

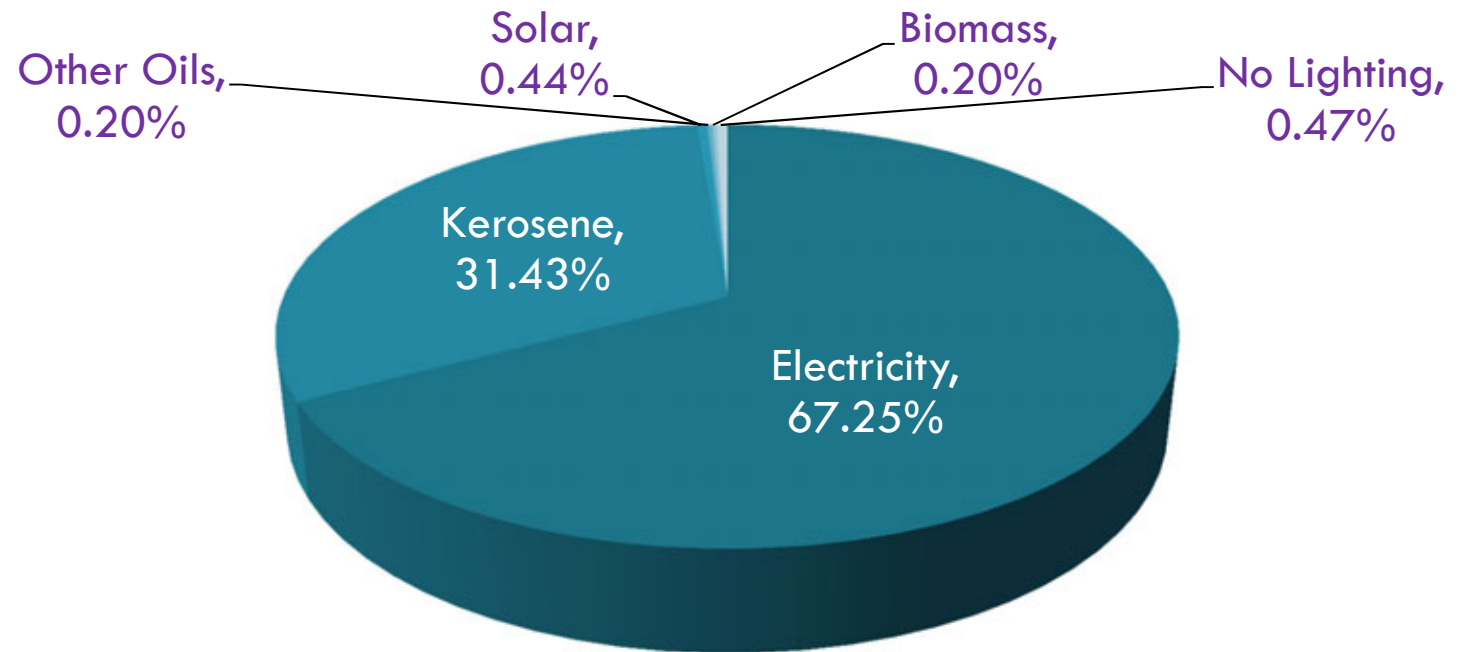
SUSTAINABLE MINI-GRID

A MODEL FOR MAHARASHTRA

20/06/2014

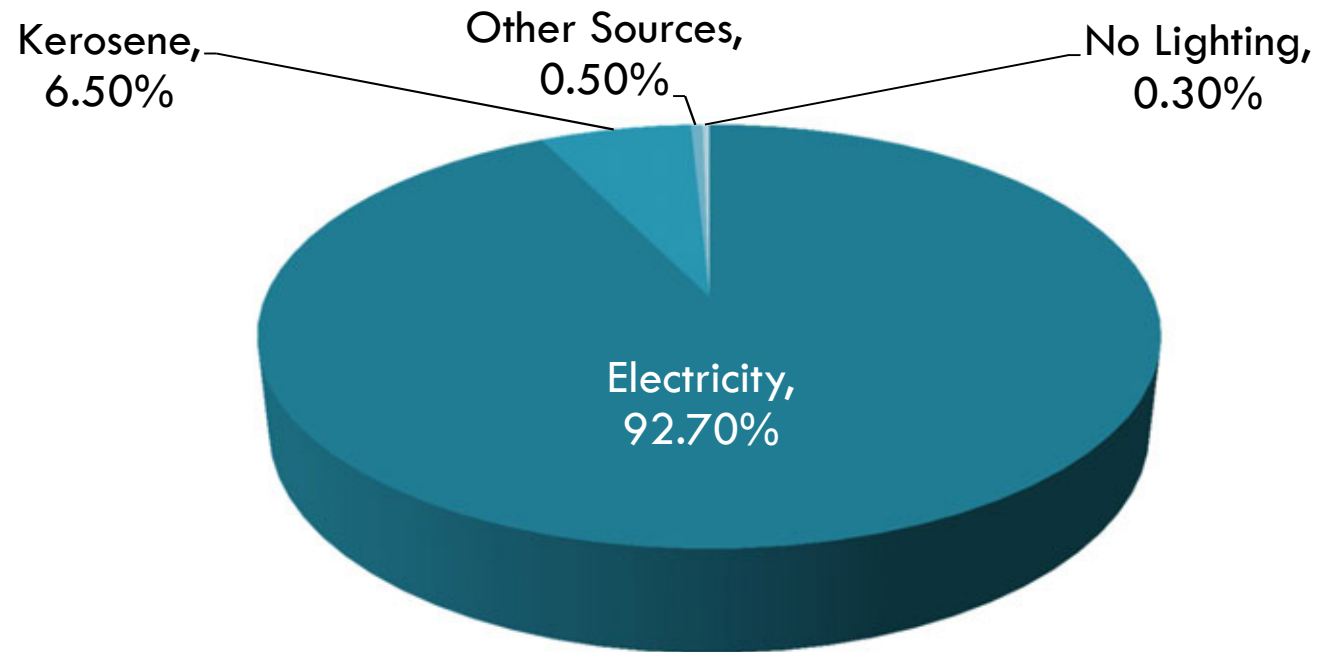
NAYANJYOTI GOSWAMI

Energy Access - India

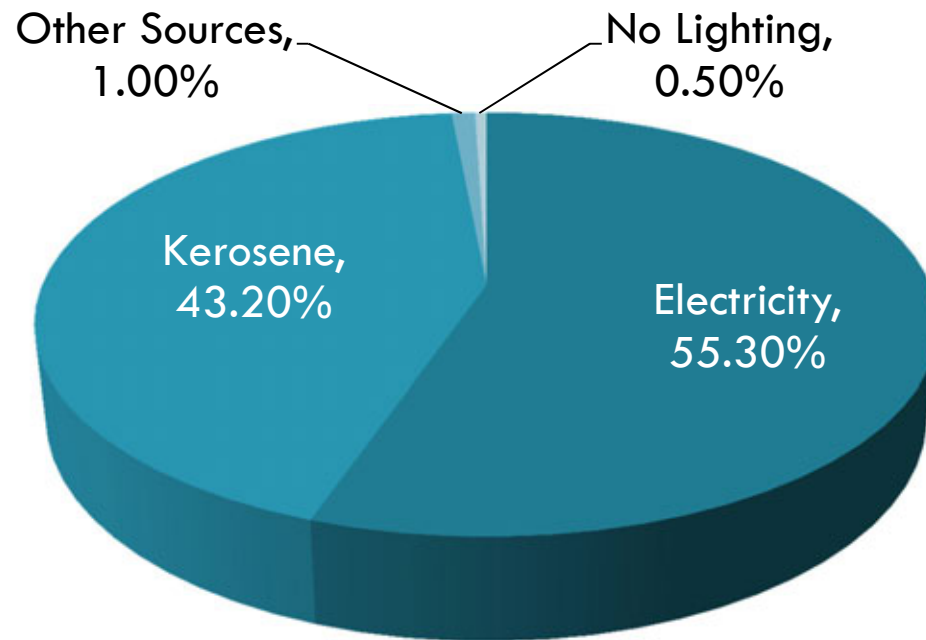




Energy Access – Urban India

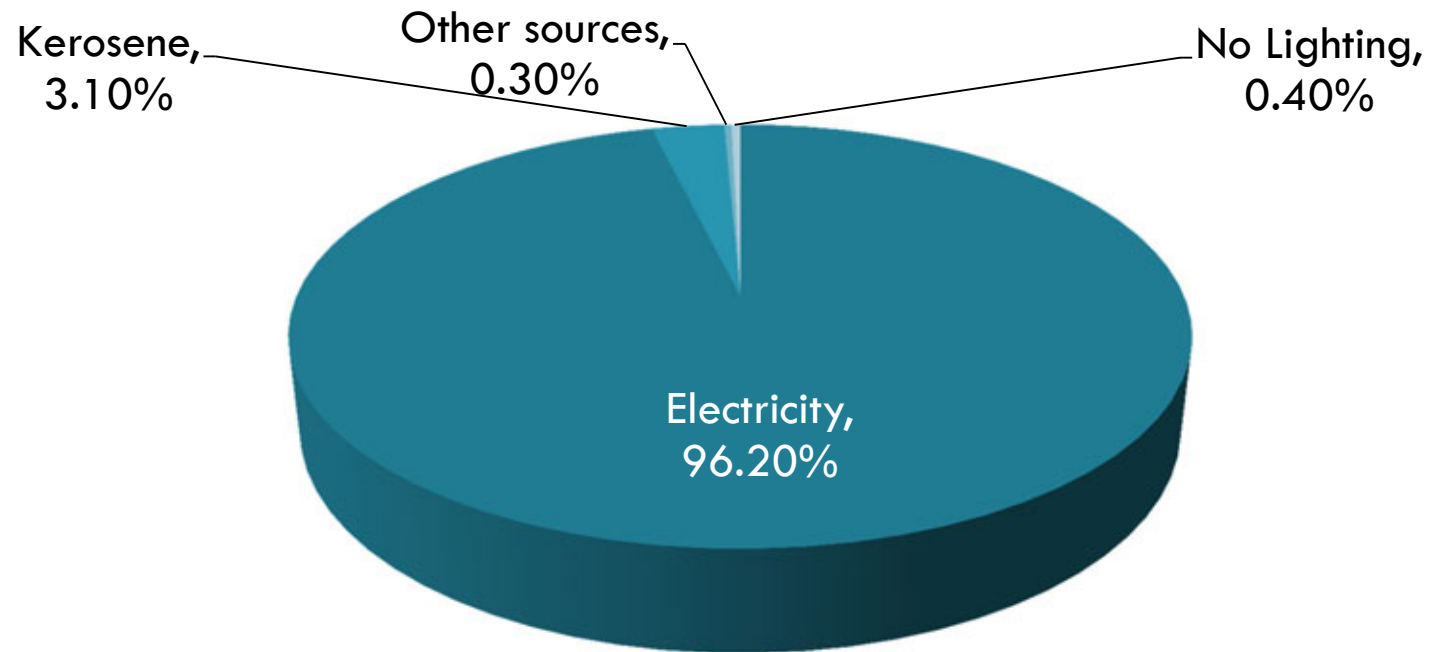


Energy Access – Rural India



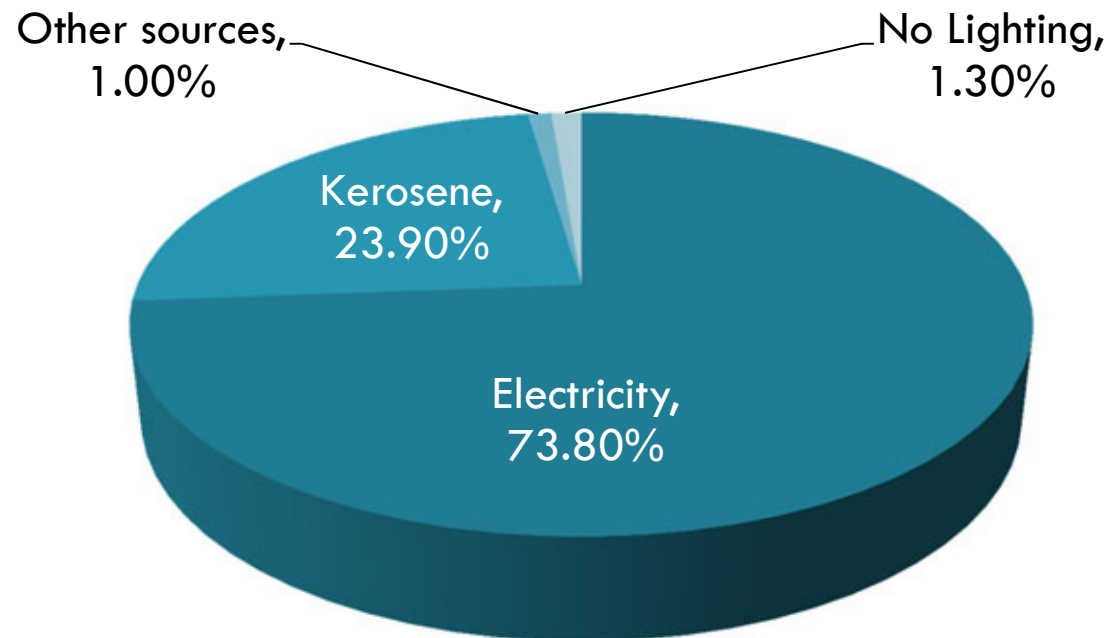


Energy Access - Urban Maharashtra





Energy Access - Rural Maharashtra





What is Mini-Grid?

- Grid – High voltage backbone system of interconnected transmission lines, substations and generating plants.
- Mini-grid – Smaller version of a grid
- But how small it is?
 - 1.5 kW serving 200 customers?
 - 32 KW serving 400 customers?



Rural household requirement

Appliance	Load (W)	Quantity (No)	Hours of consumption	Consumption/day (Wh)	Consumption/month (kWh)
CFL lamps	11	2	6	132	3.96
CFL lamps	8	1	6	48	1.44
Ceiling fans/table fan	75	1	12	900	27
Mobile charging	8	1	3	24	0.72
Television	80	1	5	400	12
VCD drive/set-top box	30	1	5	150	4.5
	212	7	37	1654	49.62



Requirement for 50 households

Appliance	Load (W)	Quantity (No)	Hours of operation	Consumption/day (Wh)	Days /month	Consumption/month (kWh)
Residential needs for 50 households						2481.00
Pump set	3000	1	4	12000	20	240.00
Livelihood (marketplace)	11	20	5	1100	30	33.00
Flour mill	5000	1	2	10000	20	200.00
Street lighting	11	10	10	1100	30	33.00
Community centre/ anganwadi/hospital	500	1	4	2000	30	60.00
Total demand per month						<u>3047.00</u>
Technical and commercial losses @ 20 per cent						<u>761.75</u>
Total number of units required to be generated per month						<u>3808.75 ≈ 3800.00</u>



Definition of mini-grid

- A set of electricity generators, possibly with energy storage system interconnected to a distribution network that is capable of generating at least 3800 units per month in peak power condition to serve 50 households.
 - Technology neutral
 - A minimum size is defined
 - A minimum service parameter is defined



Challenges in the definition

- What will happen to the excess power if demand is less?
 - ▣ Interconnected to grid if available
 - ▣ If grid is not available – excess power is wasted
 - Proper assessment of demand & its growth
 - Scheduling of power based on demand
 - Economic activities - productive activities
 - Base loads



Amendments in policies

- Electricity Act – 2003
 - ▣ Define mini-grid
 - ▣ Direct NEP to formulate policies for DISCOMs to sell and purchase power from mini-grids
 - ▣ Energy equity – equivalent to kerosene replacement cost
 - ▣ Electricity supply code for mini-grids
 - ▣ Institute MVA for monitoring, verification and rating
 - ▣ Follow certain clause of EA part - VI



Amendments in policies

- National Electricity Policy - 2005
 - ▣ Redefine REDB
 - ▣ Lay down grid interconnectivity with mini-grids
- National Tariff Policy – 2006
 - ▣ RPO must include certain % of power from mini-grids
 - ▣ Mandate SERCs to decide preferential tariff for mini-grids
- Rural Electrification Policy - 2006
 - ▣ Shift the focus from grid extension to mini-grids



Amendments in schemes

- DDG
 - ▣ Mini-grids in grid connected villages where electricity is less than 12 hours
- JNNSM
 - ▣ Mini-grids in remote villages only through proposed REAP scheme
 - ▣ Off-grid applications like – solar pumps



Tariff Mechanisms

- Mini-grids in grid connected areas
 - ▣ Feed – in – Tariff from REC directly.
 - Sources – RGGVY, Kerosene subsidy
 - ▣ Tariff from served customers
- Mini-grids in remote areas
 - ▣ Generation based incentives from MNRE directly.
 - Sources – NCEF Fund, Green Climate Fund
 - ▣ Tariff from served customers



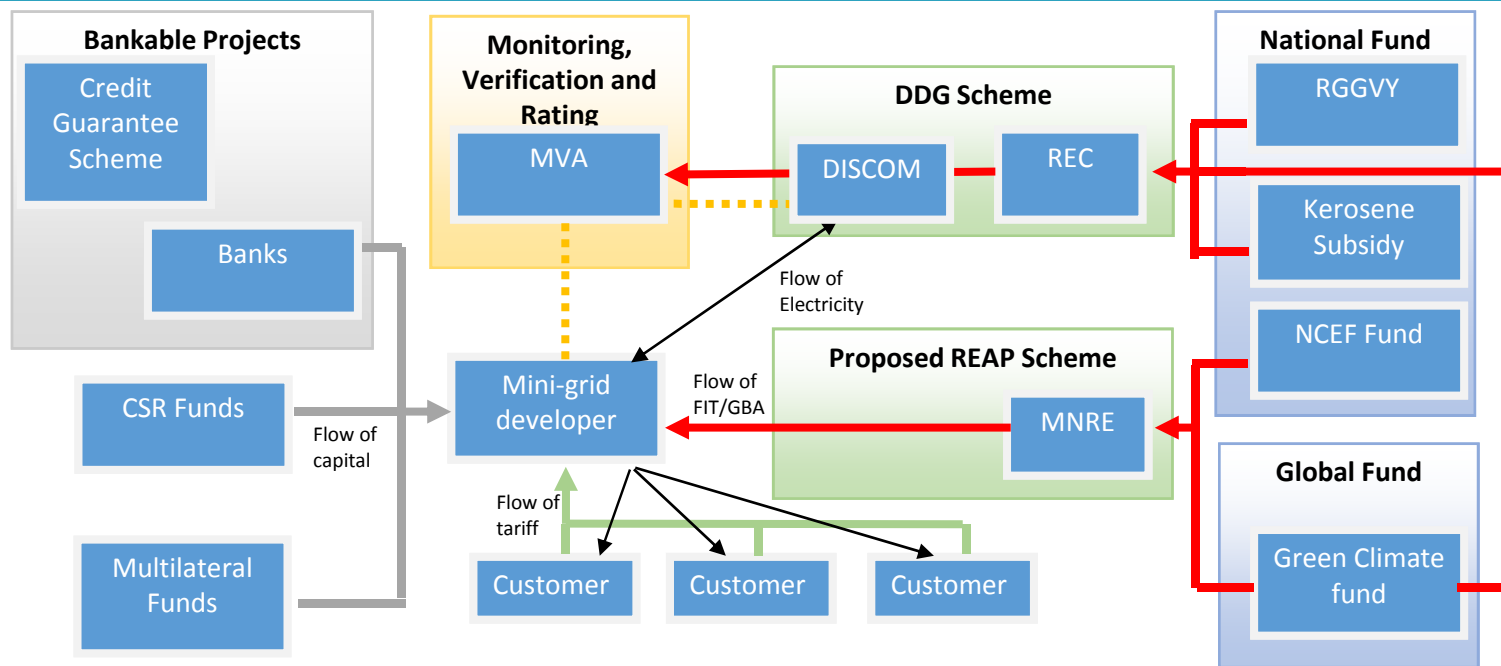
Capital Expenditure

- Debt Finance
 - ▣ Bank with soft loans – backed by credit guarantee from government for bankable projects
 - ▣ CSR Funds / Multilateral funds for non bankable projects
- Equity Finance
 - ▣ Mini-grid developer

Renewable Energy



The Model



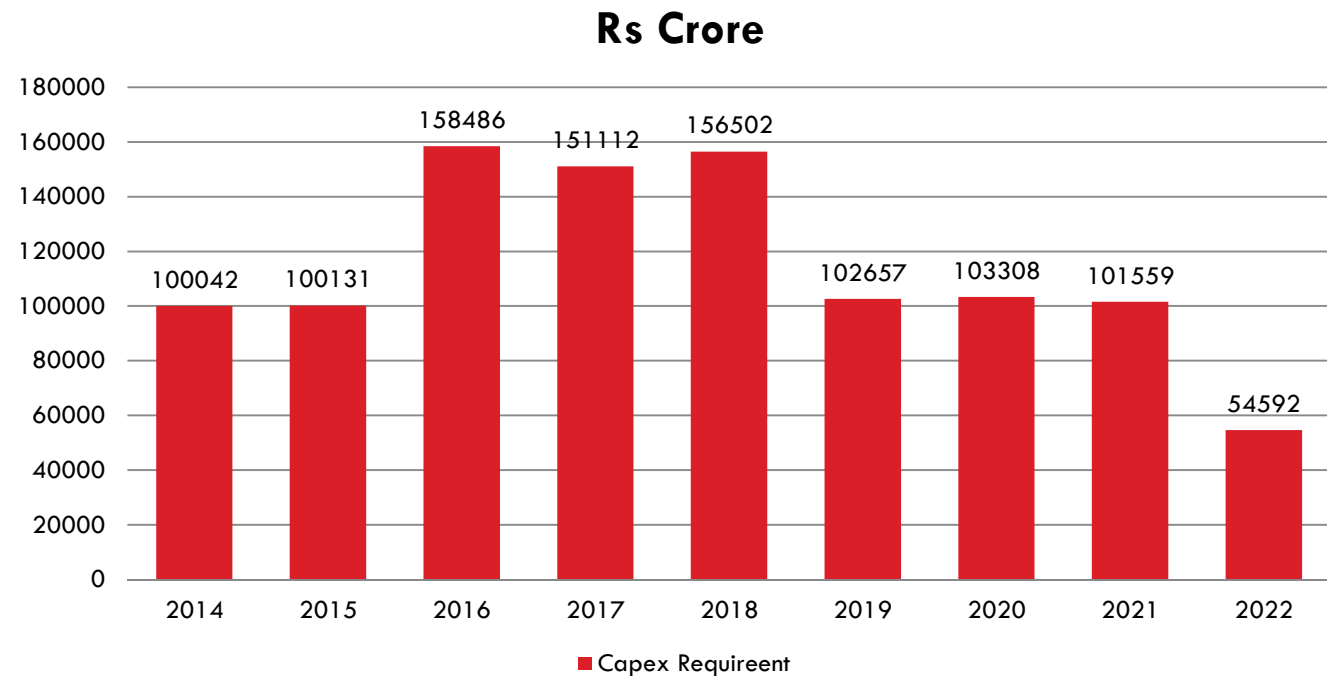


Features of the model

- ❑ Source and flow of funds defined
- ❑ Bankable and non bankable projects dealt separately
- ❑ MVA for monitoring, verification and rating
- ❑ Global fund for FIT / GBI
- ❑ Cluster approach
- ❑ Grid interconnectivity if grid is available
- ❑ Energy equity

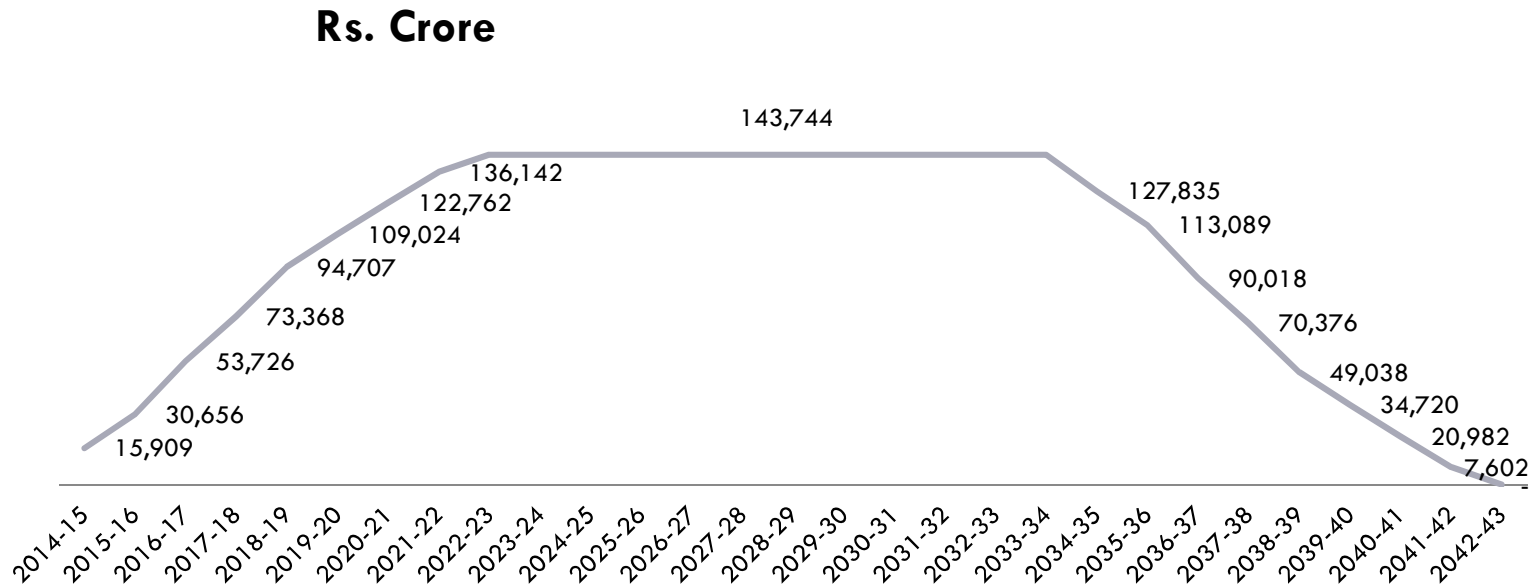


Cap-ex requirement - India





FIT/GBI requirement - India





Selection of mini-grid developer

- Bidding
- Bid preparation
- Financial eligibility
- Distribution of electricity – adhere to provisions
- O&M and capacity building