

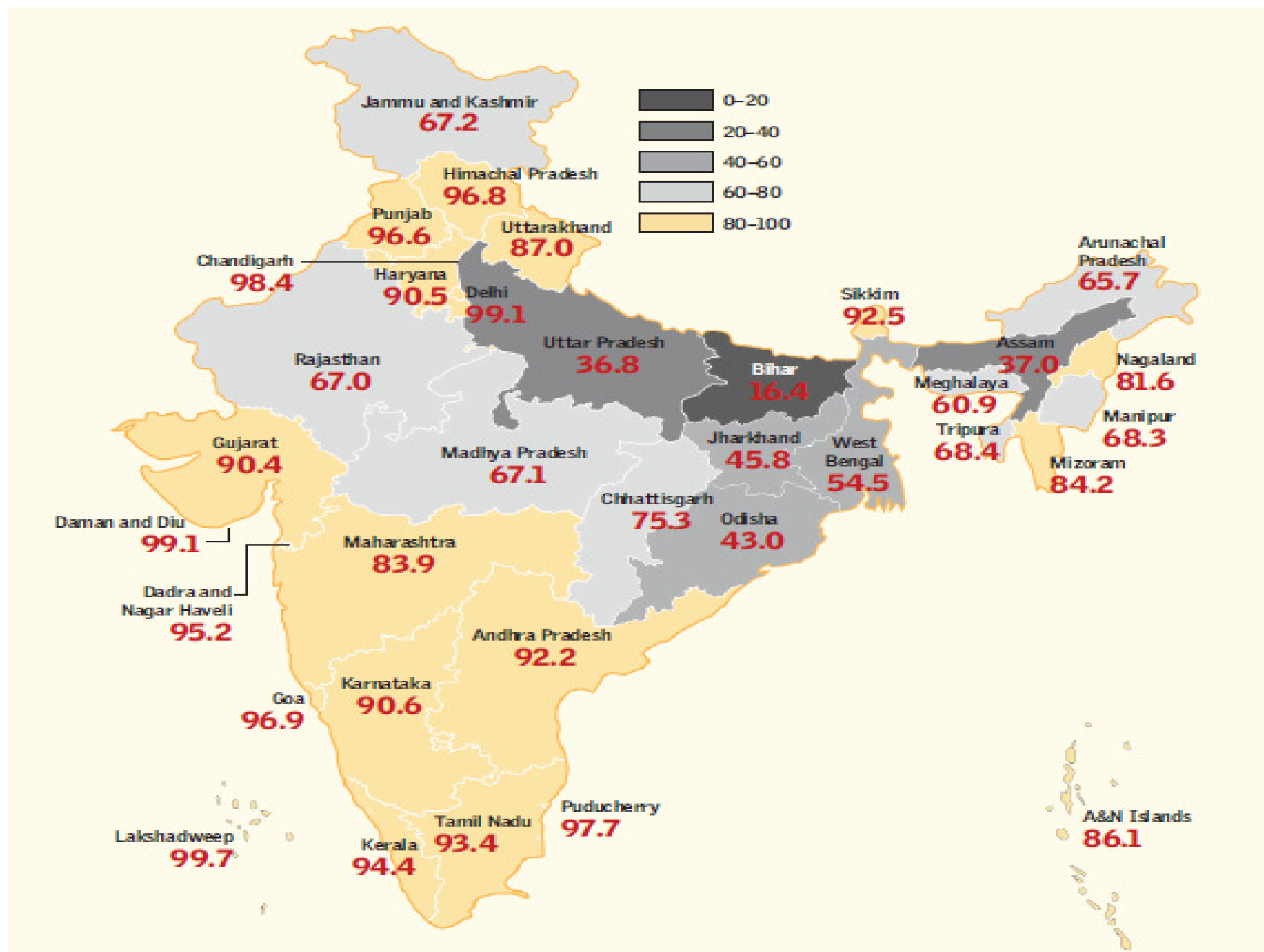
RENEWABLE ENERGY BASED MINI-GRIDS

Electricity to All



- Only 67.2% households connected to the grid in India
 - 92.7% urban households
 - 55.3% rural households
 - Per capita consumption is only 8 kWh per month in rural areas and 24 kWh per month in urban areas.
- 32.3% use other energy sources for lighting
 - 31.4% kerosene
 - 0.5% other sources
 - 0.4% solar energy (1.1 million households)
- 0.5% ~ 1.2 million households go dark after sunset

CENSUS 2011: LIGHTING



- RGGVY and DDUGJY was based on only grid expansion. Grid expansion has not been able to provide electricity to the poor in the country and may yet fail to do so
 - Ability and willingness to supply on the part of the distribution companies (discoms)
 - Expectation of free electricity
 - Poor bill collection
 - Other paying customers

FAILURE OF GRID

Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY) considers a village electrified if the following criteria is met:

- Basic infrastructure such as distribution transformers and/or distribution lines are available in the inhabited locality
- Public places like schools, panchayat offices, health centres, dispensaries, community centres, etc. can avail power supply on demand
- 10 per cent or more of households are electrified

DEFINITION OF ACCESS

- Indian average per capita per annum consumption of electricity - 957 units
- In the US, annual per capita consumption of electricity is 12,954 units
- World average is around 3,064 units
- In the ten years between 2003–04 and 2013–14, the per capita consumption of electricity in the country has increased at a rate of only 4.9 per cent every year

PER CAPITA CONSUMPTION

- In a country with a population of around 1.3 billion people, almost 240 million people do not have access to electricity
- The International Energy Agency projects that India will still have 147 million people without electricity in 2030
- If the rapid growth of the conventional power sector has failed to serve the energy-poor in the country, then why we are planning to opt for the same route in future as well?

ENERGY ACCESS

MINI-GRIDS

Existing markets and shortfalls

- There are at least 3000 mini-grids and micro-grid operating in the country
- They are mostly solar based, few are biomass and even fewer are based on hydel
- Very heavily dependent on subsidies, are not financially viable
- Aim to provide few hours of electricity in a day mainly for lighting
- Very little focus on anchor load or productive load

MINI-GRIDS TODAY

Electricity consumed in residential sector is cross subsidized by the commercial and industrial sector

- They are typically charged Rs 4-7 per unit of electricity

Electricity for the poor is usually available for 6 hours a day or provided by mini-grid developers

- They are charged from Rs 20 to Rs 90 per unit of electricity generated from solar mini-grid

AFFORDABILITY

- Remote Village Electrification Programme – limited in scope, just for lighting, lack of after sale service, lack of ownership
- Decentralized Distributed Generation scheme – 90% subsidy, no one responsible for achieving the target, lack of monitoring, actual working conditions of the project unknown
- Off-grid solar programme under JNNSM –
 - Target of 200 MW, achieved 252 MW by the end of 2013
 - Only 27.5 per cent of targets were for the benefit of rural households
- Meeting targets without actually ensuring that installations takes place for providing access to electricity to people who need it.

FAILED SUPPORT

- High capital and operating expenditures
- Demand in rural areas
- Irregular tariff collection
- Bureaucratic delays
- Social challenges
- Technological and operational challenges
- Large players versus small
- Competitive environment

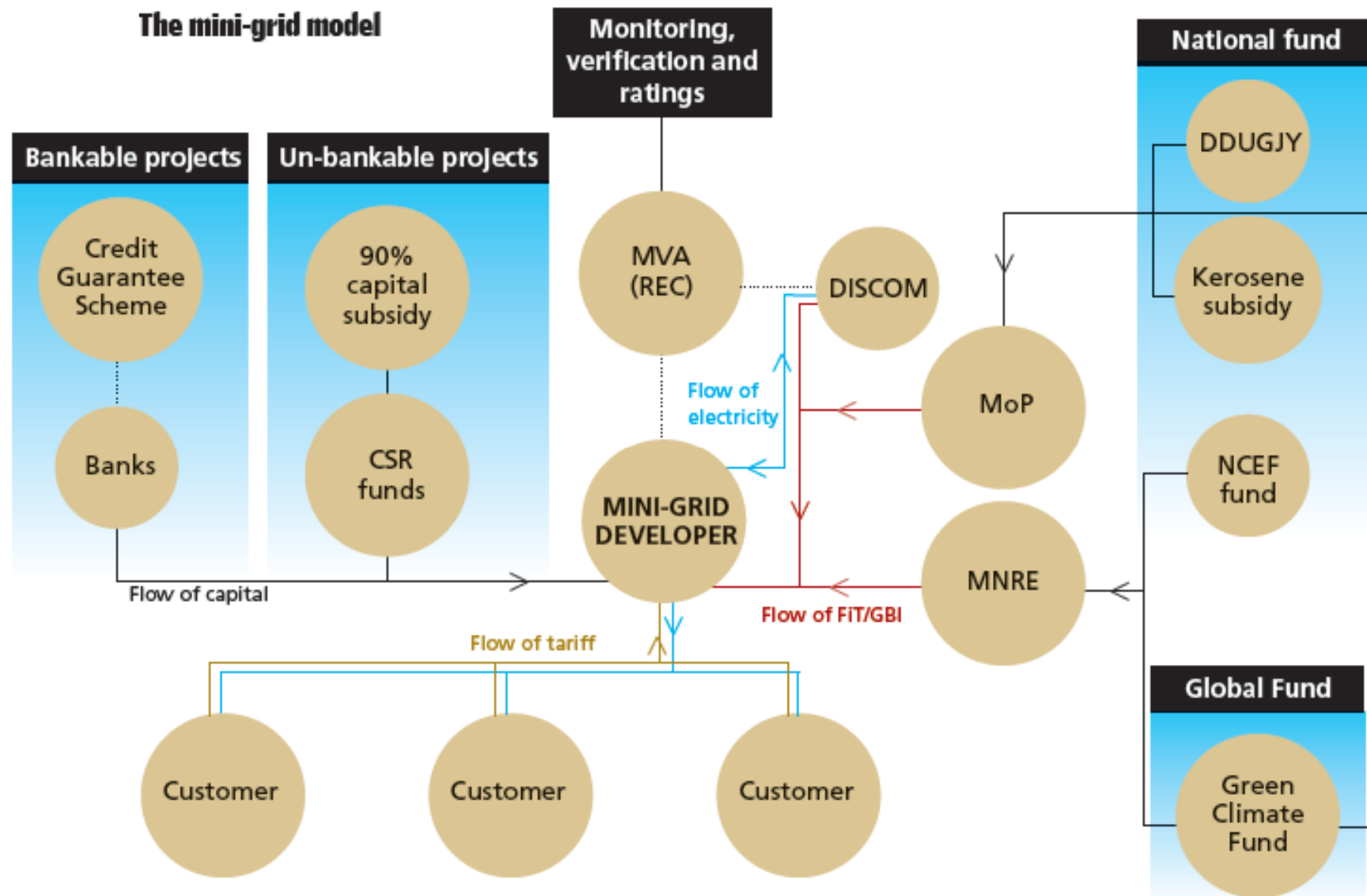
CHALLENGES

CSE POLICY MODEL

Creating a market for mini-grids



The mini-grid model



- MNRE will implement the programme. It would be the policy and funding agency
- REC will be the monitoring and verifying authority (MVA) and the programme will be implemented by state nodal agencies (SNAs)
- SNAs will formulate the plan to achieve target set by MNRE in the national mini-grid policy

IMPLEMENTING AGENCIES

- Decision would be based on detailed project report (DPR)
 - Demand growth and how the mini-grid plans to meet the increased demand in future
 - Plans for capacity building like skill and microenterprise development
 - Choice of combination of technologies/ renewable energy sources to provide the services at the least cost
- Bidding Process done by REC on the basis of reverse bidding

SELECTION OF DEVELOPER

- Bringing mini-grids under regulation and support projects through feed-in tariff (FiT)/ generation based incentive (GBI). This will increase bankability of projects
- Capital subsidy be provided for the development of the transmission and distribution infrastructure of these mini-grids.
- A combination of capital subsidy and FiT/GBI would make most projects bankable

ADDRESSING FINANCE

There could still be some mini-grids which are not bankable but are important from the energy access point of view. For example, mini-grids set up in very remote areas. These could be financed by either of the following means:

- Encouraging companies to use CSR funds to set up mini-grids.
- 90 per cent capital subsidy by the government to support mini-grids.

ADDRESSING FINANCE

- Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY) now called Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY)
 - Fund created for extension of grid
 - Portion of money is allocated for Decentralized Distributed Generation (DDG) – Rs 1000 crores allocated (approx USD 150 million)
 - 12th Five Year Plan (2012-17) had an earmarked expenditure of Rs 24,000 crores

SOURCES OF FUNDING: DDUGJY

- India has a coal tax of Rs 400 per on every ton of coal purchased, which gets transferred into a fund called NCEF
- Now called Clean Environment Fund
- Currently they are at approximately Rs 10,000 crores

SOURCES OF FUNDING: CEF

- In FY 2014-15, Rs 20,000 crores was spent on kerosene subsidy
- This money can be directly used today for developing mini-grids

SOURCES OF FUNDING: DIVERSION OF KEROSENE SUBSIDY

- The UNFCCC has developed a Green Climate Fund (GCF) in order to support programmes, policies and other activities of participating developing nations.
- As the development of mini-grids is an attractive proposition to leapfrog 1.2 billion energy-poor people from dirty fossil fuel directly to clean energy, a sizable portion of the Green Climate Fund should be used to support mini-grids through FiT/GBI in developing nations.

SOURCES OF FUNDING: GCF

- PD will act as a discom franchisee
- PDs will generate electricity, supply it to customers and receive tariff as paid by customers at a rate decided by the SERC. PDs will receive the differential amount as GBI for the number of units of electricity supplied to the customer
- Excess power produced by the mini-grid is fed back into the grid. For excess power, PDs receive FiT from the discom, as decided by the SERC. In case of deficit, PDs will buy power from the main grid at a mutually agreed rate with the discoms.

GRID INTERACTIVITY

CASE STUDY

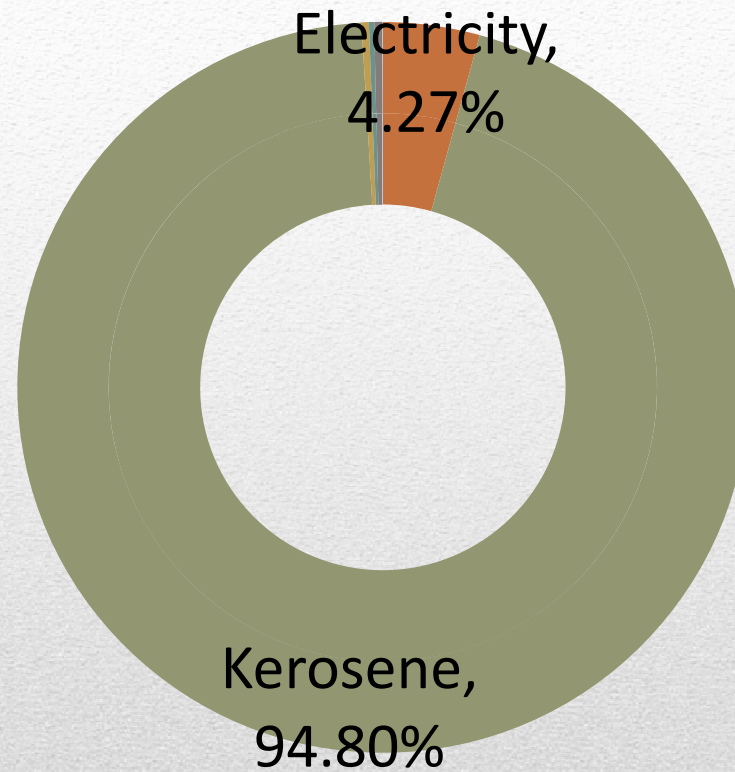
State: Bihar

District: Samastipur

Sub-district: Bibhutipur

- According to census data, this particular sub-district has 13 large size villages having population of more than 10,000 each. At the same time, electrification rate in this sub-district is one of the lowest in Bihar
- According to the GARV dashboard, the entire district of Samastipur only has 16 non-electrified villages. Latest data (21 June 2016) suggests 14 of these villages are now electrified.

BIBHUTIPUR SUB-DISTRICT



SOURCES OF LIGHTING

- Based on historical household growth rate and rate of electrification in the 10 years between 2 census, we have calculated out of 82,427 households, 76,721 do not have access to electricity
- Out of the households that have been electrified, 75 per cent do not receive even one unit every day
- Total number of households that need to be supplied one unit of electricity per day is 81,000

UNELECTRIFIED

Description	Unit	2011	2016
Census Data on Rural Households	Nos	67,023	82,427
Percentage of rural Households with access to electricity	%	4.27%	6.92%
Number of rural Households with access to electricity	Nos	2,864	5,707
Rural Households without access to electricity	Nos	64,159	76,721
Rural Households receiving less than 1 unit a day per houshold (assumption)	%		75%
Rural Households receiving less than 1 unit a day per houshold	Nos	2,148	4,280
Total number of households that need to be supplied one unit of electricity per day	Nos	66,307	81,000
% of households to be covered by Mini-grid	%		100%
Electricity required to serve the target number of households per year considering 1 unit per day per households	kWh		29,565,181

Description	Unit	2016
Solar mini-grid penetration by 2016		40%
Biomass mini-grid penetration by 2015		60%
Number of units required to be generated from the solar mini-grid installed in the year	kWh	11,826,073
Number of units required to be generated from biomass mini-grid installed in the year	kWh	17,739,109
Required installed capacity of the solar mini-grids considering 19% CUF	MW	7.11
Required installed capacity of the biomass mini-grids considering 65% CUF	MW	3.45
Cost of solar based mini-grid per KW	₹	104,353
Cost of biomass based mini-grid per KW	₹	60,833
Govt subsidy of 90% per KW for setting up the distribution system	₹	27,000
Total capital required for solar based mini-grids per year excluding govt subsidy	₹ crores	54.96
Total capital required for biomass based mini-grids per year excluding govt subsidy	₹ crores	11.66
Total capital required for mini-grid development	₹ crores	66.62
Total government support required for mini-grid development till 2025	₹ crores	27.60

- Considering FiT mechanism to support the mini-grids over its life cycle of 20 years, we find that the government will have to provide a total of Rs 27.60 crore in the first eight years of the project
- Applying a discount factor of 10.67 per cent (as per CERC guidelines), we find that the government will have to give Rs 19.59 crore at the net present value
- For the present population of 338,149, over an eight year period, the subsidy given by the government would be Rs 6 per person per month.

GOVERNMENT SUPPORT

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