



# Overview of the Off-grid PV Sector in India

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# Outline

- India at a glance
- The Energy Access Landscape
- The Policy & Regulatory Scenario for PV
- The Off-grid PV Market
- Opportunities for the German RE Industry
- What we can do for you



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# India at a glance

## The Growth Story

- GDP – \$ 1,590 billion
- GDP growth rate 4,5% in 2013
- Infl. (WPI) – 4.89%
- Strong financial sector
- Access to quality HR
- Good infrastructure, although bottlenecks exist

Source: [statisticsofindia.com](http://statisticsofindia.com)



## The Development Challenge

- Ranked 136 – HDI, 2013
- Large parts of rural India lack access to basic infrastructure – energy, water, health, sanitation
- India likely to miss 2015 targets on some of the MDGs – poverty ratio, child mortality, hunger & nutrition



# Installed Generation Capacity

| Type             | Capacity (MW) | %     |
|------------------|---------------|-------|
| Coal             | 145,408.39    | 59.25 |
| Gas              | 21,781.85     | 8.88  |
| Oil              | 1,199.75      | 0.49  |
| Hydro            | 40,531.41     | 16.48 |
| Nuclear          | 4780.00       | 1.95  |
| Renewable Energy | 31,692.14     | 12.91 |

- **Energy shortage – 8.7%; Peak power – 9% (*Energy Statistics, 2013*)**
- **Does not take into account the latent demand of nearly 300 million people without access to electricity**
- **Average electricity consumption of households per capita ~ 139 kWh; World Average – 726 kWh (*Source: WEC, 2011*)**



## RE Achievements – On-grid

| System          | Achievements (20013-14)<br>(MW) | Cumulative<br>(MW) |
|-----------------|---------------------------------|--------------------|
| Wind            | 2084.80                         | 21,136.30          |
| Solar PV        | 960.60                          | 2647.00            |
| Small Hydro     | 171.40                          | 3,803.70           |
| Biomass         | 100.40                          | 1,365.20           |
| Bagasse Cogen   | 311.00                          | 2,648.40           |
| Waste to Energy | 10.50                           | 106.60             |

- **The wind sector is mature and attracts commercial investment**
- **Recent thrust in the Solar PV sector on account of the National Solar Mission with a target of 20 GW in on-grid by 2022**



# RE Achievements – Off-grid

| System                                 | Achievements (20013-14) | Cumulative          |
|--|-------------------------|---------------------|
| Biomass Gasifiers (MW)                 | 0.70                    | 17.50 MW            |
| Watermills/Micro hydro (MW)            | 2.61                    | 13.21 MW (2643 nos) |
| Family Biogas (nos)                    | 70,000                  | 4,740,000           |
| Biogas Energy Sys. (MW)                | 0.55                    | 3.77                |
| Solar Water Heating (in million sq.m.) | 1.10                    | 8.10                |
| SPV Systems (MW)                       | 49.70                   | 174.40              |

- **Several subsidy programmes but the actual impact on the ground limited due to lack of adequate M&E mechanisms**
- **Recent thrust in the Solar PV sector on account of the National Solar Mission with a target of 2 GW in off-grid by 2022**



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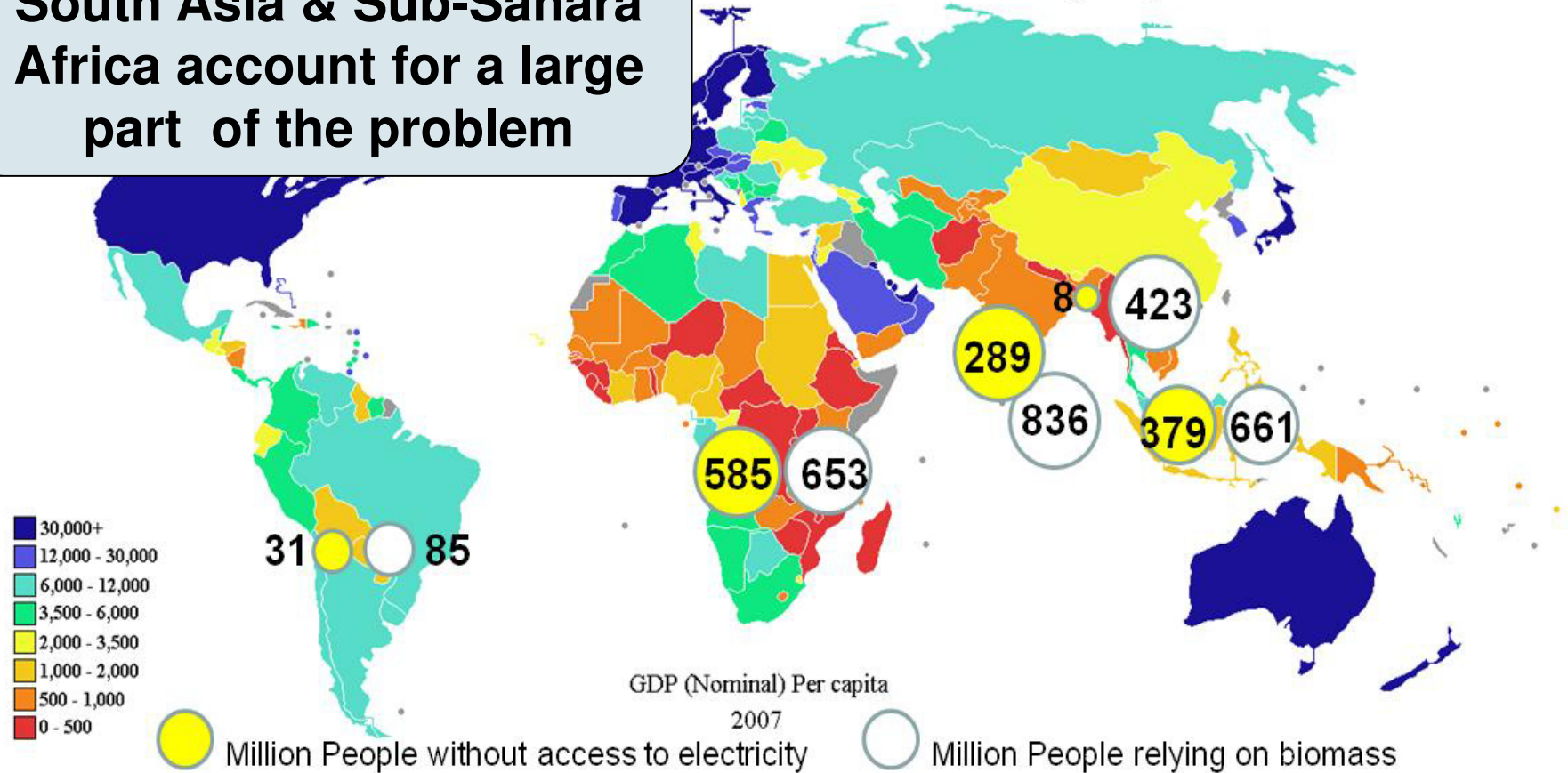




# The Energy Access Challenge

**South Asia & Sub-Sahara Africa account for a large part of the problem**

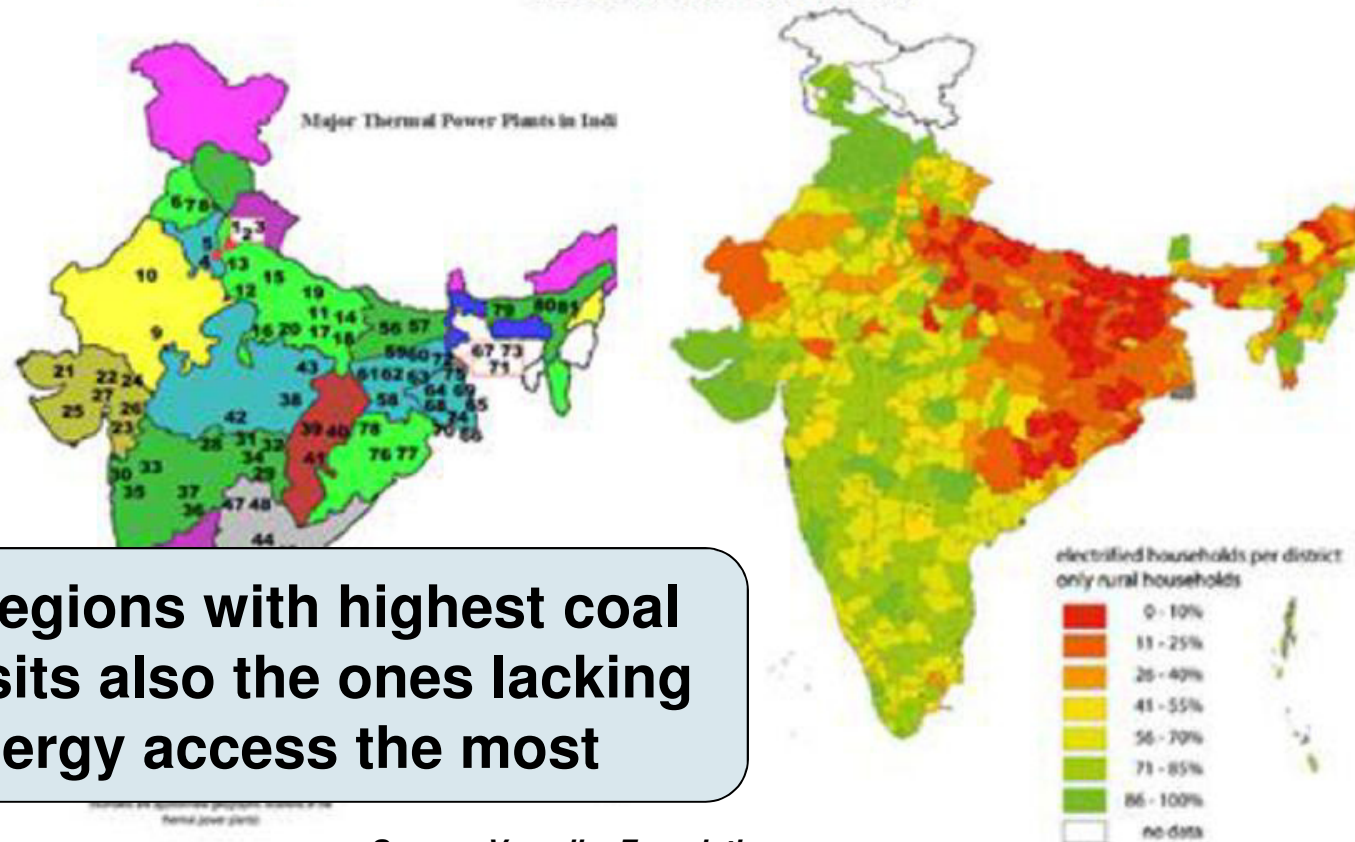
Source: IEA Report, October 2011





# The Energy Access Paradox

Comparative Map of India with Thermal Power Plants and level of household electrification



**The regions with highest coal deposits also the ones lacking energy access the most**

Source: Vasudha Foundation



# Key Drivers in the Energy Access Space

- ❑ Over 30% of the population, especially a large portion of rural India, still doesn't have access to electricity
- ❑ Grid supply - where available - is highly unreliable
- ❑ Several government schemes to encourage the uptake of off-grid renewables, but limited impact
  - Key policy in recent times – the National Solar Mission
- ❑ Social enterprises, typically based on RE solutions, have stepped in to fill this gap
  - Nascent sector, but fast growing
  - Innovative business models for delivery but inadequate support on the policy and technology front
  - Key challenge remains scale-up/replication for widespread impact



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# National Solar Mission - Targets

| Segment          | Phase I<br>(2010 – 2013) | Phase II<br>(2013 – 2017) | Phase III<br>(2017 – 2022) |
|------------------|--------------------------|---------------------------|----------------------------|
| Grid connected   | 1,100 MW                 | 4,000 MW                  | 20,000 MW                  |
| Off-grid         | 200 MW                   | 1000 MW                   | 2000 MW                    |
| Solar Collectors | 7 M sq.m.                | 15 M sq.m.                | 20 M sq.m.                 |

*Source: MNRE*



# NSM - Guidelines

- Multiple Channels to facilitate contact between users and suppliers
- Accreditation process for partners; in line with international standards
- Financial support
  - 40% capital subsidy
- Benchmark price
  - Rs. 300/W<sub>p</sub>/ Rs. 210/W<sub>p</sub> (w/o batteries); Rs. 240/W<sub>p</sub> currently
  - 10% decrease per year, leading to grid parity by 2022



## NSM Phase 2 – Proposed Targets

- ❑ 1 GW of off-grid power – product linked or enhancing income generation activities
  - Energy Access Scheme (mini-grids) – 20,000 villages/hamlets/bastis
  - Off-grid Lighting - 10 lakh solar lanterns, SLHS & Street Lights
  - Solar Pumping – 25,000 pumps
  - Solar Cookers – 50,000
- ❑ Thrust on Microfinance Institutions for financing solar products
- ❑ Human resource development – 25,000 village level technicians



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# Solar PV Lighting/Electrification (1)

|               | Lighting Products             | Home Lighting Systems   | Mini-grids (Lighting)                                | Mini-grids (Electrification)  |
|---------------|-------------------------------|---|--|---|
| Configuration | LED/CFL<br>Lanterns (1 – 5 W) | <ul style="list-style-type: none"> <li>• 10 – 100 W DC</li> <li>• &lt; 1 kW AC</li> </ul> | 200 W DC;<br>connected to 40 h/h within 100 m radius | kW scale DC/AC;<br>connected to 50 – 400 h/h                          |
| Service       | Lighting +<br>Mobile charging | Lighting + Mobile charging +<br>Entertainment   | Lighting +<br>Mobile charging                        | Lighting + Mobile charging +<br>Entertainment +<br>Productive end-use |
| Price (€)     | 10 - 50                       | 100 - 500   | 1,500 – 2,500  | 40,000 – 150,000  |



# Solar PV Lighting/Electrification (2)

|                                | Lighting Products     | Home Lighting Systems   | Mini-grids (Lighting)                     | Mini-grids (Electrification) |
|--------------------------------|-----------------------|---|---|------------------------------|
| Buss. Model                    | Cash sales; MFI loans | Asset financing through rural banks                           | Entrepreneur driven fee for service model |                              |
| Market Potential (€, million)* | 14                    | 20  | 1500                                      |                              |
| Stage of Market                | Growth                | Growth (boost from the NSM)                                   | Nascent                                   | Nascent                      |
| Market Drivers                 | Non-subsidy market    | Partial subsidy (40% on benchmark cost of €4/W <sub>p</sub> ) | Subsidy & Non-subsidy models              | Requires significant subsidy |

\*Source: Power to the People, WRI Report, 2009



# Solar PV Pumping

|                  | PV Pumping  |
|------------------|---|
| Configuration    | AC/DC Configuration; Surface & Submersible; 1 – 5 HP  |
| Service          | Irrigation or drinking water  |
| Price (€)        | 2,000 – 10,000  |
| Business Model   | Individual/Group Farming; Direct sales  |
| Market Potential | Potential replacement of 12 million electric and 9 million diesel pumps (4,5 million PV potential – 17 GW) (21% of total electricity consumption) |
| Stage of Market  | Nascent   |
| Market drivers   | Subsidy driven market   |

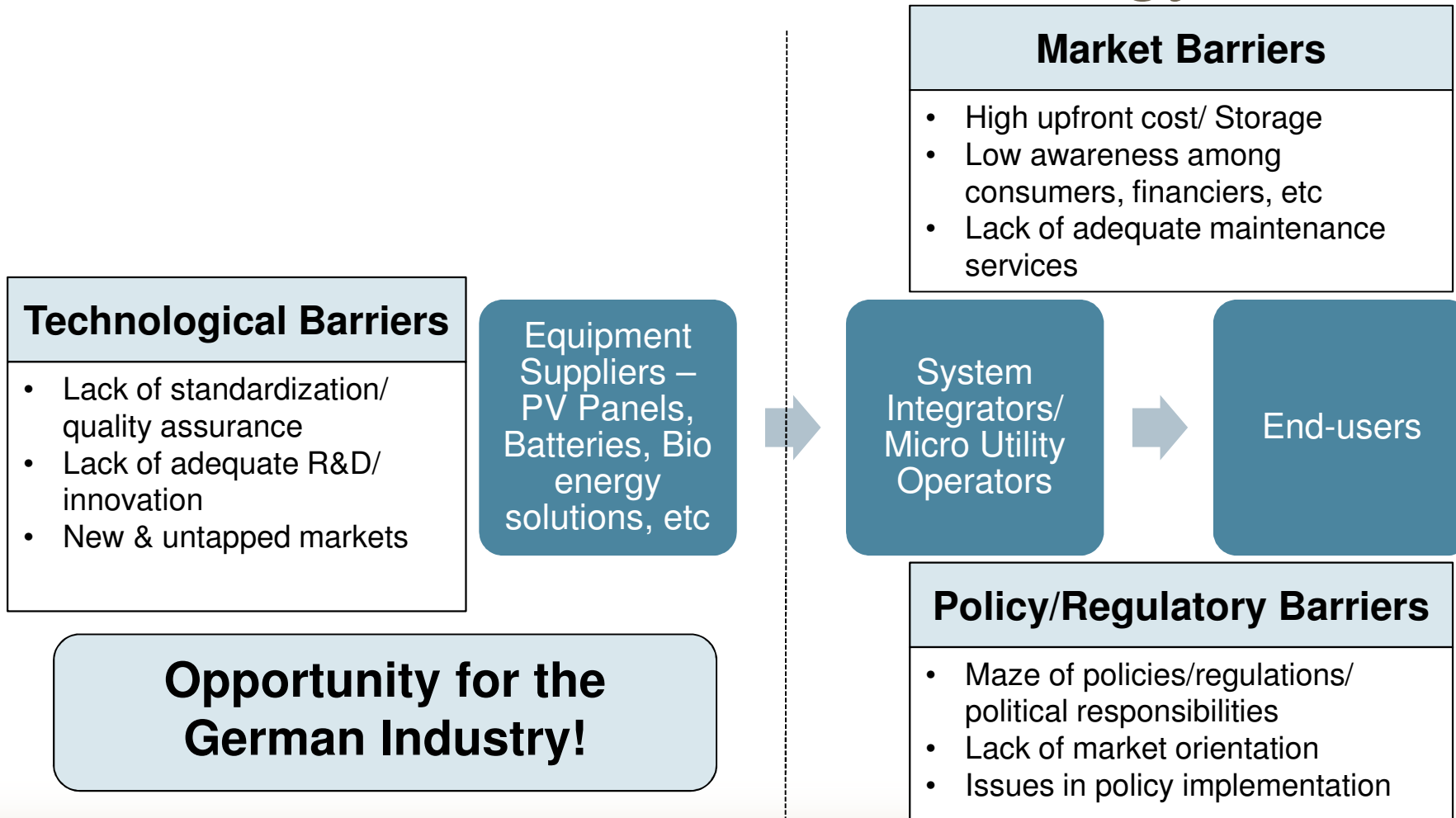


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# Market Structure – Rural Energy Service





# PV Home Lighting Systems & Products

## Strengths

- Strong policy thrust – National Solar Mission
- Relatively mature sector (since 1995)
- End user financing available
- Several private sector players



## Opportunities

- Better storage solutions/batteries
- More flexible plug and play solutions to cater to increasing demand
- Energy efficient appliances designed for rural areas

**GIZ, on behalf of BMZ, is providing support to the SELCO Incubation Centre, where potential entrepreneurs are exposed to the business model and processes of SELCO, one of the most successful social enterprises in this sector**



# PV Mini-grids

## Strengths

- Strong policy thrust – National Solar Mission
- State level programmes to promote solar mini-grids
- Several private sector players with innovative business models



## Opportunities

- Low cost pre-paid meters
- Low cost grid integration solutions
- Better storage solutions/batteries
- Anchor models with telecom towers

**GIZ, on behalf of BMZ, is supporting the development of a sustainable framework for promoting solar mini grids in Uttar Pradesh. There are over 20 million rural households without access to electricity in this state alone.**



# PV Pumping

## Strengths

- Strong policy thrust – National Solar Mission
- Several private sector players and associations



## Opportunities

- Reduction in cost of technology
- Mobile pumping solutions

**GIZ, on behalf of BMZ, is promoting innovative business models and end user financing for PV pumping in Bihar.**





# Doing business in rural India

- ❑ Link up with **strong local partners** with good understanding of the ground realities, e.g. social enterprises, NGOs
- ❑ Take time to **analyse and understand the market** (e.g. through CSR activities)
- ❑ Design **affordable technologies that meet the local demand** (demand-driven instead of technology-driven)
- ❑ **Lower expectations** on immediate high returns
- ❑ Be aware of **rules and regulations** for FDI in India: more information available at [moia.gov.in/pdf/foreign\\_direct\\_investments.pdf](http://moia.gov.in/pdf/foreign_direct_investments.pdf)



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# Developing Partnership – Claro Energy

## Innovative Business Models - Pilot

- Pay - per - use model with a farmer cooperative
- Replacement for a diesel pump entrepreneur
- Individual/Marginal farmer ownership

## Capacity building

- Bank Manager Training on technology/viability
- Developing appropriate financial products
- Training of local entrepreneurs/technicians



## Awareness raising

- Documentation of business models/ lessons
- Dissemination workshops
- Engagement with policy makers



# What can we do for you?

- ❑ Links to potential sources of additional information
- ❑ Feedback on potential plans for market entry
- ❑ Access to networks / potential partners – through the CLEAN Energy Alliance (an alliance of energy access enterprises)
- ❑ Coordinate German Industry Delegations to India (with support from IGEF)  
[Hannah.Sternberg@giz.de](mailto:Hannah.Sternberg@giz.de) [www.energyforum.in](http://www.energyforum.in)
- ❑ In selected cases: possible support under the existing project portfolio - Integrated Development Partnership Project (iDPP)

➔ For more information contact GIZ in India: [Hari.Natarajan@giz.de](mailto:Hari.Natarajan@giz.de)



Thank you for your attention.

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# Selco Solar

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- ❑ Established in 1995 to provide solar lighting solutions in rural Karnataka
- ❑ Key elements of their business model
  - Customized solutions based on end user needs
  - Dedicated service network (26 centres across Karnataka)
  - End consumer financing through various channels
- ❑ Over 150,000 systems to date
  - Nearly 85% of the customers are rural (2/3/4 light systems)
  - Around 90% of these systems are financed through RRBs, Commercial Banks, Cooperative Banks & MFIs



# Selco's Customers



Dairy Customer



Household Lighting



Silk Cocoon Farmer



Rural Clinic



Vegetable Vendor



# PV Mini grids

## ❑ Bosch Solar – Gram Oorja

- 10 kW system serving 35 households in Western India
- Bosch covered the entire capital cost for the pilot
- Interesting lessons with regards demand increase, WTP, etc



## ❑ SPEED Programme

- Anchor load – telecom tower or any other rural enterprise forms the base load/revenue source for the mini-grid
- Surplus power is sold to households in surrounding communities

