



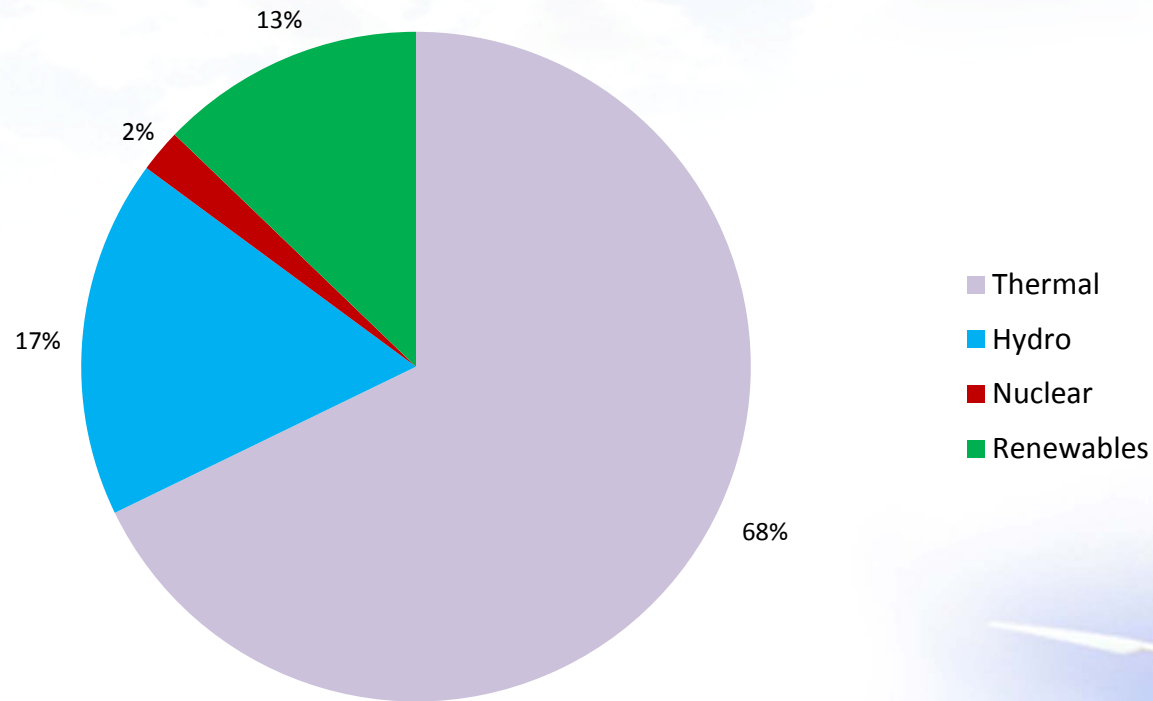
Networking the NE Region – Building Connection through Renewable Energy

**Ministry of New and Renewable Energy
Government of India**

**Tarun Kapoor
Joint Secretary**

Indian Power Sector

Power Installed Capacity = 230.072 GW



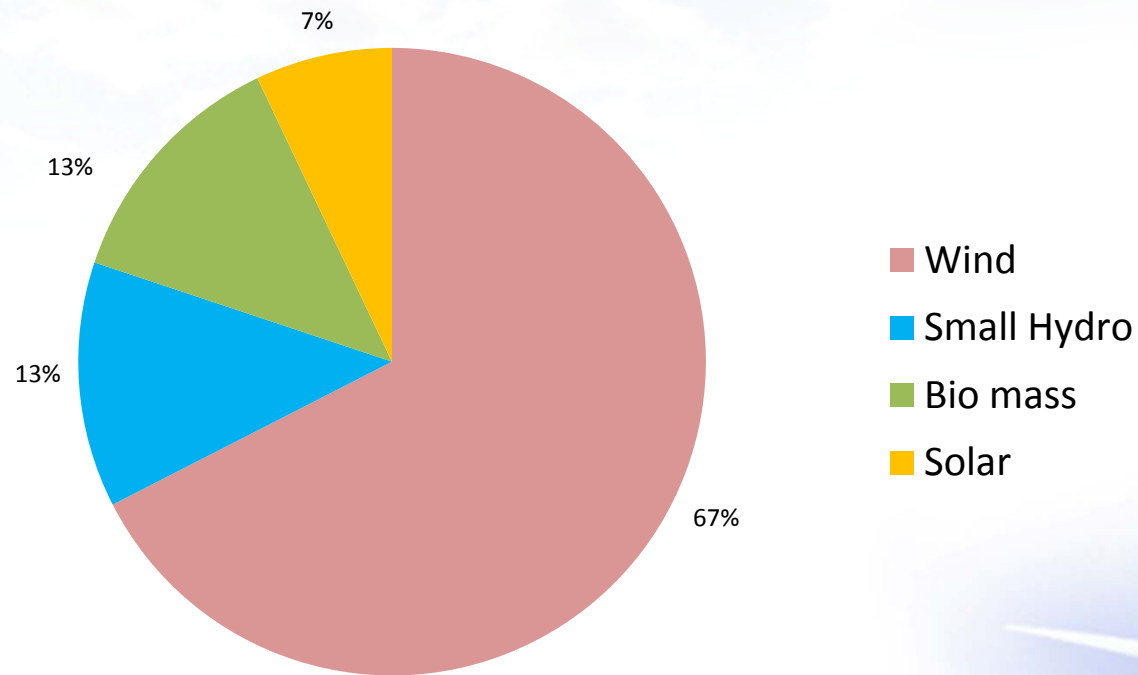
Thermal	Hydro	Nuclear	Renewable	Total
1,55,969 MW	39,788 MW	4,780 MW	29,535 MW	2,30,072 MW

Electricity Access

State-wise Rural Household Electrification Levels

Electrification Levels	States/Union Territories
90% and above	Himachal Pradesh (96.6%), Punjab (95.5%), Chandigarh (97.3%), NCT of Delhi (97.8%), Sikkim (90.2%), Daman & Diu (98.3%), Andhra Pradesh (89.7%), Dadra & Nagar Haveli (91.7%), Goa (95.6%), Lakshwadeep (99.8%), Tamil Nadu (90.8%), Kerala (92.1%) and Puducherry (95.8%)
Between 80-89%	Jammu & Kashmir (80.7%), Uttarakhand (83.1%), Haryana (87.2%), Gujarat (85%) and Karnataka (86.7%)
Between 70-79%	Nagaland (75.2%), Chhattisgarh (70%), Maharashtra (73.8%) and A&N Islands (79.4%)
Between 60-69%	Manipur (61.2%), Mizoram (68.8%) and Tripura (59.5%)
Between 50-59%	Rajasthan (58.3%), Meghalaya (51.6%), Arunachal Pradesh (55.5%) and Madhya Pradesh (58.3%)
Between 40-49%	West Bengal (40.3%)
Less than 40%	Uttar Pradesh (23.8%), Bihar (10.4%), Jharkhand (32.3%), Assam (28.4%) and Odisha (35.6%)

Renewable Power Capacity (29,535 MW)



Wind 19,881 MW	Small Hydro 3,727 MW	Solar 2150 MW	Biomass 3,777 MW	Total 29,535 MW
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India has a 400 million energy poor population.....

- **Nearly 75 million rural households without grid connectivity nationally**
- **The corresponding figure for urban households is 6.5 million**
- **Residents of off-grid villages resort to burning kerosene in basic lanterns to produce light at night**
 - *The average off-grid rural household in India spends Rs. 150 (\$3) per month for 5 liters of kerosene for lighting*
- **Many electrified villages also face severe shortage of electricity**
 - *33% of the Indian population is estimated to be facing significant under-electrification-accessing less than 50 kWh of electricity per month/household*



Renewable Energy in North East Region

Relevant RE Technologies

- SPV Lighting and pumping system
 - Solar Home Lights
 - Solar Street Lights
 - Solat Lanterns
 - Solar Power packs
 - SPV Pumping system
- Solar Thermal Applications (Heating, cooking , drying)
- Power Generation
 - Small Hydro
 - Biomass



SPV Lighting and Pumping Applications



Solar Home Lights



Solar Lantern

Solar Water Pump



Solar Street Light



SPV Lighting and Pumping Systems in NE Region

Cumulative Installation of SPV Systems

States/UT	Lanterns Nos.	Home Lights Nos.	Street Lights Nos.	Pumps Nos.	Stand Alone (KWp)
Arunachal Pradesh	14433	18945	1071	18	17.1
Assam	1211	6170	98	45	910
Manipur	4787	3890	928	40	216
Meghalaya	24875	7840	1273	19	50.5
Mizoram	9589	6801	431	37	241
Nagaland	6766	1045	271	3	1050
Sikkim	23300	10059	504	0	150
Tripura	64282	32723	1199	151	365
TOTAL	149243	87473	5775	313	2999.6

Solar Thermal Applications



Solar Water Heater



Solar Cooker



Solar Steam Cooking



Solar Air-Conditioning



Solar Cold Storage



Solar Drier

Solar Thermal Applications



Solar Water Heater



Solar Cooker



Solar Steam Cooking



Solar Air-Conditioning



Solar Cold Storage



Solar Drier

Solar Cookers



Community Cooking

Sabarmati Jail, A'bad



Sainik School, Bangalore



Space Cooling

100 Ton integrated heat recovery system at Mahindra & Mahindra vehicle manufacturers Pune

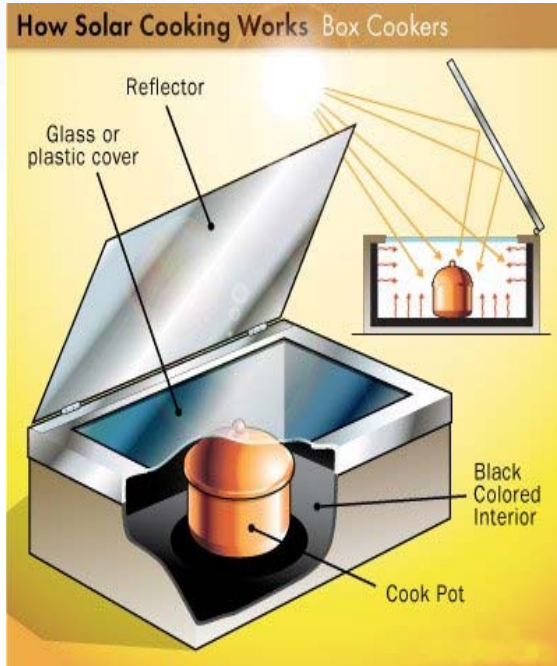


**Mahindra & Mahindra,
Pune**



VAM for cooling

Different Types of Solar Cooker



← Box Type Solar Cooker



↑ Panel Type Solar Cooker



Parabolic Solar Cooker



SWH System installations in North-East States in India

SI No	State	FPC		ETC		Total	
		No. of Systems	Collector Area (M2)	No. of Systems	Collector Area (M2)	No. of Systems	Collector Area (M2)
1	Arunachal Pradesh	1	4	0	0	1	4
2	Assam	18	198	55	839	73	1037
3	Meghalaya	2	4	3	41	5	45
4	Nagaland	0	0	3	32.8	3	32.8
5	Sikkim	0	0	46	167.14	46	167.14
	Total	21	206	107	1079.94	128	1285.94

Power Generation

Biomass Power

Assessed Potential

17 GW

(As per present estimate-from surplus agro biomass)

Tapped Potential

1.26 GW

Projected capacity: 5 GW by 2017 and 8 GW by 2022

Biomass through dedicated energy plantation

2500 MW require 0.5 million hectare land with fast growing species and some agro practices. Green Mission aims at 5-10 million hectare land

- These will be small 1-2 MW tail end plants
- Save transmission losses by 7% better power factor
- Facilitate electricity supply to rural areas
- Bamboo forests regularly harvested would capture carbon efficiently (12 tonne/ha/yr against 0.5 to 1.5 tonne/ha/yr for other species)

Electrification of Villages linked with Energy Plantation in North Eastern States

- **Wasteland availability:** NE Region has about **4 million hectare** wasteland.

S. No.	State	Wasteland Atlas of
1	Arunachal Pradesh	5744
2		8778
3	Manipur	7027
4	Meghalaya	3866
5	Mizoram	6021
6	Nagaland	4815
7		3281
8	Tripura	1315
Total		40847

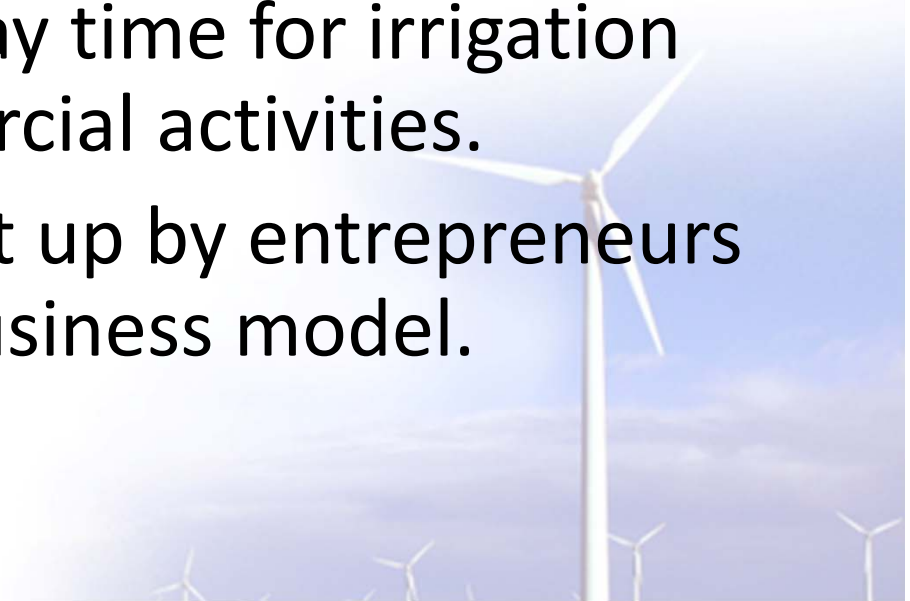
Unelectrified Villages in NE:

About 8500 villages and 33600 hamlets are unelectrified in NE States

S No.	State/UT Name (Total No. of Districts)	No. of Villages			No. of Hamlets	
		Already Electrified	Un-Electrified	De-Electrified	Already Electrified	Un-/De-Electrified
1	ARUNACHAL PRADESH (16)	1756	1798	331	159	205
2	ASSAM (23)	13330	4439	4086	15673	27605
3	MANIPUR (9)	1378	436	446	447	698
4	MEGHALAYA (7)	3536	1573	370	3087	1524
5	MIZORAM (8)	570	42	95	592	115
6	NAGALAND (11)	1152	62	43	552	956
7	SIKKIM (4)	418	25	0	1510	190
8	TRIPURA (4)	642	160	0	3603	2349
TOTAL		22782	8535	5371	25623	33642

Possible Options for electrification through Biomass Gasifier

- Electrification of villages of 300-400 houses would require small biomass gasifier system of 32-40 kW capacities.
- Such villages could be provided electricity for 4-6 hours in the evening for lighting and other uses and 5-6 hours in day time for irrigation and other small commercial activities.
- These projects to be set up by entrepreneurs based on sustainable business model.



Power Generation

Biomass Power

Biomass Power Costs

- **Capital Cost = Rs. 5 Crore (approx.) per MW**
- **Cost of Generation = Rs. 4 per KWh**

Biomass Power in India (as on 31.03.2013)

- **2337 MW - Bagasse Cogeneration,**
- **1265 MW - Biomass &**
- **97 MW - Waste to Power**

Land & Water Requirements

- **10 acres for 7.5 – 12 MW**
- **12-14 tons/ hr for 10 – 12 MW**

Power Generation

Small Hydro Power

MNRE responsible for SHP upto 25 MW capacity.

Type	Use	Capacity
Water Mills	For local use	Up to 5 KW
Micro	Village electrification	Up to 100 kW
Mini	Village Electrification & Grid	101 kW to 2000 kW
Small	Grid	2001 kW to 25000 kW

Small Hydro Power Plant Installations in India



4.5 MW Capacity SHP Generator at Manglad, Himachal Pradesh

Cumulative Installation of Small Hydro in NE Region

States/UT	Unit Installed	Capacity (MW)
Arunachal Pradesh	149	103.905
Assam	5	31.110
Manipur	8	5.450
Meghalaya	4	31.030
Mizoram	18	36.470
Nagaland	10	28.670
Sikkim	17	52.110
Tripura	3	16.010
TOTAL	214	304.755

Scheme Highlights

OFF – GRID PROGRAMME

- Demand driven/subsidy driven
 - 30% subsidy & loan @ 5% for individuals & non-commercial
 - 30% subsidy OR loan @ 5% for commercial
 - 60%/90% subsidy for Government projects in North East and special category States and in other remote and difficult areas

Features

- Focus on Standards, Accreditation, Performance monitoring, test lab

Area

- Solar Water pumping/ windmills /Solar mini grid/micro grid/ Solar PV Roof-top Systems /solar lanterns home lights, street lights/ Solar lantern charging stations /Solar thermal for heating /Solar cooker for cooking /Solar air heater for drying



***NE Region Progress and
Important Projects***

Status So Far under JNNSM

Arunachal Pradesh

Completed Projects

- Power plants at battalions of SSB(320kWp)
- Power plants at battalions of Arunachal Police (200kWp)
- Home Lighting systems in remote villages(4373nos.)

On going projects

- Power plants at BSNL exchanges(200kWp)
- Power plants at schools in Kurring Kumrey district(9x1kWp)

continue

New Projects

- Street Lights at NIT, Jote(600no.)

Funds sanctioned

- 2010-11 8.64 Crore
- 2011-12 9.04 Crore
- 2012-13 5.20 Crore
- 2013-14 1.10 Crore

Assam

Completed

- SPV Power plant at Bijulee Bhawan(100kWp)
- SPV Power plants at Guwahati University(150kWp)
- SPV Power plant at Guwahati Airport(50kWp)
- SPV Power plant at SSB battalions (300kWp)
- SPV Power plants at Colleges (760kWp)

On going projects

- SPV Power plants at DC office and Deputy Commissioner Offices(354kWp)
- SPV Power plant at State Secretariat (100kWp)

continued

- SPV power plants for drinking water in Dibrugarh (90kWp)
- SPV Power plant at Guwahati High Court(50kWp)
- **Funds sanctioned**
 - **2010-11 8.10 Crore**
 - **2011-12 22.79 Crore**
 - **2012-13 21.49 Crore**

Manipur

- **Completed Projects**

- SPV Power plants at DC Offices(225kWp)
- SPV power plants at Navodaya Vidyalayas(120kWp)
- Power plants at Assam Rifles battalions(350kWp)

- **On Going projects**

- SPV Power plants at CSCs(399kWp)
- SPV Power plants at schools/police stations (205kWp)
- SSPV Street Lighting Systems (6900no.)

- **New Sanction**

- SPV Power plants at subordinate courts(31x5kWp)

Continued

- Funds sanctioned
- 2010-11 3.72 Crore
- 2011-12 22.32 Crore
- 2012-13 25.96 Crore
- 2013-14 2.67 Crore

Meghalaya

- **Projects completed**
- SPV Power plants at Schools (41x3kWp)
- SPV Home lighting systems (3350nos.)
- **On Going Projects**
- SPV Power plants at English & Foreign languages University (50kWp)
- SPV Power plant at Meghalaya Assembly(100kWp)
- **New sanction**
- SPV Power plants at CSCs (225nos.)

Continued

- Funds sanctioned
- 2010-11 10.59 Crore
- 2012-13 12.67 Crore
- 2013-14 4.33 Crore

Mizoram

- **Projects completed projects**
- SPV Power plants at police battalions (530kWp)
- SPV Power plants at Mizoram University (700kWp)
- SPV Power plants at Hospitals (500kWp)
- **On Going Projects**
- SPV Power plants at CSCs (436kWp)
- SPV Street Lighting Systems (1000no.)

continued

- **Funds sanctioned**
- **2010-11** **3.36 Crore**
- **2011-12** **18.31 Crore**
- **2012-13** **34.10 Crore**

Nagaland

- **Completed projects**
- SPV Power plants at Govt. buildings (670kWp)
- **On Going projects**
- SPV Street Lighting Systems (4200no.)
- SPV Pumps (25nos.)
- **New Sanction**
- SPV Power plants at Common Service centres(261kWp)

Continued

- **Funds sanctioned**

- 2010-11 2.00 Crore
- 2011-12 17.46 Crore
- 2012-13 9.65 Crore
- 2012-13 4.75 Crore

Sikkim

- **Projects completed**
- SPV Power plants at Govt. Buildings (530kWp)
- Home Lights (5000no.) and lanterns (14300no.) for earth quake affected people
- SPV power plants for SSB battalions (115kWp)
- **On Going projects**
- SPV Power plants at Govt. Institutions (115kWp)

Continued

- Funds sanctioned
- 2010-11 4.10 Crore
- 2011-12 21.75 Crore
- 2012-13 1.55 Crore

Tripura

- **Project completed**
- SPV Power plant TIDC Agartala
- SPV Power plant NIT Agartala
- SPV Power plants at Police stations (66x5kWp)
- **Funds sanctioned**
- 2010-11 7.29 Crore
- 2011-12 8.01 Crore

SPV Programme Common Service Centres in NE States

- SPV Power plants at 399 nos. Common Service Centres(CSC's) in Manipur.
- SPV Power plants at 436 nos. Common Service Centres(CSC's) in Mizoram.
- SPV Power plants at 225 nos. Common Service Centres(CSC's) in Meghalaya.
- SPV Power plants at 267 nos. Common Service Centres(CSC's) in Nagaland.

Success story

Solar Lighting Systems Through Bank Loans

Funded through a mix of debt and incentives- 20 % cost by user

Financial support -40 % subsidy and 60% loan at normal interest rate.

Each household saves Rs 50 per month even on subsidized kerosene- Total kerosene cost per household with out subsidy is Rs 250 per month (Average income level of rural areas is Rs 10 per day per person)

0.92 million solar home lighting Systems have been set up in the country

Under National Solar Mission 20 million lighting systems are aimed by 2020



Success story 2- Central Charging Station based Solar Lighting systems

- Villagers own the lantern, or pay rent for lantern & a fee for charging lantern on a daily/monthly basis
- Every evening, villagers bring the discharged lantern and take a charged lantern with them
- Alternatively, the charging station owner arranges for delivery & collection of lanterns
- A typical setup consists of a 50 lantern charging facility which includes 250 Watts of solar panels, costs Rs 150,000
- An entrepreneur earns up to Rs 4000 per month
- Micro-financing for purchase of lanterns by the poor
- Business supporting this initiative under CSR



Success story 3

Rice husk gasifier system for Village Electrification

- One 32 kWe rice husk gasifier system provides electricity to about 400 households in one village.
- About 200 villages / Hamlets are benefiting in East and West Champaran, Bihar
- Villagers pay Rs 2-2.5 per day (Rs 60-75 per month) for 1-2 CFL of 15 Watt,
- Saving on kerosene cost- Rs 50 per month
- Farmers pay Rs 50 /hr from saving of diesel cost used in irrigation pump sets
- Government meet 40% of total cost besides support for training of O&M Technicians, entrepreneurs etc
- Viable Model if demand is 15 to 20 kW in the village



Success story 4

Mini/Micro-Hydel based Village Electrification

- Largely for Himalayan and sub-Himalayan Region
- KW size power generation systems- to caters to cluster of villages
 - Average financial support is around Rs 1 lakh /KW
 - Serves multiple purpose –lighting and productive activities
 - Focus on Community Participation/Cluster Approach



Owned, Built and Managed by Rural Community



Productive Applications

Success story 5

Solar mini-grid -Meerwada Project-Guna, India

- **14.3 KW Solar system with battery bank**
 - Designed for 140 CFLs, 75 Fans, 15 TVs-all for 8 hours daily
 - Actual usage-60 households 70 lights, 15 fans and 1 TV
 - Excess energy used to draw water from 4 HP pumps for 4 hours daily, solving the water problem in the area.
 - Local Ownership
 - Established local leadership Council
 - Volunteer Leader for every 10
 - Households to collect dues, protect system, resolves issues
- **Private initiative**
 - Seeks to access federal support
 - Company CSR funding
 - Expansion plans

New focus areas

- **Solar Pumps for irrigation**
- **Power plants to telecom towers**
- **Increase the capacity to 500KW for diesel replacement**
- **Increase in capacity for individuals up to 3kW**
- **More target for solar home lighting systems by involving more RRBs**
- **To bring MFIs into programme to promote small lighting systems**



Thank You