NanoPower…

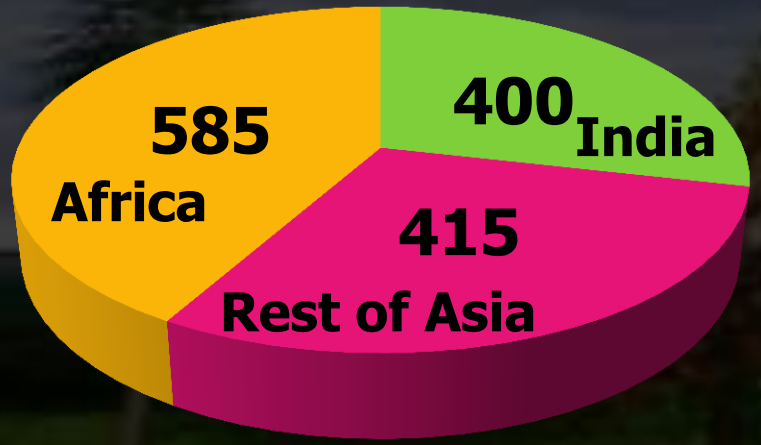
The Solution for Energy Security and Socio-economic Development

sunmoksha

Ashok. K. Das, Ph.D.
Founder CEO, SunMoksha
www.sunmoksha.com

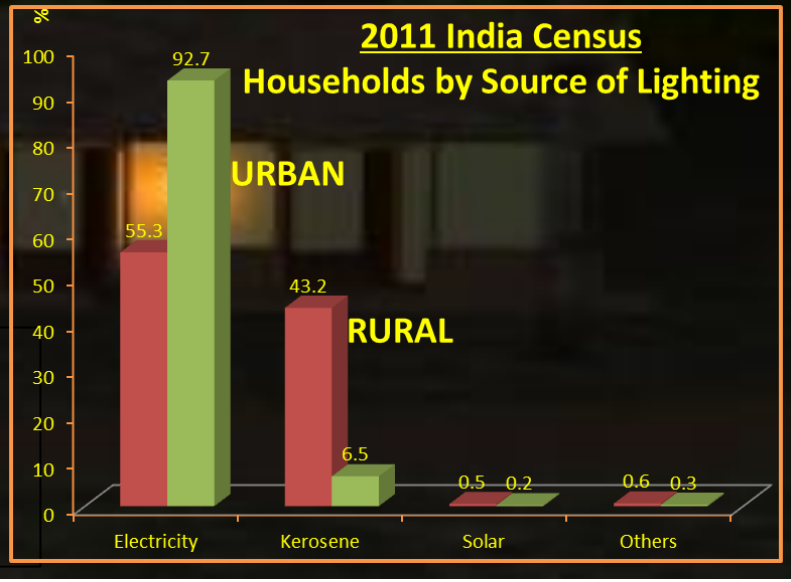
Access to Energy Challenge

- 2011 IEA Report – 1.4B or 20% of world's population do not have access to electricity – 80% rural



Population w/o Access to Electricity (in Million)

- 2011 India Census Data – 43% w/o access to electricity



RURAL SCENARIO:

55% Electricity Availability

43% Kerosene Dependent

The problem is so daunting …

UN has declared 2014-24 as *Decade* of SE4ALL

Challenges in Expanding Access to Electricity

Expanding Access to Electricity

Grid Expansion

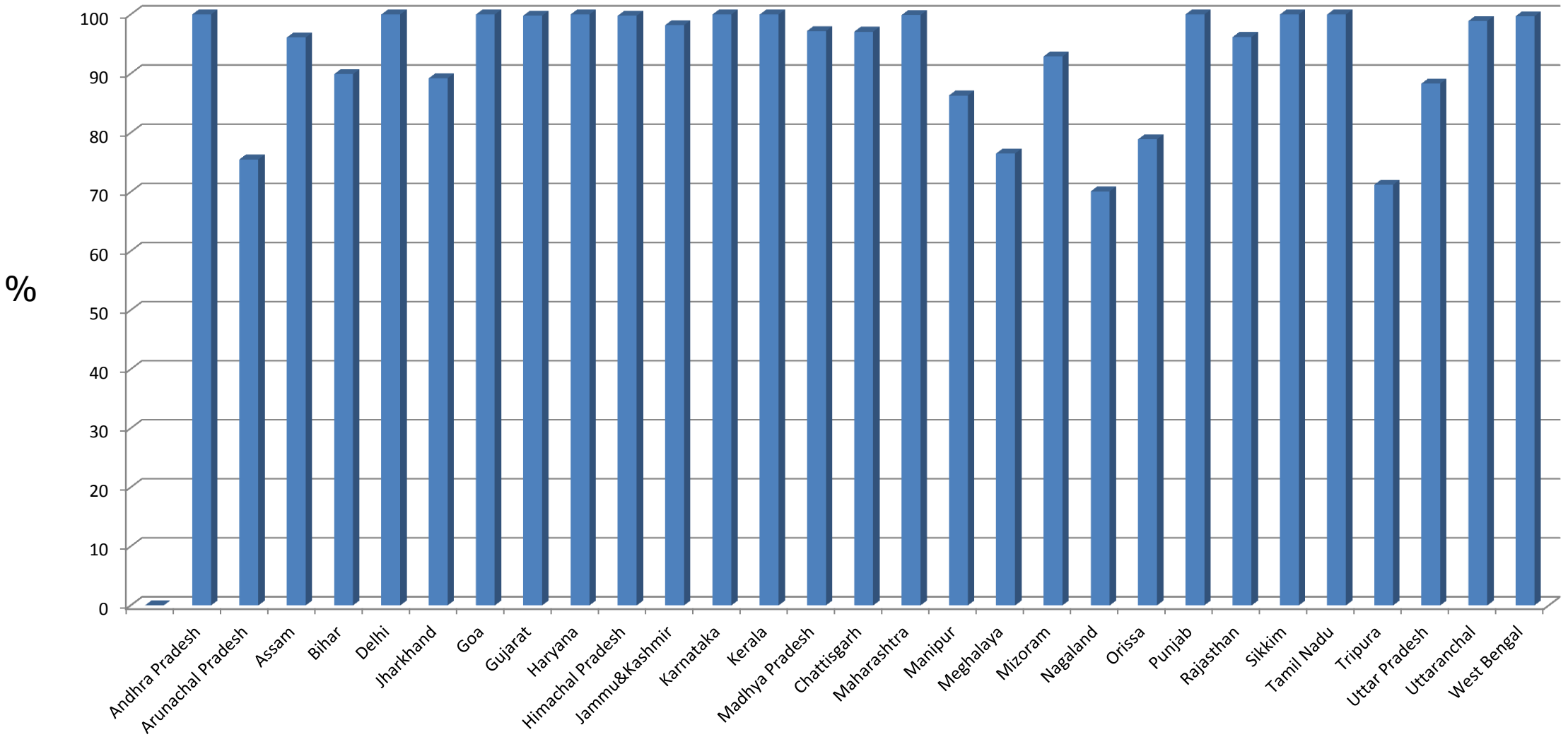
- PowerGrid + Private Players
- RGGVY

Off-Grid Expansion

- Micro-Grid Solutions
- Home Lighting Solutions

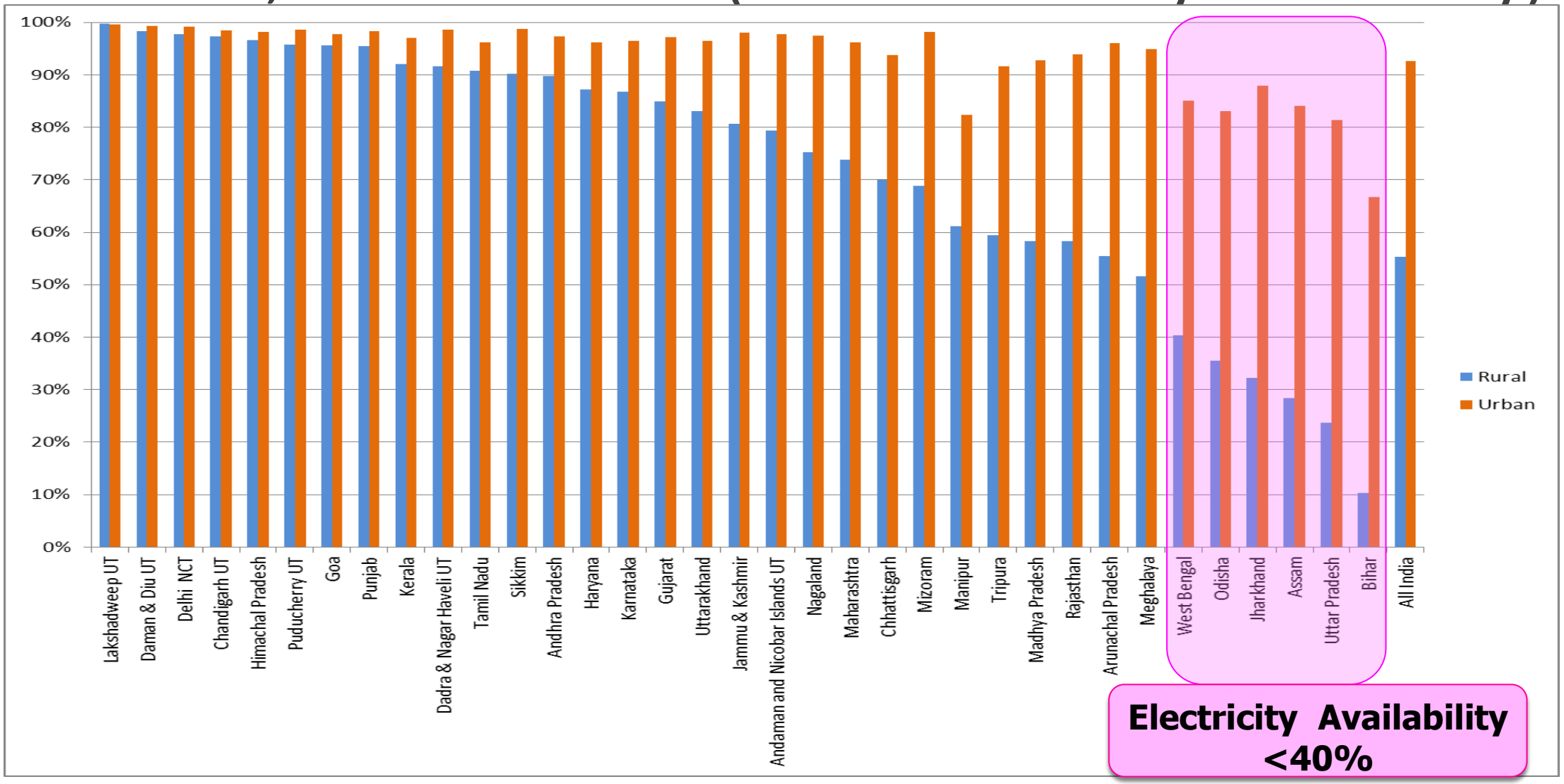
CEA RGGVY –

93% of Villages Electrified as on 31-3-2012



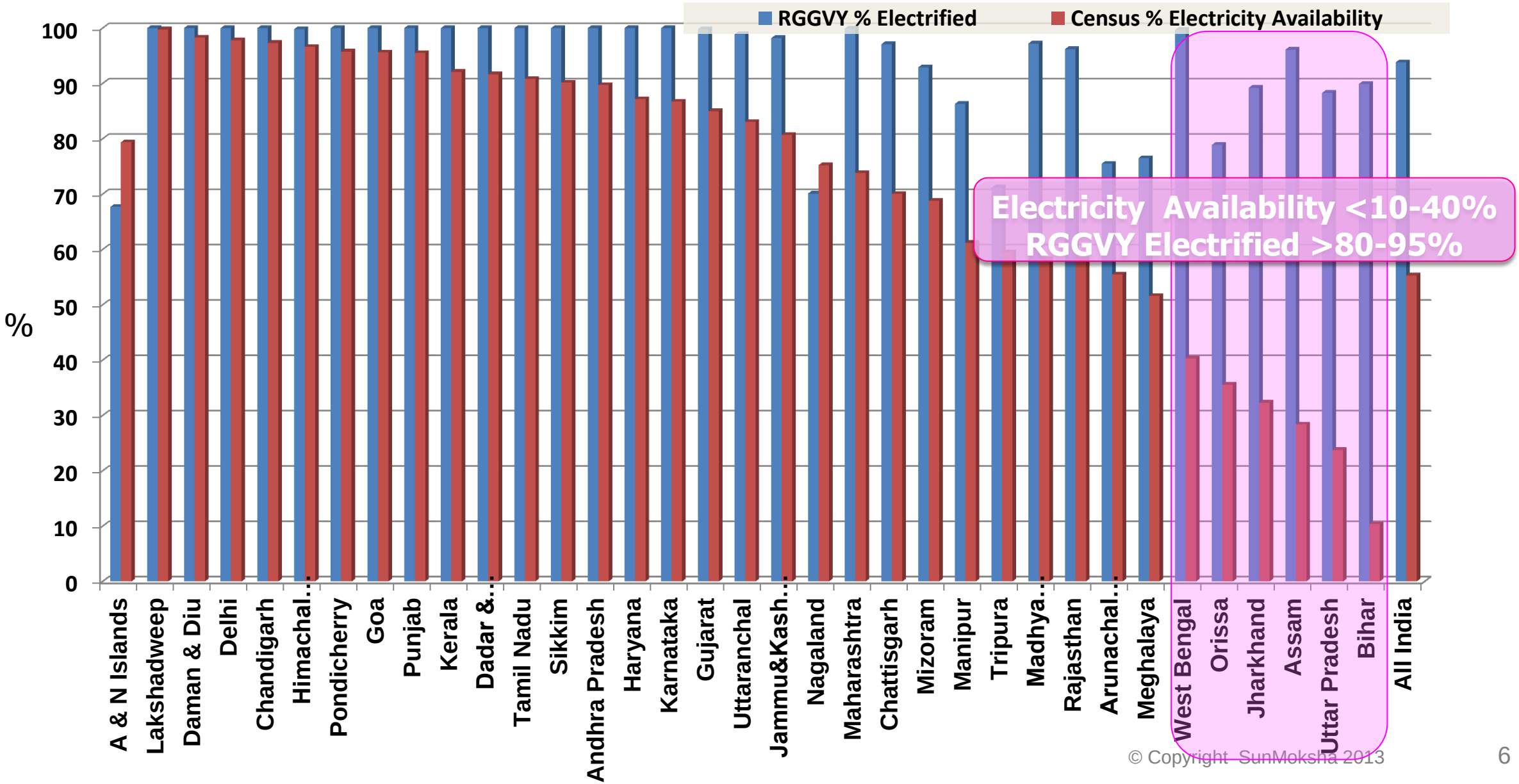
http://rggvy.gov.in/rggvy/rggvyportal/index.html

2011 Census Data – Bihar, UP, Odisha, Assam, Jharkhand, WB at bottom (<40% Electricity Availability)

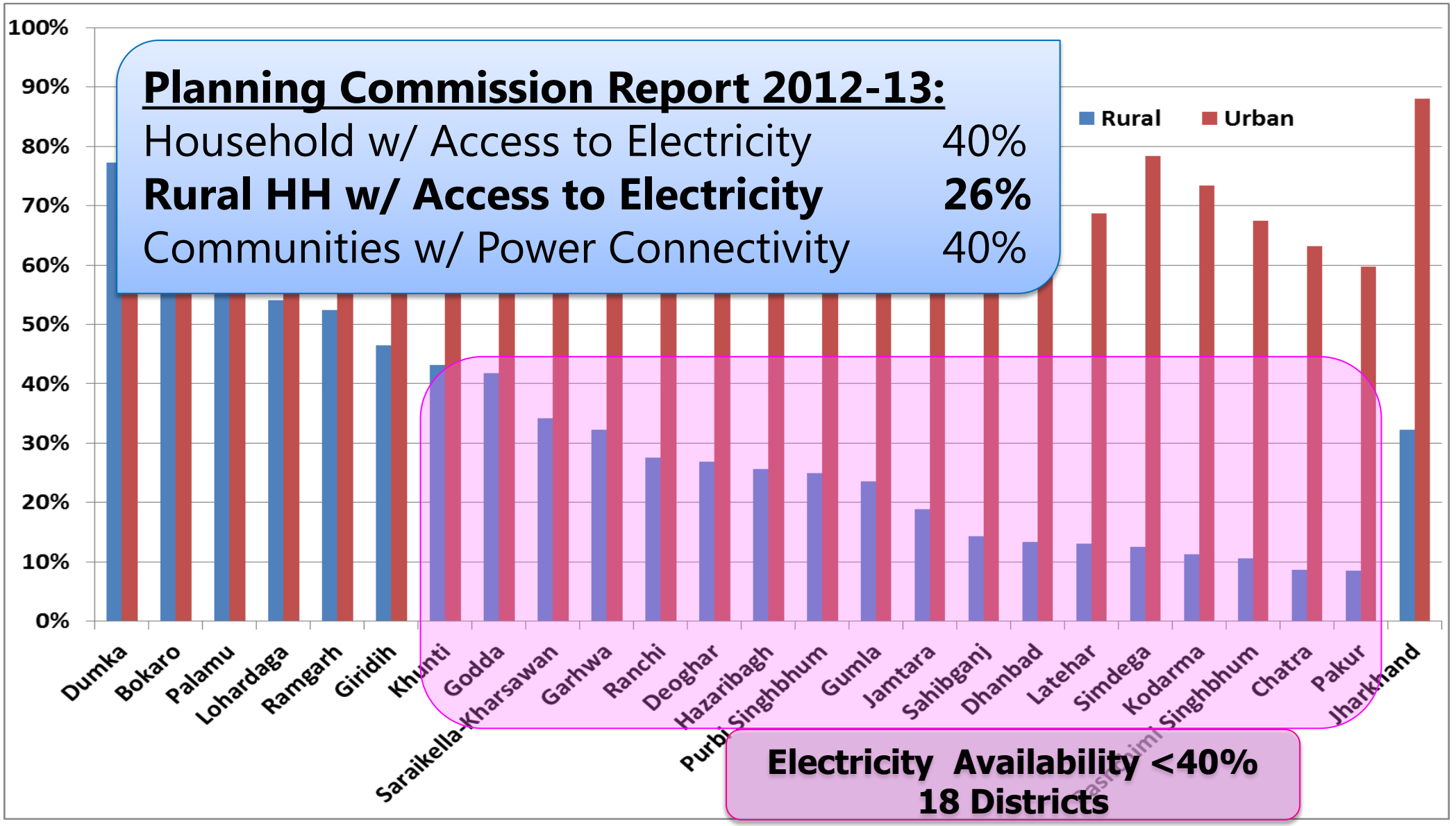


http://www.censusindia.gov.in/2011census/hlo/HLO_Tables.html

RGGVY Electrified vs Census Electricity Availability



2011 Census Data – Jharkhand Districts

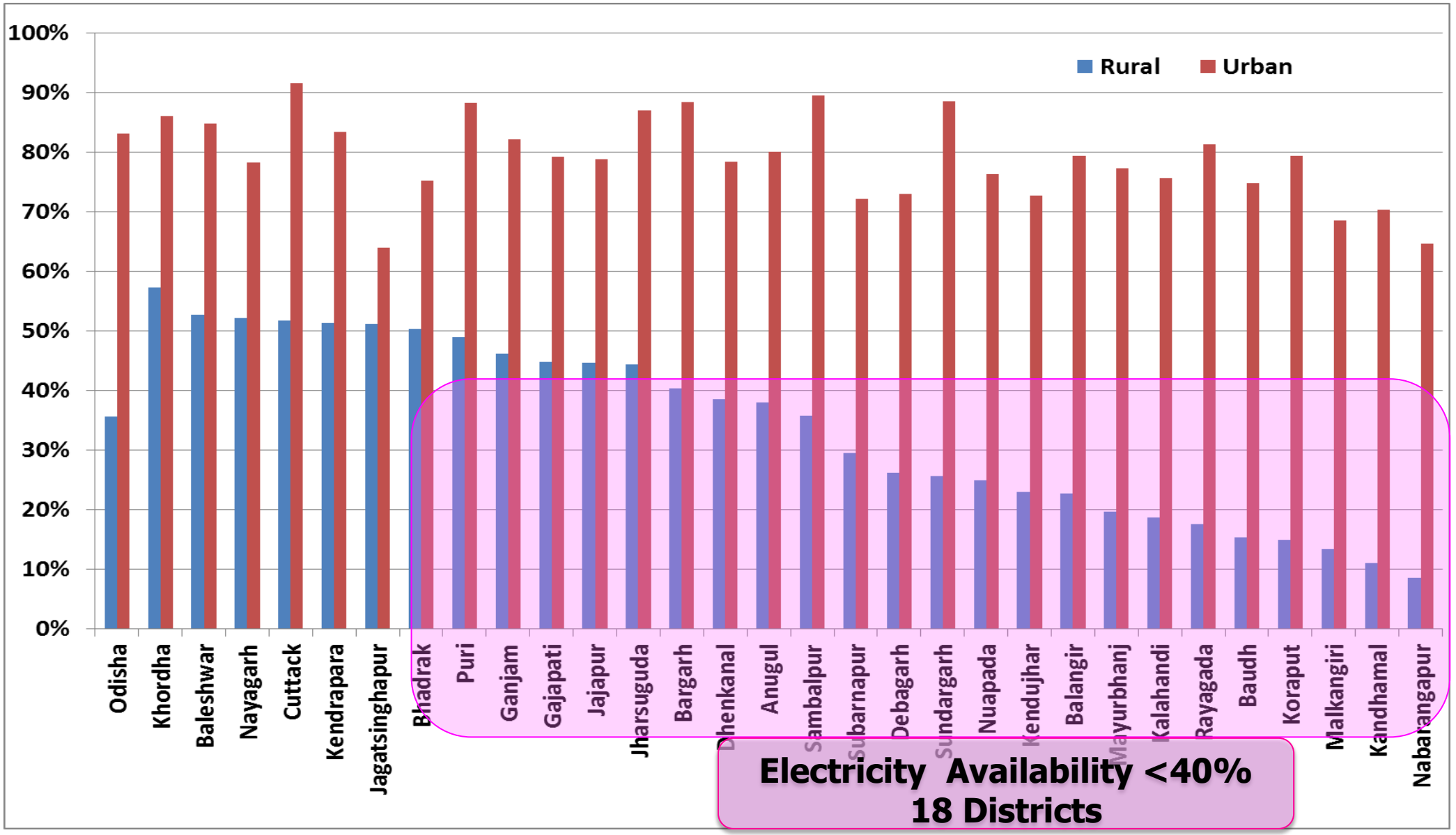


Planning Commission Report 2012-13:

Household w/ Access to Electricity	40%
Rural HH w/ Access to Electricity	**26%**
Communities w/ Power Connectivity	40%

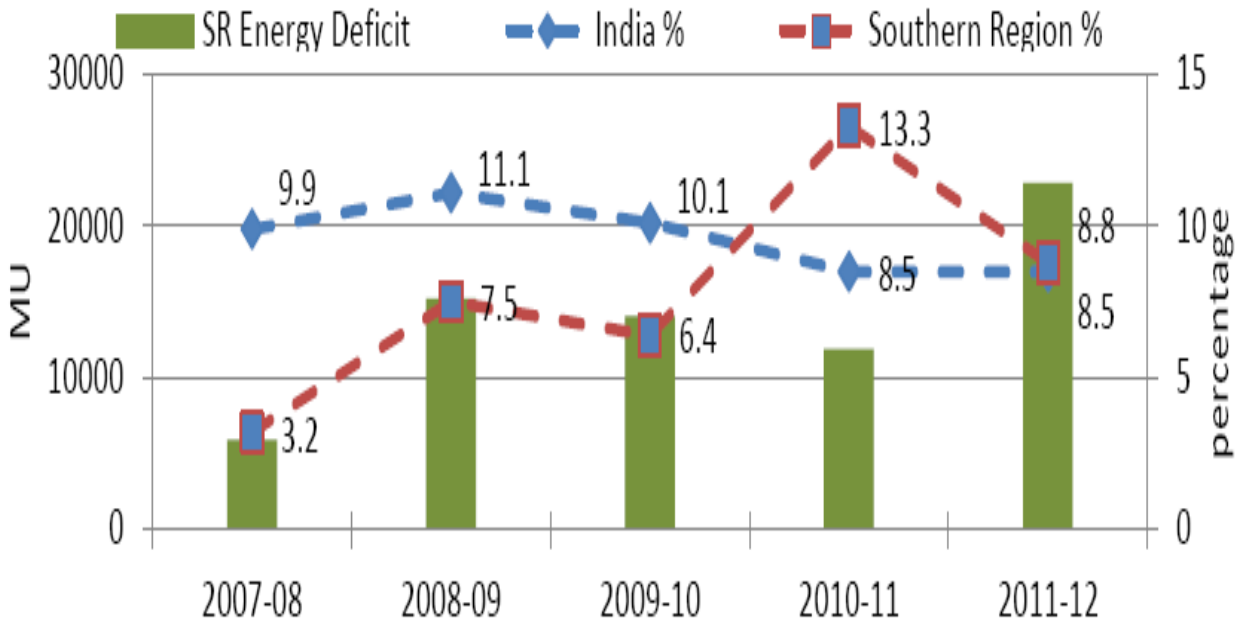
Electricity Availability <40%
18 Districts

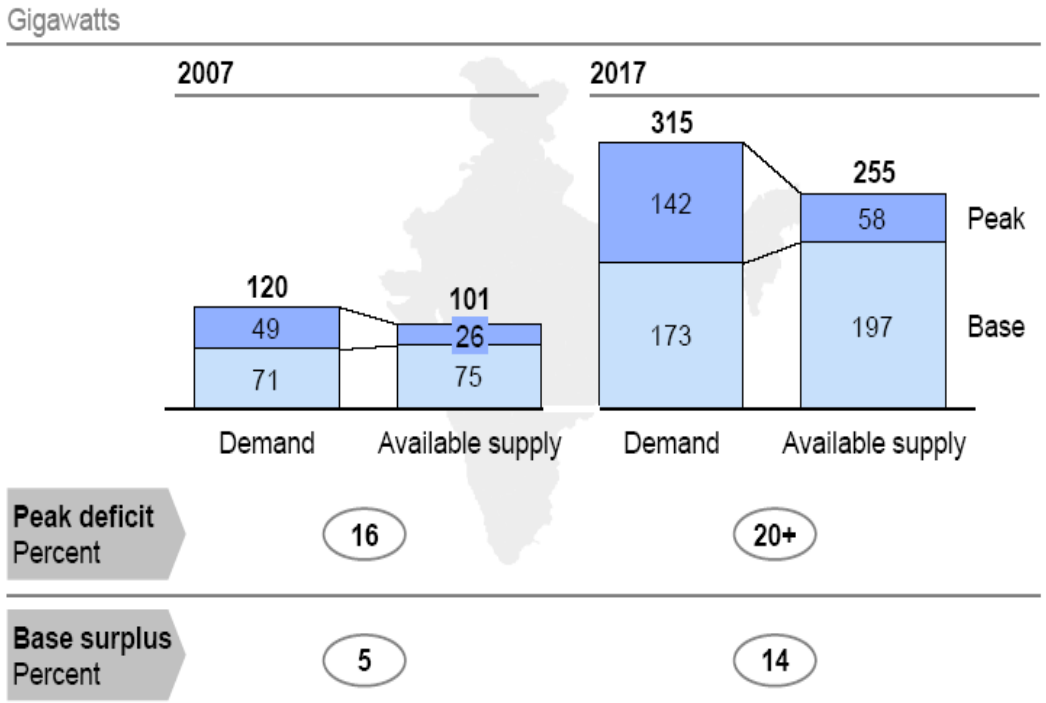
2011 Census Data – Odisha Districts



Energy Deficit is the Root Cause

- Energy deficit runs between 8 to 11%
- Will get worse





Power Shortages in India's Southern Region: Challenges for Growth, S Narayan, ISAS Insights No. 168 – 13 June 2012. http://www.isas.nus.edu.sg

Load Generation Balance Reports, Government of India, Ministry of Power, Central Electricity Authority. http://www.nrpc.gov.in/reports/lgbr.html

McKinsey Report – "Environmental and Energy Sustainability: An Approach for India", August 2009

Expanding Access to Electricity

Expanding Access to Electricity

Grid Expansion

PowerGrid + Private Players

पावरग्रिड

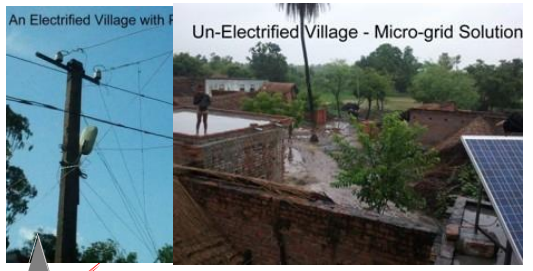
RGGVY

Ministry of POWER
GOVERNMENT OF INDIA

Bharat Nirman
A Business Plan for Rural Infrastructure

Off-Grid Expansion

Micro-Grid Solutions



DESI Power ™

मेरा गांव MGP

HUSK POWER SYSTEMS हस्क पावर सिस्टम्स तमसो मा ज्योतिर्गमय

GRAMPOWER

MINDA NexGenTech Ltd.

Home Lighting Solutions

SELCO

Ministry of New and Renewable Energy

TATA BP SOLAR

teri

orb

simpanetworks

Challenges in Expanding Access to Electricity

Grid Expansion

- 94% electrified, 55% energized
- Energized for 2-4 hours a day
  - idle >~80% of the time
  - huge wastage of investment
- 30-40% T&D losses
- Rural areas last priority, except irrigation

Challenges in Expanding Access to Electricity

- Generation
  - Technology, resource availability
- DC^2 – Distribution, Collection, Control
- Financing
  - HLS Model – issue with scale-up
  - Micro-grid – needs micro biz financing
  - Investment – needs patient capital
- Business Models
  - Micro-biz, local enterprise, ownership
- Capacity
- Policy

Off-Grid Expansion

"Investors are worried about uncertainties in this sector"
- Nikhil Jaisinghania, Mera Gao Power

"Availability of talent is a major problem in this sector"
- Gyanesh Pandey, Husk Power,
- Praveen Bhasin, Minda NextGenTech

Challenges in Expanding Access to Electricity

Expanding Access to Electricity

Grid Expansion

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- RGGVY

Off-Grid Expansion

- Micro-Grid Solutions
- Home Lighting Solutions

Both the routes have unique challenges

13

Issues with Micro-Grids as Scalable Solution

- Focus on supply, but no demand management
  - Traditionally power generated to meet peak demand, as per customer's demand and schedule
  - Very little consideration to manage demand
  - Result in overdesign, lower efficiency, and lower plant load factor.
- Single-source power generation
  - Supplying power through a single source of renewable energy
  - Resulted in limited scope to meet demands and achieve scalability
- Operational issues
  - Operational cost of collecting fees
  - Issues of non-payment due to manual operations and collection methods
- Field support and skill gap
  - Issue of getting skilled personnel and transferring the technology nuances to rural personnel
  - Requirement for hand-holding local personnel hindered scaling
- Business models
  - Lack of business models to make these decentralized solutions self-sustaining and scalable

Addressing Challenges in Access to Electricity

Expanding Access to Electricity

Grid Expansion

Off-Grid Expansion

PowerGrid + Private Players

RGGVY

Micro-Grid Solutions

Home Lighting Solutions

How to address these challenges?

On 31 July 2012 – the Historical Black Out Day – ***NanoPower**** was conceived to address electricity access

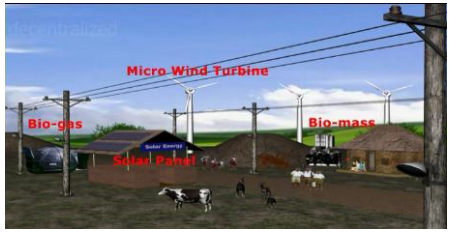
Nano **≡ Small, Modular, Affordable for the masses**

Key Interventions of *NanoPower*

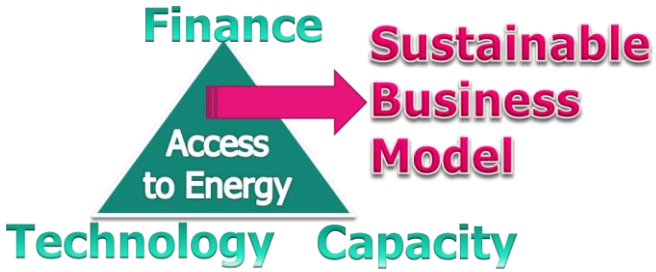
IT-Based Remote Monitoring, Management and Maintenance of Micro-Grid

Demand-Supply Management

Customer Interface Over Mobile Devices For Communication, Transaction and Value-add Services

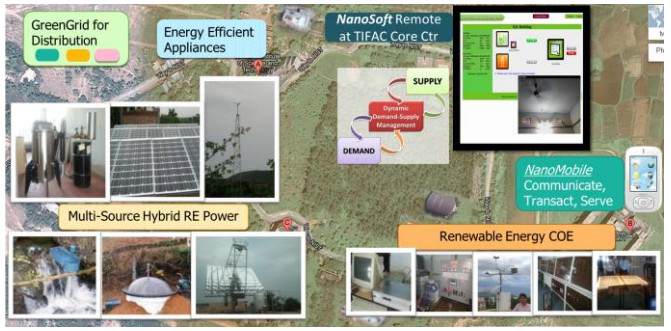


Hybrid Generation & Utilization of Existing Grid, where Possible



Scalable Sustainable Micro-Enterprise Models & Ecosystem

Skills and Capacity Building In Partnership with Institutions



Development & Testing at Living Laboratory

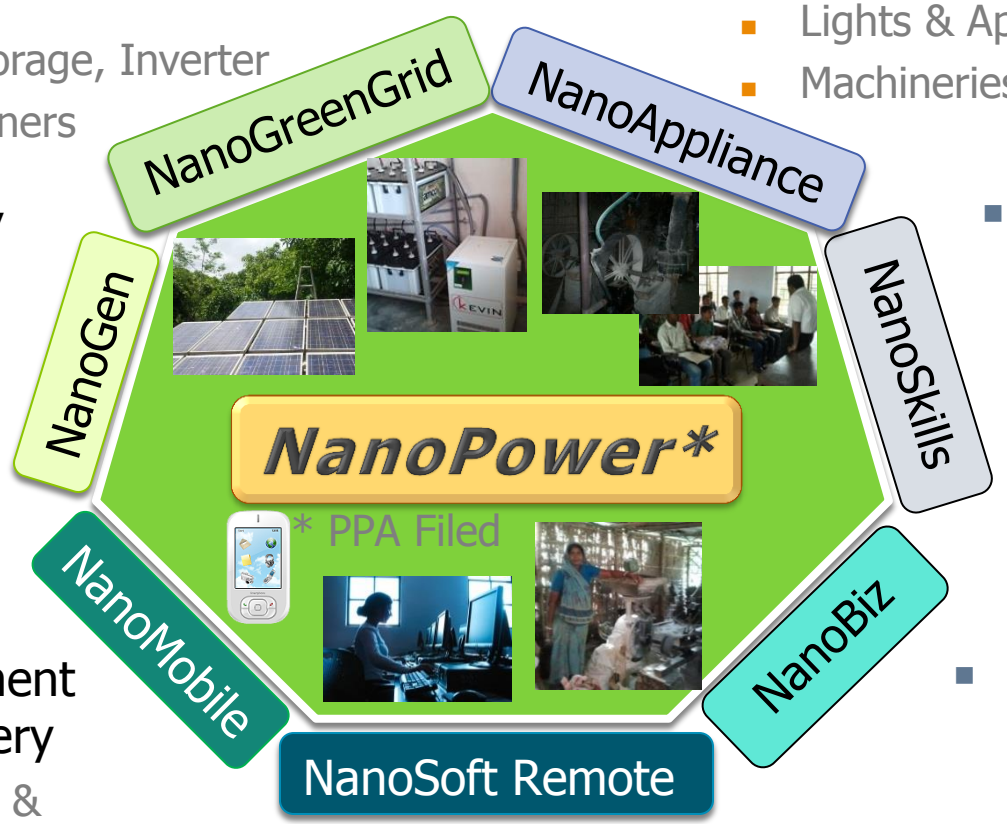
Kalamandir
The Celluloid Chapter Art Foundation

Gram Vikas

Close Partnership with Villagers Through Grassroots Organizations

The *NanoPower** Ecosystem

- Local Green Distribution & Middleware
  - Distribution, Storage, Inverter
  - Power factor tuners
- Local Green Supply
  - Biomass
  - Biogas
  - Solar
  - Wind
  - Hydro
- Remote Management and Service Delivery
  - Communication & Operations
  - Financial Transactions
  - Value-add Services
  - Training



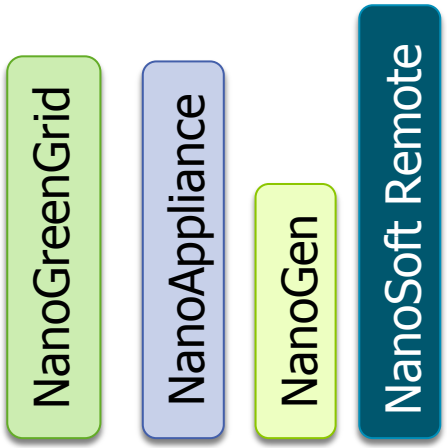
- Local Green Consumption or Demand
  - Lights & Appliances
  - Machineries, Pumps & Motors
- Local Skills and Capacity Development
  - Renewable Energy
  - Energy Efficiency
  - Microenterprises
- Sustainable Local Business Development
  - Technology
  - Capacity
  - Finance
  - Co-ownership
- Dynamic Remote Management of energy supply and demand
  - Monitoring
  - Management
  - Maintenance

* PPA Filed

Challenges <=> Solutions

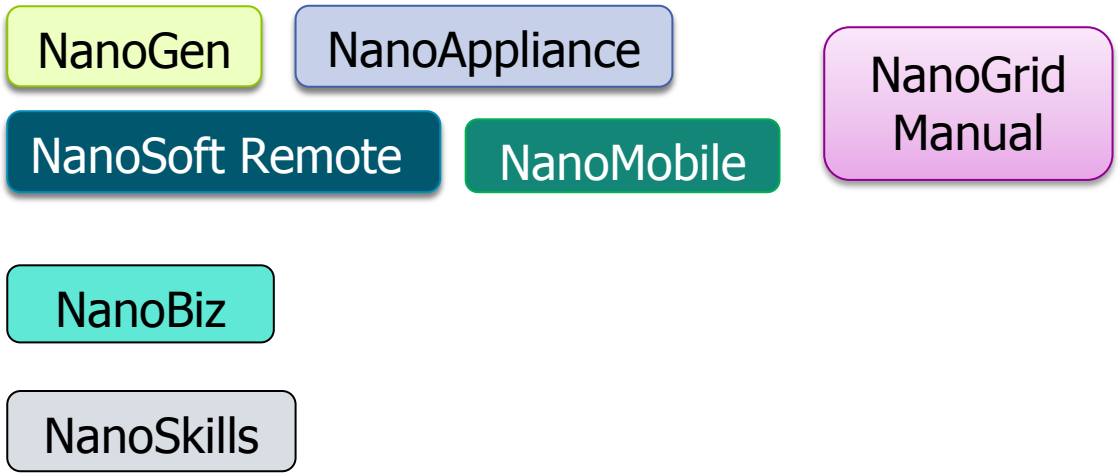
Grid Expansion

- 94% electrified, 55% energized
  - idle >~80% of the time
- 30-40% T&D losses
- Rural areas last priority



Off-Grid Expansion

- Generation
- DC^2 – Distribution, Collection, Control
- Financing
- Business Models
- Capacity



Challenges <=> Solutions = ***NanoPower****

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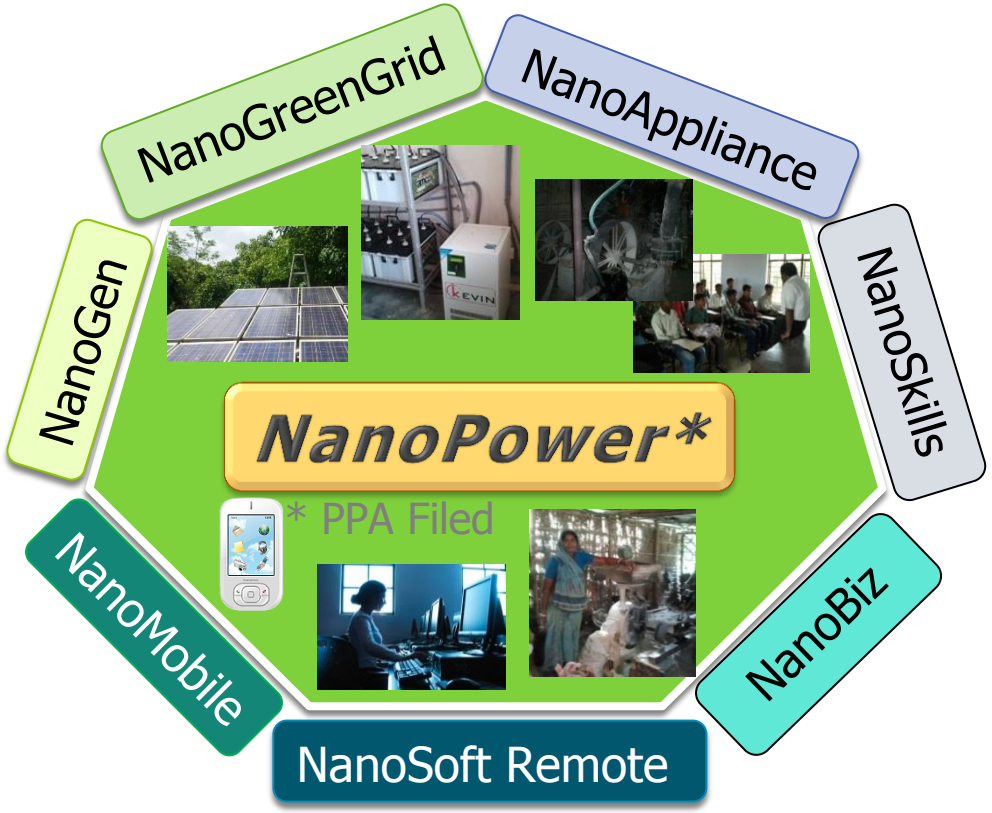

* PPA Filed

An **RGGVY** Electrified Village

sun moksha

An **RGGVY** Electrified Village

…with endless wait for power to arrive!

A *NanoPower** Electrified Village

* PPA Filed

sun moksha

NanoGen: Multi-Source Hybrid Power

NanoGreenGrid
Distribution & Delivery

Solution 1 Solution 2 Solution 3

A *NanoPower** Electrified Village

* PPA Filed

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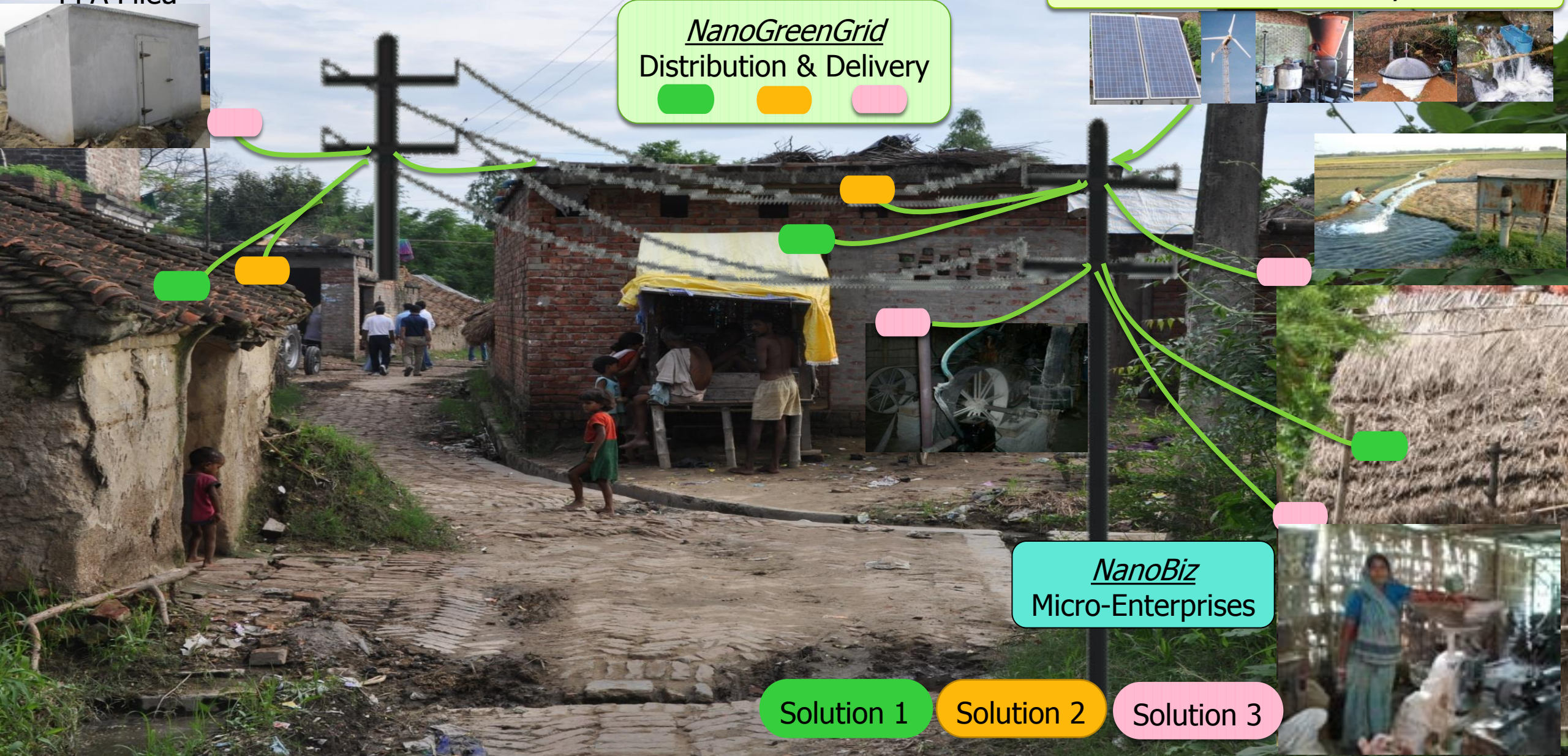
NanoGen: Multi-Source Hybrid Power



A *NanoPower** Electrified Village

sun moksha

* PPA Filed

NanoGen: Multi-Source Hybrid Power

NanoGreenGrid
Distribution & Delivery

NanoAppliance
Energy Efficiency

NanoAppliance
Energy Efficiency

NanoAppliance
Energy Efficiency

NanoBiz
Micro-Enterprises

Solution 1 | Solution 2 | Solution 3

A *NanoPower** Electrified Village

* PPA Filed

sun moksha

NanoGen: Multi-Source Hybrid Power

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NanoBiz
Micro-Enterprises

Solution 1

Solution 2

Solution 3

A *NanoPower** Electrified Village

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* PPA Filed

NanoGen: Multi-Source Hybrid Power

NanoGreenGrid
Distribution & Delivery

NanoAppliance
Energy Efficiency

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Energy Efficiency

NanoAppliance
Energy Efficiency

NanoSoft Remote
Monitor, Control,
Manage, Maintain

NanoBiz
Micro-Enterprises

NanoMobile
Communicate,
Transact, Serve

Solution 1 Solution 2 Solution 3

A *NanoPower** Electrified Village

* PPA Filed

sun moksha

NanoGen: Multi-Source Hybrid Power

NanoGreenGrid
Distribution & Delivery

NanoAppliance
Energy Efficiency

NanoGreenGrid

NanoAppliance

NanoGen

NanoSkills

NanoMobile

NanoBiz

NanoPower*

* PPA Filed

NanoSoft Remote

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Micro-Enterprises

Solution 1

Solution 2

Solution 3

Challenges <=> Solutions = ***NanoPower***

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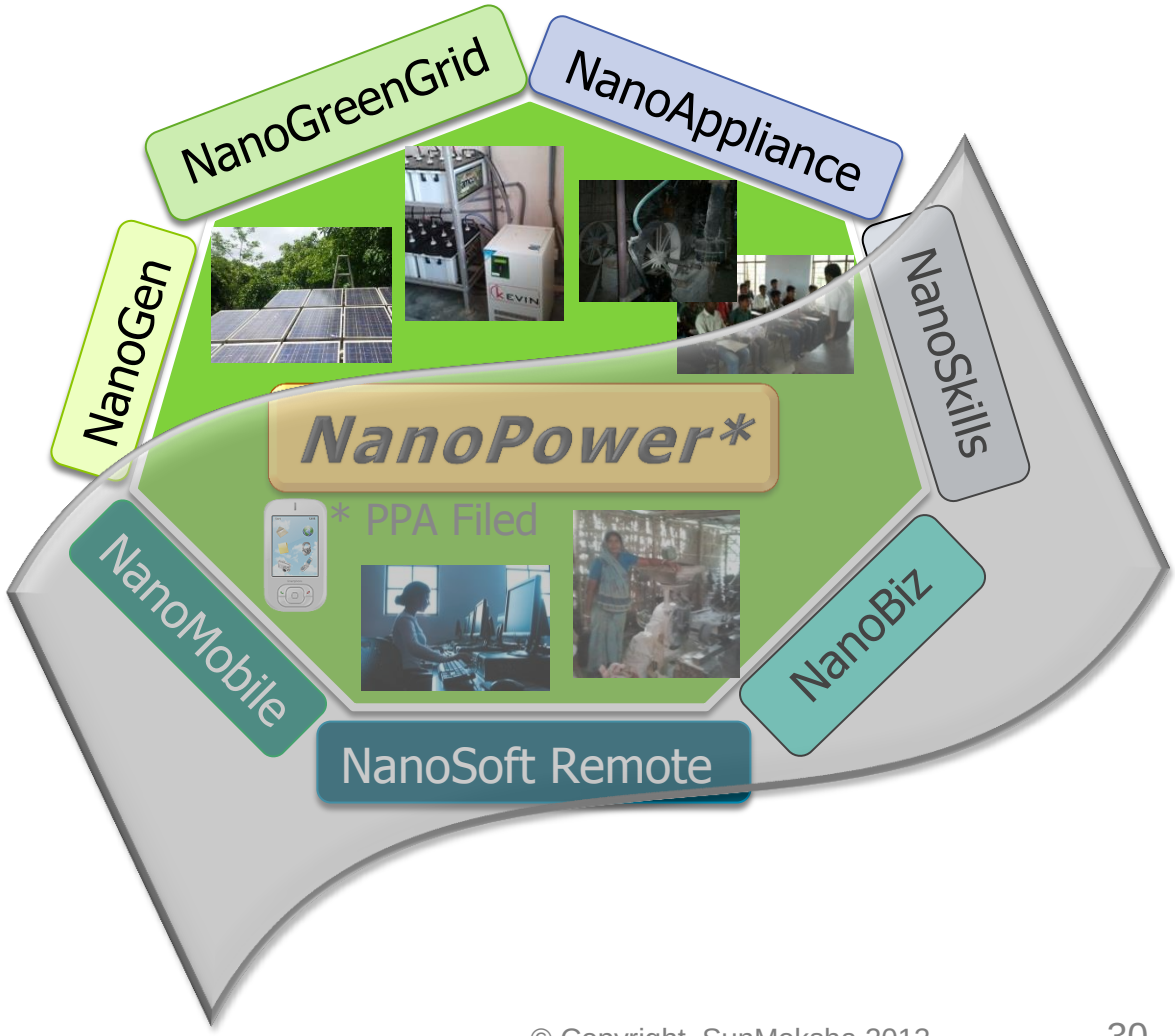
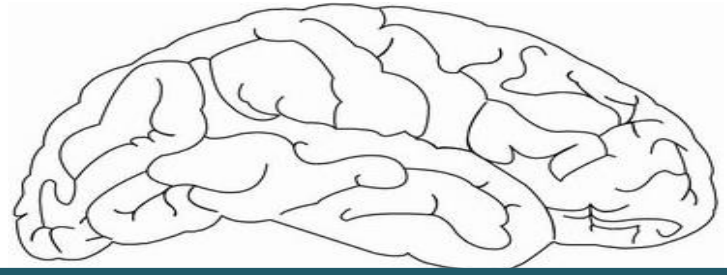


NanoSoft and *NanoMobile* – core of the solutions

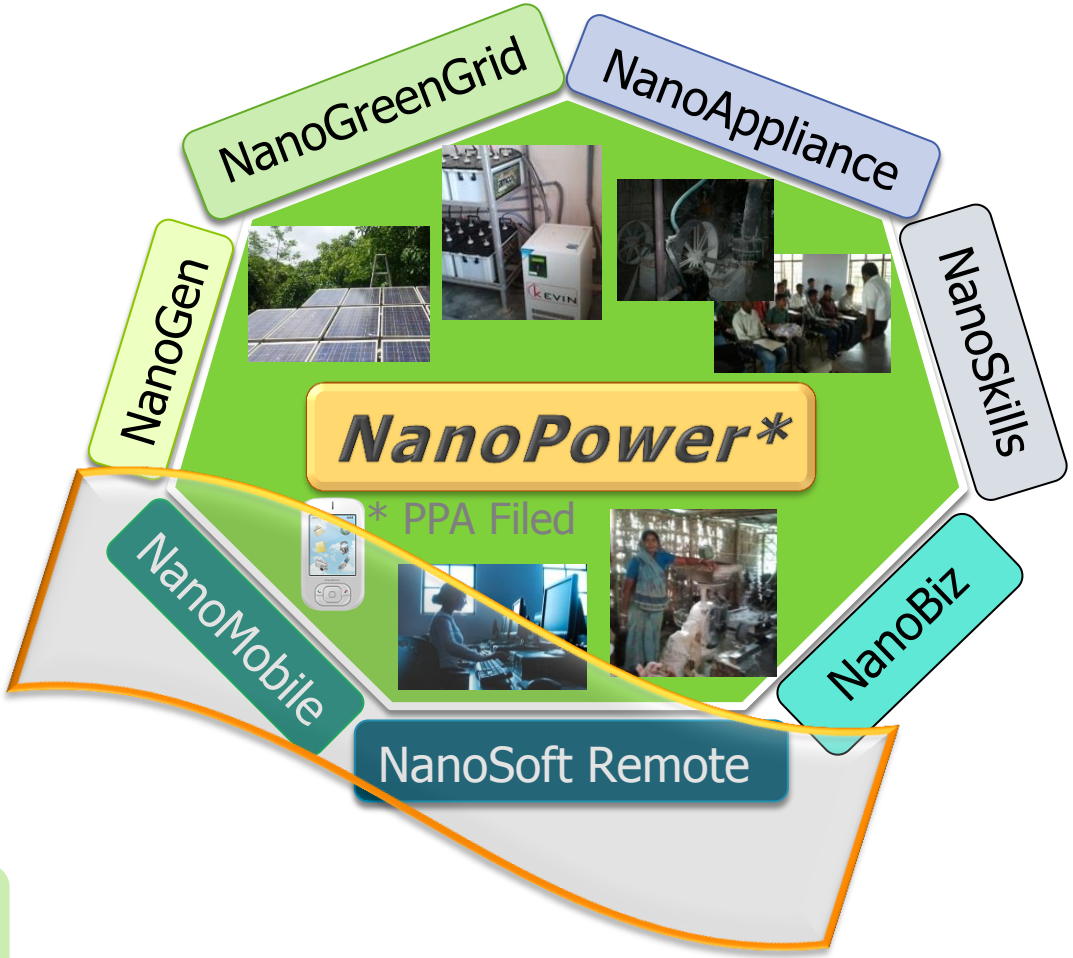


NanoSoft Remote

Monitor | **Manage** | **Maintain**

NanoMobile

Communicate | **Transact** | **Serve**



NanoSoft Remote – micro-grid management

sun moksha

NanoSoft

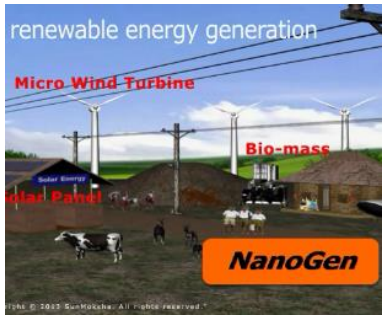
A comprehensive solution for operations & management of *NanoPower* micro-grid.

Monitor

Generation,
Consumption,
Appliances,
Resources
GHGs
Security

Customers
Information
Scheduling
Metering
Billing
Payments
Complaints

Manage



Resources
Generation
Scheduling
Personnel
Training

Demand
Usage
Scheduling
Balancing

Governance
Performance
Financials
Personnel
Policy

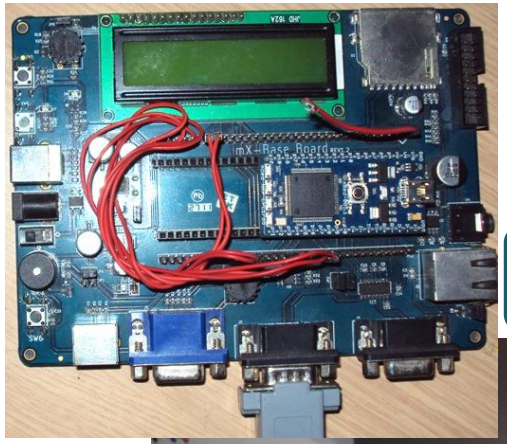
Maintain

Equipment
Appliances
Services
Discussions

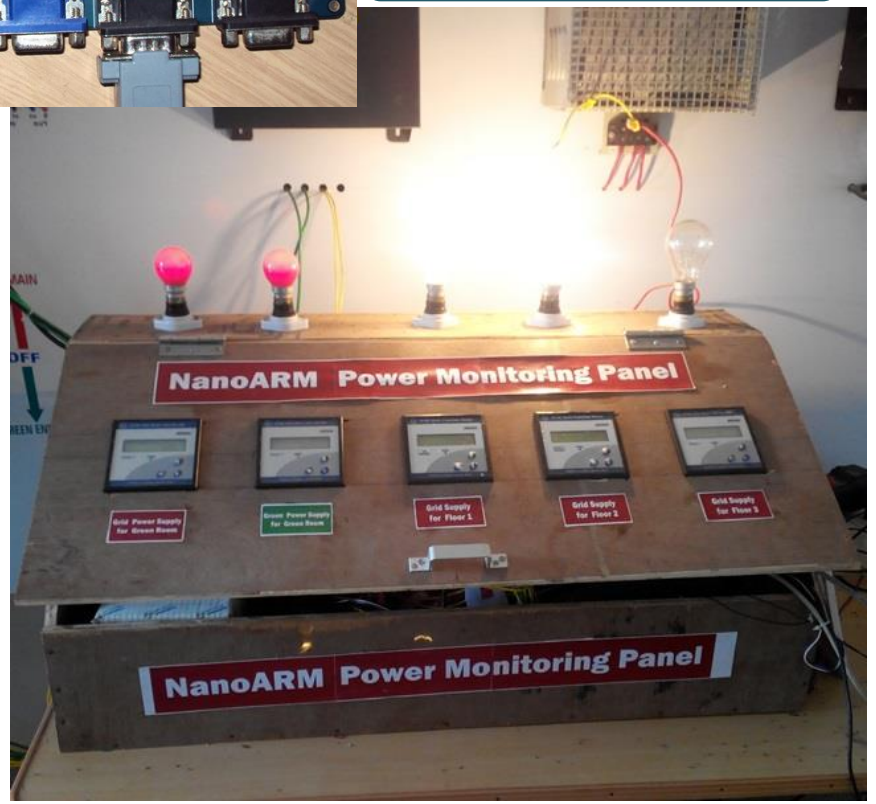
Appliance & Asset Tracking, Human Resource Mgmt, ERP, Training, CRM, Policy, Emissions, ROI

NanoSoft Remote – State-of-the-Art Technology

- State-of-the-art telecommunication, information and mobile technologies
- Communicates through state-of-the-art middleware board, NanoARM
  - Equipped with all modes of communication - Ethernet, WiFi, RF, ZigBee, PLC, fiber-optics
  - Can be integrated with all energy meters and all sensors following RS232/RS485 protocols
  - Can calculate emissions by measuring GHGs
- Integrates SCADA, GIS, SGIP, WSN protocols for universal compatibility and security
- Accesses full functionality of remote operations from any hand held device or standard computer, with net connectivity
- Customers select only the modules they need
- Independent third party monitoring tool



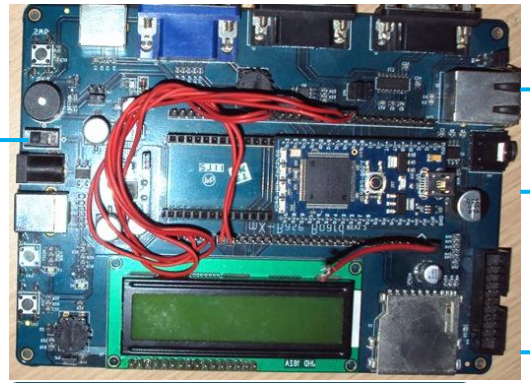
***Nano*ARM**



NanoSoft/ARM Schematics

The Cloud

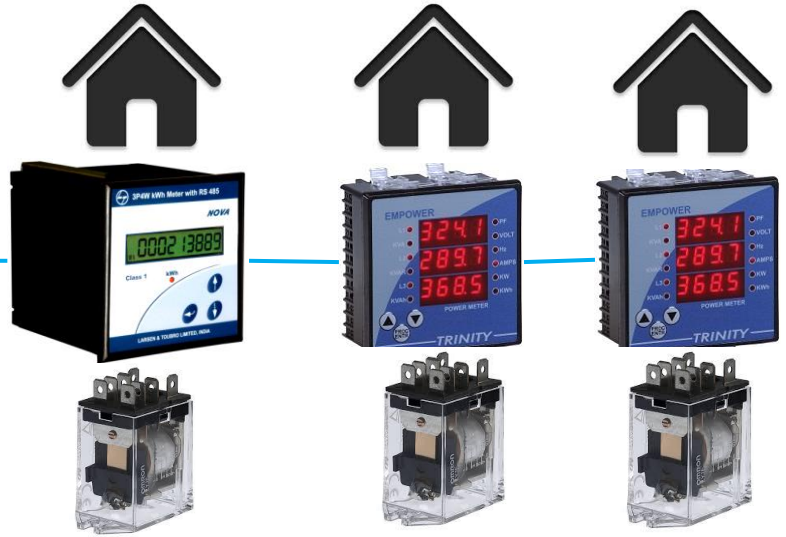
NanoSoft



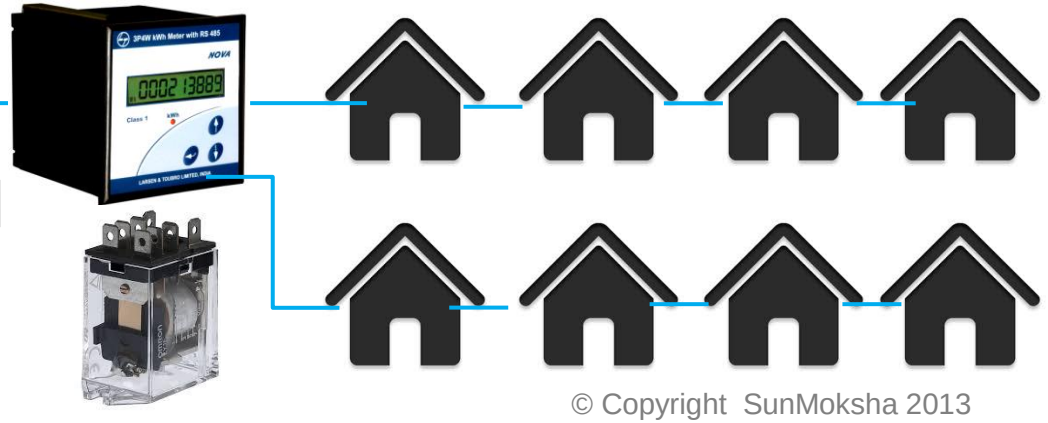
NanoARM

Can connect up to
5 Control points

1 Control,
1 meter,
1 HH



Modbus
connection to
multiple meters
& control points



1 Control point and
meter can connect
to many HH

www.nanosoftremote.com

NanoSoft Remote

Monitor, Manage & Maintain

sunmoksha Clean Technology Solutions

nist Technology Consulting Services *Redefine Excellence...*

Home | About Us | Contact

- Discussion forum
- New Customer
- ◊ Apply New Connection
- ◊ Check Application Status
- ◊ Print Application

NanoSoft Remote is a comprehensive cloud-based solution to remotely monitor, manage, and maintain micro-grid electricity generation, distribution, delivery, metering, and billing. It also comprises modules for asset tracking, human resources, ERP, training, CRM, policy, emissions calculation, and ROI estimation.

NanoSoft is an integral part of SunMoksha's patented NanoPower solutions to address access to energy issues, including skills development and business models for employment generation. The word "Nano" signifies small, modular, and affordable for the masses.

Existing User

Sign in

Login Name / ID :

Password :

Login

Monitor

- Generation
- Consumption
- Appliances
- Resources
- GHGs
- Security

Manage

- ⇓Customers
  - Information
  - Scheduling
  - Metering
  - Billing, Payments
  - Complaints
- ⇓Resources
  - Generation
  - Scheduling
  - Personnel
  - Training
- ⇓Demand
  - Usage
  - Scheduling
  - Balancing
- ⇓Governance
  - Performance
  - Financials
  - Personnel
  - Policy

Maintain

- Equipment
- Appliances
- Services
- Discussions

www.nanosoftremote.com

Google

NanoSoft Remote

Monitor, Manage & Maintain

sun moksha
Clean Technology Solutions

nist Technology Consulting Services
Redefine Excellence...

Welcome : Ashok Das 16th Dec, 2013 05:27:26 PM | Home

Customer Desk

Maintain Customer Details

Metering and Billing

Service and Maintenance

Dashboard

Discussion Forum

Document Management

Visual Display GUI

sun moksha

Action : Control Meter | Power Supply Scheduling | Power Consumption | Average Power Consumption | Power Consumption Comparison

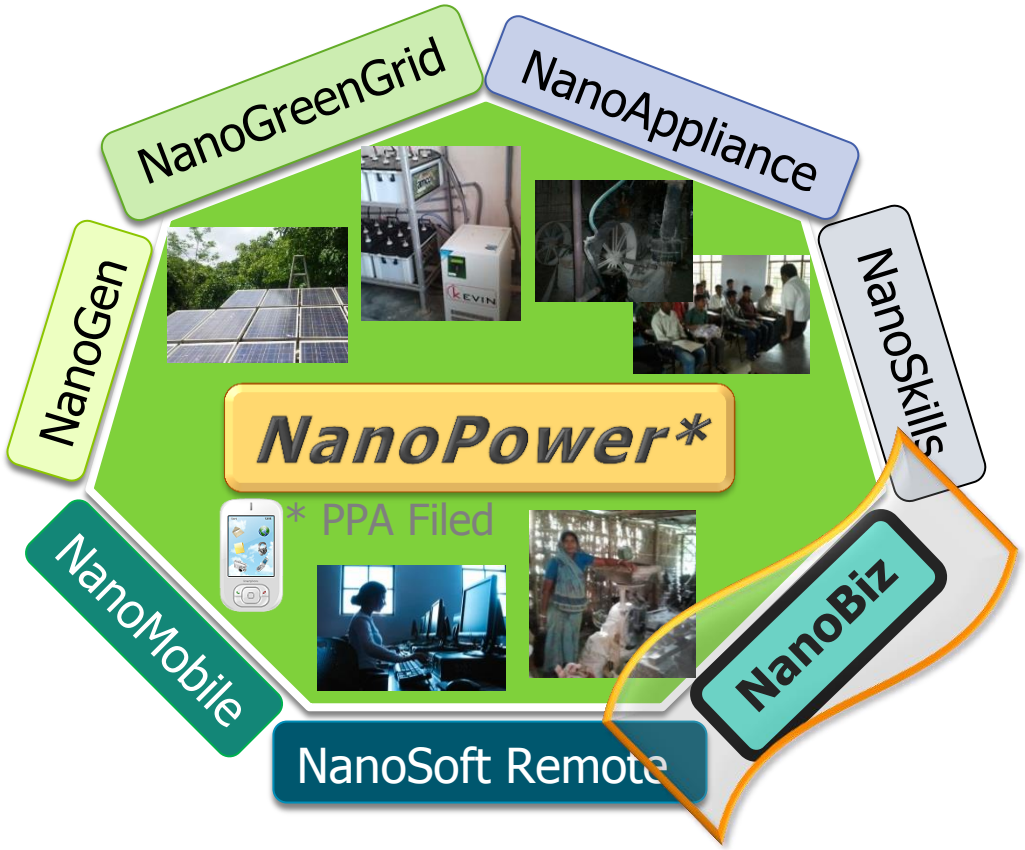
- Geographical display of nodes
  - meters and sensors
- Control nodes
- Manage Power Supply Scheduling
- Monitor Power Consumption
- Compare power consumption

NanoMobile – customer interface

NanoMobile

- **Communicate**
  - Operations
  - Usage
  - Scheduling
  - Alerts
  - Voice /Text/Data
- **Transact**
  - Billing
  - Payment
  - Banking
  - Purchasing
- **Serve**
  - Maintenance
  - Agriculture
  - Health
  - Training
  - Livelihood

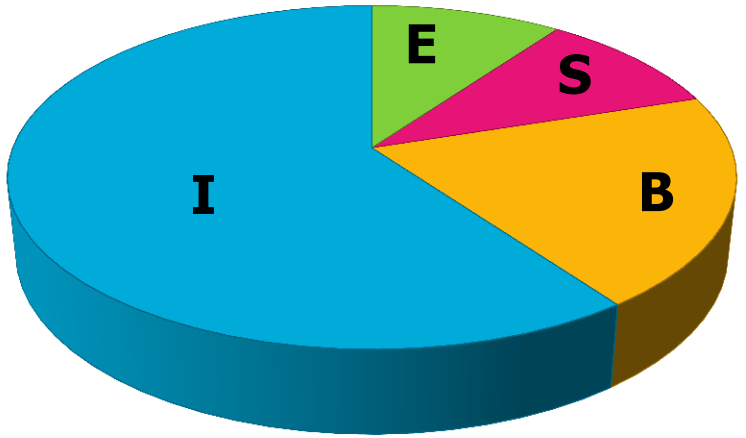
The *NanoPower* Ecosystem

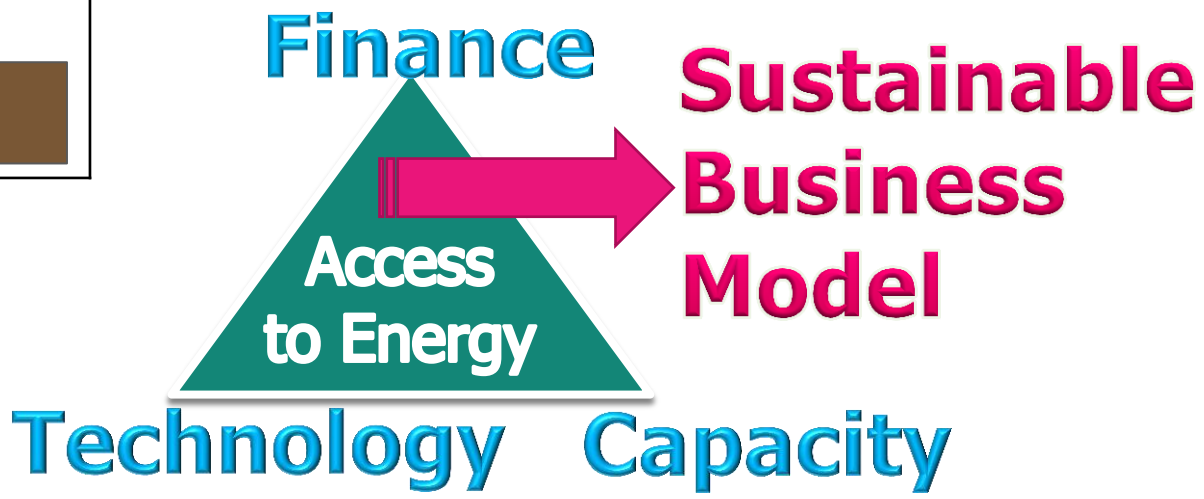


- Sustainable Business Development
  - Technology
  - Capacity
  - Finance
  - Co-ownership

NanoBiz – Sustainable Microenterprise Biz Models

		Business Entities		
		Model 1	Model 2	Model 3
Applications	App1	✓	✗	✓
	App2	✓	✓	✓
	App3	✓	?	✓
Financial Instruments		Business Equity/Debt/Grant		

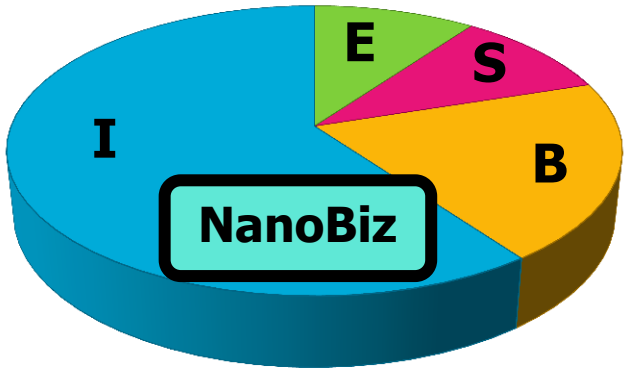


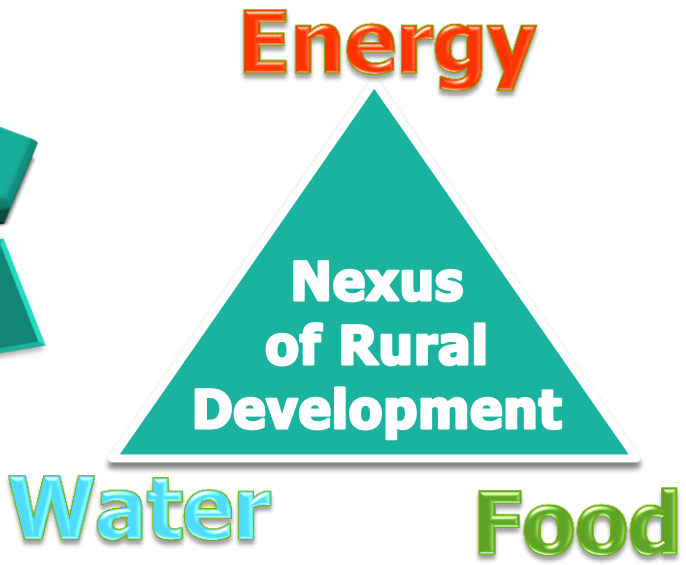


- Local models, Local ownership
- Local economy => Local currency
- Governance by Remote Monitoring

⇒ Sustainable Development

NanoBiz for Moving the Farmers Up the Agricultural Value Chain





"पानी है तो किसान है,
बिजली है तो रोजी है"

(Water is farmer's life,
Electricity is livelihood)

– Mahishanand Sardar, Baharbari Village, Bihar

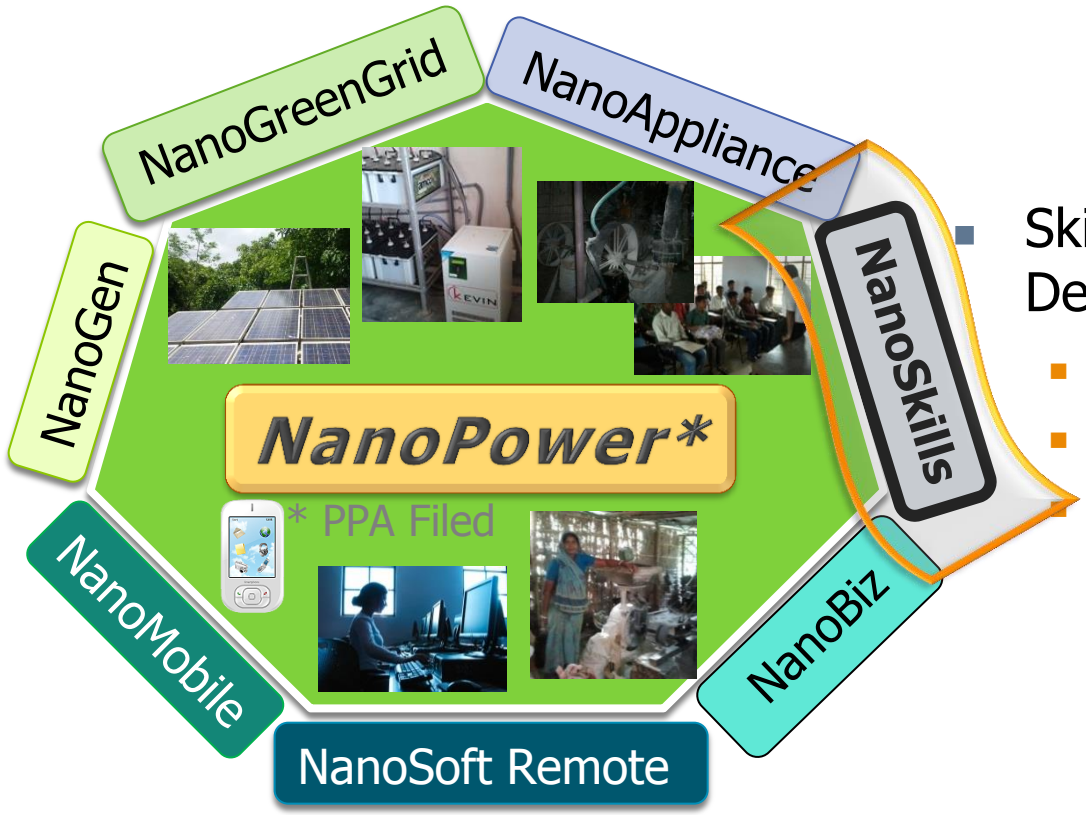
NanoBiz – an Inclusive Business Model

- A sustainable business that benefits low-income communities
  - A business initiative that, keeping its for-profit nature, contributes to poverty reduction through the inclusion of low income communities in its value chain
  - It is all about including the poor in the business process be it as producers or consumers.

http://en.wikipedia.org/wiki/Inclusive_business

http://www.ifc.org/inclusivebusiness

The *NanoPower** Ecosystem



- Skills and Capacity Development
  - Renewable Energy
  - Energy Efficiency
  - Microenterprises

* PPA Filed

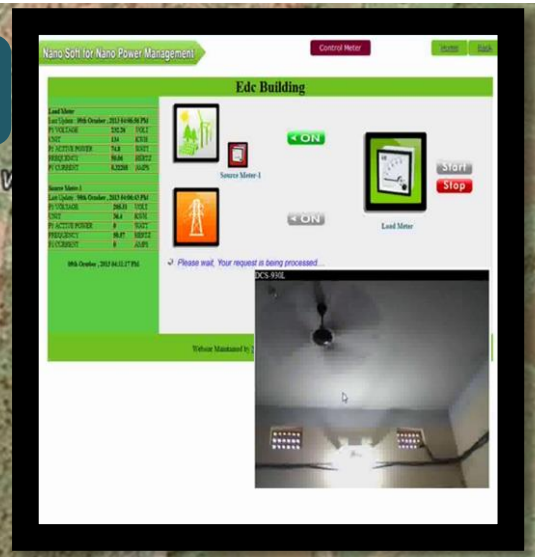
NanoSkills – Living Laboratory at nist

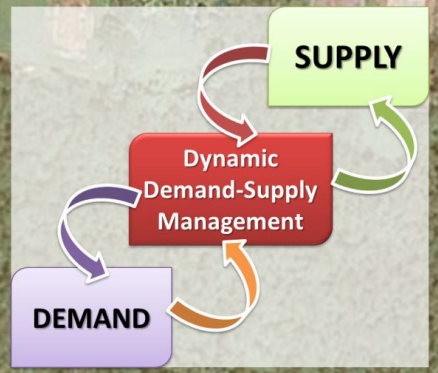
sun moksha

GreenGrid for Distribution

Energy Efficient Appliances

NanoSoft Remote at TIFAC Core Ctr





Map

Photos

Multi-Source Hybrid RE Power

NanoMobile
Communicate, Transact, Serve

Renewable Energy COE

NanoSkills – Comprehensive Training at nist

http://www.nist.edu/

Living Laboratory

NanoSkills

A 3-pronged Approach:
Basic Skills, Vocational, Engg.

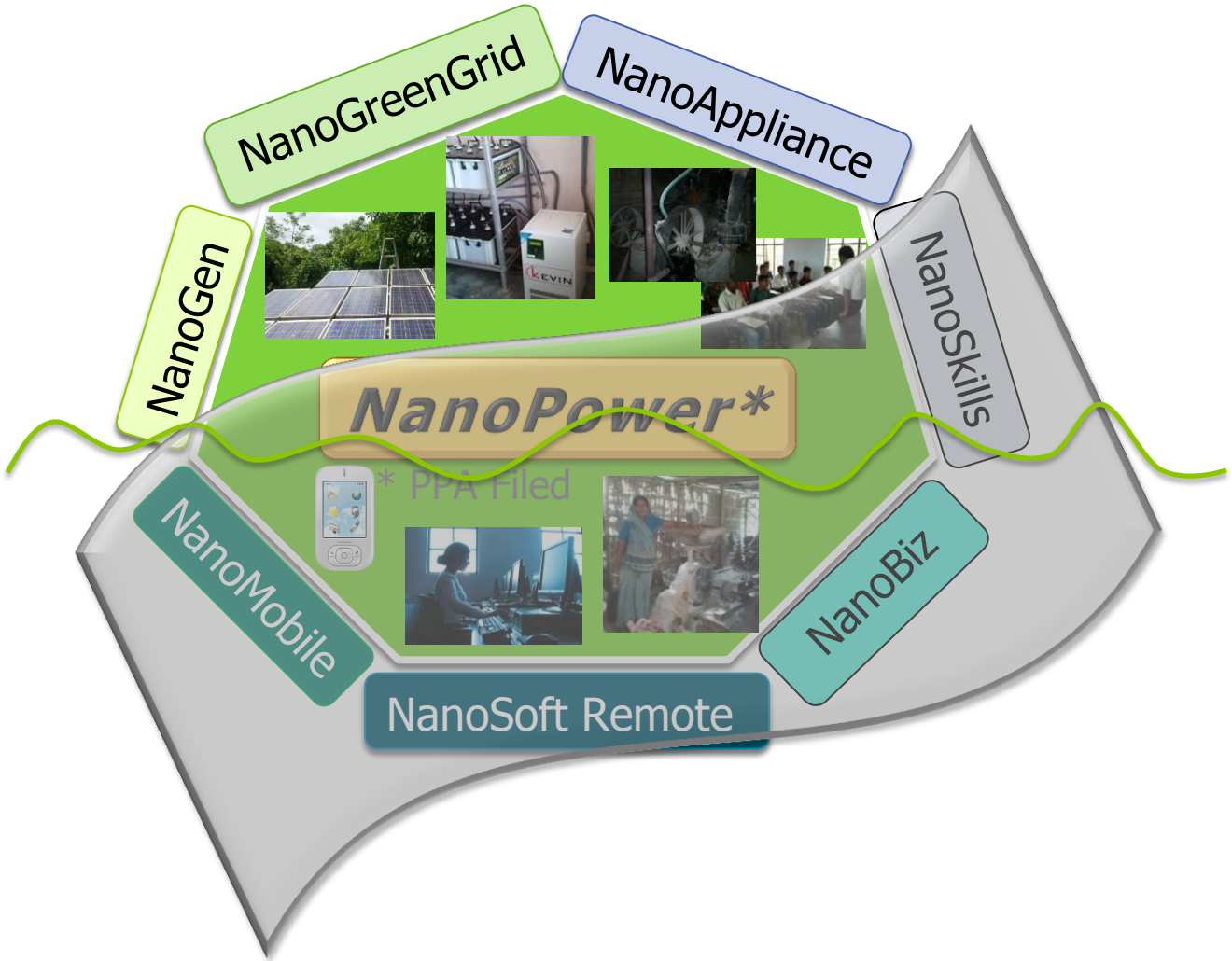
http://www.apexorissa.com/itc.html

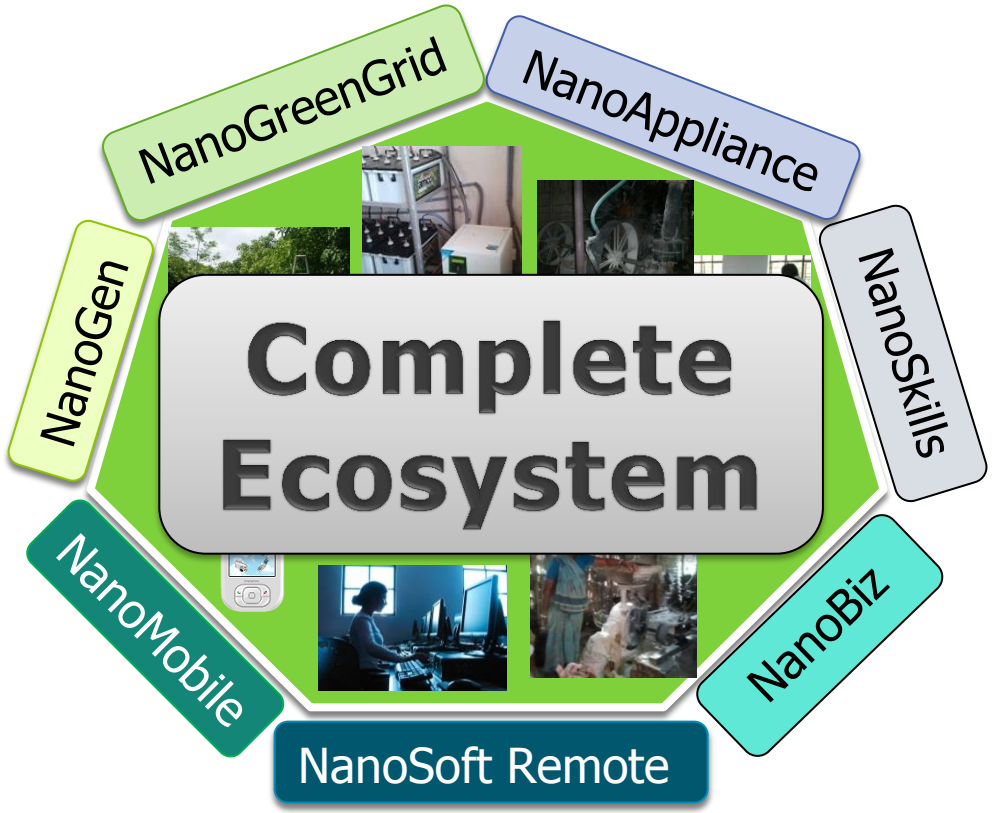
Faculty & Students in the Villages

Employment-Oriented Program (EOP)

- NIST CSR Program since 2006 for economically backward yet talented youth of South Odisha
- Runs under Entrepreneurship Development Cell (EDC), assisted by DST, GOI
- Each year ~100 students enroll for 6-month training
  - Trained by highly qualified faculty and staff
  - Stipend of Rs. 1100.00 per month
  - Free lodging, boarding, transport, study materials etc.
- Disciplines
  - Basic computer Skill (BCS)
  - Computerized Digital Technology and Printing (DTP)
  - Electronics Repair & Maintenance(ERM)
  - Repair of Electrical Equipments (REE)
  - Computer Repair & Maintenance (CRM)
  - Workshop Practice (WP) - lathe, carpentry, welding, CNC, milling

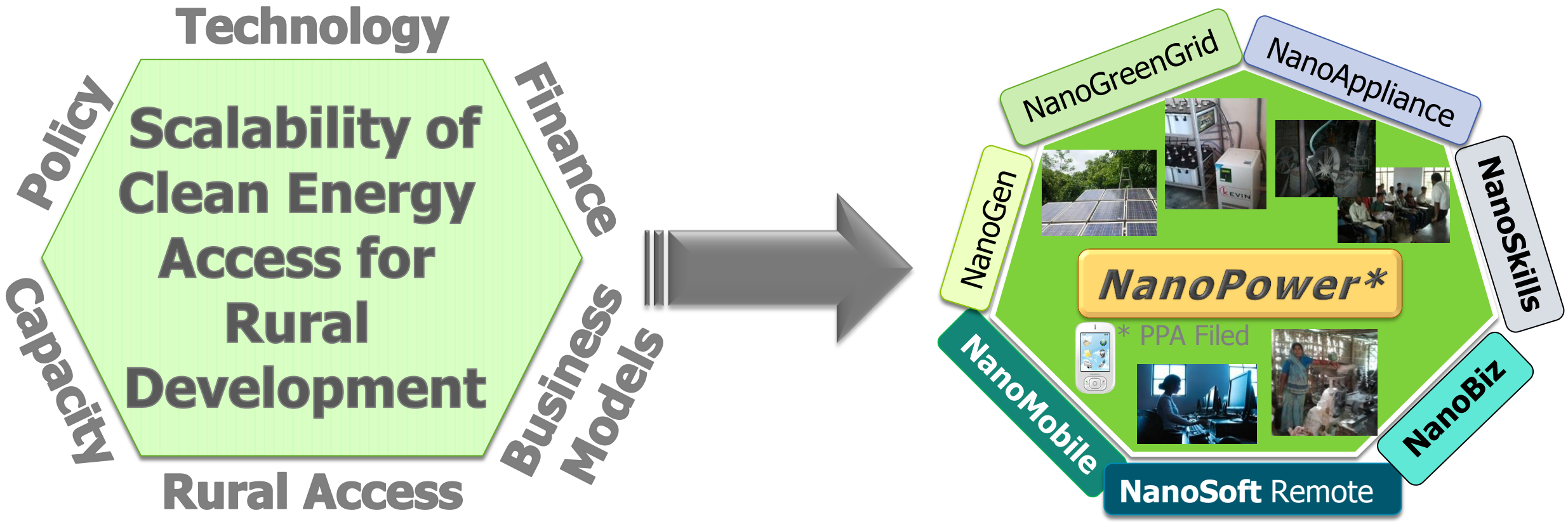
The *NanoPower* Ecosystem





* PPA Filed

*NanoPower** Addresses Scalability for Rural Energy



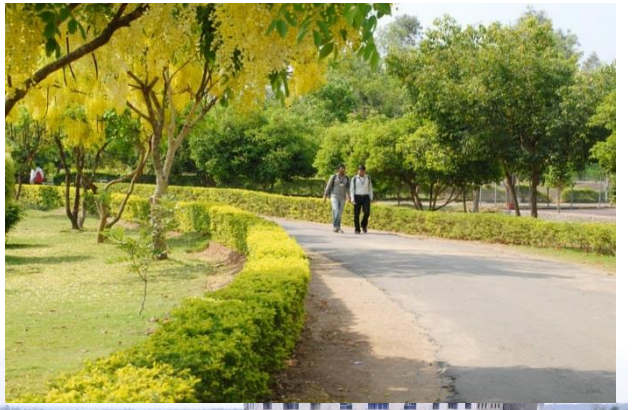
- ***NanoSoft, NanoMobile, NanoBiz*** and ***NanoSkills*** are key to scalability.
- **Local Partners** are key to success.

* PPA Filed

Super Cyclone Phailin – Odisha – October 2013

- Substantial damage to trees, buildings, infrastructure, power transmission lines
- Huge damage to NIST infrastructure and greenery
- 1-2 Months to restore power in several parts of the region – including NIST
- A micro-grid approach would have restored power in at most a few days








Microgrid powers Borrego during emergency

- Heavy rain, flash floods, high winds and severe lightning shattered the transmission line
- All repairs made and power restored to the community in ~25 hours after the initial lightning strike
- Local micro-grid approach proved to be the life-saver

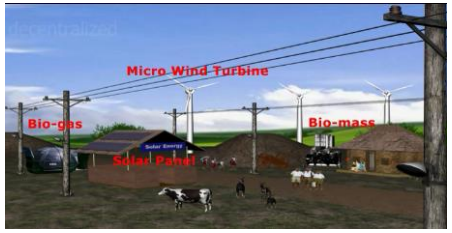
http://www.utsandiego.com/sponsored/2013/nov/10/sgde-repair-crews-storm/

Key Interventions of *NanoPower*

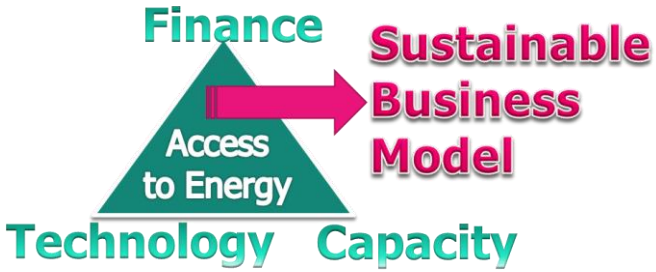
IT-Based Remote Monitoring, Management and Maintenance of Micro-Grid

Demand-Supply Management

Customer Interface Over Mobile Devices For Communication, Transaction and Value-add Services

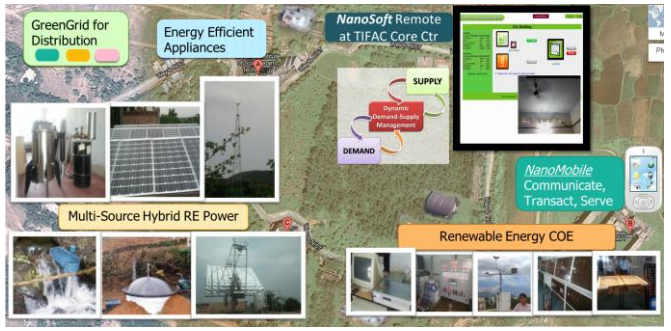


Hybrid Generation & Utilization of Existing Grid, where Possible



Scalable Sustainable Micro-Enterprise Models & Ecosystem

Skills and Capacity Building In Partnership with Institutions



Development & Testing at Living Laboratory

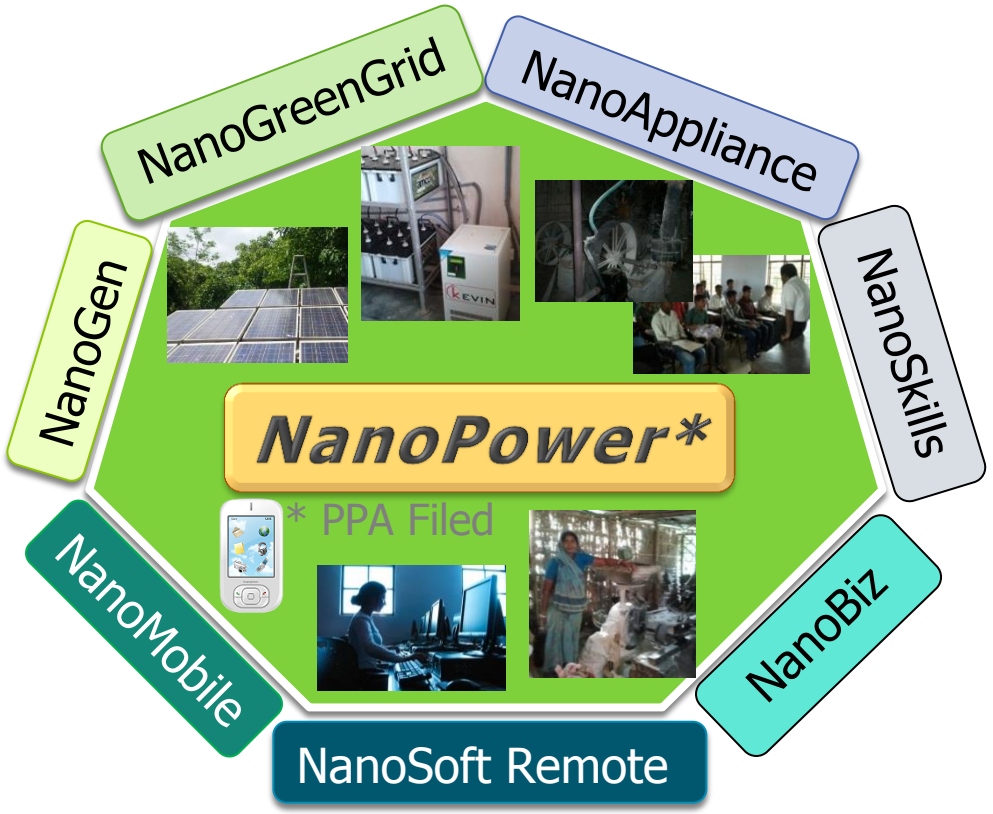
Kalamandir
The Celluloid Chapter Art Foundation

Gram Vikas

Close Partnership with Villagers Through Grassroots Organizations

NanoPower – indigenous rural solutions

- Designed and developed in a rural setting by engineers from villages
- A truly local solution…



…of the villagers, for the villagers, by the villagers

Our Mission…

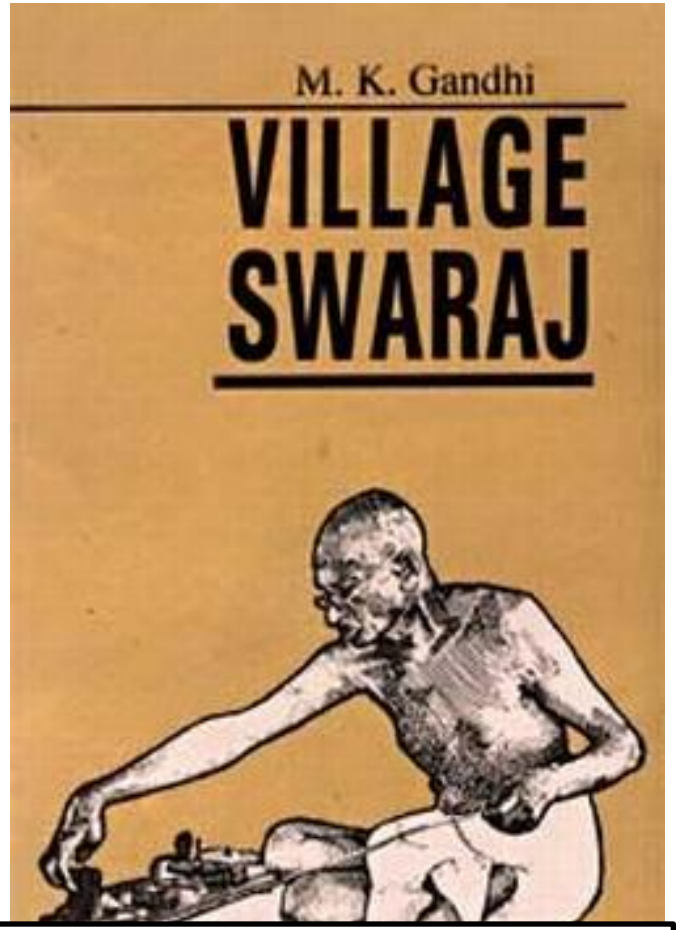
Provide access to electricity

to the power-starved rural community

Local Generation, Local Consumption, Local Economy!

Our motto: attain *Village Swaraj*

sun moksha



Not mass production, but production by the masses.

– MK Gandhi

http://www.columbia.edu/itc/mealac/pritchett/00routesdata/1900_1999/gandhi/spinning/spinning.html

Our Vision…
Develop *PURA** Villages

Roads, Drainage, Sewerage

Water Supply

Waste Management

Dr. KALAM's "PURA" VILLAGE

Education and Health

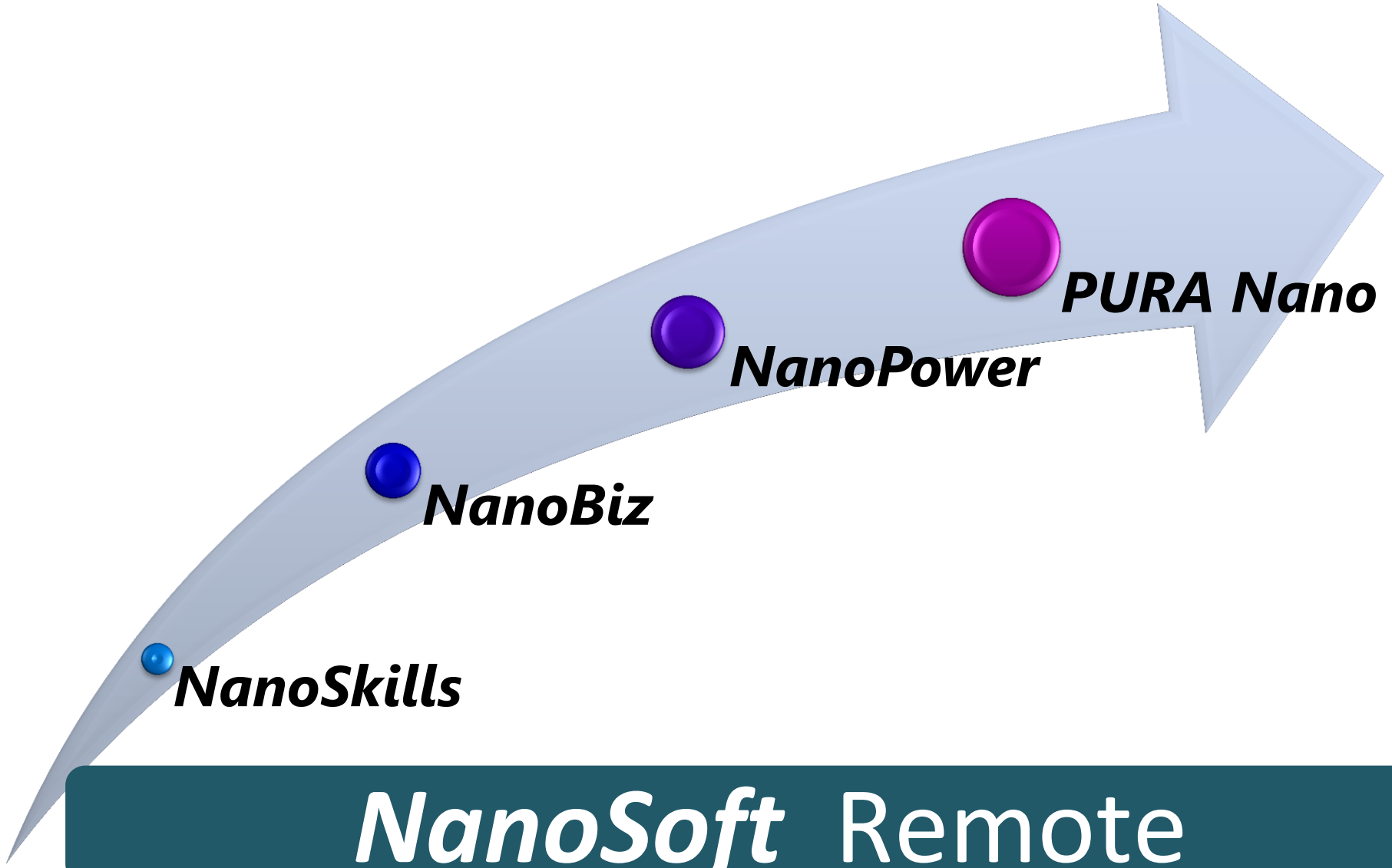
Street Lights And Power Distribution

Economic and Skill Development

Energy is THE enabler

*PURA ≡
Provision of **U**rban amenities for **R**ural **A**reas

Our Path to Rural Empowerment – *Nano Solutions*



NanoSoft Remote

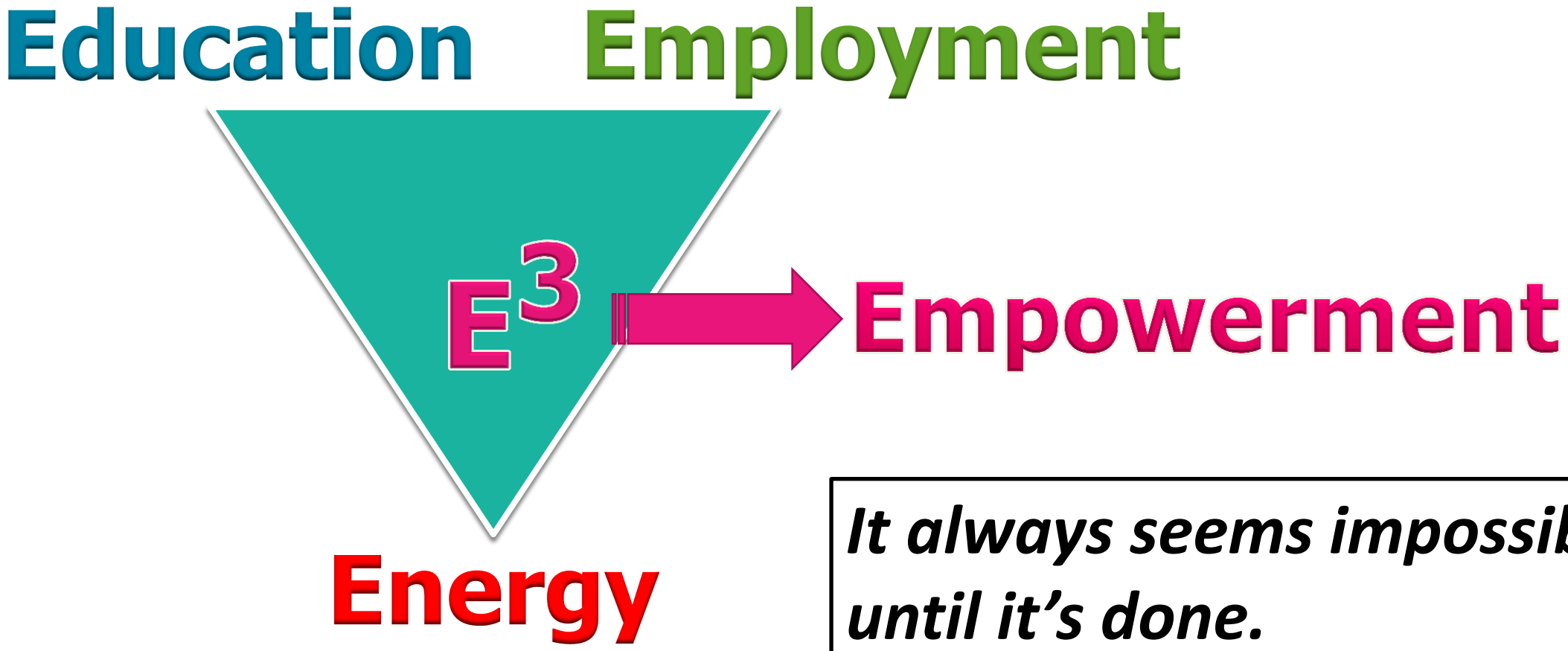
Our Ultimate Goal…

Achieve *MDG* through *PURA Nano*

UN Millenium Development Goals:
http://www.undp.org/content/undp/en/home/mdgoverview.html

Our Belief…

E^3 – key to address SE4ALL, BOP, PURA and MDG



It always seems impossible until it's done.

– Nelson Mandela

About SunMoksha

For Corporates, Industries, Institutions

- Energy Efficiency
- Renewable Energy
- Remote Energy Management
- Green Campus
- Market & Technology Research
- Green Journey

For Villagers

- Renewable Energy Micro-grid
- Business Models for Micro-enterprises
- Remote Operations & Management
- Capacity and Skills Development

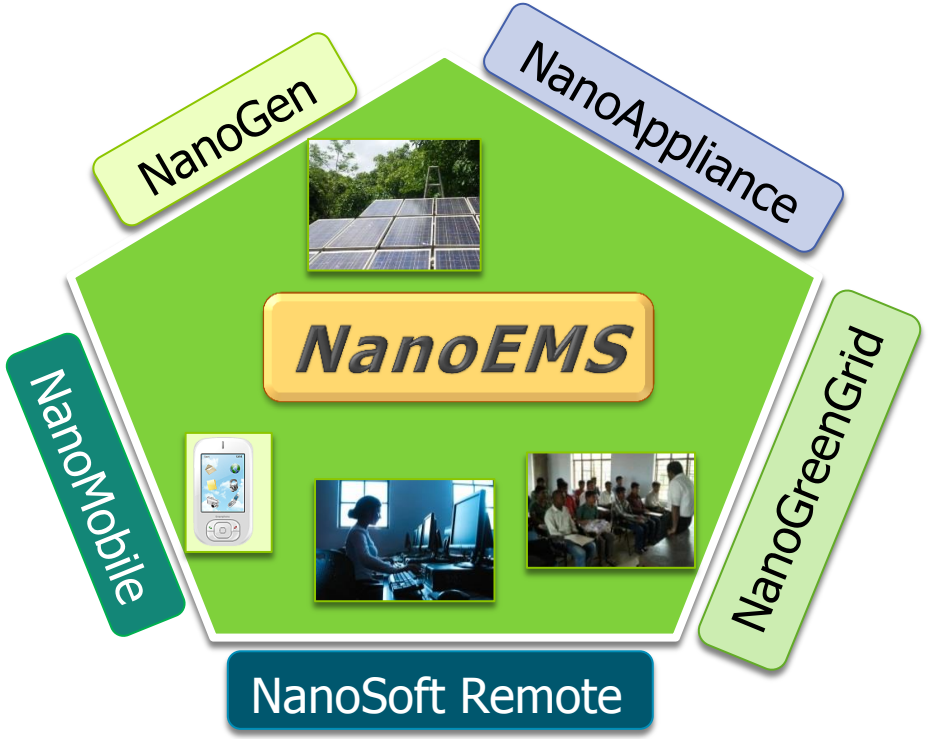
- Founded in 2008 to provide sustainable clean energy solutions for the society.
- Develops and implements novel solutions for rural electrification.
- Provides consulting and implementation services in clean energy solutions to corporates, institutions and MSMEs.

Our Key Products and Services

Green Energy Solutions

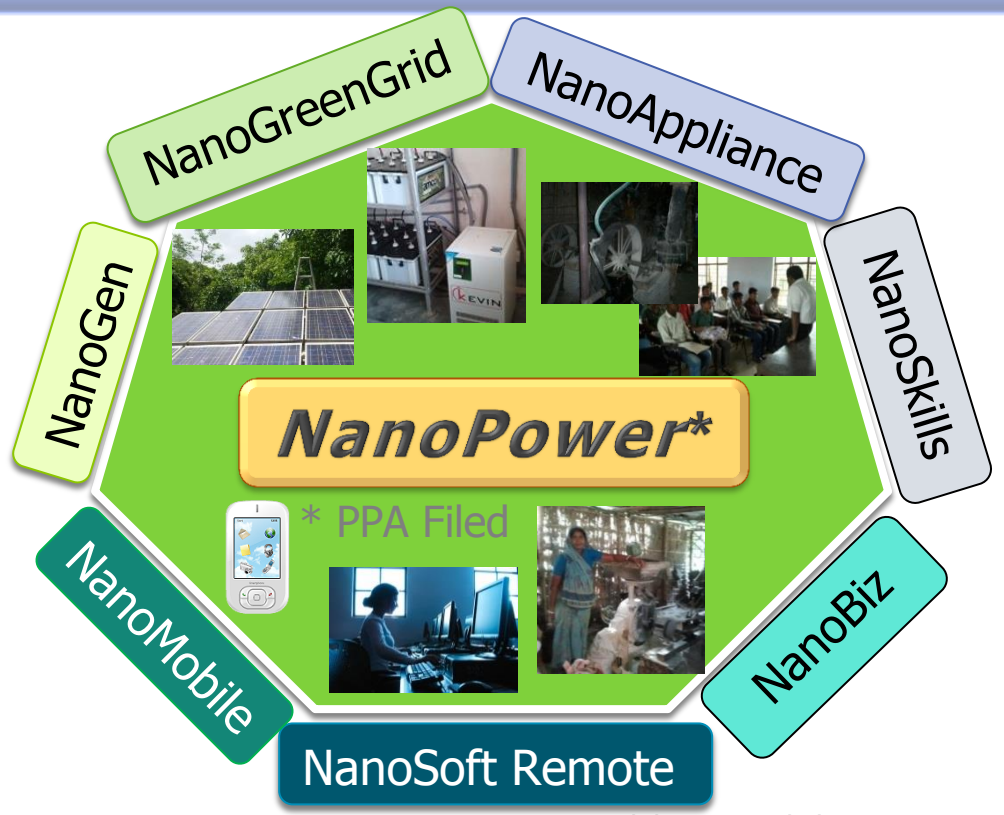
For Corporates, Industries, Institutions

Energy Management System

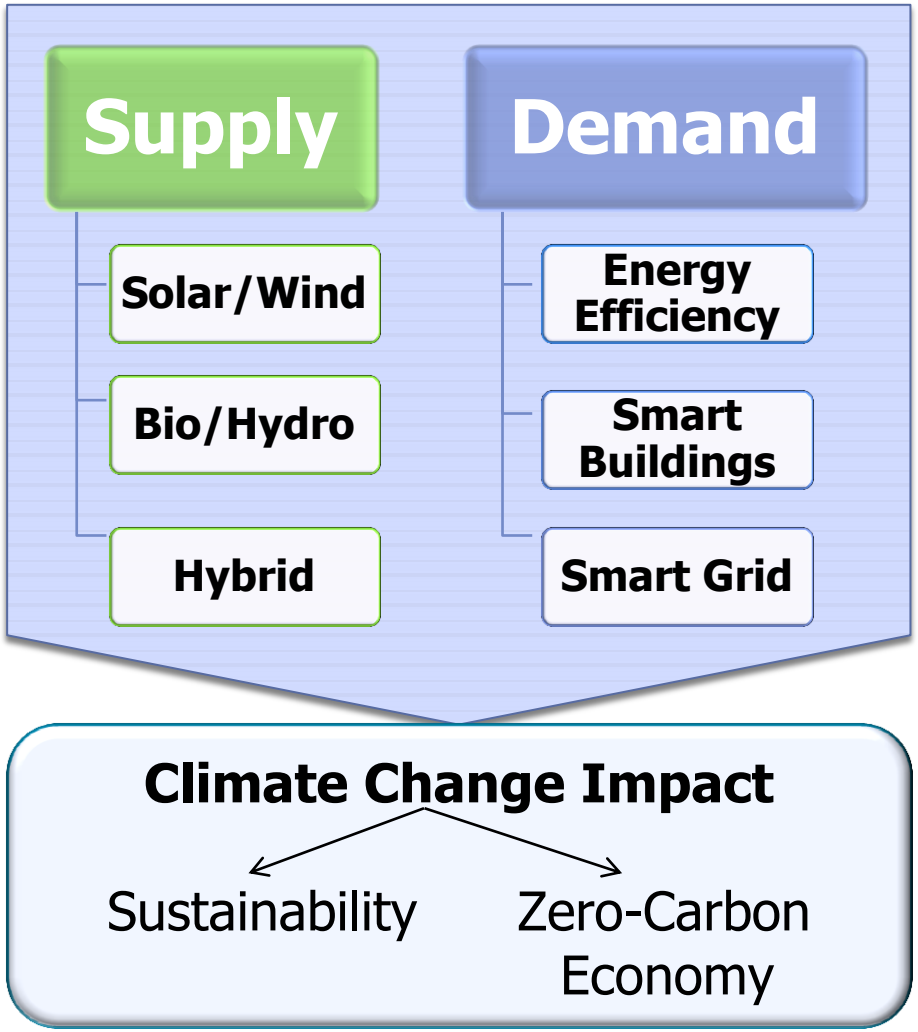


For Villagers & Farmers

Rural Electrification Solutions

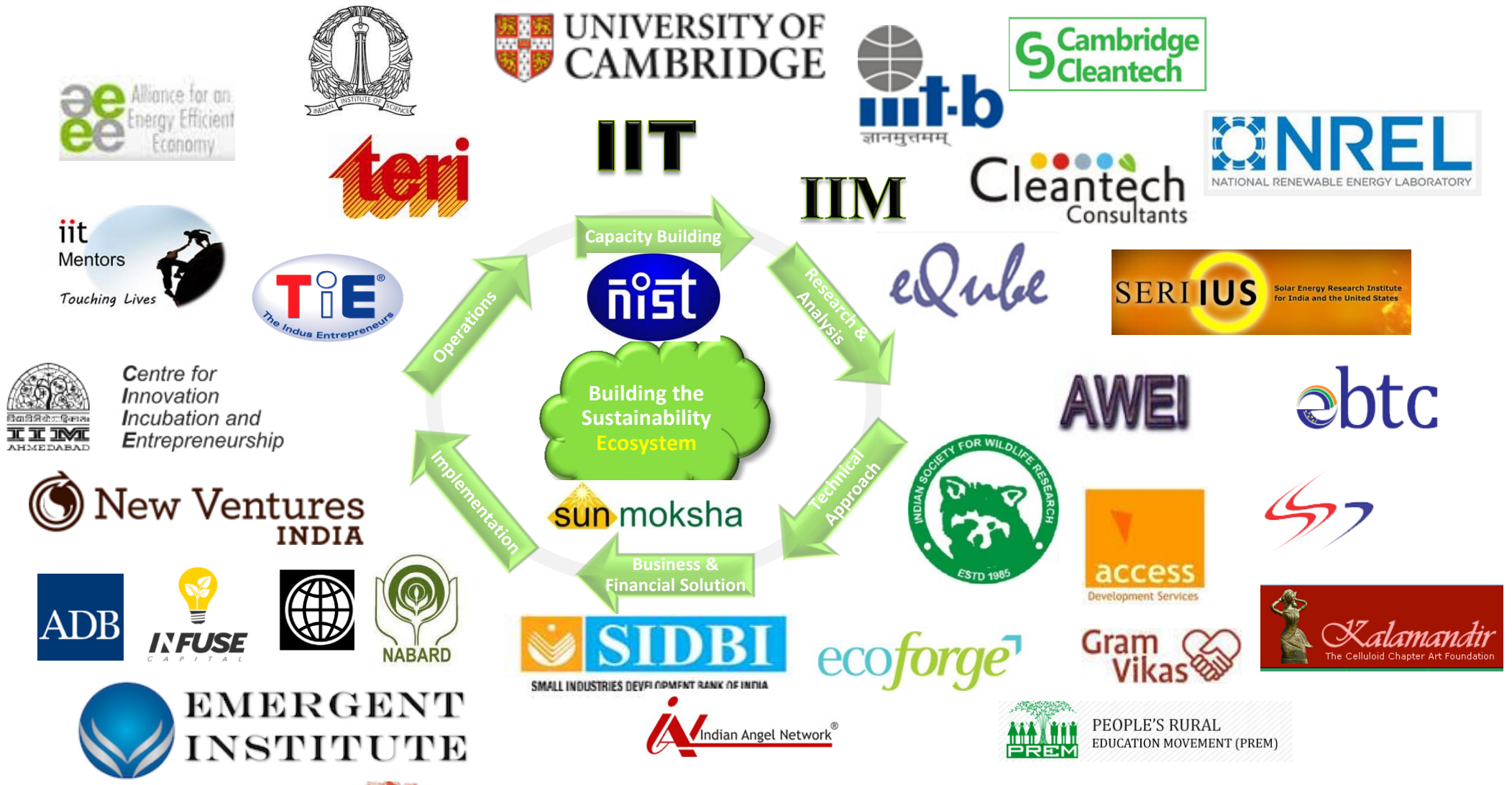


Our Domains – EE and RE



- Our domains on the supply side include renewable energy from solar, bio, waste, and hybrid renewable sources
- On the demand side, we focus on energy efficiency, smart buildings and smart grid
- We provide complete sustainability ecosystem

Our Network and Ecosystem



About NIST

- A premier engineering college at Palur Hills in the rural heartland of Odisha
- Established in 1996 with the mission to "create engineering minds capable of mastering the global challenges of tomorrow's technology"
  - Leadership in research oriented curriculum and academic environment in the region
  - Scored 4th rank in the Eastern Region and 31st in All India in the 2012 Dataquest survey
  - Awarded the "Best Technical Institute in R & D Activities" in the State of Orissa in 2013
- The Eastern region's first TIFAC CORE 3G/4G Centre is hosted at NIST in partnership with GoI's DST and a consortium of private industries
- Joint research projects with international institutes in Japan and Taiwan
- Very active in renewable energy with a RE lab and a renewable energy club
- Developing a Living Laboratory under the guidance of SunMoksha with a wind-solar-biomass connected within a smart micro-grid already in place
  - Biogas, solar thermal etc. planned

NanoPower... a *zero emissions* path to take the villages from darkness to luminance

sunmoksha

Ashok. K. Das, Ph.D.
Founder CEO, SunMoksha
www.sunmoksha.com