



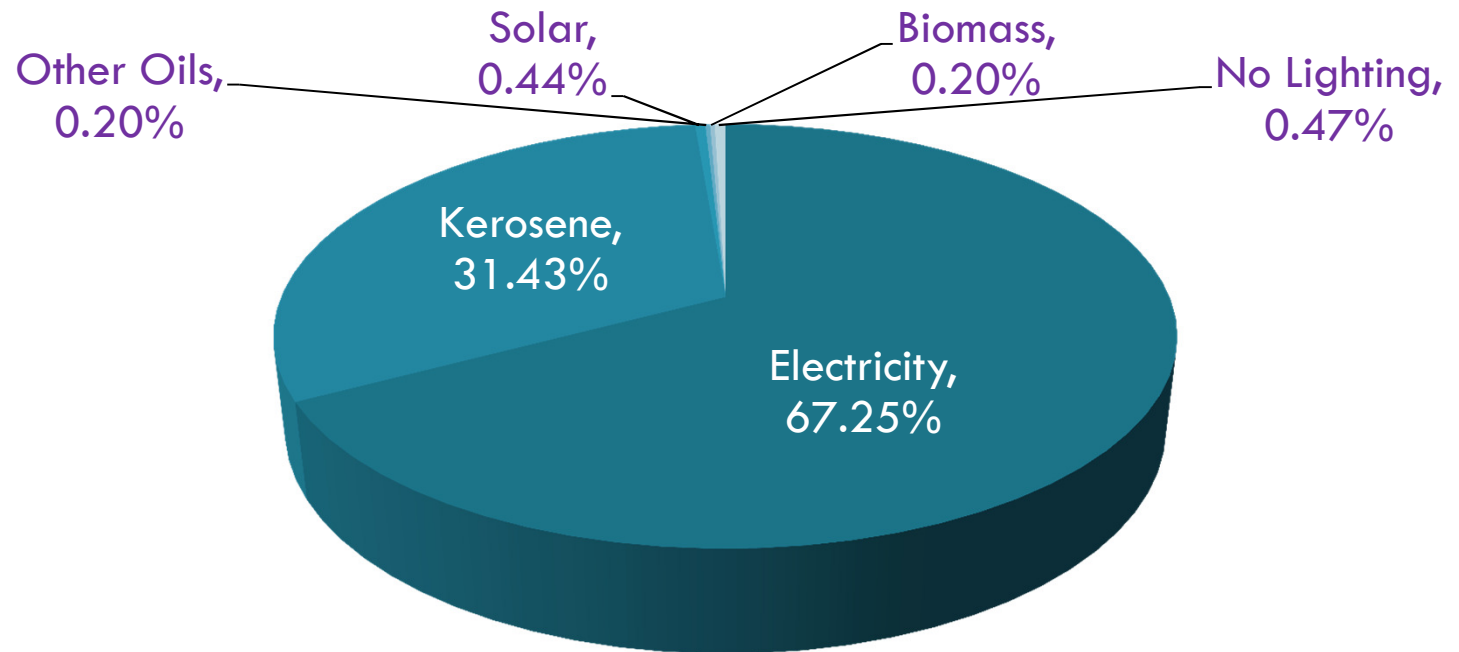
# SUSTAINABLE MINI-GRID

## A MODEL FOR BIHAR

30/05/2014

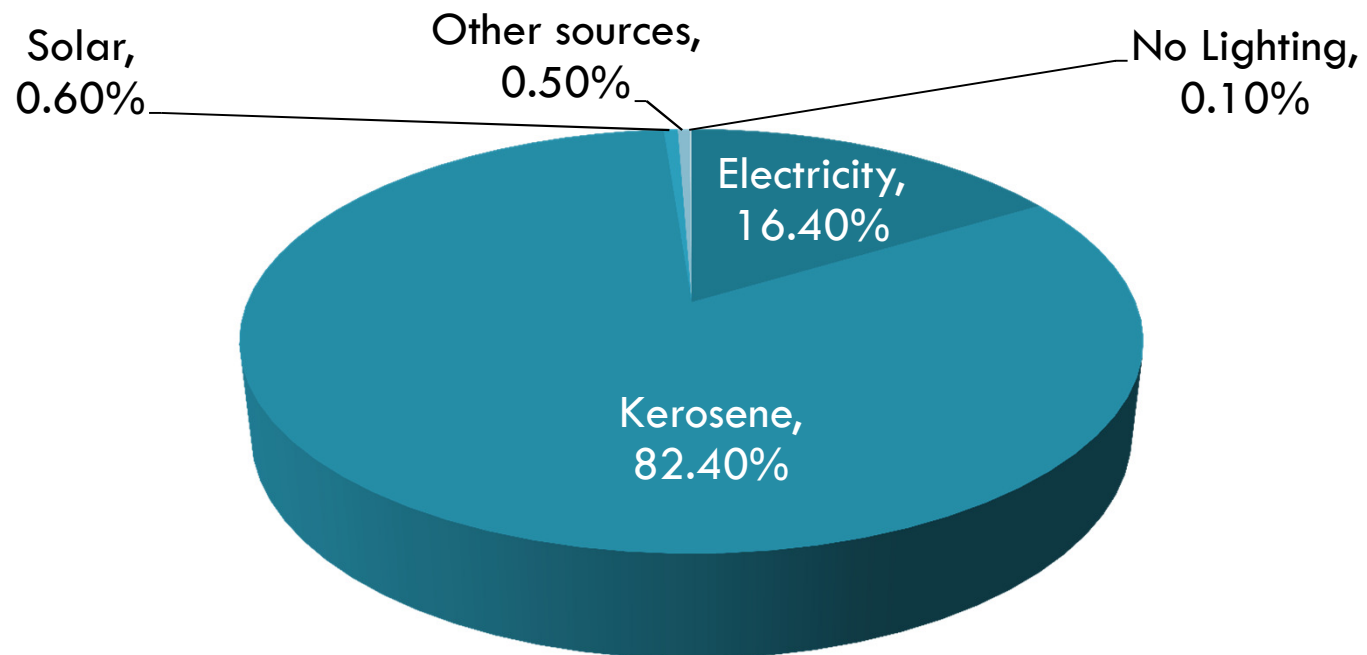
NAYANJYOTI GOSWAMI

# Energy Access - India



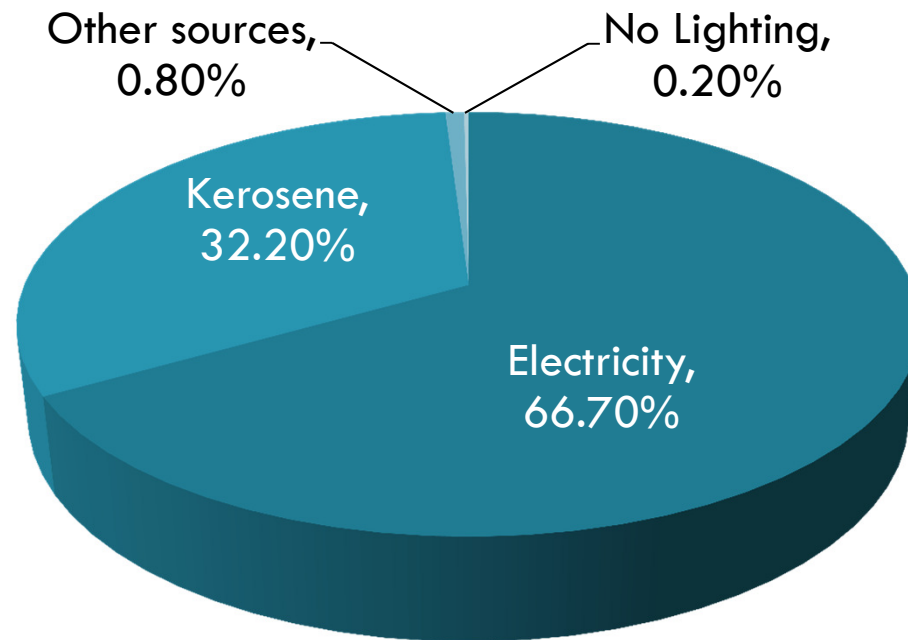


# Energy Access - Bihar



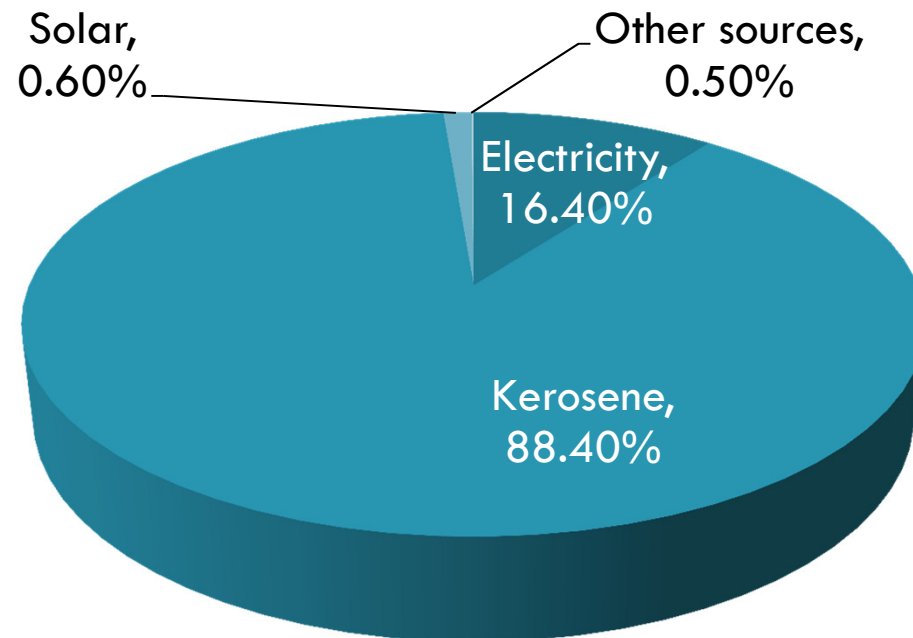


# Energy Access – Urban Bihar





# Energy Access – Rural Bihar





## 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
	<b>212</b>	<b>7</b>	<b>37</b>	<b>1654</b>	<b>49.62</b>



# 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
<b>Total demand per month</b>						<b><u>3047.00</u></b>
<b>Technical and commercial losses @ 20 per cent</b>						<b><u>761.75</u></b>
<b>Total number of units required to be generated per month</b>						<b><u>3808.75 ≈ 3800.00</u></b>





## 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



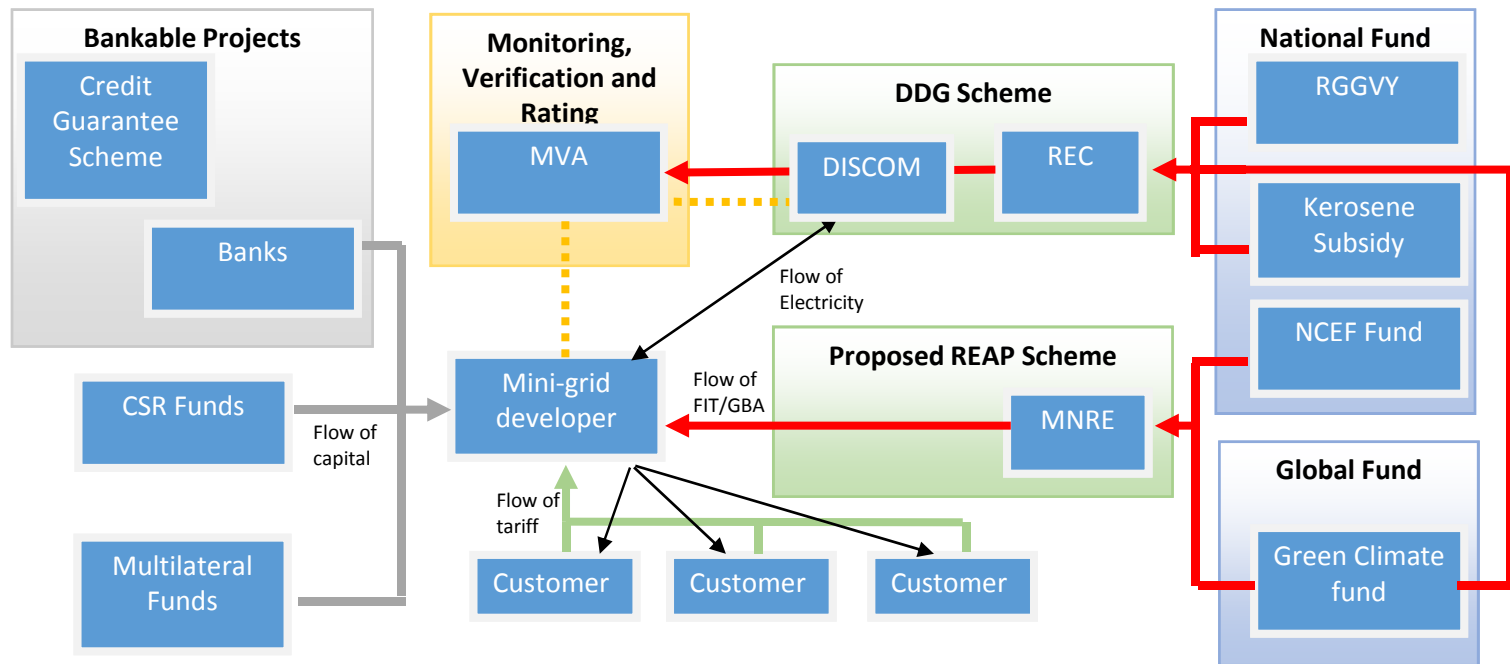
# Capital Expenditure

- 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





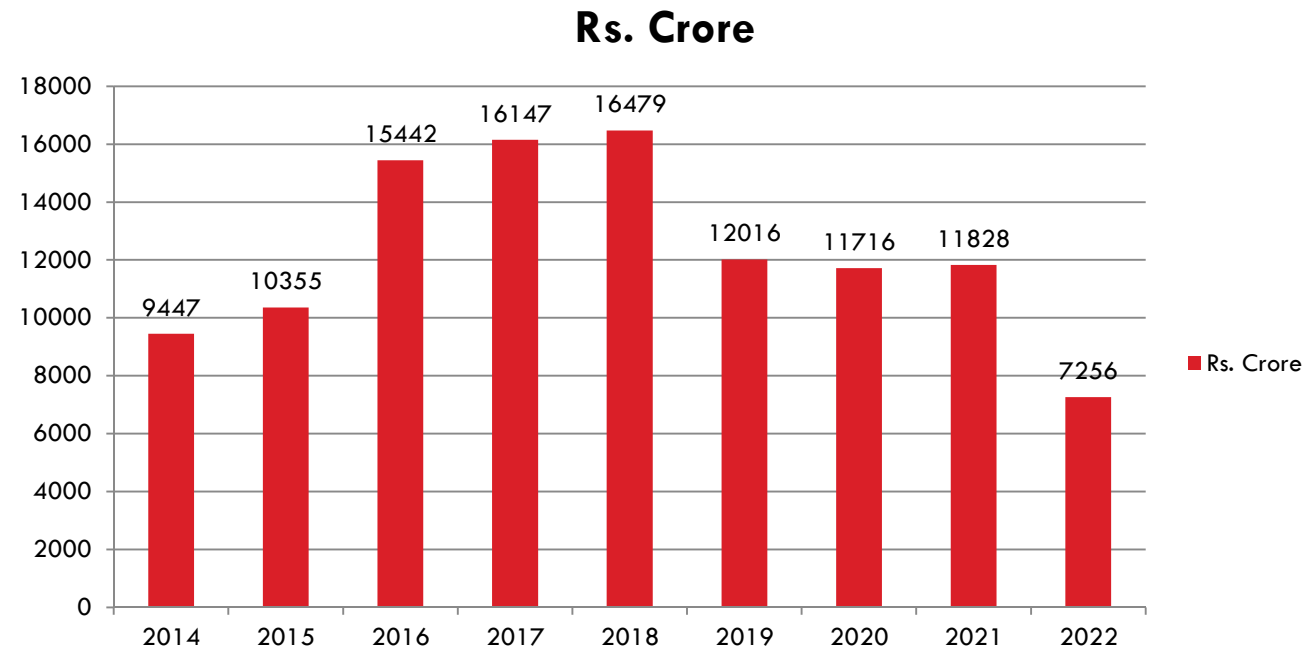


## Features of the model

- ❑ 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



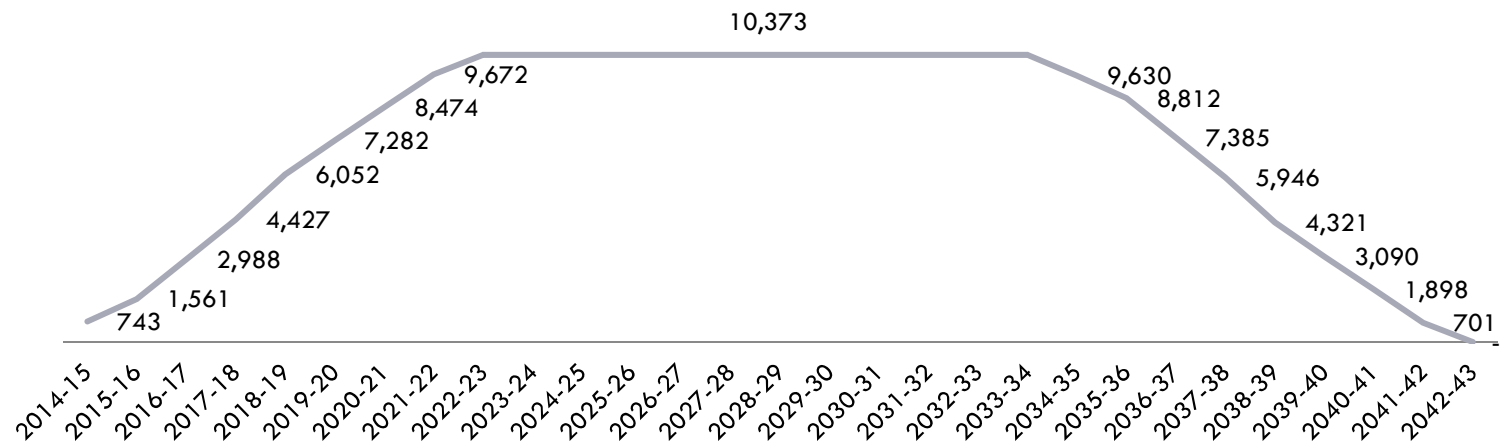
# Cap-ex requirement - Bihar





# FIT/GBI requirement - Bihar

**FIT / GBI support required per year in Rs. Crore**





# Selection of mini-grid developer

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