information from such a system would help clean cooking solution providers understand the extent of deviation between the lab and the field data, and provide insights to them as well as stakeholders such as the Government and resource partners.

As is evident from the products detailed above, the main need on the appliance side is for increased efficiency of AC appliances and additional DC appliances in the market to meet a variety of end user needs. To complement this, the demand for performance enhancement tools captures the importance of testing technologies under field conditions, the interest in adopting newer battery technologies and remote monitoring mechanisms to improve operational efficiency and costs for the end user.



### **Skilling in the DRE sector: Solar Technician training**

With reference to skills and training in the sector, an important development has been the creation of the Sector Council for Green Jobs (SCGJ) in 2015. The Council is responsible under the Ministry of Skill Development and Entrepreneurship, for the creation of qualification frameworks and packs, certification of training institutions, and evaluation and certification of students undergoing courses in green jobs. Currently, the Sector Council is primarily focused on solar technician training. Biogas and clean cookstoves trainings are to follow.

In the same year, the National Institute of Solar Energy (NISE) under the direction of MNRE began the Suryamitra Skill Development Program to help train 50,000 skilled solar PV technicians by 2019, with the aim of achieving the 100GW target of the National Solar Mission by 2022. In alignment with NSM, Make in India mission and the Skill India Mission, several training programmes have been started to serve the dual purpose of filling the skill gap in the solar energy sector while generating employment opportunities.

Currently, both the SCGJ and NISE play similar roles in promoting the Suryamitra training on solar technician development, albeit with slightly different models, timeframes and support mechanisms.

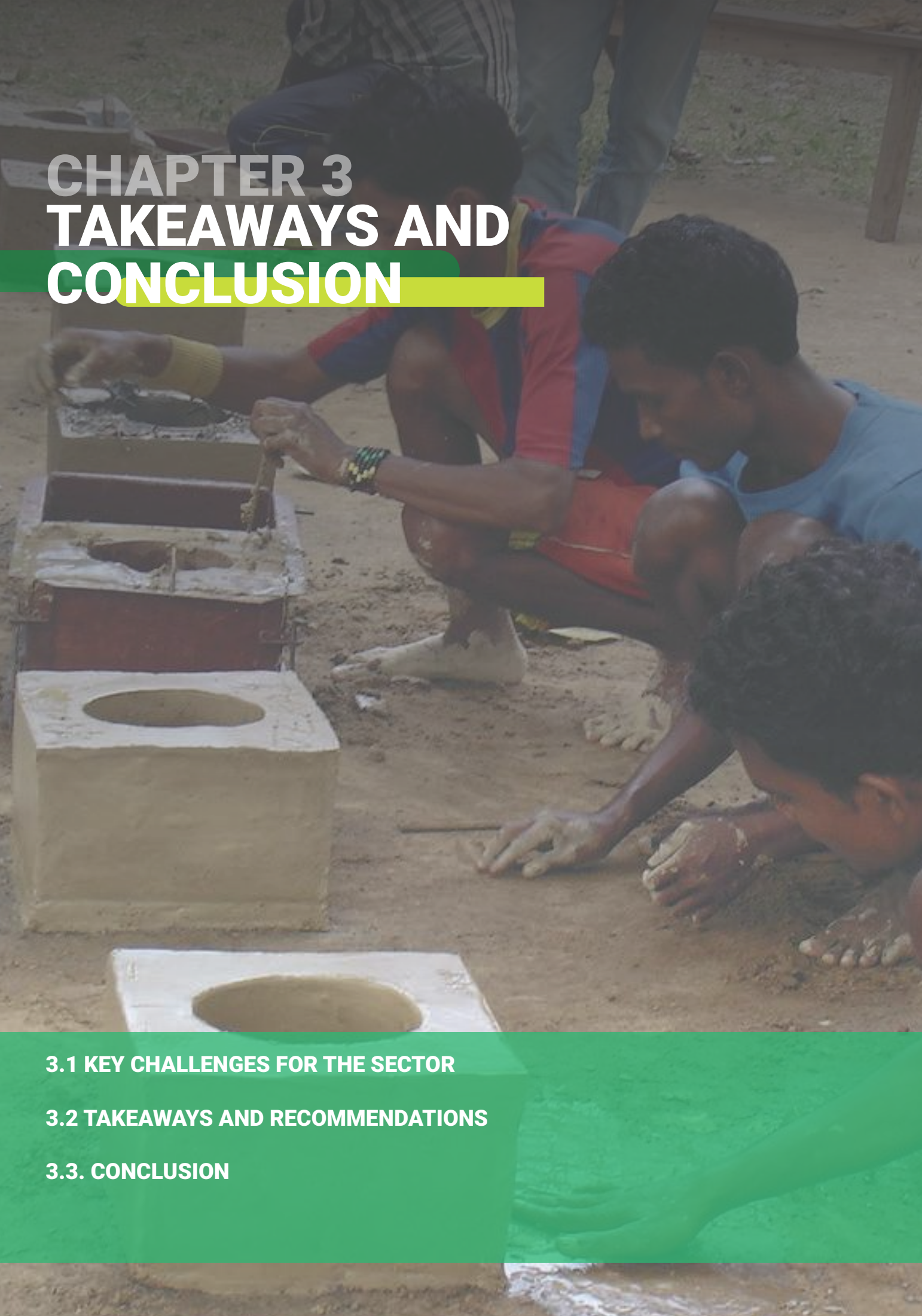
The NISE training began in 2015 through a group of accredited training institutions that took on targets and were provided support on a per trainee basis from MNRE and the SNAs. Till date, more than 10,000 people have been trained through 150+ training institutes (MNRE 2017). CLEAN undertook a basic evaluation to understand the effectiveness of this program by speaking with members and training institutions. CLEAN reached out to 20 of its members and 10 training institutes.

This was complemented by a review of the reports released by NISE on the training and placement data of this program.

The findings suggest that those organisations that did recruit Suryamitra trainees are satisfied with their performance at work. However, few members have made an effort to recruit trainees coming out of this program. The main reason being that the regions where last-mile delivery entities operate are far away from where the training is undertaken. The trainees, who are typically graduates from Industrial Training Institutions (ITI) or diploma holders are recruited into the training institution locally and post-training begin looking for opportunities in the same region or in towns and cities. Language constraints between states may also become a challenge.

Recruiting organizations find it easier to find local individuals with limited skills and train them on-the-job as this increases their retention rate. Moreover, the wage levels that DRE entities can pay to the trainees are not commensurate with their qualifications. Hence, while this program contributes to grid-connected solar projects, is not designed in a manner that can address the skill gap in the DRE sector.

For the DRE sector, it would require adding the technical skill sets to someone who is already trained in the local area and mapping the number of trainings to the demand in the region. An alternative is to introduce the solar technician training as a part of the electrician trade within every ITI and similar vocational training institution. This would go a long way in ensuring the next generation of electricians in this country are able to design, install and maintain solar energy systems even if they are not taking up a full time role in that profession.



# CHAPTER 3 TAKEAWAYS AND CONCLUSION

**3.1 KEY CHALLENGES FOR THE SECTOR**

**3.2 TAKEAWAYS AND RECOMMENDATIONS**

**3.3. CONCLUSION**

## Chapter 3: Takeaways and Conclusion

This section summarizes the larger level challenges within the sector and the key takeaways based on the state of the DRE sector in India in 2016-17. These are based on the analysis conducted by CLEAN on the operations of members, access to finance, current policy scenario and an assessment of technology and skills needs. A summary of the recommendations and possible actions to address the key challenges and the relevant stakeholders for each is also provided. The section ends with higher level insights and a vision for the state of the sector report for 2017-18.

### 3.1 KEY CHALLENGES IN THE SECTOR:

The main challenges for the sector within each vertical/ ecosystem factor are outlined below:

#### Information:

- Lack of strong data management systems and limited data availability in smaller enterprises, primarily owing to the organization's internal capacity and the lack of clarity on usage and value add of data sharing
- Limited attempts to evaluate improvements in electricity and cooking energy access, beyond connections and number of systems installed or disseminated, mainly owing to resource intensive processes for impact evaluation (particularly for the DRE sector). Multiple factors about the enabling environment also need to be considered while determining if energy access is able to bring about economic improvements.

#### Access to finance:

- Inability of enterprises to show proof of a strong track record on operations and financial processes combined with weak business plans make bankers more reluctant to lend
- Reduced access to commercial debt for enterprises owing to restrictive conditions such as high interest rates and collateral requirements
- Limited long-term debt availability that affects the possibility of longer term planning, organizational growth and expansion
- Gap in deal flows on debt financing; Despite availability of credit lines and funds, limited accessibility and/or utilization by energy enterprises

#### Policy:

- Negative implications of GST including increased cost of improved cookstoves and disrupted flow of business requiring reorganization of accounting systems and ensuring all input providers are also part of the system (without which input credit cannot be claimed); On a positive note, over time GST is likely to spur more organised operations and this could then improve the long-term financing prospects for the sector
- Proposed diversion of NCEEF resources and reduced resource availability for clean energy R&D and innovation

- Near-exclusive focus on centralized schemes and approaches to rural energy access with limited or no recognition of DRE in complementing centralized schemes; discontinuation of NSM-off-grid scheme, delays around National mini grid policy and near-exclusive focus on LPG in clean cooking. In combination they reduce confidence of bankers and investors

#### Technology and Skills:

- Inadequate resources to experiment with technology solutions on the field and low availability of efficient appliances, particularly for livelihood applications in the market, that can be powered on DRE
- Limited benefits reaped by the DRE sector from the Suryamitra programme owing to gaps in terms of training location (where the training is undertaken vs. where the trainees are required), remuneration expectations (higher than paying capacity of DRE enterprises) and inadequate demand mapping.

### 3.2 TAKEAWAYS AND RECOMMENDATIONS:

#### Information:

- **Data collection:** The time and resource challenges faced by enterprises in managing data and sharing it need to be addressed. This would require development of more efficient mechanisms for collection of data on an ongoing basis that ensures a seamless process from data gathering at the enterprise/ organizational level to analysis and presentation of aggregates and trends at a sectoral level.  
Regular data collection and trend analysis when compared with previous years would be instrumental in indicating how the sector is progressing and will provide insights for insiders and key stakeholders enabling them to undertake better policy making and financing.

- **Indicators and metrics for energy access:** It is critical to improve the set of indicators that are used to measure household electrification, clean cooking access, and energy availability for livelihood, health and education. By increasing the benchmark for energy provision and supporting with information from the ground on the current scenario, better plans can be developed to achieve a higher standard of energy provision that leads to well being and income generation. By engaging with policy makers, these indicators could be institutionalized to ensure better evaluation of progress on schemes as well.

#### Access to Finance:

##### Demand side:

- **Interest rates and collateral:** There is a need for CLEAN, philanthropies and other organizations to come together and address the main obstacles that enterprises are facing in their attempt to access debt- interest rates and collateral requirements. There have been examples of efforts to use credit guarantees to enable end-user financing for energy from banks and financial institutions. It is worth exploring if similar mechanisms and interest subsidy provisions could reduce bank risk, unlock commercial debt and begin to help build a credit history for DRE enterprises as a whole.
- **Training and capacity building:** Financiers have clarified that poorly developed business plans, lack of track records and enterprise understanding of financial needs have been the main reasons for rejection of debt applications. To address this, CLEAN and other capacity-building institutions must come together to develop short, robust enterprise financial capacity building programmes that are delivered to various levels of personnel within each

enterprise to overcome financier hesitation around engaging with the sector. Highlighting the benefits of maintaining proper books of account and providing access to accounting software could help.

- **Long-term debt needs:** No enterprise would be able to build a strong business, undertake innovation and expand into un-served regions without access to long-term debt. Without this, enterprises are having to plan from one year to the next which affects the potential for impact. However, in order to access long-term debt, a shift in policy is vital. In the past, the sudden withdrawal/ modification of schemes and introduction of new ones without adequate consultations have been serious issues. Without a policy level certainty and recognition of the sector and involvement of key energy agencies, financiers will continue to be hesitant about treating decentralized clean energy provision as rural infrastructure and providing it the terms and conditions that accrue to rural infrastructure projects.

#### Supply side:

- **Limited utilization of existing schemes and credit lines:** Despite a number of DFIs and multilateral and bilateral institutions developing new funds and credit lines for energy access, most lie unutilized. Those that are utilized are most often used for rooftop projects that don't necessarily address the energy access challenge. It requires a change in the mindset of those leading or coordinating these credit lines to overcome conditions around ticket sizes, profitability and so on. It would also require more effort to enable deal flow by creating opportunities for interaction between practitioners and financiers, clarifications around terms and conditions and support for enterprises to put in their applications. Perhaps,

some of the unutilized resources could be diverted to target the interest rate and collateral barriers to unlock commercial capital.

- **Financier capacity building:** A more detailed understanding is required of what financiers want to see within 'track records' and 'business plans'. In addition to addressing the policy uncertainty issue, additional data and information on end use and the financials of the solution could increase confidence around the 'business of providing energy access'. It may also require practitioners and financiers to come together for a session that helps clarify ambiguous aspects of the financing process and allows for feedback.
- **Training of impact investors:** In order to ensure that the equity investments can provide stability for enterprises that are looking to expand and take on more debt, it is critical for impact investors to also be trained in the measurement, monitoring and valuation of energy access and associated benefits with a practitioner centric lens. Such trainings should also identify opportunities that ensure maximization of energy access benefits, thereby facilitating better structuring of credit lines and funds in the future.

#### Policy level:

- **DRE as a part of energy access plans- Shifting the narrative:** The current limitations of grid based electricity provision and LPG supply warrant a change in the Government position on DRE solutions. To view them as longer term solutions that can complement other approaches to energy provision and unlock capital for the sector, there is a need for a concerted effort to shift the narrative about the role and value-add of the DRE sector. CLEAN, as part of a collaborative effort with key entities in



the DRE sector, is working to determine how this shift can take place for electricity access. This would include a change in messaging and action points for the integration of DRE into energy access plans:

- Promotion of an Inter-ministerial approach to clean energy, with energy access being a deliverable within various programmes and ministries, ensuring a cross-cutting approach of using energy to achieve developmental goals
- Facilitate field visits for Government representatives to communities, households using DRE systems to enable better understanding of the value-add and sustainability of solutions
- Strong recognition of DRE enterprises as MSME companies to enable better linkages to existing Government programmes and campaigns including Start-up India, Make in India, MUDRA scheme and so on
- Engagement with DISCOMs and accreditation of energy enterprises as franchisees for last mile distribution particularly for rural segments that are seen as loss-making by the DISCOM and whose needs cannot be met during peak hours or who cannot be connected due to geographical constraints
- In terms of cooking, engagement with key stakeholders and Government to take cognizance of 'stacking' and the limitations of a 'one-size-fits-all' approach to cooking solutions, owing to the diversity in cooking practices based on food types, heating needs.

Promotion of a strategy in policy making where all options that are clean, reliable and

affordable are provided similar incentives, rather than focusing on subsidizing one fuel alone (in this case LPG).

- **Subsidies:** A level playing field would need to be created for all options by removing or phasing out subsidies on kerosene and grid extension. This would help ensure better comparison of alternate energy options for end-user to make a more informed decision about their energy choice. It is also essential to ensure that changes in the subsidy regime are indicated well in advance to allow the market and enterprises to be better prepared.
- **Introduction of new economic regulations:** The economic policies and regulations of the last 11 months, particularly demonetization and introduction of GST, have had repercussions on the operations and financials of last mile energy delivery enterprises, significantly disrupting business on the ground. As it is too early to determine the details of the impact and implications on the sector, these will be important to review in next year's report.

#### **Technology, Skills and capacity building:**

- **Resources and facility for niche applications:** To address the field R&D needs, a facility may be required with a focus on niche applications for DRE, improving reliability / sustainability of DRE through means such as hybridization or grid integration in the context of grids, R&D facility for developing clean cooking systems that are based on multiple criteria such as efficiency, affordability, flexibility, ease of use etc

- **Additional capacity building for smaller enterprises:** A significant percentage of unit sales for each product comes from a handful of enterprises. This provides insight at an overarching level on the need for additional support to smaller enterprises, particularly on aspects of human resource development, financial and operational training to improve their capacity to deliver
- **Revised understanding of skills in the sector:** There is a need to revise the understanding of skill and capacity requirements in the sector, with a focus on the following aspects:
  - Existing trades could incorporate components of RE training as a value add to the existing skill
  - An assessment of the job market relevant to specific sectors, including the geographical spread of enterprises and their manpower requirements, remuneration expectations for skilled individuals and the willingness of DRE enterprises such as CLEAN members to pay, additional job opportunities.



A summary of the takeaways from the DRE sector, with a focus on Information, Access to Finance and Policy, is provided below. The relevant stakeholders for specific recommendations are also referred to.

KEY CHALLENGE	RECOMMENDATION	RELEVANT STAKEHOLDERS
<b>INFORMATION:</b>		
<ul style="list-style-type: none"> <li>Lack of data availability</li> <li>Limited internal capacity of enterprises to record and share data</li> <li>Limited metrics on energy access provision</li> </ul>	<ul style="list-style-type: none"> <li>Improve engagement processes with enterprises</li> <li>Adopt best practices on data collection to ease effort from enterprises</li> <li>Present value-proposition to respondents on the data shared, including visibility, increased finance flows, engagements with policymakers and financiers</li> <li>Improve the set of indicators used to measure household electrification, clean cooking access, energy availability for livelihood, health and education</li> </ul>	<p>Last mile energy enterprises and DRE practitioners, CLEAN, GOGLA, Policymakers (particularly on metrics for energy access provision)</p>
<b>ACCESS TO FINANCE:</b>		
Demand side:		
<ul style="list-style-type: none"> <li>High interest rates and collateral requirements</li> <li>Limited access to long term debt</li> </ul>	<ul style="list-style-type: none"> <li>Use of philanthropic capital and existing credit lines to unlock commercial capital while addressing demand side challenges</li> <li>Engage with policymakers and advocate for greater policy certainty and inclusion of DRE in Energy access plans to enable operational stability for projects and increase confidence of financiers</li> </ul>	<p>Philanthropic organizations, select Banks and NBFCs, Last mile energy enterprises, Financing facilitators, Incubation centers, CLEAN</p>
Supply side:		
<ul style="list-style-type: none"> <li>Need for more detailed, well-structured business plans and loan applications</li> </ul>	<ul style="list-style-type: none"> <li>Undertake capacity building with enterprises based on feedback of financiers- such as better documentation of track record and stronger plans and financial processes</li> </ul>	

KEY CHALLENGE	RECOMMENDATION	RELEVANT STAKEHOLDERS
<ul style="list-style-type: none"> <li>Limited utilization of schemes and credit lines</li> </ul>	<ul style="list-style-type: none"> <li>Facilitate platforms and interactions to clarify terms of existing credit lines, reasons for limited utilization and ways to address the barriers and enable deal flow</li> </ul>	
<b>POLICY:</b>		
<ul style="list-style-type: none"> <li>Near-exclusive focus on schemes and approaches to rural energy access with little or no recognition of the role of DRE</li> </ul>	<ul style="list-style-type: none"> <li>Promote DRE as a complement to current energy access programmes</li> <li>On electricity- enabling linkages between DISCOMs and DRE enterprises to better address rural segment needs in a more cost effective manner</li> <li>On cooking- providing similar incentives to various clean energy options to allow for clean cooking fuel and stoves choices based on consumer needs</li> </ul>	Ministries such as MNRE, MoP, MoRD, MoPNG and their SNAs, DISCOMs, Ecosystem facilitators working on Policy issues, CLEAN
<ul style="list-style-type: none"> <li>Continued subsidies for kerosene with limited incentives to DRE</li> </ul>	<ul style="list-style-type: none"> <li>Create a level playing field for subsidies and incentives across energy options- with a view to promote cleaner alternatives as part of India's commitment to local development and environmental sustainability</li> </ul>	
<ul style="list-style-type: none"> <li>Challenges occurring on account of GST introduction- operations and diversion of funds</li> </ul>	<ul style="list-style-type: none"> <li>Support DRE enterprises in understanding and navigating the GST regime to help stabilize their businesses</li> <li>Allocate a certain percentage of NCEEF to the continued R&amp;D for clean energy (as opposed to complete diversion of resources to compensate States for GST losses)</li> </ul>	

Table 7: Summary of key takeaways from the DRE sector

Source: CLEAN Analysis

### 3.3 CONCLUDING REMARKS

Last mile delivery of energy access solutions, particularly for electricity and clean cooking, are at the core of the Decentralized Renewable Energy sector. The state of the sector report for DRE in India summarizes the operations, geographic focus, access to finance scenario and debt needs of enterprises and organization providing such solutions on the ground. While this does not cover the universe of DRE solution providers in India, it provides an indication of the characteristics, needs, concerns and efforts of MSMEs and not-for-profit organizations of working on energy access provision that are part of the CLEAN membership base. Key points worth noting about the sector include the following:

- Recent changes in energy policies and more broadly, economic policies have created multiple challenges for enterprises that need to be addressed in order to restore confidence amongst financiers about the viability of the DRE sector.
- Access to finance through commercial and philanthropic sources continue to be vital to the sector. The sector presents a huge opportunity for investments. In addition to equity, enterprises are in need of short term working capital, long term financing and end user financing that need to be unlocked from commercial sources at more conducive terms and conditions.
- Training and capacity building for enterprises on accessing debt and interactions with financiers to ensure clarity around expectations is important in improving access to debt and thereby enabling deployment.
- Active recognition of the role of DRE in complementing existing solutions in policy making and launching key policies and programmes that are in the pipeline - Mini grids, revamped NSM- solar off grid scheme- are vital to providing the certainty and stability required for enterprises to operate and financiers to make investments in the sector
- Allocation of government funds for R&D and innovation are critical to helping step-up the delivery of DRE solutions- through improved performance of biomass cookstoves, data logging and monitoring of usage and system performance, energy storage and appliance usage on the ground and so on.
- A detailed process needs to be developed for information collation and sharing at the enterprise and sectoral levels to enable regular data availability on the dissemination of DRE solutions and their impact on the ground

The sheer number of last mile energy enterprises and organizations deploying DRE solutions in this country is a testament to the role India can play as a global leader on DRE solution provision. Through agencies such as the International Solar Alliance and partnerships with practitioner networks in other regions, there is an opportunity to facilitate replication of processes and solutions in other under-served regions across the world.

The limitations of this year's report and the aspects requiring further data and analysis will inform next year's report on the state of the DRE sector. CLEAN aspires to provide a more holistic and inclusive assessment of the sector, including the efforts of ecosystem facilitators and non-member businesses engaged in last mile delivery of energy solutions.

## References:

- Bhatia, M. and Angelou, N. (2015). *Beyond Connections: Energy Access Redefined*. ESMAP Technical Report; 008/15. Washington, DC: World Bank. Available at: <https://openknowledge.worldbank.org/handle/10986/24368> License: CC BY 3.0 IGO. [Accessed 15 September 2017]
- Bloomberg New Energy Finance. (2016). Financing India's clean energy transition. (Online). Available at: <https://about.bnef.com/blog/financing-indias-clean-energy-transition> [Accessed 15 September 2017]
- Bridge to India. (2017). *Solar modules to be taxed at 5% under GST as against 18% declared earlier*. (Online). <http://www.bridgetoindia.com/solar-modules-taxed-5-gst-18-declared-earlier/>. [Accessed 15 September 2017]
- Chaudhary, J. (2017). *India diverts clean energy funds for GST compensation*. India Climate Dialogue. (Online). Available at: <http://indiaclimatedialogue.net/2017/08/25/india-diverts-clean-energy-funds-indirect-tax-regime> [Accessed 15 September 2017]
- Chawla, K. (2017). *GST: Slowing Down the Good Solar Tariffs?* CEEW website. (Online). Available at: <http://ceew.in/pdf/CEEW%20-%20Demystifying%20the%20impact%20of%20GST%20on%20India's%20solar%20tariffs%2019Jul17.pdf> [Accessed 15 September 2017]
- cKinetics. (2013). *Financing DRE mini grids in India*. New Delhi: cKinetics. Available at : <http://www.ckinetics.com/DRE-Financing/Financing%20DRE%20Minigrids.pdf>. [Accessed 15 September 2017]
- Council on Energy Environment and Water. (2013). *Developing Effective Network for Energy Access- An Analysis*. (Online). Available at: [http://ceew.in/pdf/an\\_analysis\\_on\\_developing\\_effective\\_networks\\_for\\_energy\\_access.pdf](http://ceew.in/pdf/an_analysis_on_developing_effective_networks_for_energy_access.pdf). [Accessed 15 September 2017]
- Dalberg Global Development Advisory. (2017). *Improving Access to electricity through decentralized Renewable Energy, Policy Analysis from India, Nigeria, Senegal and Uganda*. The Dalberg Group. (Online). Available at: <http://sun-connect-news.org/fileadmin/DATEIEN/Dateien/New/Dalberg-offgrid-policy.pdf> [Accessed 15 September 2017]
- Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). (2016). *Access to finance for MSMEs in the Renewable Energy Sector in India*. New Delhi: GIZ. Available at: [www.igen-access.in/download/publication/1490610095.pdf](http://www.igen-access.in/download/publication/1490610095.pdf) [Accessed 15 September 2017]
- Garg, V. et al. (2017). *Kerosene Subsidies in India: The status quo, challenges, and emerging path to reform*. (Online). Available at: <https://www.iisd.org/sites/default/files/publications/kerosene-in-india-staus-quo-path-to-reform.pdf>. [Accessed 15 September 2017]

GARV Platform (2017). *Village Electrification and Household electrification*. (Online). Available at: <https://garv.gov.in/garv2/dashboard/garv>. [Accessed 25 September 2017]

International Finance Corporation. (2017). *Off-Grid Solar Products Tax Ready Reckoner*. New Delhi: IFC.

Jain, A. (2017). Power For All, Always. *The Indian Express*. (Online). Available at: <http://indianexpress.com/article/opinion/columns/power-for-all-always-electricity-24x7-indian-households-2022-target-4856673> [Accessed 23 September 2017]

Jain, A. et al. (2015). *Access to Clean Cooking Energy and Electricity*. New Delhi: Council on Energy Environment and Water. Available at: <http://ceew.in/pdf/CEEW-ACCESS-Report-29Sep15.pdf>. [Accessed 15 September 2017]

Microgrid Investment Accelerator. (2016). *Accelerating Investments in Energy Access for Microgrids*. (Online). Available at: <https://www.microgridinvest.org/>. [Accessed 15 September 2017]

Ministry of New and Renewable Energy and Ministry of Power. (2016). *Energy Access in India-Review of current Status and Role of Renewable Energy*. New Delhi: Lok Sabha Secretariat. Available at: [http://164.100.47.193/lssccommittee/Energy/16\\_Energy\\_22.pdf](http://164.100.47.193/lssccommittee/Energy/16_Energy_22.pdf) [Accessed 15 September 2017]

Ministry of New and Renewable Energy and Ministry of Power. (2017). *National Solar Mission- An appraisal*. New Delhi: Lok Sabha Secretariat. Available at: <http://www.indiaenvironmentportal.org.in/files/file/national%20solar%20mission%20-%20an%20appraisal.pdf>

Ministry of New and Renewable Energy. (2016). *National Policy for Renewable Energy based Micro and Mini grids (Draft)*. (Online). Available at: [http://mnre.gov.in/file-manager/UserFiles/draft-national-Mini\\_Micro-Grid-Policy.pdf](http://mnre.gov.in/file-manager/UserFiles/draft-national-Mini_Micro-Grid-Policy.pdf) [Accessed 15 September 2017]

Ministry of Power. (2015). *Guidelines- Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY)*. (Online). Available at: [http://www.ddugjy.gov.in/mis/portal/memo/DDUGJY\\_Guidelines.pdf](http://www.ddugjy.gov.in/mis/portal/memo/DDUGJY_Guidelines.pdf) [Accessed 15 September 2017]

The National Institution for Transforming India (NITI Aayog). (2017). *Draft National Energy Policy*. (Online). Available at: [http://niti.gov.in/writereaddata/files/new\\_initiatives/NEP-ID\\_27.06.2017.pdf](http://niti.gov.in/writereaddata/files/new_initiatives/NEP-ID_27.06.2017.pdf) [Accessed 15 September 2017]

Overseas Private Investment Corporation (OPIC). (2016). *The Government of India and Leading Foundations Announce New U.S.-India Clean Energy Finance Initiative*. (Online). Available at: <https://www.opic.gov/press-releases/2016/opic-government-india-and-leading-foundations-announce-new-us-india-clean-energy-finance-initiative> [Accessed 15 September 2017]

Reserve Bank of India. (2011). *Master Circular on Lending to Priority Sector*. (Online). Available at: <https://rbi.org.in/scripts/NotificationUser.aspx?Id=6603&Mode=0> [Accessed 15 September 2017]

2017]

SELCO Foundation. (2016). *Electricity mapping - Availability of electricity supply in different parts of Karnataka*. (Online). Available at: <https://selcofoundation.org/wp-content/uploads/2017/06/Electricity-Mapping-SELCO-Foundation-2016.pdf> [Accessed 15 September 2017]

Shakti Sustainable Energy Foundation and Intellecap Advisory Services Private Limited. (2014). *Alternate Financing Facility for Energy Access in India*. New Delhi: Shakti Foundation. Available at: <http://shaktifoundation.in/wp-content/uploads/2014/02/Alternate-Financing-Facility-for-Energy-Access-in-India.pdf> [Accessed 15 September 2017]

## Appendix

### List of CLEAN members (as on 20th September 2017)

Angaza Design	Greenway Grameen	Ravi Engineering and Chemical works
Anthropower	GSES India Sustainable Energy Pvt. Ltd.	Reinenergy Infratech Pvt. Ltd.
Arc Finance	GTNFW-SEWA	Renewable Energy & Energy Conservation Foundation
Barefoot Power	Hand in Hand Inclusive Development and Services	Renewable Energy Applications and Products
Boond	Human Organisation for Patronisation of Environment(HOPE)	Riya Solar
cKinetics	Husk Power Systems	Rural Spark
Claro Energy	India Resources Trust	Samuchit Envirotech
Cygni Energy	Indian Network on Ethics and Climate Change	SELCO India
d.light	Integrated Research and Action for Development	SEWA Bharat
DESI Power	IT Power Consulting Pvt. Ltd.	S.G Foundation
Desi Technology Solutions	JJ PV Solar Pvt. Ltd.	Shramik Bharti
Devidayal Solar Solutions	Lytyfy	Sidhi Vinayak Solars
Dharma Life/ Gajam India Pvt. Ltd.	Mahindra Susten Private Limited	Simpa Networks
E hands energy	Mangaal Sustainable Solutions Pvt. Ltd.	SKG Sangha
Envo Business Solutions	MeraGao Power	Smart Power India
Ecoforge Advisors Pvt. Ltd.	Microenergy Credits	Spektron Solar
Ecosense Appliances Pvt. Ltd.	MLINDA	Sri Sri Rural Development Program Trust
Ecozen Solutions	Naturetech Infrastructure	Sun-Mitra Solar
Emsys Electronics	NERD society	Sun Saluter
Envirofit	Nishant Bioenergy	Supernova Technologies
Environ Energy	OMC	Supreme co.
Environmental Defense Fund	Omnivoltaic Energy Solutions Co. Ltd.	SURE
First Energy	Onergy	SustainEarth Energy Solutions
Forum for the Future	Oorja: Empowering Rural Communities	Sustaintech
Free power tech	Ovel Education Pvt. Ltd.	Swami Samarth Electronics
Frontier Markets	Phoenix Products	SwitchON
Gautam Solar	Playsolar Systems	Technology Informatics Design Endeavour
GOGLA	Pollinate Energy	The Batti Ghar Foundation
Gram Oorja	Practical Action Foundation	Udyama
Gram Swaraj	Prakruti Renewable Power Pvt. Ltd.	UNesar Pvt Ltd
Grameen India Innovations	Prakti	Urjaa Samadhan Pvt. Ltd.
Grassroots and Rural Innovative Development	Prayas Energy group	Vayam Renewable
Grassroots Energy	Puhor Solar Centre	Vikram Solar
Green light planet	Pushan Renewable Energy	Volksenergie
Greentech Knowledge Solutions Pvt. Ltd.	RAL consumer products Ltd.	Water Energy Food Transitions (WEFT) Research





A: A-23, 2nd Floor, Behind Green Park Free Church, Aurobindo Marg, Green Park Main, New Delhi-110016  
P: +91-11-41601543 W: [thecleannetwork.org](http://thecleannetwork.org)