

Addressing Climate Change: Decentralized Energy Management in India



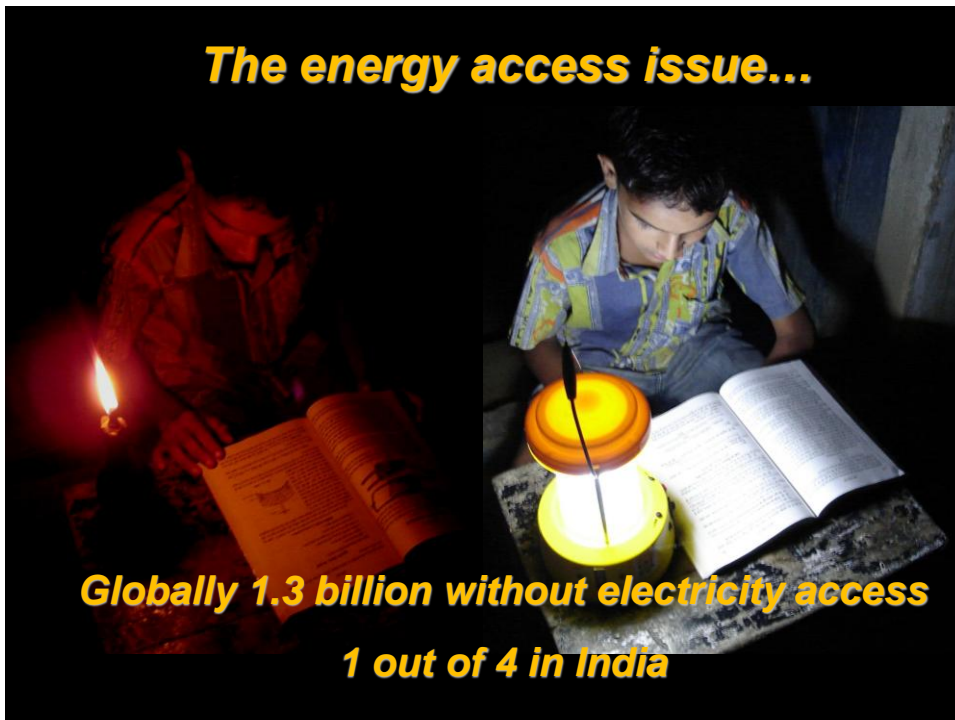
SANDEE Workshop

Economic Instruments for Greening Development

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TERI

The energy access issue...



***Globally 1.3 billion without electricity access
1 out of 4 in India***

People lacking access to electricity



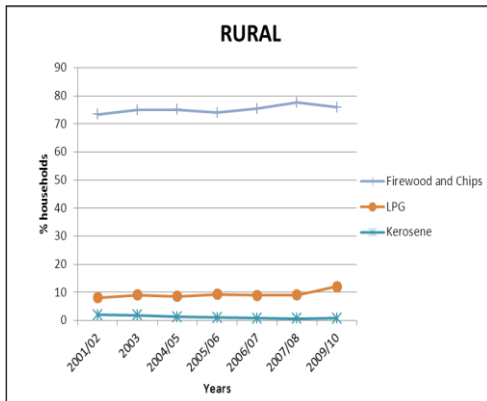
| | Number of people lacking access to electricity (in million) | Number of people relying on traditional use of biomass for cooking (in million) |
|-----------------------|---|---|
| Africa | 587 | 657 |
| Sub-Saharan Africa | 585 | 653 |
| Developing Asia | 675 | 1937 |
| China | 8 | 423 |
| India | 289 | 855 |
| Other Asia | 378 | 659 |
| Latin America | 31 | 85 |
| Developing Countries* | 1314 | 2679 |
| World | 1317 | 2679 |

Source: World Energy Outlook 2011

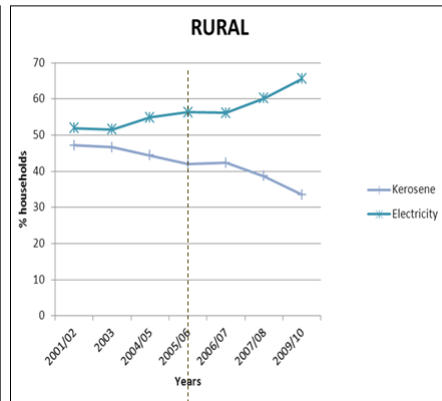
Trend: % distribution of households by primary energy source in India



Cooking



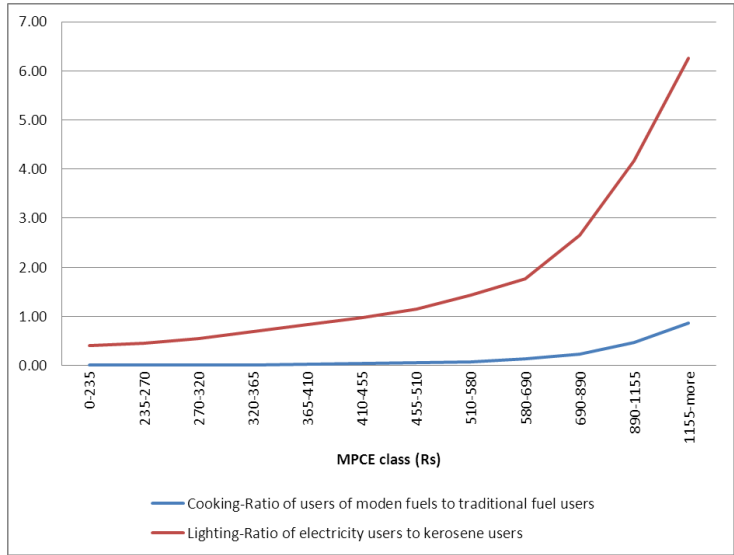
Lighting



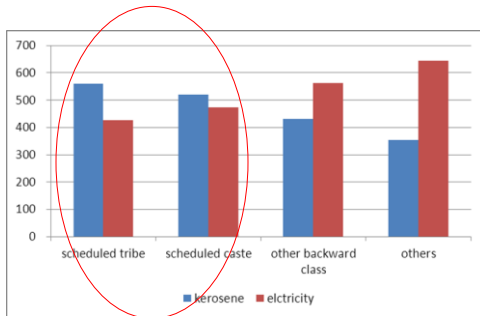
RGGVY

Source: NSSO 57th to 66th Round

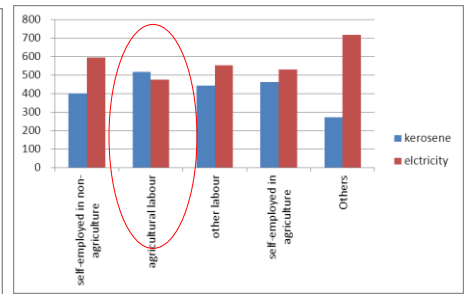
Energy transition at household level - 'sticky' for cooking; pronounced 'income effect' in case of lighting



Still, access to electricity is in favour of the relatively privileged



Kerosene and electricity users (for lighting) across social groups



Kerosene and electricity users (for lighting) across occupational groups

What does this data tell us?

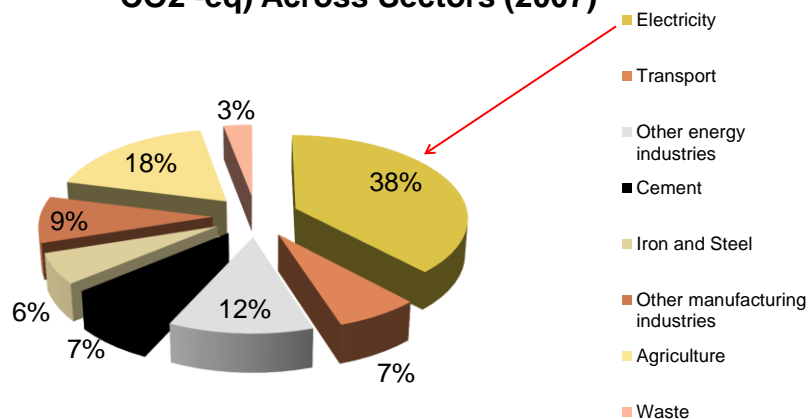


- 'Energy poverty' of those who are vulnerable on other development dimensions as well
- Need to ensure that these people use clean energy so as to not aggravate the emissions problem and that the imminent climate change does not push them further into the poverty trap (**Mitigation and Adaptation**)

Current energy use in India is largely sourced from fuels that are high GHG carriers



GHG Emissions Distribution in India (MT CO₂-eq) Across Sectors (2007)



Source: Expert Group on Low Carbon Strategies for Inclusive Growth, Planning Commission, Government of India, 2011

Opportunities for Decentralized Renewable Energy Systems



These are modular power **generation** technologies that can be combined with energy **management** and **storage** systems, and used to improve the operations of electricity delivery systems near the end user.

These technologies can be off-grid ('stand alone') or grid-connected.

Available Technologies



Commercial

- Solar PV (Photovoltaics)
- Biomass Gasifier

Prospective

- Wind aero generators
- Wind Solar Hybrid
- Hybrid DG source based mini grid
- Fuel cell

Solar Lighting- TERI's Lighting a Billion Lives

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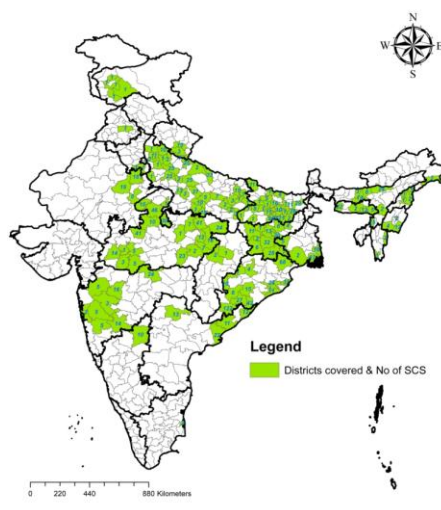
- LaBL sets up solar charging stations in remote villages to provide quality solar lighting solutions to the local people on a fee for service model.
- A trained local entrepreneur operates and manages the charging station and rents the solar lamps every evening for a affordable fee.



Progress in last 5 years

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Coverage & Spread of LaBL SCS



370 000
lives
impacted

75 000
solar
lanterns

1486
villages
covered

21 States
5 countries

> 1500
green jobs
created

> 60
NGOs
involved

Mitigation Potential of Solar Lighting

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- 72 million households (HHs) still use kerosene (as per 63rd Round of NSSO Survey)
- Replacing kerosene based lighting into solar lighting systems- there could be 10 million CO₂ emission avoided annually (Deshmukh et al, 2010) – a huge **co-benefit** !

Stand Alone Solar PV Systems

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A stand-alone residential system consists of:

- Solar PV panels
- Battery to store power
- An inverter to allow conventional appliances to be powered by solar electricity



A 100 KW capacity of solar roof-top could save around 50,000 litres of diesel annually

Solar PV pumping systems

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- Water output is equal to 5 HP diesel pumpsets with 3 hours running per day for 240 day /year (for irrigation purposes)
- Annual electricity saving of 3360 units



11/11/2014

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Biomass Gasifier - Thermal Applications

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Silk reeling in Karnataka



Dyeing oven in Andhra Pradesh



Rubber drying in Kerala



Italian oven in Tamil Nadu



Large scale cooking in Punjab



Crematorium in Himachal Pradesh

Mitigation Co-benefit of Gasifier

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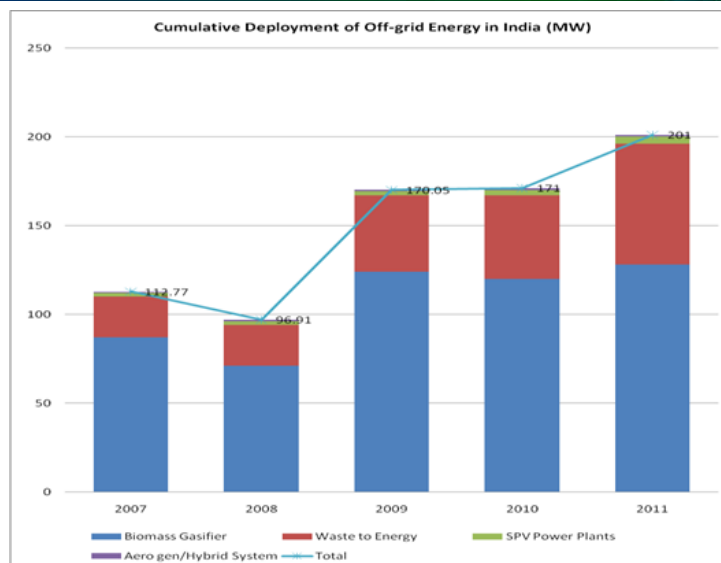
One 10 KW biomass gasifier operating for 5 years:

- Would generate about 1.5 lakh units of electricity
- Given to industry which currently depends on diesel genset, this would amount to a savings of about 45 - 50 thousand litres of diesel fuel
- Would mitigate around **115 tons of CO₂**

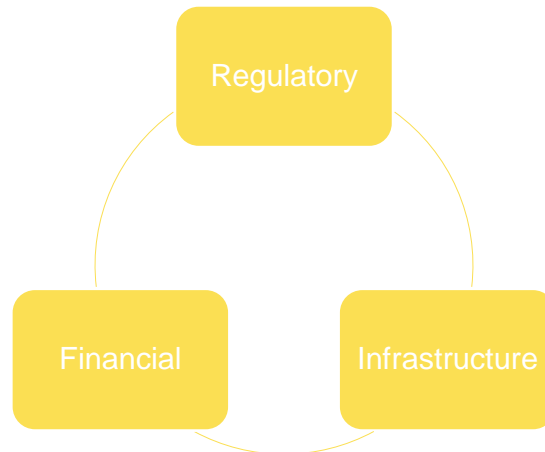
Progress

Cumulative deployment of off-grid/decentralized renewable energy systems in India, 2007-11

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Key challenges



Regulatory



- The 2003 Electricity Act mandates State Electricity Regulatory Commissions to specify Renewable Purchase Obligation (RPO) of electricity producers and distributors, but few state regulators have specified **enforcement provisions for non-fulfillment of RPO**
- Downsizing of RPO % in several states owing to shortfall in RE capacity addition within the state

Infrastructure



- Renewable energy resource assessments
- Fuel supply chains, specifically, for biomass
- Land acquisition
- Local environmental impacts– need for EIA for RE

Financial



- Poor response from banks- shying away from RE projects
- National Clean Energy Fund
- Appropriate fiscal incentives



Thank You!