
Stepping Up: Lighting to Livelihoods

*Shifting narrative of Decentralised Renewable
Energy Access in India*



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About Shakti Sustainable Energy Foundation

Shakti Sustainable Energy Foundation seeks to facilitate India's transition to a sustainable energy future by aiding the design and implementation of policies in the following areas: clean power, energy efficiency, sustainable urban transport, climate change mitigation and clean energy finance.

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Executive Summary

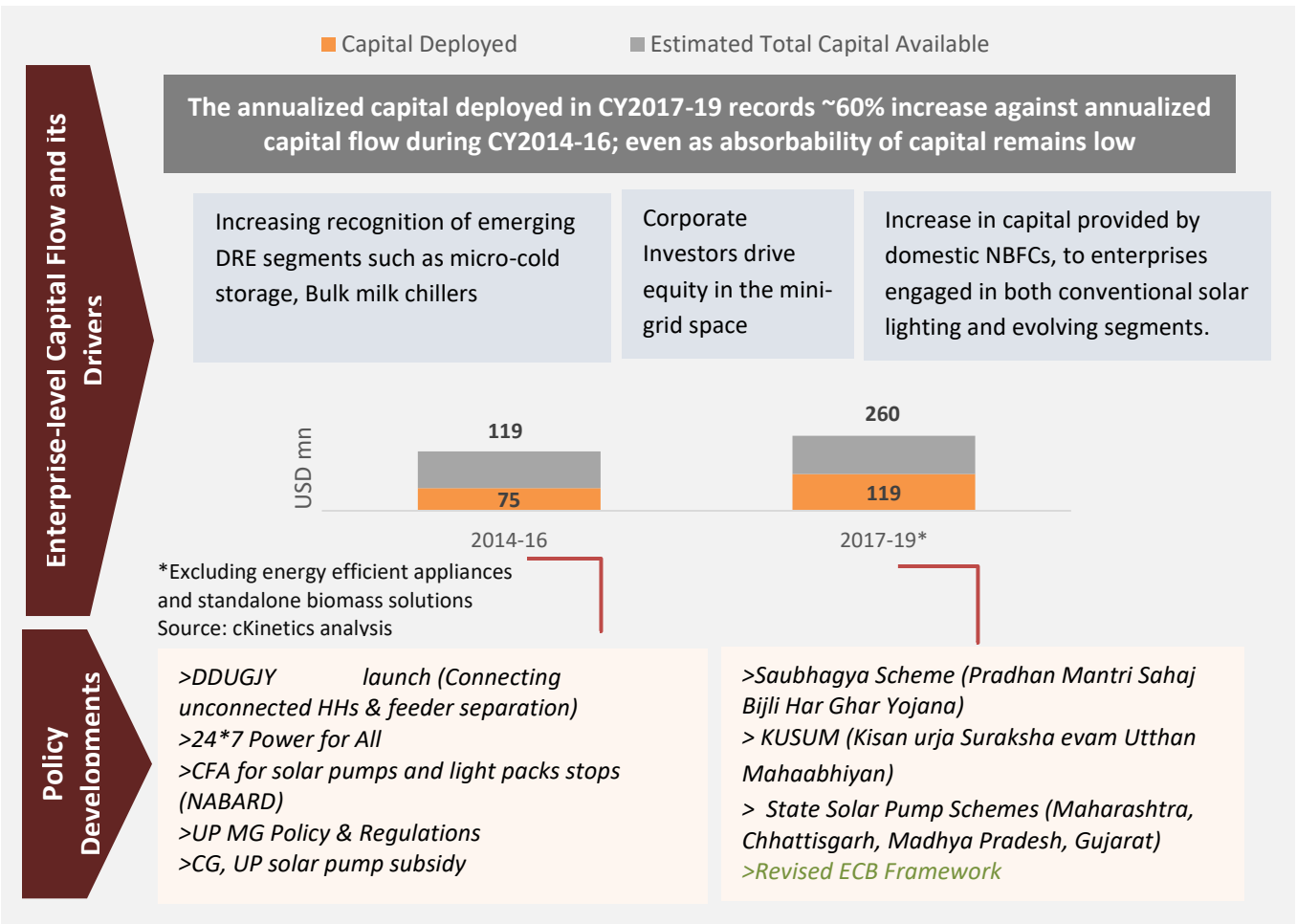
DRE segment continues to grow and observe emergence of newer segments

Decentralized Renewable Energy (DRE)-based Energy Access solutions have continued to witness an increase in capital deployment over the past few years. In India, government declared having reached 100% household electrification under the Saubhagya scheme and correspondingly, the focus of the government has shifted from solar lighting solutions to solar pumps. The solar pump segment has received a thrust on the back of the recently launched KUSUM scheme (Kisan urja Suraksha evam Utthan Mahaabhiyan), which aims to increase the total deployment by nearly 10 times against the current installations. Meanwhile, various enterprises have emerged in productive-use based applications such as solar-cold storages, solar dryers, bulk milk chillers, etc. which have attracted witnessed capital deployment from various investors.

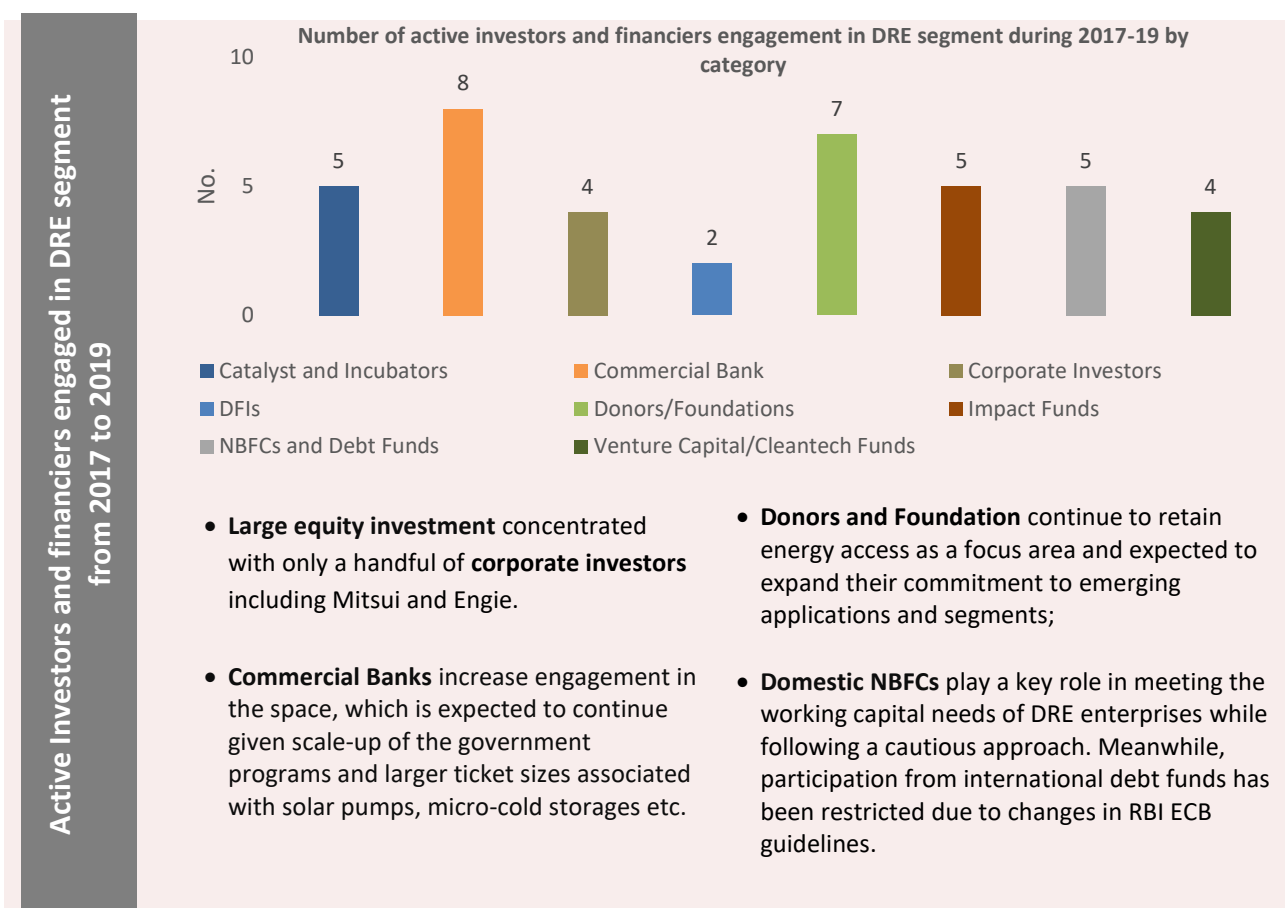
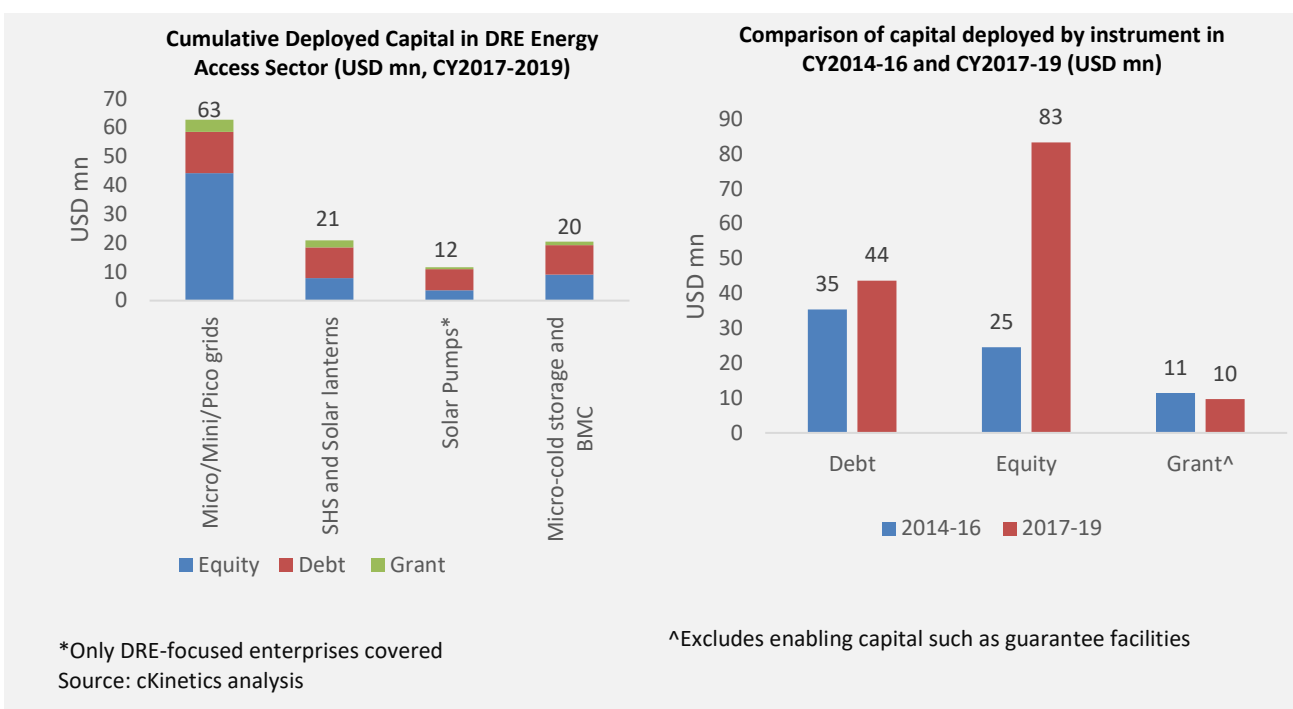
While policies are well-intended, the impact of the same on enterprise capital finance differs in varying degrees

Quantum of capital for DRE energy access enterprises has improved over the last three years. Most of the capital flow has been catalysed by the mini/micro/pico grids segments, and emerging segments. While domestic NBFCs have been increasingly meeting the capital requirements for enterprises in the DRE energy access space, international debt funds refrain from investing in India due to restrictive norms. Furthermore, even as overall capital deployed has improved, key concerns regarding viable business models, pace of scale and dependence on government subsidies pose challenge for the growth of the segment. To resolve these challenges and enable evolving segments to emerge at scale, the sector requires credit guarantee and risk mitigation mechanisms, capacity building amongst financiers as well support for emerging business models, amongst other interventions.

DRE Energy Access Enterprise Financing Landscape (USDmn, CY2017-2019)

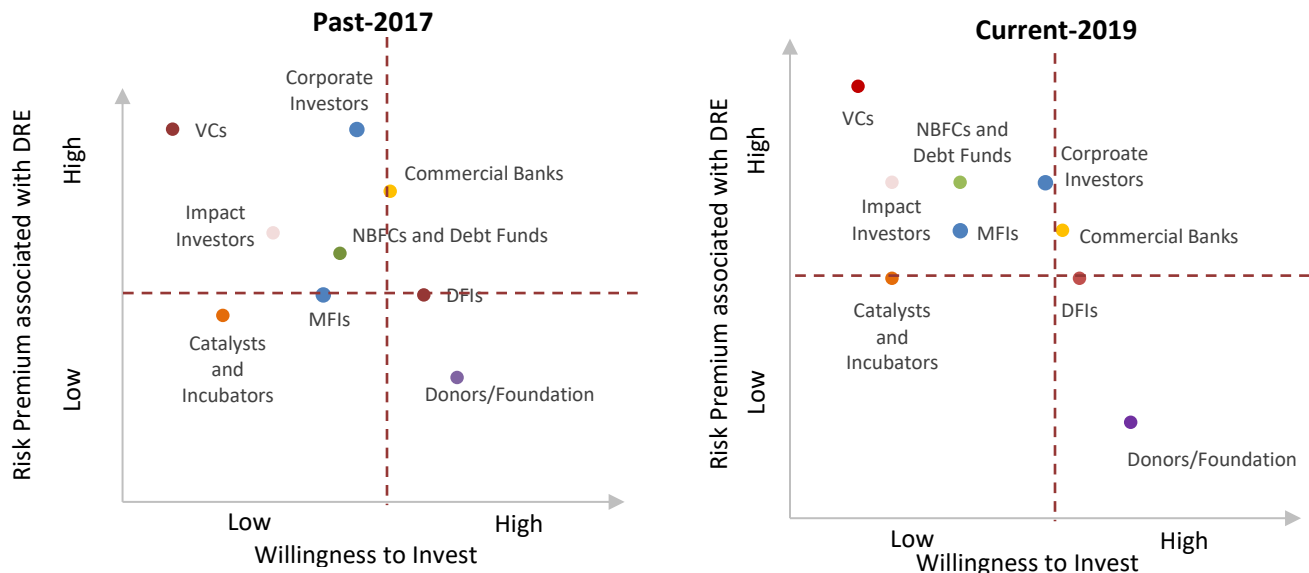


Equity investments from corporate investors into a few mature models a key development in the recent years



Investors continue to attach high risk premium with the sector

While risk perception of the sector has improved for some investors (corporate investors), for others – particularly NBFCs and impact funds, the perception signals a cautious approach for the sector.



Source: cKinetics analysis

Based on investors' interactions and analysis of the policy landscape and reported challenges, the following recommendations to address the same are deemed as critical.

Key Challenges

- Lack of adequate progress amongst mature organizations
- Lack of scalable business models
- Risk perception amongst financiers due to high dependence of enterprises on government subsidies
- Restrictive norms for investment by foreign institutions
- Competing government policies
- Low awareness regarding emerging technologies

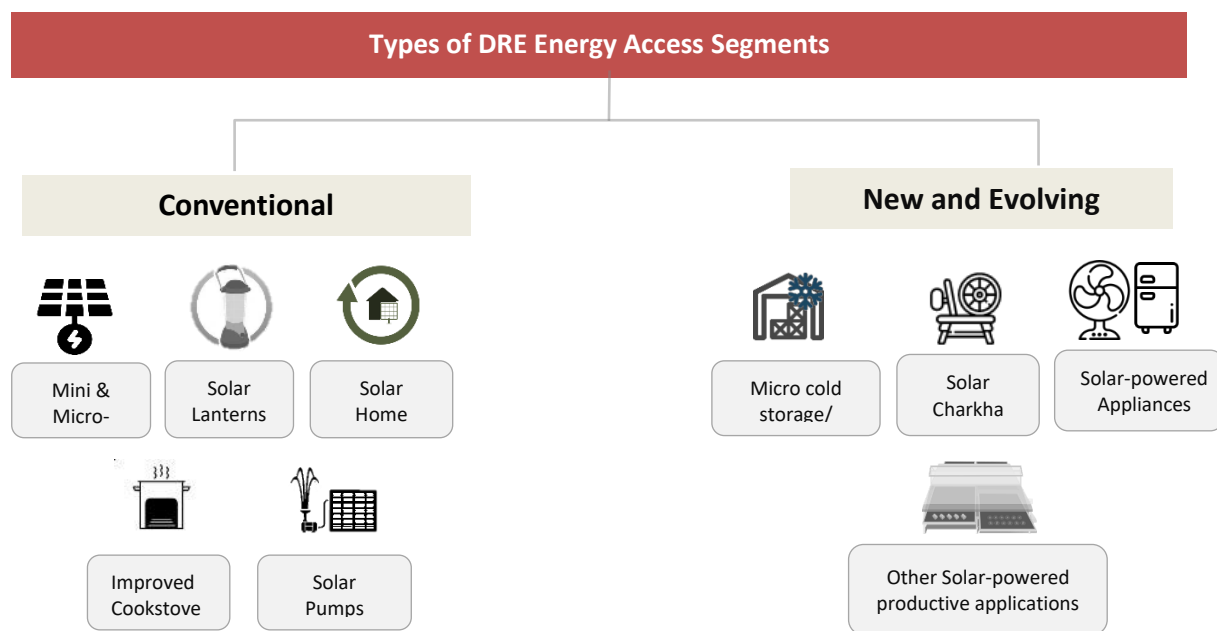
Way forward

- Bridge finance to address risks related to delay in subsidy disbursement
- Credit guarantee and risk mitigation mechanisms to encourage engagement from lenders
- Support for new and emerging business models
- Long term (patient capital) for innovators to scale up
- Explicit recognition for solar powered applications for rural livelihood schemes
- Subsidy for DRE technologies should be at par with subsidy for other technologies

2 Introduction

Decentralised Renewable Energy (DRE)-based Energy Access solutions have witnessed a structural change over the last two years with foray into newer geographies and markets influenced by rapid electrification and rising aspirations. The pivot into newer segments is aligned to the role of these solutions in meeting positive development outcomes of livelihood creation, improved health and food security among others. As a result, there has been emergence of different kinds of DRE enterprises with a range of offerings to address different unmet energy needs.

To this end, the enterprises in the DRE domain offer a wide variety of solutions to address the energy requirements in rural areas, including conventional solutions such as solar lanterns and solar home systems (SHS) for lighting purposes as well as new and evolving segments which includes solutions for productive uses such as micro-cold storages and other solar powered appliances (such as solar dryers, solar-powered reeling machines, etc.). An overview of these different solutions / segments is represented below.



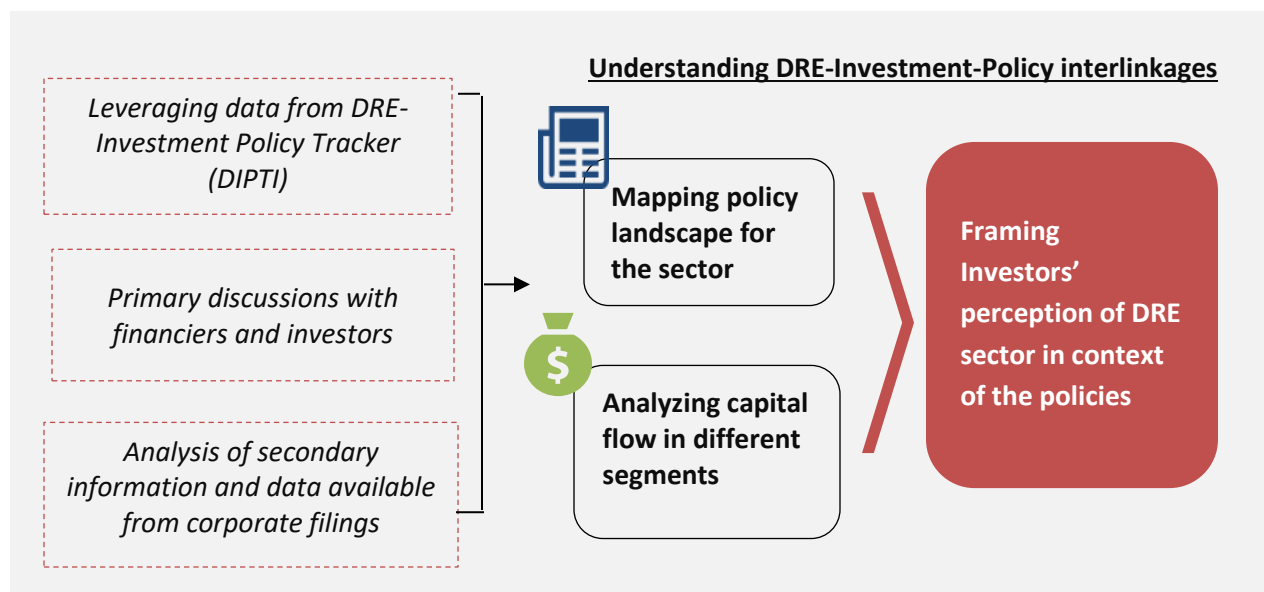
To enable the growth of the sector, the central and state governments have launched several policies, programs and initiatives over the last three years, which focus on leveraging solar lighting solutions for rural infrastructure development, particularly for agriculture in line with the government mandate for doubling farmers' income. Similarly, on the financing front, the segment is witnessing investment in the newer segments.

This report has been prepared to comprehensively synthesize and analyse the information captured in the DRE-Investment Policy Tracker for India (DIPTI), a tracker created by cKinetics with support from Shakti Sustainable Energy Foundation – with focus on aspects related to market progression, investment flows, policy and regulatory framework as well as ecosystem changes,

which directly or indirectly impact the capital availability in the DRE sector. The objective of this report is to present the landscape of DRE sector in India and highlight impact of policy and regulatory changes on the investment flows in this sector.

2.1 Approach for the Study

Snapshot of the methodology for the study is provided below.



Mapping Policy landscape for the DRE segments

To ensure a holistic synthesis of the operating landscape in the sector, the study maps missions, policies, regulations, rules/guidelines and programs/schemes implemented by the Central and State Government departments, with a focus towards those which are currently active including the key government interventions announced since 2017.

These policies/regulations/schemes (characterized as DRE specific policies and financial policies as explained below) have been further evaluated to assess their potential implications on the momentum in the sector and limitations, if any.

- **DRE Specific Policies-** These include both direct and indirect policies pertaining to energy access or rural electrification in general which impacts on one or more of the outlined segments
- **Financial Policies-** These include financial regulations and other policy guidelines which impact/have a bearing on the capital flow into the different DRE segments.

While the direct policies explicitly focus on one or more of the energy access segments, the indirect policies do not have a specific reference or provision for energy access, but lend themselves to influence the interventions in the segments.

Analyzing Capital flow

The study maps trends in both enterprise as well as end-user financing within the DRE sector in the country. The capital flowing into the DRE sector – in form of equity, debt, subsidy, grants, etc. – has been mapped alongside the investor categories (catalysts and incubators, commercial banks, NBFCs and debt funds, DFIs, donors/foundations, corporate investors, impact funds and venture capital/private equity providers).

For enterprise-financing, over 50 financial institutions have been mapped to evaluate the trends in capital flow into the various segments up till December 31, 2019. The capital flows have been tracked leveraging multiple sources such as secondary data, corporate filings of enterprises, and investor discussions.

Meanwhile, the end-user financing has been estimated by mapping subsidy provided by central and state government as well as loans disbursed in the corresponding period by MFIs/SFBs as well as commercial banks.

Investors' Engagement

In order to frame a comprehensive view of the investment-policy interlinkages, investors' sentiments were assessed and synthesised via interactions with 38 financiers and investors as represented in table 1.

The mapping covers the segments of focus for each of the financiers and highlights the segment of particular engagement over the past two years or currently being considered. The mapping also illustrates cases where the financiers have disengaged with the sector (or specific segments).

The investor interactions focused on understanding the sentiment of different categories of investors viz. different energy access segments in India in context of the policy developments to help synthesize the influencers (drivers and risks) for different investors to invest in this sector.

The engagement with these investors has also helped in framing the policy recommendations to retain investor confidence and catalyse greater capital flow into the various segments.

Table 1: Status of investor engagement across different segments

Organisation/FI	Type	Segment of Focus									
		Conventional				New and evolving					
		MG	SHS	SL	SP	IC	BMC	MCS	SR	SF	Others
CIIE	Catalyst and Incubators										
D-Labs	Catalyst and Incubators										Y
Social Alpha	Catalyst and Incubators	Y			Y	Y		Y			Y
Sangam Ventures	Catalyst and Incubators	Y	Y		Y			Y			
Village Capital	Catalyst and Incubators										
Villgro	Catalyst and Incubators				Y		Y	Y			Y
RBL Bank	Commercial Bank		Y		Y						
Allahabad Bank	Commercial Bank				Y						
Bank of Baroda	Commercial Bank				Y						
Engie	Corporate Investors	Y	Y								
Mitsui	Corporate Investors	Y									
Shell Ventures	Corporate Investors	Y									
IFC	DFIs		Y	Y					Y		
Proparco	DFIs		Y								
KfW	DFIs	Y	Y		Y						
NABARD	DFIs				Y			Y			
FMO	DFIs	Y	Y	Y							
IKEA Foundation	Donor/ Foundation	Y	Y	Y	Y		Y	Y			Y
Good Energies	Donor/ Foundation	Y		Y	Y						
Doen Foundation	Donor/ Foundation		Y	Y	Y						
HCL Foundation	Donor/Foundation	Y									
Rockefeller Foundation	Donor/ Foundation	Y									
Lemelson Foundation	Donor/ Foundation						Y				
MacArthur Foundation	Donor/ Foundation	Y									
USAID	Donor/Foundation	Y	Y	Y	Y	Y					
UNDP	Donor/Foundation	Y						Y			Y
Aavishkar	Impact Investor										
cKers Finance	NBFC and debt funds	Y	Y	Y	Y		Y	Y			Y
Maanaveeya	NBFC and debt funds	Y	Y		Y			Y			
Caspian	NBFC and debt funds		Y				Y	Y			
IREDA	NBFC and debt funds	Y	Y	Y	Y		Y	Y	Y	Y	Y
ResponsAbility	NBFC and debt funds										
Sunfunder	NBFC and debt funds										
Symbiotics	NBFC and debt funds										
Saija	MFIs and SFBs		Y	Y						Y	
Arohan	MFIs and SFBs		Y	Y						Y	
ESAF Bank	MFIs and SFBs			Y		Y					
Infuse Ventures	VC/Cleantech Firm										



Exited segment



New engagement



No direct engagement in India

MG: Mini/Micro grids; **SHS:** Solar home systems; **SL:** Solar lanterns; **IC:** Improved Cookstoves; **BMC:** Bulk Milk chillers; **MCS:** Micro-cold storage; **SR:** Solar refrigerator; **SF:** Solar fan; **Other:** Other productive use applications such as solar dryers





3 Sector overview

Over the last two years, the DRE space has witnessed a push from the government for enhanced interlinkages of DRE solutions with global sustainable development goals pertaining to economic growth, good health and well-being and job creation. In parallel, even as electrification of households under Saubhagya has concluded, the demand for higher value solar lighting solutions seem to be increasing, which is being catered to by the private players.

In particular, Solar pumping segment in India is seeing a lot of market momentum on the back of subsidy provisions and significantly scaled up targets under PM-KUSUM¹. In addition, several schemes have been launched to scale up the DRE based systems such as solar charkha, micro-cold storage, etc.

This section provides an overview of the state of the sector, key players, financiers and evolving business models.

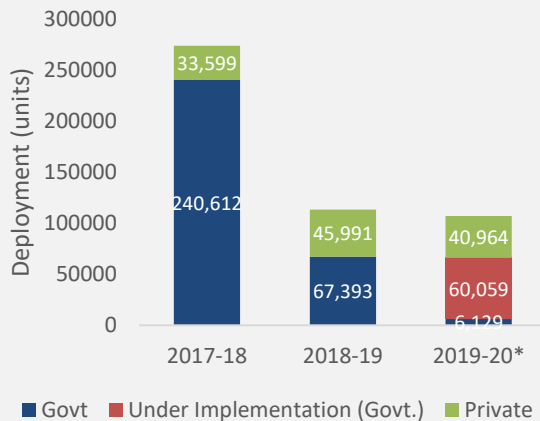
Figure 1: State of deployment of conventional segments during 2017-20

 <p>~495,000+ SHS deployed*</p>	<ul style="list-style-type: none"> As a positive outcome for the sector under the Saubhagya scheme, the government procurements grew considerably in 2017-18 with a little over 240,000 systems procured that year. Since then, such tender based procurements continue to add about 65,000 systems annually. Meanwhile, the private driven segment continues to see an increase in sales of multi-light systems and SHS with revenue of key players recording a CAGR of 20%.
 <p>12.5 million+ Solar lanterns sold</p>	<ul style="list-style-type: none"> The solar lantern market in India has observed a 7 per cent decline in government driven deployment and nearly 20 per cent decline in private sales. The decline in government deployment is emerging from the phasing out of the different schemes for basic lighting (such as the 7 million solar study lamp scheme); meanwhile, in the private segment, consumers are increasingly shifting towards higher value systems.
 <p>139,300 Solar pumps set</p>	<ul style="list-style-type: none"> Solar pump market in India is seeing significant scale-up driven by government procurement to address the aggressive targets under the KUSUM scheme. The market is expected to see sales of around 300,000 - 400,000 pumps annually per the current MNRE plans as enshrined in the FY21 budgetary announcement.
 <p>9,200 kW+ Mini/micro/pico grids capacity</p>	<ul style="list-style-type: none"> Around 440 mini/micro/pico grids have been installed during 2017-19. The mini-grid enterprises are increasingly focusing on catering to the energy requirement of rural enterprises, as they need to operate productive use appliances. The segment has witnessed a major new initiative with the tie-up between Tata Power and the Rockefeller foundation to set up 10,000 mini-grids in India over the next decade.

¹ Pradhan Mantri-Kisan Urja Suraksha evam Utthan

Government market for Solar home systems (SHS) plateaus, while private-sector driven sales pick

Figure 2: Deployment of SHS during 2017-20



*Private deployment till Dec'2019

Source: MNRE, GOGLA off-grid market report

Key players:

Selco Solar, Cygni, Simpa Energy

Key Policies:

- Saubhagya Scheme

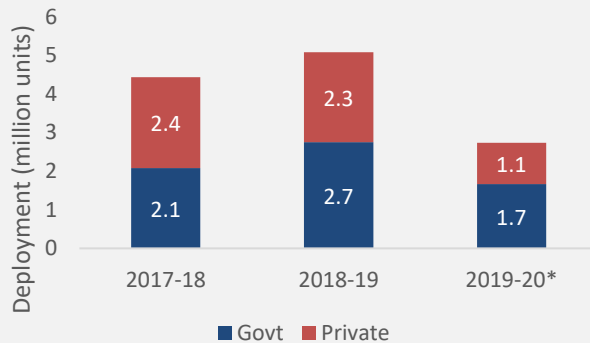
Key States: UP, Bihar, Assam, Jammu and Kashmir

Markets identified under various tenders beyond households:

- Anganwadi centres (in coordination with Ministry of Women and Child Development)
- Rural sub-centres and PHCs

Solar Lanterns segment witnessing a declining trend

Figure 3: Deployment of Solar Lanterns during 2017-20



*Private deployment till Dec'2019

Source: MNRE, GOGLA off-grid market report

Key players:

Greenlight Planet, D.light, RAL Products

Key Policies:

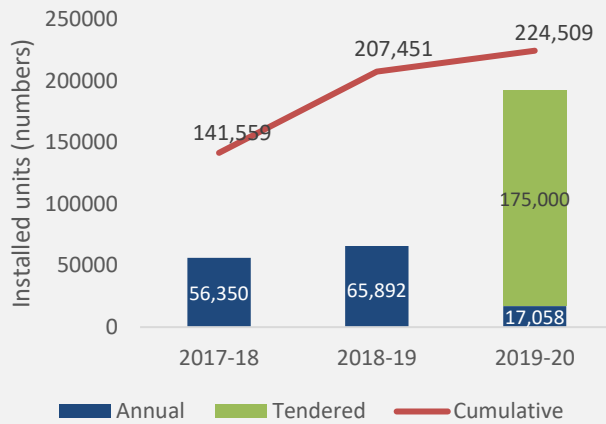
- Off-grid and decentralised Solar PV applications-Phase III
- 70 Lakh Solar Study lamp scheme

Key States:

- Uttar Pradesh forms the largest market for solar lanterns. Over 30 per cent government deployment is in UP, followed by Bihar and Jharkhand.

Solar pump segment to grow 10 times on back of government push

Figure 4: Deployment of Solar Pumps during 2017-19



Note: Tender for 175,000 floated by EESL under KUSUM
Source: MNRE

Key players:

- **Pump Manufacturers:** Shakti Pumps, Rotomag, Central Electronics Limited
- **Integrators/EPC Players:** Tata Power Solar, Premier Solar Claro energy,

Key Policies:

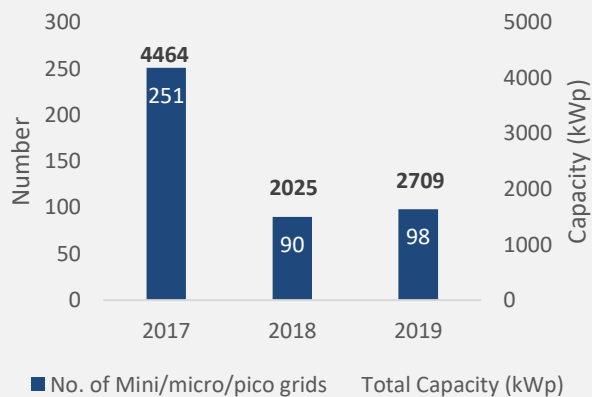
- KUSUM Scheme
- State-solar pump schemes

Key States: Rajasthan, Chhattisgarh and Andhra Pradesh cumulatively form more than 50 per cent of the total deployment.

Innovative business models: *Irrigation as a service* (owned by RESCO/village entrepreneur suitable for small farmers; *Excess power to grid* (owned by farmer, excess power sold to ..

Mini-grid enterprises increasingly focusing on rural enterprises

Figure 5: Deployment of Mini/Micro/Pico grids along-with Annual Capacity during 2017-19



Source: cKinetics analysis

Key Players:

ESCOs: OMC Power, Husk Power Systems, Tata Power Solar

State mini-grid Policies:

- State Mini-grid regulations (UP, Odisha, MP)

Key States:

- Primarily set up in Uttar Pradesh, Bihar and Jharkhand

Innovative business models: *Mini-grids operators as distribution franchise for DISCOMs in rural areas.*

Recent initiatives increasingly focused towards livelihoods

Over the last year, several new tie-ups targeted at delivering DRE solutions to address the productive use potential have been launched in the rural energy access sector. The table below highlights key developments and initiatives that can help in enabling scalability for DRE segment in India.

Key initiatives/developments in the rural energy access segment

Partnership of Tata Power and Rockefeller Foundation

Tata Power partnered with Rockefeller Foundation to launch TP Renewable Microgrid Limited which envisaged setting up of 10,000 microgrids by 2026 across India. Through collaboration with Smart Power India and Institute of Transformative Technologies, it aims to provide clean power to nearly 5 million households as well as support 100,000 rural enterprises and provide irrigation for over 400,000 local farmers.

Scale up of Global Energy Access Fund

ResponsAbility had launched \$34 million Energy Access fund in 2015 in collaboration with Shell Foundation and IFC. The fund has been scaled up to \$150 million which is intended to have a wider scope and will cover Commercial and industrial rooftop segment as well.

Launch of €30 million partnership between Shell Foundation and DFID

Shell Foundation launched a €30 million, five-year co-funding partnership with DFID's Research and Evidence Division (RED) for 'Catalysing Agriculture by Scaling Energy Ecosystems (CASEE) programme. The programme will deliver access to energy for smallholder farmers in sub-Saharan Africa and South Asia by supporting agriculture-focused businesses to test new models and technology with the potential to reach commercial viability.

The Samridhi Fund

SIDBI Venture Capital, in association with DFID launched an INR 4 billion social capital fund. The primary objective of the Fund is to provide risk capital to scalable enterprises which provide economic, social or environmental benefits to the poor in eight low income states of India (Bihar, UP, MP, Odisha, Chhattisgarh, Jharkhand, Rajasthan and West Bengal), while achieving attractive risk-adjusted returns through long term capital appreciation. Clean energy is one of the focus areas under the fund.

4 Policy developments shaping the DRE segments

Shift of rural energy access sector towards newer segments and geographies

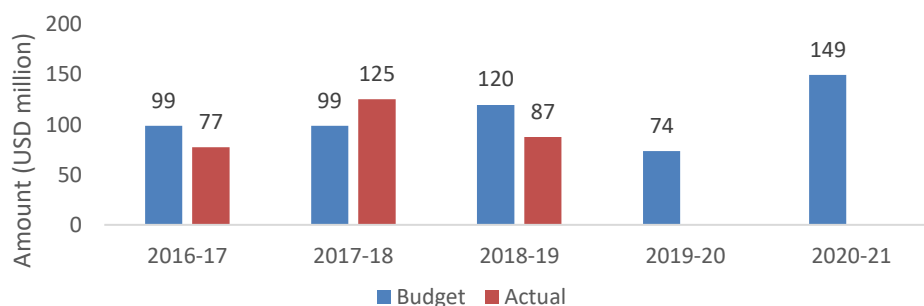
The rural energy access sector has witnessed considerable change during the last two years. With Saubhagya initiative enabling the electrification of unconnected households across most parts of the country, the distributed renewable energy access sector is pivoting towards newer market segments such as productive applications (particularly for irrigation) and in newer geographies, with the North-east region emerging as a key area of focus.

The potential of distributed systems, as a resilient energy source, in shaping economic growth is increasingly being recognized – a key indicator for the same is the budgetary allocation for decentralised solar power by Ministry of New and Renewable Energy (MNRE) in general but more specifically as enshrined in the Kisan Urja Suraksha evam Utthaan Mahabhiyan (KUSUM) scheme.

This flagship scheme of the government entails three main components i.e. setting up of 10,000 MW of grid-connected solar or other renewable energy-based power plants, installation of 1.75 million off-grid solar agricultural pumps (increased to 2 million in the budget for FY 21) and solarization of one million grid connected agricultural pumps in the country (wherein component A and C entail 1,000 MW of capacity initially in pilot mode). The targets are intended to be met by 2022.

The total budgetary allocation by MNRE for DRE energy access in India has increased by 100 per cent from 2019-20 to 2020-21, of which more than 60 per cent (~USD 100 million) is allocated for solar pumps under the KUSUM scheme to achieve an annual target of 437,500 solar pumps²; as against a target of 100,000 solar pumps under 'Off-grid and decentralized solar applications scheme' in 2018-19³. However, considering the cost of a solar pump to be USD 3,521⁴ (INR 250,000 for a 3 HP pump) and an MNRE subsidy of 30 per cent for a solar pump, the budgetary allocation against the target should have been much more - nearly USD 324 million (INR 23 billion).

Figure 6: Budget allocation for decentralized rural energy access in India by MNRE (USD million)



Source: MNRE Annual Union Budgets

² MNRE

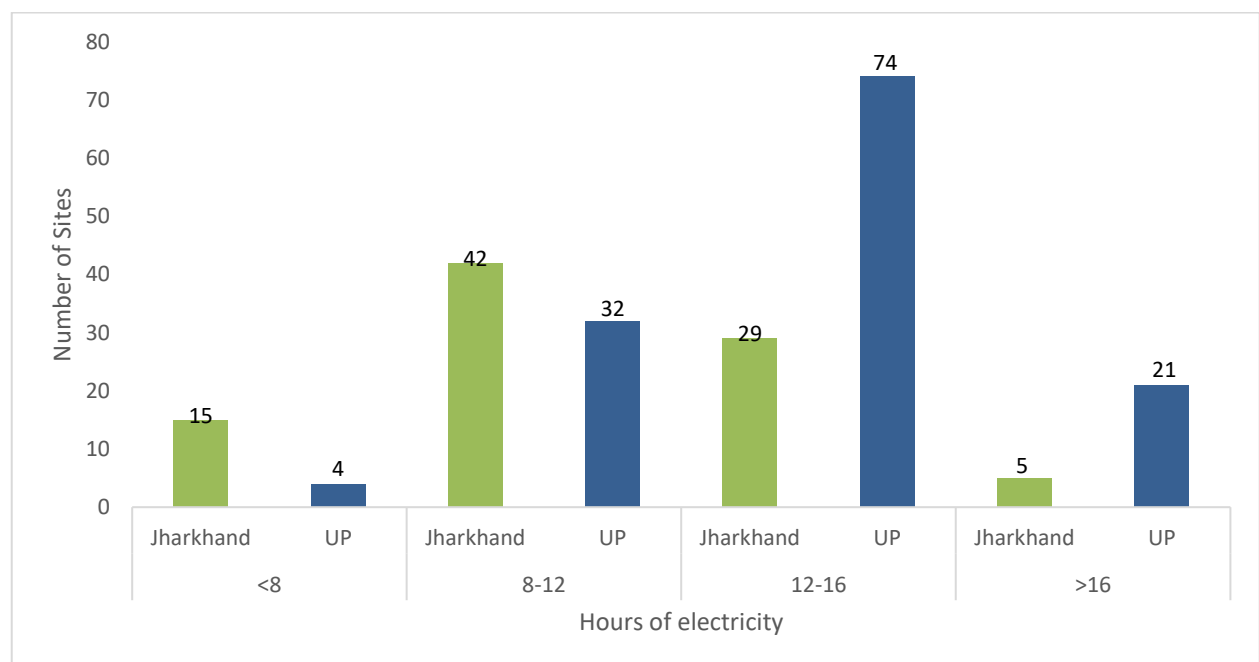
³ <https://www.indiabudget.gov.in/budget2018-2019/ub2018-19/eb/sbe67.pdf>

⁴ 1 USD=INR 71

Meanwhile, there has been a reduction in the budgetary allocations for the conventional access segments that can be attributed to increased penetration of grid electricity in households across the country.

However, even as the hours of electricity provided to households has improved over the years, the reliability of power supply in context of 24*7 Power for All vision is expected to take a few more years to come to fruition. As per a cKinetics survey of more than 200 villages in Uttar Pradesh and Jharkhand during first half of 2019, around 88 per cent of rural households reported electricity supply of less than 16 hours a day with majority of the villages surveyed in Uttar Pradesh having access to electricity for a little over 12 hours a day consistently through the year.

Figure 7: Grid electricity supply hours in rural areas



Source: cKinetics analysis

Moreover, the supply of grid electricity to households represents only one of the access segments. Some critical parts of the rural infrastructure such as the health institutions (particularly rural sub-centres and primary healthcare centres) have not been covered under the Saubhagya scheme. As a result, nearly one-fourth of rural health infrastructure (3.2% of all rural PHCs and 24.7% of all rural sub-centres) in the country remains un-electrified.

Therefore, the next frontier for access related electrification is about providing uninterrupted and quality supply of power to support income generation as also improved health and education and gender equality among others. The shift towards a second order of energy access is evident through several policies/schemes formulated by the government such as state solar pump

schemes, Solar Charkha Mission, and Mission Integrated Development of Horticulture (MIDH) amongst others.

Targeted budgetary allocations for productive solar applications emerge as a key lever for catalyzing momentum

Horticulture, dairy and other village industries

Decentralized renewable energy for electrical, thermal and mechanical applications can support rural livelihoods activities (such as poultry, dairy, horticulture, animal husbandry and other villages industries) to reduce poverty, increase employment and improve the rural quality of life. In addition, solar products such as solar powered cold storage and solar dryers are an integral part of the Mission of Integrated Development of Horticulture. For the non-farm sector, government is promoting solar charkhas for KVICs and has allocated USD 14 million in budget for 2020-21

Healthcare

Many state governments have taken initiatives to install off-grid solar systems in their respective state rural health centres which are either funded by both state (typically health department) and central government or entirely through state budget. In certain cases, such rollouts have been undertaken through partnerships between the government ministries with international organisations. More than 2200 PHCs in India have been electrified through standalone solar systems⁵.

An overview of the key government policies/schemes, focused at the rural energy access interventions as well as financial regulations impacting the DRE sector in India, introduced since 2017 are summarized in the table overleaf.

A more comprehensive list of active policies and schemes covering the entire range of segments in the sector are included in Annexure 1.

⁵ cKinetics analysis

Table 2: Segments targeted by DRE focused policies /schemes introduced since 2017

Name	Mini/ Micro/ Pico grids	Solar Pumps	SHS	Solar Lanterns	Biomass Cookstoves/ Solar cookers	Micro cold storages /BMC	Others productive use appliances	Status
Saubhagya Scheme			✓					Completion of 100 per cent household electrification. Some states like UP continue to report unelectrified households (put footnotes) and consequently on-going opportunity for SHS exists.
70 lakh solar lamp study scheme				✓				The scheme has been closed and 6 million solar lamps have been distributed along with establishment of 1769 repair maintenance centers ⁶
Dairy Entrepreneurship Development Program						✓		-
KUSUM Scheme		✓						MNRE has sanctioned installation of 171,070 stand-alone off-grid solar water pumps as of March 2020 ⁷ .
Off-grid and Decentralized Solar PV Applications Program in Phase III				✓				1,347,498 of solar study lamps and 4.6 MWp of off-grid SPV power plants Sanctioned as of Feb 2020 ⁸ . Extended till March, 2021
Off-grid and Decentralized solar thermal applications					✓		✓	-

⁶ https://mnre.gov.in/img/documents/uploads/file_s-1584533275516.pdf

⁷ <http://164.100.24.220/loksabhaquestions/annex/173/AU2335.pdf>

⁸ https://mnre.gov.in/img/documents/uploads/file_s-1584533275516.pdf

Name	Mini/ Micro/ Pico grids	Solar Pumps	SHS	Solar Lanterns	Biomass Cookstoves/ Solar cookers	Micro cold storages /BMC	Others productive use appliances	Status
Solar Charkha Mission							✓	Against 50 clusters to be set-up, 10 proposals have been approved as of March 2020 ⁹ .
State Solar Pump Schemes (Karnataka, Madhya Pradesh, Punjab, Chhattisgarh, Andhra Pradesh, Uttar Pradesh, Maharashtra, Gujarat)		✓						-
Revised ECB Guidelines	✓	✓	✓	✓	✓	✓	✓	
RBI Guidelines for Investment by Foreign Portfolio Investors (FPI)	✓	✓	✓	✓	✓	✓	✓	

In the background of the policy landscape, the following section provides an overview of the capital deployment into the various segments at enterprise as also broad retail (end-user) financing level; as also the drivers impacting the investor actions.

⁹ <http://164.100.24.220/loksabhaquestions/annex/173/AU2388.pdf>

5 Capital Flow for Enterprise-level Financing

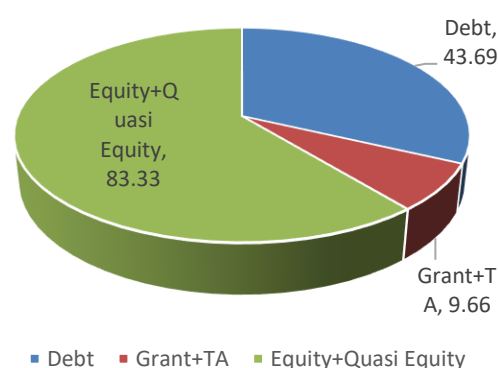
Capital financing by investors is influenced by policies in varying degrees

Financing for DRE energy access enterprises – manufacturers, project developers and distributors – has seen significant capital commitments since 2017 including capital getting invested in enterprises seeking to tap into newer segments. This section provides the salient highlights.

Over USD 137 million deployed in energy access enterprises between 2017 and 2019 with more than 90 transactions across 30 enterprises

Outside of the central and state capex subsidies, as per reported data, DRE energy access sector has witnessed deployment of USD 137 mn across different segments in form of equity/ quasi-equity, commercial loans (short term and long term) and grants between 2017 and 2019. The annualized capital deployed during CY2017-19 recorded a ~60% increase against annualized capital flow during CY2014-16 however significant amount of capital available remained untapped - with only 50 per cent of total available capital (USD 260 mn) deployed during the period.

Figure 8: Capital Deployed in DRE Energy Access Enterprise Financing (FY2017-2019, USD mn)



More than 50 per cent of the new inflows are equity / quasi equity. The sector also has seen a little over USD 45 mn of debt and nearly USD 15 mn of grants in the same period¹⁰. The table below provides an overview of capital deployed in India across different DRE energy access segments between 2017 and 2019.

The capital mapping for enterprises engaged in the solar pumping space is limited to DRE enterprises primarily focused in this segment only (i.e. it excludes the EPC companies or suppliers engaged in large government contracts across a whole range of products /projects).

Table 3: Capital deployed in DRE energy access enterprises between 2017 and 2019 (USD million)¹¹

Type of Capital	Year	Micro-/Mini-Grids	SHS & Solar Lanterns	Solar Pumps	Micro-cold storage & BMC	Energy efficient appliances	Others	Total
Equity+ Quasi Equity	2017	11.50	-	2.00	-	-	0.01	13.51
	2018	20.00	7.47	0.10	0.15	-	0.02	27.74
	2019	12.65	1.15	1.57	8.91	10	7.86	42.14
	Total	44.15	7.82	3.57	9.06	10	7.89	83.3
Debt	2017	0.19	1.90	1.47	2.15	0.60	NA	6.00

¹⁰ The assessment has been conducted based on capital deployed across companies included in Annexure 4

¹¹ This excludes capex subsidy provided by the government

Type of Capital	Year	Micro-/Mini-Grids	SHS & Solar Lanterns	Solar Pumps	Micro-cold storage & BMC	Energy efficient appliances	Others	Total
	2018	14.08	6.90	4.00	7.86	0.58	NA	33.42
	2019	0.08	1.79	1.87	0.14	0.30	NA	4.17
	Total	14.35	10.59	7.34	10.15	1.48	-	43.59
Grant	2017	2.03	0.80	-	1.08	-		3.91
	2018	-	1.24	-	0.15	-	0.79	2.18
	2019	2.16	0.44	0.67	0.02	-	0.37	8.32
	Total	4.19	2.48	0.67	1.25	-	1.16	14.32
Total Capital ¹² (2017-19)		67.35	20.89	11.58	20.46	11.16	9.05	136.73

Source: cKinetics analysis

A snapshot of the leading institutional investors, lenders and donors active across the different energy access segments is presented in table below.

Table 4: Key investors /financiers based on commitments during 2017-19

DRE Energy Access Segments	Key Investors from 2017-19		
	Equity + Quasi-Equity	Debt	Grant/TA
Micro-/Mini-grids	<ul style="list-style-type: none"> Mitsui ENGIE Rassembleurs d'Energies S.A.S Electrifi 	<ul style="list-style-type: none"> Maanaveeya FMO RBL Bank IREDA Rockefeller Foundation 	<ul style="list-style-type: none"> Rockefeller Foundation Doen Foundation IKEA Foundation
SHS and solar lanterns	<ul style="list-style-type: none"> ENGIE Rassembleurs d'Energies S.A.S Endiya Partners Doen Foundation RISE Fund Beyond the Capital 	<ul style="list-style-type: none"> Maanaveeya RBL Bank Kotak Mahindra Bank IndusInd Bank cKers Finance Caspian 	<ul style="list-style-type: none"> Doen Foundation Shell Foundation
Solar Pumps	<ul style="list-style-type: none"> SIDBI Venture Capital Volo Foundation Foundation for Innovation and Social Entrepreneurship Shell Ventures Sangam Ventures 	<ul style="list-style-type: none"> cKers Finance DCB Bank Axis Bank HDFC Bank Maanaveeya RBL Bank Allahabad Bank Bank of Baroda 	<ul style="list-style-type: none"> Doen Foundation CISCO

¹² This excludes enabling capital such as guarantee facilities that may not be getting invested in projects or companies directly but is leveraged to catalyze capital infusion into the projects or companies.

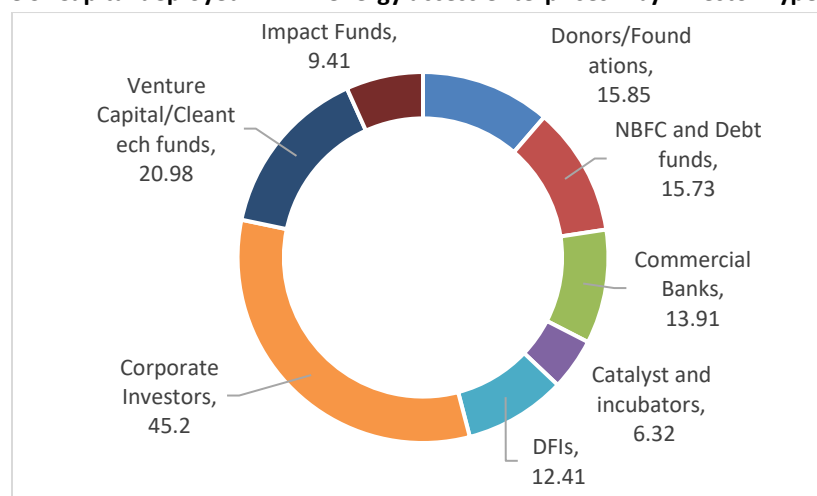
DRE Energy Access Segments	Key Investors from 2017-19		
	Equity + Quasi-Equity	Debt	Grant/TA
Micro cold storage and Bulk Milk Chillers	<ul style="list-style-type: none"> Acumen Villgro IFA fund Omnivore Partners Hivos-Triodos 	<ul style="list-style-type: none"> Caspian cKers finance Kotak Mahindra Bank Northern Arc 	<ul style="list-style-type: none"> Shell Foundation Global Innovation and Technology Alliance
Others (solar dryers, solar spinning, etc.)	<ul style="list-style-type: none"> SBI Caps Neev fund 		<ul style="list-style-type: none"> IKEA Foundation Social Alpha

Source: cKinetics analysis

Sector seeing an increase in equity funding from corporate investors

Previously, the energy access primarily saw donors/foundations as the key capital providers. However, over the last 2-3 years, corporate investors have started picking up reasonable stakes in sector enterprises. Further, there has been an increase in the disbursements reported by the domestic NBFCs active in this sector.

Figure 9: Capital deployed in DRE energy access enterprises – by Investor Type (2017-2019)



Source: cKinetics analysis

The **mini-grid segment** saw one of the largest initiatives in the segment yet - the partnership between Rockefeller Foundation and Tata Power which envisages deployment of 10,000 mini-grids in India. More than 60 per cent of the overall capital deployed in the segment during these past couple of years, aggregating to a little over USD 41 million, is equity funding from corporate investors such as Mitsui and ENGIE. The segment has also seen continued interest from development finance institutions such as FMO. In addition, commercial debt has also been deployed by institutions such as RBL Bank. Further, the first

commitment under the Euro 20 mn KfW-IREDA Energy Access line has been made to Mlinda, an ESCO which deploys mini-grids in Jharkhand.

The **SHS and solar lantern segment** saw 50% (nearly USD 10 million) of direct capital coming in from commercial banks and NBFCs in almost equal measure. These include IndusInd Bank, cKers Finance, Caspian and Maanveeya. Meanwhile, donors/foundations continue to remain engaged in this segment as 20 per cent of the capital flowed from donors such as Shell Foundation and Doen Foundation. A key change has been the lack of participation from international DFIs, who were previously one of the key capital providers in this segment.

Solar pumps segment is witnessing an increasing (albeit slow) engagement from banks and NBFCs with more than 50 per cent of the capital corresponding to nearly USD 6.5 million being provided by commercial banks and domestic NBFCs, as per the reported data for pure-play DRE enterprises¹³. Some of the active lenders include Axis Bank, RBL Bank, and cKers finance. Further, banks such as DCB Bank and HDFC Bank have also entered this space. Barring SIDBI ventures' infusion into Claro, no mainstream domestic venture capital fund successfully invested in the sector during this period.

Growing focus on emerging segments

Investment in the emerging segments of DRE has increased to a great extent in 2019. The emerging segments include cold storage solutions, bulk milk chillers, solar dryers, refrigeration units, amongst others. In particular, enterprises focused on delivering energy efficient appliances and micro-cold storage solutions have seen significant interest from different investors and financiers. Some of the key enterprises in this segment include Ecozen Solutions, Atomberg Appliances, Inficold, S4S Technologies, among others. The energy efficient appliances segment has mainly been driven by venture capital funds, whereas the micro-cold storage solutions segment has witnessed capital deployment by impact funds and domestic NBFCs. Other evolving segments such as solar refrigeration solutions and solar dryers have seen funding from DFIs and donors such as IFC and Shell Foundation.

¹³ Excludes capital provided for large enterprises focused on renewable energy

6 Capital Flow for End User-level Financing

At the end-user level, various modes of financing have been used in order to ensure uptake of the DRE solutions, including government subsidies, micro-finance, and CSR capital, among others. While government has been playing a key role in providing subsidies for products such as solar lanterns, and solar home systems, the private market channels such as micro-finance institutions and CSR funds have also been extensively engaged in end-user financing. Increasingly, in the last few years, there has been a growing participation from banks as well, with regards to end-user financing for solar pumps.

Government subsidy drives the deployment of basic standalone solar products

The central and state governments have several subsidy schemes for supporting deployment of standalone solar products. Over the last two years, this has also got extended to the solar pumping segment in a major way.

The table below captures the estimated subsidy and loans deployed to support end user-level financing of DRE devices and systems. In case of solar home systems, these products were subsidized significantly by the central government under Saubhagya to enable electrification at a household level, whereas previously under 'Off-grid and decentralised solar applications-Phase 2' scheme, only 30 per cent subsidy was provided and financial institutions such as RRBs played a key role in financing the product. Meanwhile, for solar lanterns, with the central financial assistance (CFA) from MNRE being to the tune of 85%, beneficiary only has to bear 15% of the total cost.

Table 5: Estimated subsidy support in DRE energy access sector for end-user financing (2017-2020, USD million)¹⁴

<i>Financial Year</i>	<i>Solar Home Systems (USDm)</i>	<i>Solar Lanterns (USDm)</i>	<i>Solar Pumps (USDm)</i>
<i>2017-18</i>	83.0	21.1	232.5
<i>2018-19</i>	23.2	20.6	189.0
<i>2019-20</i>	2.1	12.4	58.7
<i>Total</i>	108.3	54.1	430.0

End-user financing expected to pick up significantly for solar pumps with engagement from the commercial banks

Various banks such as SBI, Canara Bank and Bank of Baroda have developed retail loan products, especially for financing solar pumps. Previously, in several state-specific solar pumping schemes the aggregate subsidy (aggregate of central and state government components) amounted to nearly 80-90%, and therefore, the ticket size for the loans, where needed, were not aligned to bank products and hence not sought in great measure. However, the recently launched PM-KUSUM scheme entails a provision of maximum 60% subsidy, aggregating from central and state government, and guides banks

¹⁴ Source: Estimated based on deployment provided in MNRE Annual reports

to provide 30% of end-user financing for farmers. Over the last two years, given the government thrust on solar pumps, there has been a growing focus amongst banks towards this sector.

A snapshot of a few banks active in end-user financing of solar pumps is provided below.

Table 6: Key financial Institutions active in end-user financing for solar pumps

Financial Institutions	Key Examples
Bank of Baroda	<ul style="list-style-type: none"> Bank of Baroda offers loan to individuals, SHGs, JLGs, FPO for solar pumps with a maximum repayment period of 10 years. No collateral is required up loans up to USD 7,042 (INR 500,000) for solar pumps. BoB has a MoU in place with Self Employed Women's Association (SEWA) under which it is aiming to extend upto 7 year term loans for upto 15,000 solar pumps in Gujarat. As part of Phase-3, over 1000 solar pumps have been supported by the bank so far¹⁵. Bank of Baroda also foresees DRE solutions being an area of focus for their new KfW backed USD 113 million solar line of credit
Yes Bank	<ul style="list-style-type: none"> Yes Bank offers loan for solar pumps under agri-financing products. As part of the SEWA initiative in Gujarat, Yes Bank has extended interest subvention to SEWA which enabled loan extension to more <i>agariyas</i>¹⁶. The architecture for the blended financing was formulated by IFC.
Axis Bank	<ul style="list-style-type: none"> Axis Bank, backed by a First loss default Guarantee (FLDG) provided by SwitchOn foundation, has initiated financing of solar pumps. The corpus for the FLDG has been grant funded by Good Energies Foundation.
RBL Bank	<ul style="list-style-type: none"> RBL Bank provides financing for 2 HP, 3 HP and 5 HP pumps with tenure of upto 5 years. They have financed a little over 50 pumps till date, mostly across West Bengal and Odisha, backed by the FLDG from SwitchON Foundation. SwitchON also acts as the business correspondent for the bank, thus crafting bank's presence in areas where they have no branches.

End-user financing for SHS is slowly shifting towards higher value solar products

Over the past two years, in addition to end-user financing from MFIs, SFBs and PAYG (Pay-as-you-go) schemes from suppliers, commercial banks have started introducing products focused at segments in the sector. The table below highlights the total end-user financing provided under different channels for these segments.

Table 7: Estimated end-user financing in Private Sector driven standalone solar product segments

Financial Year	Solar Home Systems (USDm)	Solar lanterns# (USD m)
	Loans	Loans
2017-18	11.06	28.90
2018-19	15.41	32.10
2019-20*	18.50	22.47

*estimated; based on deployment trends; #Includes multi light systems

Source: cKinetics analysis

¹⁵ Investor interactions

¹⁶ Salt farming community

While solar lanterns still continue to be purchased by the consumers, MFIs have enhanced their product offerings to include multi-light solar light system i.e. higher value solar lighting systems as well as are seeking to tap into the growing exploring demand for product categories such as solar fans, TV and refrigeration units. Even as these are currently at a nascent stage, so far, over 50,000 solar powered appliances have been sold in India¹⁷ - with solar fans having the largest share. Per the MFIs financing the lighting systems, there hasn't necessarily been an impact of the Saubhagya scheme on the sale of solar lanterns, as consumers purchase these lamps beyond household purpose as well. However, the MFIs highlighted that sales of solar lanterns have been impacted in Assam, since mid-2019, due to the prevailing political agitation in the region.

For products such as improved biomass cookstoves, small finance banks of the likes of ESAF have been active on the end-user financing – with more than 80,000 improved cookstoves till date. However, over the past two years, the product has seen a decline due to increasing thrust on LPG, viewed as an aspirational product, under the Central Government's Ujjwala scheme. Some MFIs that explored the improved cookstoves segment in 2017-18 in Odisha have discontinued the segment financing due to lack of demand.

For emerging categories such as micro-cold storage, banks such as Axis Bank have tied up with system installers such as Newleaf Dynamics to offer loan to end-consumers at 11-12% in the state of Gujarat and Maharashtra.

Companies leveraging CSR funds to deploy DRE solutions

Apart from retail loans, there has been an increasing deployment of CSR funds in the rural energy access sector. The table below captures some of the key companies who are utilizing their CSR funds to enable rural energy access (including emerging products as also improved cookstoves).

Interestingly a few DRE product distribution enterprises engaged in the deployment of improved cookstoves in rural areas indicated a shift in channel financing partner for this product category from MFIs to utilising CSR funds.

Table 8: Key companies with deployment of CSR funds in rural energy access sector

Name of Organisation	Segment	Geography	Key Projects
Infosys	Improved cookstoves, solar lanterns	Rajasthan, Maharashtra	<ul style="list-style-type: none"> Infosys has provided USD 0.2 million for each segment i.e. improved cookstoves and solar lanterns in Rajasthan and Maharashtra. The company has partnered with enterprises such as Envirofit for improved cookstoves, as part of its carbon offset project.
ONGC	SHS, Solar pumps, Solar charkha	Bihar	<ul style="list-style-type: none"> Provided USD 0.30 million in 2018-19 for women skilling and entrepreneurship development through Khadi solar charkha in Bihar with Bhartiya Micro Credit as

¹⁷ GOGLA. 'Global Off-grid Solar Market Report H1 2019'

Name of Organisation	Segment	Geography	Key Projects
			the implementing partner.
Oil India Limited (OIL)	Solar lanterns, SHS, improved cookstoves	Assam	<ul style="list-style-type: none"> • In 2018, OIL launched OIL Urja solar solution happy home programme to provide solar lamps, SHS. • The project is being implemented by Indian Institute of Entrepreneurship (IIE) in 3 villages of Assam.
HCL Foundation	Mini-grids, solar pumps, standalone solar systems	Uttar Pradesh	<ul style="list-style-type: none"> • Under Project Samuday, HCL Foundation has installed 32 mini-grids with a financial support of USD 0.42 million in Hardoi district, UP. The mini-grids currently provide energy access to 3500 households and also supports certain productive use applications such as RO plants, atta chakki, etc.
REC Foundation	Solar lanterns, Micro-grids	UP, Rajasthan, Bihar	<ul style="list-style-type: none"> • REC has been actively supporting rural energy access projects. During 2018-19, it has provided ~USD 0.08 million for providing solar lanterns in various villages of UP.

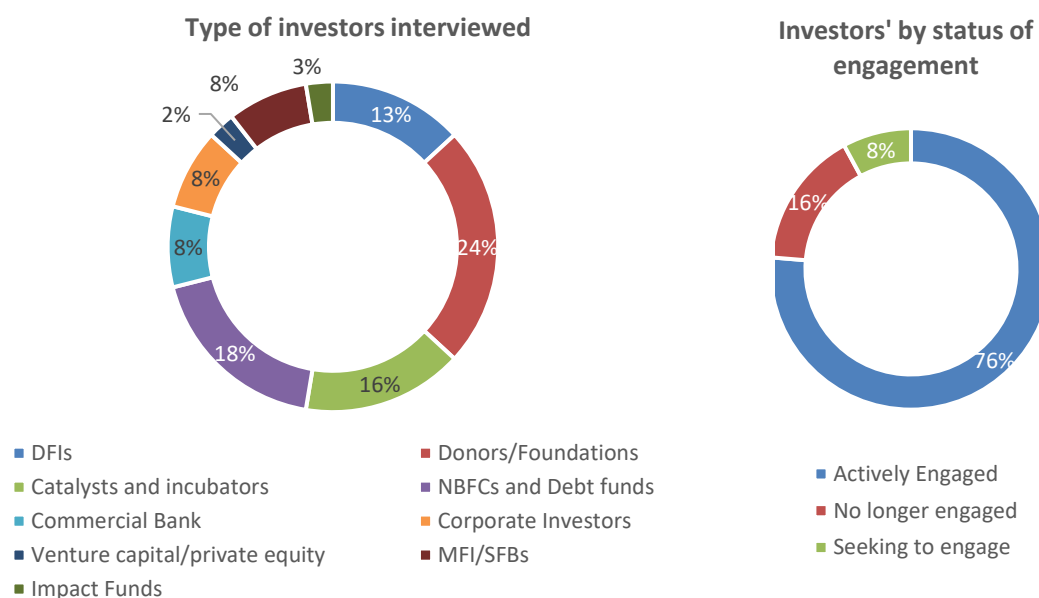
In the recent years, financiers – banks as also MFIs - have been aggressively expanding their network in the North-east region. This accords an opportunity to enterprises to tap new consumer groups, particularly ones seeking higher value solar home lighting systems.

As consumers move towards higher value products, these end-user financing channels would become even more critical to ensuring the momentum can be fully scaled up.

7 Investors' Speak

This section presents an overview of the trends, priorities and outlook of the investors towards the policies and the opportunities across the different segments of the rural energy access sector. For the purpose of this study, 38 investors' were engaged, as further detailed below.

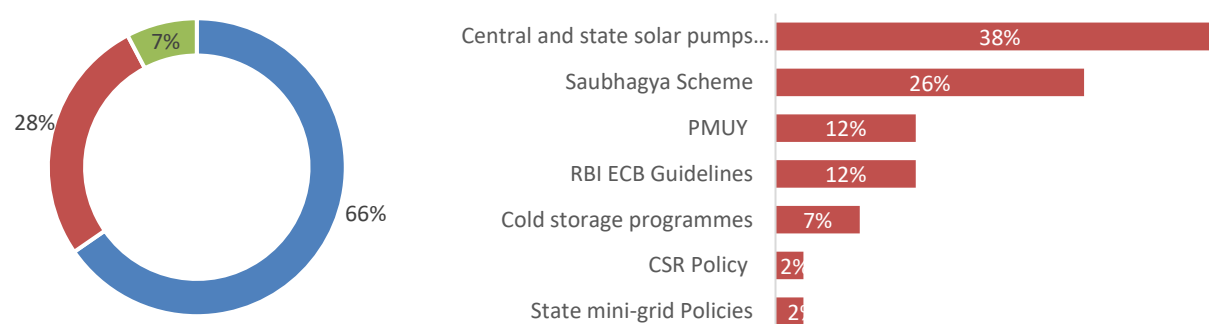
Figure 10: Overview of type of investors interviewed and their status of engagement



Policy awareness and influence on investor perception

A majority of the investors interviewed are aware of the key government initiatives specific to the DRE energy sector.

Figure 11: Policy Awareness amongst Investors (% of respondents)



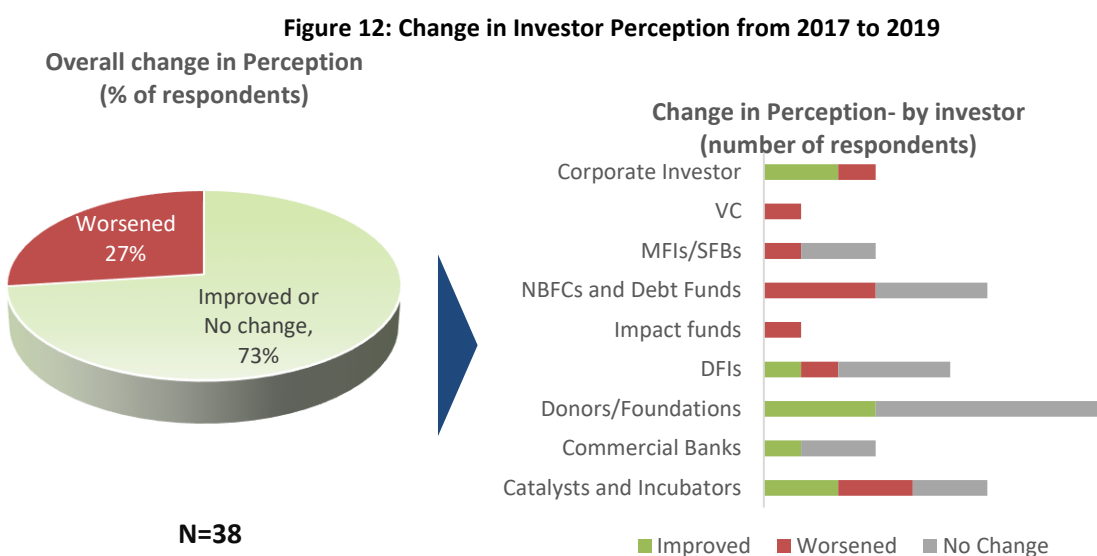
Source: Investor interviews

The government's focus on solarizing irrigation is one of the key policies shaping investors perception towards energy access sector in India. Investors view the **PM-KUSUM Scheme** as a welcome step for promoting solar irrigation in India. However, several investors have expressed concern of dependence of enterprises on the subsidy release of the government for continued financial viability of the enterprises.

Most investors, particularly donors/foundations believe that demand for DRE energy access solutions continues despite penetration of electricity grid as there is now a growing focus towards productive uses.

Perception of DRE energy access sector has improved or remained unchanged for three-fourths of the investors over the last 2 years

Between 2017 and 2019, investor sentiment towards the DRE energy access sector in India has changed positively or remained the same for approximately **73% investors**. The sentiment has largely been shaped by the sector's transition towards productive use applications.



Source: cKinetics analysis

Key perspectives shared by investors and financiers actively engaged in the sector are synthesized below:

- **Donors and Foundation** retain energy access as a priority and are increasingly expanding their commitment to emerging applications and segments; expect the demonstration effect to enhance scale and proliferation of the interventions.
- **Commercial Banks** are seeking to enhance engagement in the space given scale-up of the government programs and larger ticket sizes associated with solar pumps, micro-cold storages etc. however seek credit guarantee support given the limited size and scale of the enterprises active in the space; as also the historical concerns on agricultural loans.
- **Impact funds and VCs** are quite sceptic about engaging given the lack of adequate progress they see within the mature organizations; and don't see adequate number of enterprises presenting value propositions triggering a market pull and consequently scale-up.
- **NBFCs and debt funds** validate the working capital needs however are quite concerned on the over-dependence of the models on government procurement; further the changes in the ECB norms have also prevented several of these to tap into international capital which could be more suited to the risk profile of this sector

- **Corporate Investors** are increasing their engagement and presence in the sector, albeit slowly – the primary triggers are the outlook for leveraging DRE markets as part of their sustainability strategy as also the sustainability benefits and demonstration effect they expect such models to catalyze on ground, thus creating a real and scalable business opportunity.

On the financing front, external commercial borrowing (ECB) guidelines are a key policy for engagement of foreign lenders in India. Even as ECB notification for January 2017 enabled start-ups to issue convertible notes to foreign investors without having to arrive at valuations, the latest amendment to ECB in 2019 reduces the overall minimum maturity period to 3-5 years. However, foreign lenders expressed ECB norms to be restrictive for capital deployment in India because the minimum tenure is still of 3-5 years and the interest rate that can be charged by foreign lenders is capped at 11%; whereas foreign lenders would prefer shorter term engagement with enterprises and moreover, the interest rate cap is very low.

Further, the financiers highlighted that as per RBI guidelines for foreign portfolio investors (FPI), investment by any FPI, should not exceed 50% of any issue of a corporate bond i.e. earlier a single FPI could have invested in more than 50% of any single issue by a company, however, now a minimum of 2 FPIs are required for any corporate to undertake the issuance, which becomes an onerous task for the company and the investor¹⁸. Therefore, in order to make investments, foreign investors have to find other partners for investment in non-convertible debentures issuances.

¹⁸ <https://www.rbi.org.in/Scripts/NotificationUser.aspx?Id=11266&Mode=0>

Impact of Policy perception on investors' confidence

Figure 13 synthesizes the outlook of the different categories of investors and financiers on the key policies currently in place.

Figure 13: Impact of Policy Perception on Investors' Confidence

Investor Category	Scheme	Perception	Impact on Confidence
Catalysts and Incubators	KUSUM Scheme	Increase in market opportunity though concerned about over dependence of enterprises on subsidy release of the government for their continued financial viability	↑
	Saubhagya Scheme	Since grid electricity is subsidized, it makes it difficult for more DRE solutions to manifest.	↓
	PMUY	Heavy emphasis on LPG subsidy has acted as a barrier for penetration of other clean cooking solutions.	↓
	Cold Storage programs	There are no tenders for cold storage facilities and therefore, B2C model is difficult in case of micro-cold storage.	↓
Commercial Banks	KUSUM Scheme	These subsidies reduce loan amount for the end-user, and banks would be comfortable lending if their capital is de-risked.	↔
	Cold Storage Programs	Several banks have a product for cold storage; however, solar cold rooms have not specifically been incorporated as a separate category as demand is currently at a nascent stage but can be included as required	↑
DFIs	KUSUM Scheme	Meets the mandate given the potential development outcomes, however, there are concerns regarding how the scheme will be managed at both central and state level. Further, impact on water tables has also been highlighted as a potential drawback.	↑
	Saubhagya Scheme	There is a lack of clarity over where the reliability of the grid will be enhanced, which affects enterprises dealing with SHS and mini grids due to uncertainty over integration.	↓
	Foreign Exchange Management (Debt Instruments) Regulations 2019	The guidelines limit the subscription amount of a foreign lender to 50% of an NCD. Thus, to make investments, it is necessary to find additional NCD partners for the other 50%.	↓
	Cold Storage programs	MCS is seen as a commercially viable option and banks are open to financing it.	↑
Donors and Foundations	KUSUM Scheme	Increasing focus towards productive use applications and leveraging their capital to promote efficient use of water and creation of livelihoods.	↑

Investor Category	Scheme	Perception	Impact on Confidence
	Saubhagya Scheme	Initially there was scepticism by investors regarding impact of Saubhagya on the market. With expansion of basic lighting provision, certain financiers are moving towards productive use applications.	↔
	Foreign Exchange Management (Debt Instruments) Regulations 2019	CCD structures are compulsorily convertible, which means it has to be treated like plain equity rather than as a loan making it a time intensive process.	↓
	State-mini grid policies	While well-framed and intended, these have still not provided a signal to foreign investors about sustainability of business model for mini-grid developers.	↔
MFIs/SMBs	Saubhagya Scheme	There has been little impact of Saubhagya over sales of solar lanterns as grid electricity is still unreliable, meriting such lanterns.	↔
	PMUY	Though LPG is an aspirational product for rural women, LPG subsidies have not had a major impact on improved cookstoves as subsidy disbursals are a slow process. Moreover, LPG remains a more expensive fuel source than biomass.	↔
NBFCs & Debt Funds	KUSUM Scheme	Enterprises depend on the government for generating demand for solar pumps, which affects enterprise stability. Several investors also have skepticism regarding on-ground implementation which differs from state to state.	↔
	Saubhagya Scheme	There is no risk from grid expansion because many times grid electricity is not reliable in rural areas. However, it might pose a threat to mini grids.	↔
	RBI ECB Guidelines	RBI guidelines for foreign lenders restricts lending to 3-5 years. Moreover, the cap on the interest rate is viewed low w.r.t to the margins for these lenders.	↓
	Foreign Exchange Management (Debt Instruments) Regulations 2019	The restriction would entail a minimum of 2 FPIs for any corporate to undertake an issuance.	↓

Investor Sentiment Mapping

In context of various drivers and challenges discussed in the previous section, Figure 14 and Table 9 capture the change investor sentiment and assessment of factors that have driven that change. The following factors have emerged as parameters shaping the ground sentiment:

- **Market evolution:** Change in market landscape in terms of on-ground evidence
- **Policy changes:** Direct as also indirect policy-level changes that impact risk outlook of the sector
- **Social impact:** Need to address a pressing social challenge
- **Environmental impact:** Need to address climate change issues
- **Supporting ecosystem:** Initiates by various stakeholders – such as industry associations, government, catalysts, etc. – to support growth of the sector
- **Demonstration effect:** Learnings from own or others' past investments

Figure 14: Investor Sentiment Map

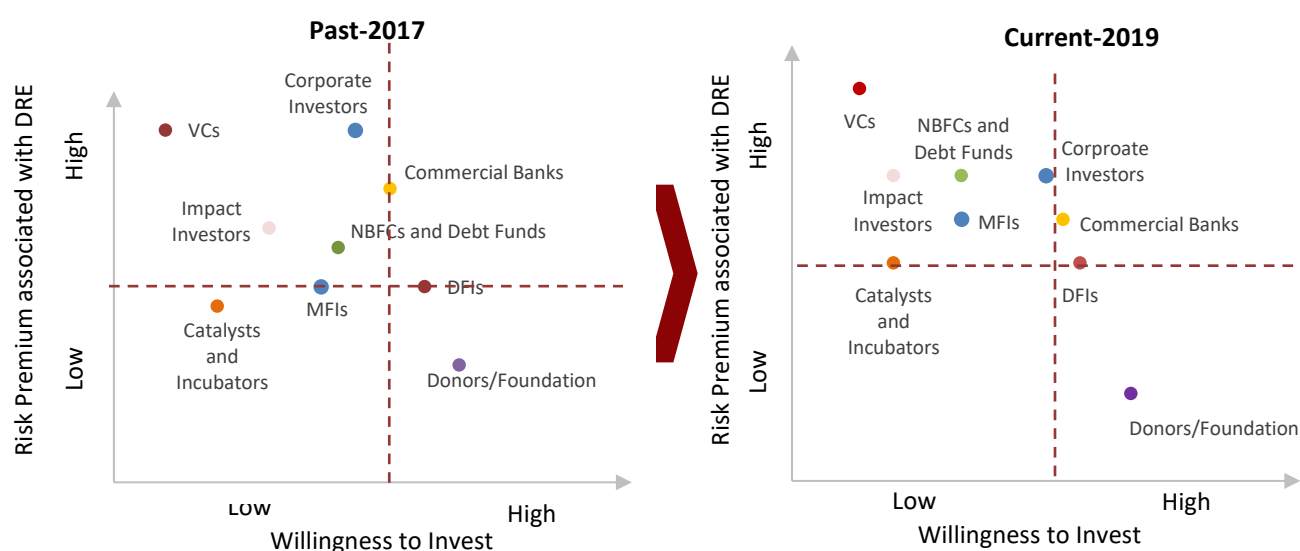


Table 9: Traceability Framework to Assess Factors Affecting Change in Investor Sentiment (2017-2019)

Investor	Market Evolution	Policy Changes	Social Impact	Climate Change /Environmental Impact	Supporting Ecosystem	Demonstration effect
Catalysts and Incubators						
Commercial Bank						
Donors /Foundation						
DFIs						
Impact Fund						
MFIs						
NBFCs /Debt Funds						
VC						
Corporate Investors						

Effect of Factors on Investor Sentiment				
Largely Positive	Somewhat Positive	Neutral	Somewhat Negative	Largely Negative

The above sentiments have been the guiding factors for the level of engagement undertaken by different investors and financiers. Few illustrative cases on changed priorities are shared below.

Figure 15: Change in Engagement of Investors and Reason for same

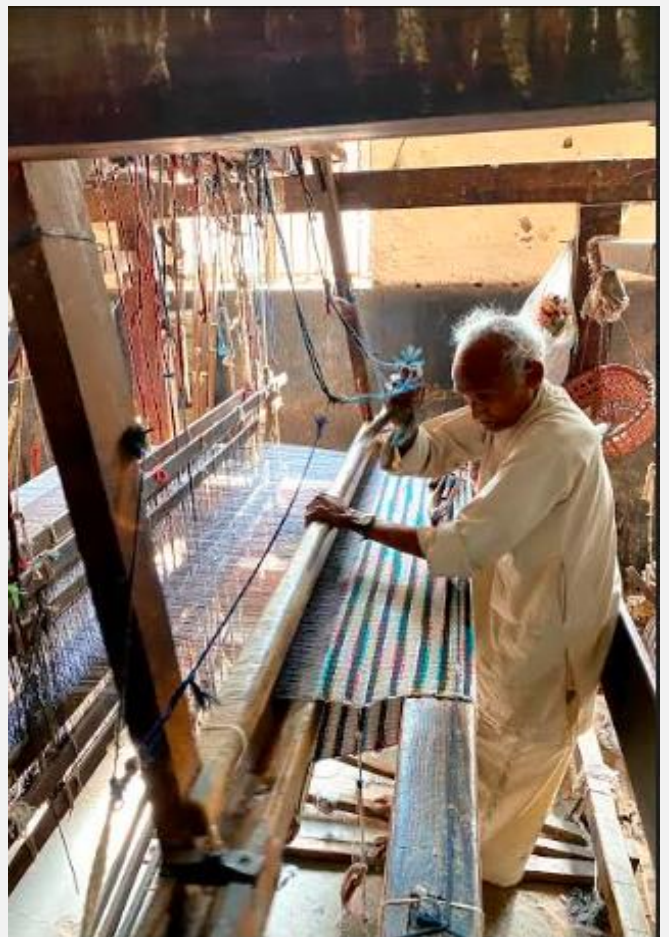
Investor/ Financier	Category	Drivers
Investors considering or scaling up engagement in the sector		
IKEA Foundation	Donors/Foundation	<ul style="list-style-type: none"> Energy access aligns with the foundations' larger focus on climate change; the sector emerged as a natural extension to promote livelihood generation for the last-mile consumer segment.
Allahabad Bank	Commercial Bank	<ul style="list-style-type: none"> In alignment with the government thrust on solar pumps, the banks seek to provide end-user financing through partnerships which ensure that credit risks are addressed.
Investors exiting/limiting engagement in the sector		
Infuse Ventures	Venture Capital/ Private Equity	<ul style="list-style-type: none"> Focus has shifted to deep cleantech investments; which is characterized by low capex investment and potential for significant scale (albeit with high risks) as opposed to energy access sector (where capex heavy models are in vogue but scale is uncertain).
FMO	DFI	<ul style="list-style-type: none"> No new commitment for energy sector in India due to change in RBI regulations pertaining to subscription of Non-convertible debentures by a single foreign investor only up to 50 per cent.
ResponsAbility	NBFCs and Debt fund	<ul style="list-style-type: none"> Typically provides capital investments of USD 5 million+, which is beyond the typical ask of most of the DRE enterprises in India. Moreover, perceive the minimum maturity tenure of 3-5 years under RBI ECB guidelines to be restrictive and prefer short-term funding for enterprises.

Clearly market scale, product innovation leading to DRE solution emerging as the products of choice and policy consistency are needed to retain the investor interest and inspire a higher level of funding into the sector.

8 Segments on the horizon

In the past few years, several solar powered productive use appliances have emerged that cater to rural livelihoods, specifically in the agricultural and textile value chains. More than 15 new enterprises have come up focused on applications like solar dryers, micro cold storages, rice mills and spinning and reeling machines. These enterprises have seen a growing interest from investors and have also secured interest from financiers such as Axis Bank and a few MFIs for undertaking end-user financing requirements of their customers.

Overall, these evolving segments present a near-term potential (by 2023) of more than USD 850 million¹⁹ (~INR 60 billion) cumulatively. A snapshot of these emerging segments and the various development aspects each enables is presented below.



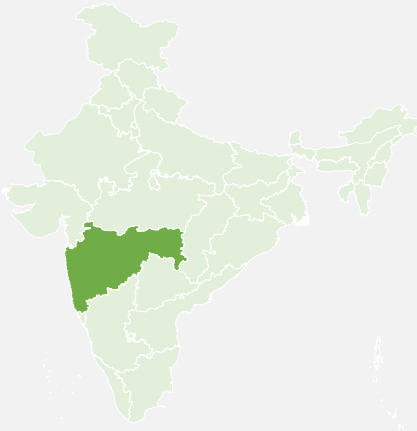
¹⁹ 1 USD= INR 71

MICRO COLD STORAGE

Though there is an established network of cold-chain infrastructure, they mainly focus on distribution and large-scale storage. This makes them inaccessible to farmers looking for storage post-harvest, forcing them to sell their perishable produce immediately after harvest. Micro-cold storage addresses this discrepancy.

Total Installations: ~400+

Figure 16: States with MCS installations



Source: cKinetics analysis

Major Players: Ecozen Solutions, Coolcrop, New Leaf Dynamics, TESSOL, Inficold

Typical System Cost: USD 16900-33,800

Key Financiers:

- Enterprise financing: Sathguru Catalysers, cKers Finance, Caspian, Omnivore, Hivos-Triadoss, IFMR, Sangam Ventures
- End-user: Axis Bank

Market Potential: USD 140 million

Impact on Livelihoods: USD 225-845 per month

SDGs Impacted:

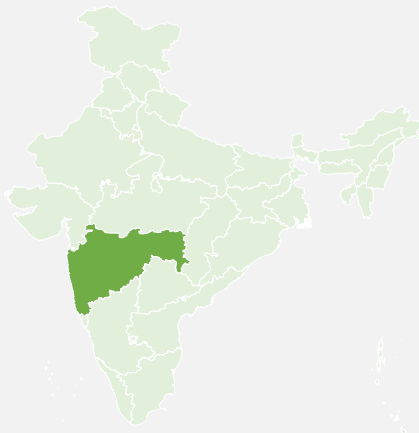


SOLAR DRYERS

Dried produce can be stored for longer durations (to about twelve months) and thus, can be sold at a higher value, which would otherwise fetch lower prices in the harvesting season. Solar dryers provide a more efficient and faster method of drying as compared to sun drying, the traditional process for food preservation.

Total Installations: 2000+

Figure 17: States with solar dryer installations



Source: Industry interactions

Major Players: S4S Technologies, PLUSS Technologies

Typical System Cost: ~USD 705-2,817

Key Financiers: Shell Foundation

Market Potential: ~USD 360 million

Impact on Livelihoods: USD 352-704 annually

SDGs Impacted:

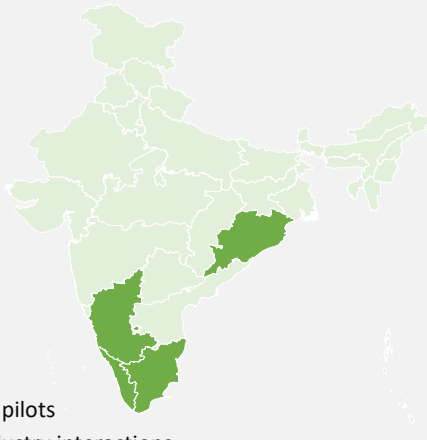


SOLAR RICE MILL

Most rice hulling in India is done through diesel powered rice mills. The farmer spends a majority of their income on buying diesel, which cuts at their savings and profits. Solar powered rice mills provide a cheaper alternative to diesel powered rice mills in the long run, while increasing output of the mill at the same time.

Total Installations: 12*

Figure 18: States with solar rice mill installations



*Excluding pilots

Source: Industry interactions

Major Players: Alto Precision

Typical System Cost: USD 2530-8500

Key Financiers:

- Enterprise incubation: Social Alpha, AIM-Sangam

Market Potential: ~USD 132 million

Impact on Livelihoods: Increase in weekly income from ~USD 282 to USD 450

SDGs Impacted:

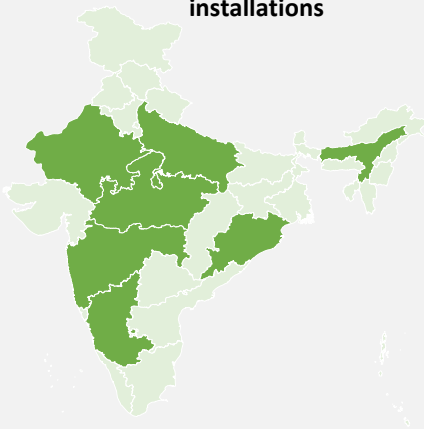


SOLAR FREEZER/REFRIGERATOR

Solar refrigerators provide a way in which rural entrepreneurs running cafes and petty shops can store cold and chilled food items. Not only do they prevent wastage of such food items but also allow the entrepreneur increased income because of better food variety. In addition, solar powered medical freezers cater to the rural needs for immunisation and blood bank collection in India.

Total Installations: 2000+

Figure 19: States with solar freezer/refrigerator installations



Source: cKinetics analysis

Major Players: Devidayal Solar, Cygni, Phocus, Godrej

Typical System Cost: ~USD 140-563

Key Financiers:

- Enterprise financing: Kotak Mahindra Bank

Market Potential: ~USD 8-10 million

Impact on Livelihoods: USD 75-250 as additional income/savings annually

SDGs Impacted:

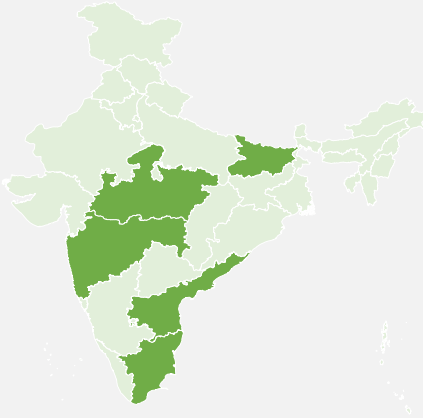


BULK MILK CHILLERS

In India's decentralized dairy industry, keeping milk fresh is a priority, as it needs to be refrigerated within a few hours after milking. Due to unreliable rural electricity, this tends to be difficult, with many dairies depending on expensive diesel generators. Solar powered and thermal storage BMCs are a solution to reducing milk wastage.

Total Installations: ~1,000+

Figure 20: States with BMC installations



Source: cKinetics analysis

Major Players: Promethean Power Systems, Inficold, New Leaf Dynamics, Ice Make

Typical System Cost: ~USD 7,042

Key Financiers:

- Enterprise financing: Sangam Ventures, Acumen, Caspian Advisors

Market Potential: USD 80 million

Impact on Livelihoods: Incremental increase in milk collected up to 55 million litres per day

SDGs Impacted:

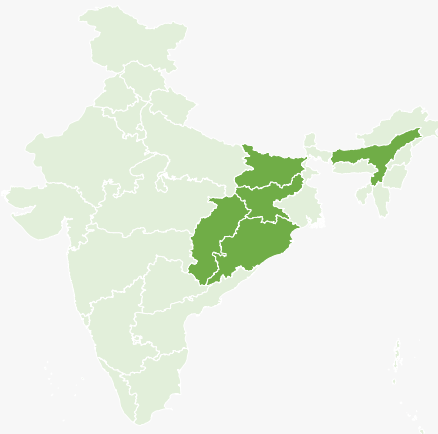


SOLAR POWERED SPINNING AND REELING MACHINES

The manual work required for reeling yarn – in the form of thigh silk reeling – is a slow process, limiting productivity. Solar powered spinning and reeling machines overcome these challenges while positively impacting weavers' livelihoods, especially in areas with limited electricity access.

Total Installations: 11,000+

Figure 21: States with solar spinning machine installations



Source: cKinetics analysis

Major Players: Resham Sutra, Microspin

Typical System Cost: ~USD 140-423

Key Financiers:

- Enterprise financing: ASME
- End-user financing: Sammuniti

Market Potential: ~USD 132 million

Impact on Livelihoods: 100% increase in monthly income

SDGs Impacted:



Pivoting the sector to the next stage of growth: DRE 2020-23

The DRE energy access sector has witnessed key transitions over the last 2-3 years. As the sector opportunity indicates, there is a huge potential to leverage DRE solutions for enabling different applications and improve rural livelihoods.

Based on the current momentum, the annual estimated market size (by value) for solar lighting segment (covering mini-grids, SHS and solar lanterns) and solar pumps is USD 75 million and USD 700 million respectively. Just over the next 3 years, this would lead to nearly USD 2.3 ~ 2.5 bn of cumulative sales with solar pumping segment still only at 50% of overall KUSUM targets. Further, market of another USD 850 million is realizable in the upcoming segments over the next 3 to 4 years.

Appropriate capital flow will be important to ensure these estimates are fully met. **Business model and product innovation leading to DRE solutions emerging as the products of choice and policy consistency are needed to retain the investor interest and scale-up the capital flows into the sector as a whole.**

Scale and Product Innovation

There is a need for DRE enterprises to innovate both in terms of product and business models. Innovation in business model is critical to address the challenges w.r.t business continuity. Given the high capex requirements of several DRE technologies, various models are being experimented in the emerging segments to enhance their uptake among different consumer segments. Enterprises are attempting to hone their business model to present a sustainable business model. For example, in solar pumps, irrigation-as-a-service has been demonstrated wherein the enterprise (partly) finances the system and engages a local service provider for renting the pump to the farmers on a pay per use basis or for ensuring a certain amount of water supply hours. Such approach helps expand the market by ensuring access of the solar pumps to small and marginal farmers who only pay on an Opex basis and yet the overall utilization of the pump is much higher than a single farmer owned model. Similarly, in the micro-cold storages segment, enterprises have been exploring 'Asset on lease' and 'Pay-per-use model' wherein cold storage (or space therein) can be booked on an as needed basis.

In the mini-grids segment, ESCOs are increasingly focused on enhancing utilization levels by focusing on electrification of rural microenterprises and powering rural livelihoods opportunities. There is also an opportunity for ESCOs to frame strategic partnership with state discoms to function as their distribution franchisees and support them with metering, billing and collection activities in rural feeders.

The continued evolution of these innovative models is key to ensuring business feasibility of enterprises targeting these segments as they seek pathways to scale rapidly.

Scaling the DRE-ecosystem through innovative use of CSR as enterprise level risk capital

A significant proportion of the equity investments in the sector are targeted towards growth-stage enterprises. While a few early-stage enterprises have been successful in getting investors interested, there is significant dearth of equity for early stage enterprises pursuing service-based business models and this ends up being a critical bottleneck in timely scale-up of these enterprises. To this end, government can proactively support enhanced flow of CSR funding into cleantech incubators and early stage funds to ensure appropriate levels of early stage risk capital is available in the space to support transition of service-based models beyond the pilot stage.

Subsidy for DRE technologies should be at par with subsidy for other technologies

The subsidies extended by the government for end-user financing for DRE technologies (such as improved cookstoves and solar charkha) should be equivalent to that being provided for other non-DRE based technologies for similar end-uses to create a level playing field in these segments.

Stronger recognition of DRE technologies in the policy spectrum needed to ensure scale-up of capital commitments from investors and financiers

Even as near 100 per cent electrification of households has been achieved, a large proportion of productive loads haven't been energized as yet. Lack of a clear mid to long term policy construct detailing role of DRE technologies as complementary to the grid in an integrated fashion has been a dampener for most investors and financiers in increasing their funding allocations to the sector.

Further even MNRE, the central nodal ministry, has exhibited wavering priorities emerging from greater thrust and prioritization for large scale RE. Moreover, there have been competing government policies w.r.t certain segments (such as LPG scheme hampering the biomass cookstove segments). This perceived lack of sustained segment level commitment adversely influences the investor outlook.

The role of DRE in enabling rural livelihoods is a great lever and it is important that upcoming schemes across these segments (whether driven by MNRE other Nodal Ministries in areas such as Health, Agriculture, Textiles) are framed with DRE as an integral element thus ensuring a resilient localized supply as also unlocking co-benefits to the communities. This will serve as a strong market signal thus intensifying the confidence of the investors and financiers.

Annexure 1: Policies, schemes and regulations impacting DRE Energy Access Sector

Government policy/ scheme	Nodal agency	Status of the policy	State/ Central scheme	Geography of focus	Applicable Technologies	DRE Segments of Focus	Year of Inception	Objectives of the policies	Capital allocated (if relevant)	Result of implementation to the DRE sector
Policies										
Bihar RE Policy (Bihar policy for the promotion of new and renewable energy sources 2017)	Bihar Renewable Energy Development Agency	Draft	All	Bihar	All	Micro- /Mini- grids; Solar Pumps	2017	(i) A dedicated target of 100 MW for mini-grid stated in the policy. (ii) As per the policy, based on the exit strategy - the developer will principally be offered flexibility in options for exit. (iii) State subsidy for promotion of solar pumps	NA	Exist strategy for mini-grid developers on advent of the grid; improved financial viability of solar pumps via subsidy
GST (Goods and Services Tax)	Department of revenue, Ministry of Finance	Final	All	Pan-India	Solar	All except biomass cook stoves	2017	Simplify the current taxation system and lowering the costs of doing business.	NA	Change in the cost of equipment impacting the financial viability of business models
Rajasthan Solar Energy Policy 2019	Rajasthan Renewable Energy Corporation Ltd.	Final	State	Rajasthan	Solar	Micro- /mini-grid; Solar pumps; SHS	2019	To establish Rajasthan as a National leader in solar energy in phased manner by creating the policy frame work for promoting use of solar energy in various applications	NA	The policy has a clause for "Decentralized Grid Connected Solar Power Projects" which refers to small capacity solar plants, the sale of electricity generated from them to DISCOMs and the solarization of grid connected pumps.
Revised ECB Regulations	Reserve Bank of India	Final	Centre	Pan-India	All	All	2019	To rationalize and provide an operational framework for ECB and Rupee denominated bonds	NA	The New ECB Framework has merged earlier Tracks I and II ECB as "Foreign Currency denominated ECB" (FCY ECB) and merged Track III and Rupee Denominated Bonds (RDBs) framework as "Rupee Denominated ECB" (INR ECB). The new framework allows all eligible entities to receive FDI. Further, all eligible borrowers can raise ECB up to US\$ 750 million or equivalent per financial year under the automatic route. However, it prohibits the use of

Government policy/ scheme	Nodal agency	Status of the policy	State/ Central scheme	Geography of focus	Applicable Technologies	DRE Segments of Focus	Year of Inception	Objectives of the policies	Capital allocated (if relevant)	Result of implementation to the DRE sector
										ECBs for repayment of rupee loan unless a foreign entity is an equity holder in the project. (Note-Under the automatic route, the hedging requirement is only for 3-5 years)
Uttar Pradesh Mini Grid Policy 2016	Uttar Pradesh New & Renewable Energy Development Agency	Final	State	Uttar Pradesh	All	Micro- /mini-grid; Pico-grid	2016	To promote decentralized generation of clean & green power by harnessing renewable energy e.g. Solar, Biomass etc in the State. As per the budget available from State govt. projects shall be installed and 30 % subsidy shall be provided.	NA	Policy/Regulations has provision of following Exit Options on Grid arrival in order to secure the investment of Mini-Grid Operators: a) Continue to supply entire quantum of electricity generated to the consumers. b) Sell excess/surplus electricity to Distribution Licensee at feed in tariff (FIT) c) Generate and supply entire electricity generated to the Distribution Licensee at feed in tariff (FIT) The policy offers developers flexibility with respect to the general business model to be pursued through the choice of two models.
Regulations										
JKSERC (Mini Grid Renewable Energy Generation and Supply) Regulations, 2016.	Jammu and Kashmir State Electricity Regulation Commission	Draft	State	Jammu and Kashmir	All	Micro- /mini-grid; Pico-grid	2016	Facilitate the supply of power to remote and unreachable villages in J&K state by setting up renewable based mini grids and address concerns of a) uncertainty of takeover of assets or payment of compensation in situations where the grid reaches the areas and b) connection of the mini-grids with the main grid to be	NA	Provides exit options to mini-grid operators in the event of arrival of the grid: a) Continue to supply entire quantum of electricity generated to the consumers through the Project Distribution Network as per the Standard Operating Procedure. The Mini Grid Operator shall supply to the consumers at mutually agreed tariff or tariff for the Mini-Grid Projects with subsidy as may be approved by the State Government b) The Mini Grid Operator shall supply to the consumers at

Government policy/ scheme	Nodal agency	Status of the policy	State/ Central scheme	Geography of focus	Applicable Technologies	DRE Segments of Focus	Year of Inception	Objectives of the policies	Capital allocated (if relevant)	Result of implementation to the DRE sector
								compatible for any such interconnection with respect to voltage imbalance, technical faults and overloading.		mutually agreed tariff or the tariff for the Mini-Grid Projects with the subsidy as may be approved by the State Govt. and sell excess/surplus electricity to the Distribution Licensee at the inter connection point at the applicable FIT c) Generate and supply entire electricity generated to the Distribution Licensee at the inter-connection point at the applicable FIT. Also states that The Mini Grid Operator shall have the option to transfer the ownership of the Project Distribution Network, provided the Project Distribution Network conforms to the standards of the Distribution Licensee's system, to the Licensee with mutual consent on depreciated value of assets.
MPERC (Micro-grid Renewable Energy Generation and Supply) Regulations	Madhya Pradesh Electricity Regulation Commission	Final	State	Madhya Pradesh	Solar	Micro- /mini-grid	2016	These Regulations shall apply to new & existing Micro-Grid projects for generation and supply of electricity to consumers in the rural areas in the State of M.P. The existing Micro-Grid projects shall within six months of notification of these Regulations, comply the technical standards and safety measures as per the Regulation.	NA	Exit Strategy for Mini-grids once the grid comes
Odisha Minigrid Renewable Energy Generation and Supply Regulations	Odisha Electricity Regulation Commission	Final	State	Odisha	Solar	Micro- /mini-grid	2019	To promote and facilitate the development, management of renewable energy	NA	It provides operational models for both when the grid exists and does not exist. Also provides exit strategy for Mini-grids once the grid comes.

Government policy/ scheme	Nodal agency	Status of the policy	State/ Central scheme	Geography of focus	Applicable Technologies	DRE Segments of Focus	Year of Inception	Objectives of the policies	Capital allocated (if relevant)	Result of implementation to the DRE sector
								generation and supply through mini-grid projects in the state of Odisha		
UP Mini-Grid Renewable Energy Generation and Supply Regulations, 2016	Uttar Pradesh Electricity Regulatory Commission	Final	State	Uttar Pradesh	All	Micro- /mini-grid; Pico-grid	2016	These Regulations shall apply to new and existing Mini-Grid Projects for generation and supply of electricity to consumers and/or sale to the Distribution Licensee in the Mini-Grid Areas in the State of Uttar Pradesh. The existing Mini- Grid Projects shall ensure the compliance of these Regulations and shall meet the Technical Standards and Safety measures as per these Regulations within six months of notification of these Regulations.	NA	Exit Strategy for Mini-grids once the grid comes
Schemes										
70 Lakh Solar Study Lamp Scheme for School going Children Scheme	Ministry of New and Renewable Energy	Final	State	Assam, Bihar, Jharkhand, Uttar Pradesh and Odisha	Solar	Solar Lanterns	2016	7 million solar study lamps to be distributed in identified block of the states	INR 4.94 billion	Solar lanterns distributed at the cost of INR 100 per lamp per student, where the rest of the cost is subsidized by MNRE.
Andhra Pradesh Solar P V Water Pumping Programme	New & Renewable Energy Development Corporation of Andhra Pradesh	Final	State	Andhra Pradesh	Solar	Solar Pumps	2014	The Govt of Andhra Pradesh is focusing on the development of solar energy projects/ programmes including Solar P V Pump Sets for Irrigation purpose in large scale in the State. Launched a major programme for irrigation with Solar Powered Pumps during the year 2014-15.		Installation of Solar pumps at a subsidized cost; REDCAP is planning to complete the installation of the allotted quantity of 10,000 nos. by March 2017.

Government policy/ scheme	Nodal agency	Status of the policy	State/ Central scheme	Geography of focus	Applicable Technologies	DRE Segments of Focus	Year of Inception	Objectives of the policies	Capital allocated (if relevant)	Result of implementation to the DRE sector
								Programme is being jointly implemented by NREDCAP along with APDISCOMs/ Agricultural Department / Fisheries Department.		
Atal Solar Krishi Yojana	Maharashtra Energy Development Agency	Final	State	Maharashtra	Solar	Solar pumps	2018	Installing 7,000 decentralized solar powered agriculture pump sets in Maharashtra for both general and SC/ST farmers	INR 2.39 billion	Financial incentives in the form of 95% subsidy (from both central and state government) to farmers for the deployment solar pumps.
Capital Investment Subsidy Scheme for construction/expansion/modernization of cold storage and storages for Horticulture Products	National Horticulture Board	Final	Centre	Pan-India		Micro-cold storages/ Bulk milk chillers	2014	Credit linked projects relating to Cold Storages including Controlled Atmosphere (CA) and Modified Atmosphere (MA) Stores, pre-cooling units, other Storages for onion, etc., their modernization are eligible for assistance under this component.		Financial incentives in the form of 40% subsidy to set up cold storage facilities of maximum capacity of 5000 MT, which can be availed for solar cold storages
Dairy Entrepreneurship Development Program	Department of Animal Husbandry, Dairying and Fisheries	Final	Centre	Pan-India		Micro-cold storages/ Bulk milk chillers	2018	(i) To promote setting up of modern dairy farms for production of clean milk (ii) To encourage heifer calf rearing, thereby conserving good breeding stock (iii) To bring structural changes in the unorganized sector so that initial processing of milk can be taken up at the village level itself (iv) To upgrade the quality and traditional technology to handle milk on a commercial scale (v) To		Financial incentives in the form of 25% subsidy to set up cold storage facilities for milk and milk products, which can be availed for solar cold storages

Government policy/ scheme	Nodal agency	Status of the policy	State/ Central scheme	Geography of focus	Applicable Technologies	DRE Segments of Focus	Year of Inception	Objectives of the policies	Capital allocated (if relevant)	Result of implementation to the DRE sector
								generate self-employment and provide infrastructure mainly for unorganized sector		
DDG scheme	Ministry of Power	Final	Centre	Pan-India	All	Micro-/mini-grid; pico-grid; SHS	2009	Electrify villages where the grid cannot reach due to geographical constraint through the Distributed Generation System		(i) 60 % Central Financial Assistance provided on the capital cost.
KUSUM Scheme	Ministry of New and Renewable Energy	Final	Centre	Pan-India	Solar	Solar pumps	2018	(i) Provide farmers with advanced technology to generate clean energy (ii) Allow farmers to sell the extra energy directly to power supply companies and generate extra income	INR 1400 billion	a) Installation of 1.75 million stand-alone solar powered agriculture pumps b) Solarization of 1 million grid-connected powered agriculture pumps c) Solarization of 50,000 grid-connected tube-wells/lift irrigation and drinking water projects d) 10,000 MW of decentralised ground mounted grid connected solar power plants As per the scheme, beneficiaries will bear only 10% of total cost to install a solar pump. The central and state government will provide subsidy of 30% each, while the remaining 30% is proposed to be financed by banks.
Mukhyamantri Solar Pump Yojana Madhya Pradesh	Madhya Pradesh New & Renewable Energy Department	Final	State	Madhya Pradesh	Solar	Solar Pumps	2017	Central Govt. & MP Govt. would provide 90% donation to farmers to install solar pump in the state. Govt. would provide Solar Pumps in those areas where electricity not available under 300 meter	Subsidy on solar pump connection up to INR 760 million	Installation of Solar pumps at a subsidized cost in the state resulting in uptake of solar pumping technology

Government policy/ scheme	Nodal agency	Status of the policy	State/ Central scheme	Geography of focus	Applicable Technologies	DRE Segments of Focus	Year of Inception	Objectives of the policies	Capital allocated (if relevant)	Result of implementation to the DRE sector
Mukhyamantri Solar Pump Yojana Maharashtra	Maharashtra State Electricity Distribution Company	Final	State	Maharashtra	Solar	Solar pumps	2018	(i) Day time power availability for agriculture pumping (ii) Decoupling irrigation sector from power subsidy burden (iii) Minimizing cross-subsidy burden on commercial and industrial electricity consumers (iv) Replacement of diesel pumps to reduce pollution	INR 34.35 billion	Financial incentives in the form of 90% subsidy to farmers for the deployment solar pumps.
Off-grid and Decentralized Solar Application Scheme – Phase III	Ministry of New and Renewable Energy	Final	Centre	Pan-India	Solar	All except biomass cookstoves	2018	Based on the experience gained during the Phase I and Phase II, the program is being expanded in Phase III, with improved technology and cost reduction through innovative procurement mechanisms. Under Phase-III, it is targeted to create 118 MWp equivalent solar power capacity by 31.03.2020 through off grid solar PV applications.	INR 6.56 billion	Financial incentives in the form of CFA to increase uptake in the market and create a sustained interest within the investor community
Off-grid & Decentralized Solar Thermal Applications Scheme	Ministry of New and Renewable Energy	Final	Centre	Pan-India	Solar	Solar cookers	2018	To promote off-grid applications of solar thermal systems (solar water heating system, solar cooker, solar concentrating system, solar thermal power pack etc.) for meeting the targets set in JNNSM	INR 700 million	Financial incentives in the form of 30% subsidy for the deployment solar thermal applications.
Punjab solar pump subsidy Scheme	Punjab Energy Development	Final	State	Punjab	Solar	Solar pumps	2013	Under this scheme, Punjab government has decided to provide INR	INR 50 million	Installation of Solar pumps at a subsidized cost in the state resulting in uptake of solar

Government policy/ scheme	Nodal agency	Status of the policy	State/ Central scheme	Geography of focus	Applicable Technologies	DRE Segments of Focus	Year of Inception	Objectives of the policies	Capital allocated (if relevant)	Result of implementation to the DRE sector
	Agency (PEDA)							0.1 million subsidy on installation of 500 solar irrigation pump sets in the state		pumping technology
Rashtriya Krishi Vikas Yojana	Ministry of Agriculture	Final	Centre	Pan-India	Solar	Solar Pumps	2007	A State is eligible for funding under the RKVY if it maintains or increases the percentage of its expenditure on Agriculture and its Allied Sectors with respect to the total State Plan Expenditure, where the Base Line (which will move every year) for this expenditure is the average of the percentage of expenditure incurred by a State Government for the previous three years on Agriculture and its Allied Sectors minus any funds related to Agriculture and its allied sectors that it may already have received in that time under its State Plan - INR 50,000 subsidy per solar/wind "water lifting device"		Installation of Solar pumps at a subsidized cost ;"Under the Rashtriya Krishi Vikas Yojana, the central and state governments are giving 75% grants on the purchase of each solar pump having a capacity of 2 horsepower and 50% grants on the purchase of a 5 horsepower capacity."
SAUBHAGYA Scheme	Ministry of Power	Final	Centre	Pan-India	Solar	SHS	2017	Provide electricity connection in installments for uptake of households having grid connections	INR 170 billion (for providing SHS)	More rural households will be part of the central grid with a subsidized tariff which will impact the financial viability and cost competitiveness of the DRE segment. However, at the same time, accounts for the use of SHS for unelectrified households located in remote and inaccessible areas.

Government policy/ scheme	Nodal agency	Status of the policy	State/ Central scheme	Geography of focus	Applicable Technologies	DRE Segments of Focus	Year of Inception	Objectives of the policies	Capital allocated (if relevant)	Result of implementation to the DRE sector
Saur Sujala Yojana Scheme	CREDA	Final	Centre	Chhattisgarh	Solar	Solar Pumps	2018	To develop agricultural yield and earning of farmer in Chhattisgarh through better irrigation services and increased use of solar power	INR 1710 million	Provision of subsidy up to 90-95% of the cost for installation of solar pumps of capacity 3 HP and 5 HP which cost INR 0.35 million and INR 0.45 million respectively. The scheme is expected to provide benefit to up to 51,000 farmers.
Solar Charkha Mission	Ministry of Micro, Small and Medium Enterprises	Final	Centre	Pan-India	Solar	Other productive use appliances	2018	(i) To ensure inclusive growth by generation of employment, especially for women and youth, and sustainable development through solar charkha clusters in rural areas (ii) To boost rural economy and help in arresting migration from rural to urban areas (iii) To leverage low-cost, innovative technologies and processes for sustenance	INR 5.5 billion	Financial incentives in the form of subsidy for solar charkhas and looms to increase uptake in the market
Surya Raitha Scheme	KRED	Final	State	Karnataka	Solar	Solar Pumps	2014	Through this scheme the farmers having 10Kwp solar power can earn nearly INR 50000/- per annum apart from his self-consumption, for irrigation, which augments his revenue sources especially during drought or unseasonal rains. The state provides free power to the agriculture sector. As a result , the subsidy agriculture consumption has shown an increasing trend year on year.	NA	Installation of Solar pumps at a subsidized cost. Further, the government will purchase excess power generated by the farmer at INR 9.56 per unit (if the farmer has not taken subsidy); INR 7.20 per unit (if the farmer has taken subsidy).

Government policy/ scheme	Nodal agency	Status of the policy	State/ Central scheme	Geography of focus	Applicable Technologies	DRE Segments of Focus	Year of Inception	Objectives of the policies	Capital allocated (if relevant)	Result of implementation to the DRE sector
Suyashakti Kisan Yojana	Gujarat Urja Vikas Nigam Limited	Final	State	Gujarat	Solar	Solar pumps	2018	To address the energy requirements of farmers, empower rural economy and eliminate/reduce financial stress on DISCOMs. The scheme is being implemented on pilot basis covering 137 numbers of agricultural feeders, covering number 12,400 number of agricultural connections.	INR 9 billion	Financial incentives in the form of 95% subsidy to farmers for setting up solar panels. The generated solar energy will be utilized by farmers for irrigation purpose and the surplus energy will be injected back to the grid for sale to DISCOMs at a tariff of INR 3.50/unit and another INR 3.50/unit (within limit of 1000/kW/annum) will be paid by state government as evacuation-based incentive. EBI will only be applicable for farmers installing the systems without a subsidy.
Unnat Chulha Abhiyan (UCA)	Ministry of New and Renewable Energy	Final	Centre	Pan-India	Biomass	Biomass Cookstoves	2009	Replace existing traditional inefficient Chulhas by the efficient improved biomass cookstoves, and hence to address the health concerns and also save biomass resource. 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	INR 2940. million	A target of 2.75 million improved cookstoves/chulhas will be disseminated/installed in the remaining period of the 12th Plan Period. Central Financial Assistance: For Natural Draft Cookstoves (including earthen chulhas with metal combustion chambers) (i) upto 50% of cost of cook-stoves with maximum ceiling of INR.400 for natural draft (including earthen chulhas with metal combustion chambers) and Rs.800 for forced draft - average support taken at INR 600/- per cookstove for the years 2013-14 and 2014-15, (ii) upto 40% of cost of cookstoves with maximum ceiling of INR300 for natural draft cookstoves(including earthen chulhas with metal combustion chambers) and INR600 for forced draft cookstoves, average support taken INR.450for the years 2015-16 and 2016-17

Government policy/ scheme	Nodal agency	Status of the policy	State/ Central scheme	Geography of focus	Applicable Technologies	DRE Segments of Focus	Year of Inception	Objectives of the policies	Capital allocated (if relevant)	Result of implementation to the DRE sector
UP Solar Pump Yojna	UPNEDA	Final	State	Uttar Pradesh	Solar	Solar Pumps	2016	To promote agriculture sector and help in developing economic conditions of the farmers	NA	Installation of 10,000 solar pumps over 2016-2017 at subsidized cost
Other Govt. Policies /initiatives impacting the DRE sector										
DDUGJY (excluding DDG component)	Ministry of Power	Final	Centre	Pan-India	NA	NA	2014	(a) Separation of agriculture and non-agriculture feeders (b) Strengthening and augmentation of sub-transmission & distribution (ST&D)(c) Rural electrification	43033 Cr for (a) and (b) and 39275 Cr for c)	The scheme targets providing access of electricity to all rural households that are currently not grid connected. More rural households will be part of the central grid with a subsidized tariff which will impact the financial viability and cost competitiveness of the DRE segment
Har Ghar Biji, Bihar, Sugam Sanyojan Yojna in UP	Department of Energy, Bihar and UPPCL	Final	State	Uttar Pradesh, Bihar	NA	NA	2017	Provide electricity connection in installments for uptake of households having grid connections	NA	More rural households will be part of the central grid with a subsidized tariff which will impact the financial viability and cost competitiveness of the DRE segment
Pradhan Mantri Ujjwala Yojana (PMUY)	Ministry of Power	Final	Centre	Pan-India	NA	NA	2016	Replace unclean cooking fuels with clean and more efficient LPG in 50 million households	Rs 2,500 Cr	On one hand, it limits the market opportunity for biomass cookstoves, but on the other hand, it also shows government's increasing focus on clean cooking and encourages developers to come out with competing products
UDAY	Ministry of Power	Final	Centre	Pan-India	NA	NA	2016	Reduction of AT&C loss to 15% by 18-19 Reduction of gap between ACoS and ARR	NA	As UDAY scheme brings more discom in restructuring their financial health, the operational resilience of the discom grid would increase hence the decrease in market for DRE sector. Also target the weakest link in the current power sector.

Annexure 2: List of FIs interviewed

CATEGORY	NAME OF ORGANISATION	NAME OF PERSON	DESIGNATION
CATALYST AND INCUBATORS	D-Labs	Anusha Reddy	Program Manager
	Sangam Ventures	Karthik Chandrasekar	Founder & CEO
	Social Alpha	Manoj Kumar	CEO
	Villgro	Ananth Aravamudan	Senior Advisor & Practice Lead (Energy)
CORPORATE INVESTORS	Mitsui	Koichi Yamada	CFO
	Engie	Rahul Banerjee	Senior Vice President
	Shell	Brian Davis	Vice President
COMMERCIAL BANKS	Allahabad Bank	S. K. Singh	Deputy General Manager
	Bank of Baroda	Krutti Patra	Senior Manager (Rural and Agri)
	RBL Bank	Raviraj Satnur	National Collections Manager
CSR	HCL Foundation	Alok Varma	Associate Project Director
DEVELOPMENT FINANCE INSTITUTIONS (DFIS)	FMO	Mark Roesink	Investor Officer (Energy, Asia & Eastern Europe)
	IFC	Anjali Garg	Energy Specialist
	KfW	Ekta Mehra	Senior Sector Specialist
	NABARD	V. S. Balasubramanian	Deputy General Manager
	PROPARCO	Philippe Serres	South Asia Regional Manager
	UNDP	Saba Kalam	Manager, Climate Change & Energy
DONORS AND FOUNDATIONS	Doen Foundation	Michelle de Rijk	Investment Manager
	Good Energies Foundation	Stephanie Jones	Program Manager
	IKEA Foundation	Biswarup Banerjee	Program Manager (RE)
	MacArthur Foundation	John Balbach	Director, Impact Investments
	Rockefeller Foundation	Pariphan Uawithya	Director, Power Initiative
	USAID	Anurag Mishra	Senior Clean Energy Specialist
MICROFINANCE INSTITUTIONS (MFIS)	Arohan	Ananya Jana	Assistant General Manager
	ESAF Small Finance Bank	Christudas KV	Lead Advisor (Sustainable Banking)
	Saija	Soubhagya Nayak	DVP Strategy
NBFCS AND DEBT FUNDS	Caspian Impact Investments	Ravinder Voomidisingh	Senior Investment Manager
	cKers Finance	Jayant Prasad	Executive Director
	IREDA	K. P. Philip	Senior Manager
	Maanaveeya	Gouri Sankar	Managing Director
	ResponsAbility	Sameer Tirkar	Principal
	SunFunder	Alycia Kellman	Chief Legal Officer
	Symbiotics	Prashant Bhardwaj	Investment Manager (South Asia)