



Electricity Access in Rural India using Solar PV mini-grids

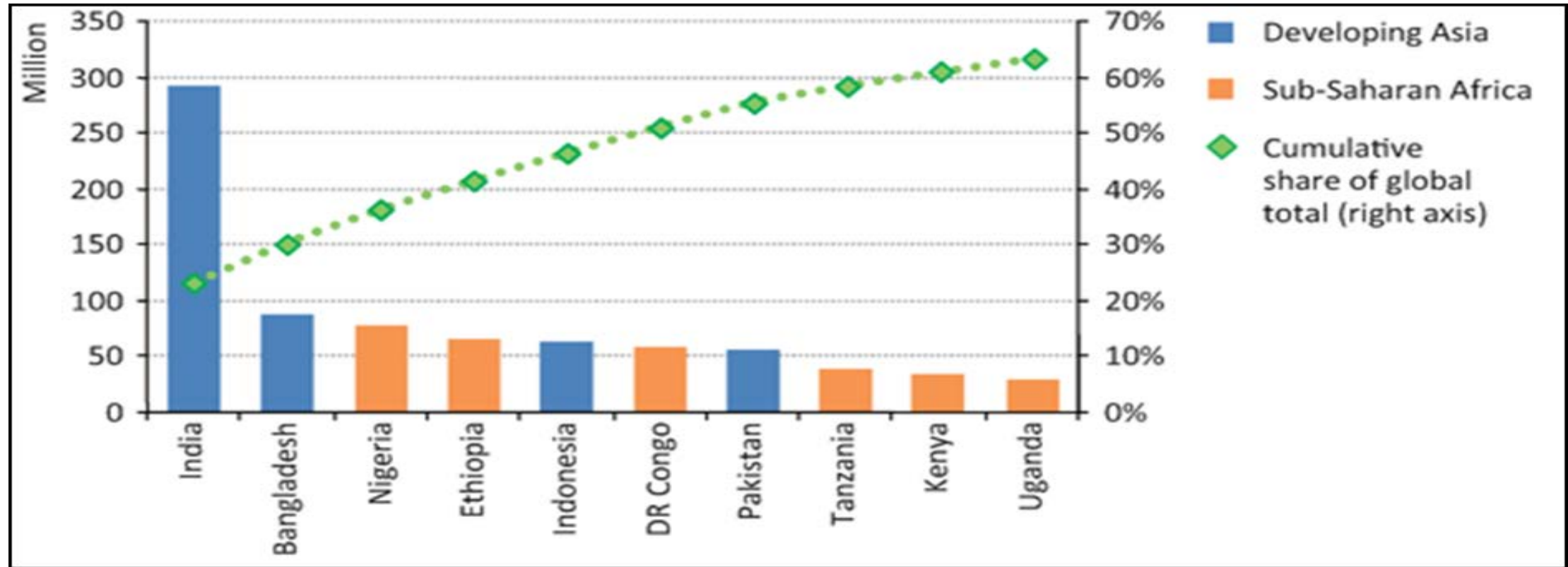
Sameer Nair



The Beauty and Challenge of remote locations: Horses transport Solar Panels and equipment to a village in Ladakh.

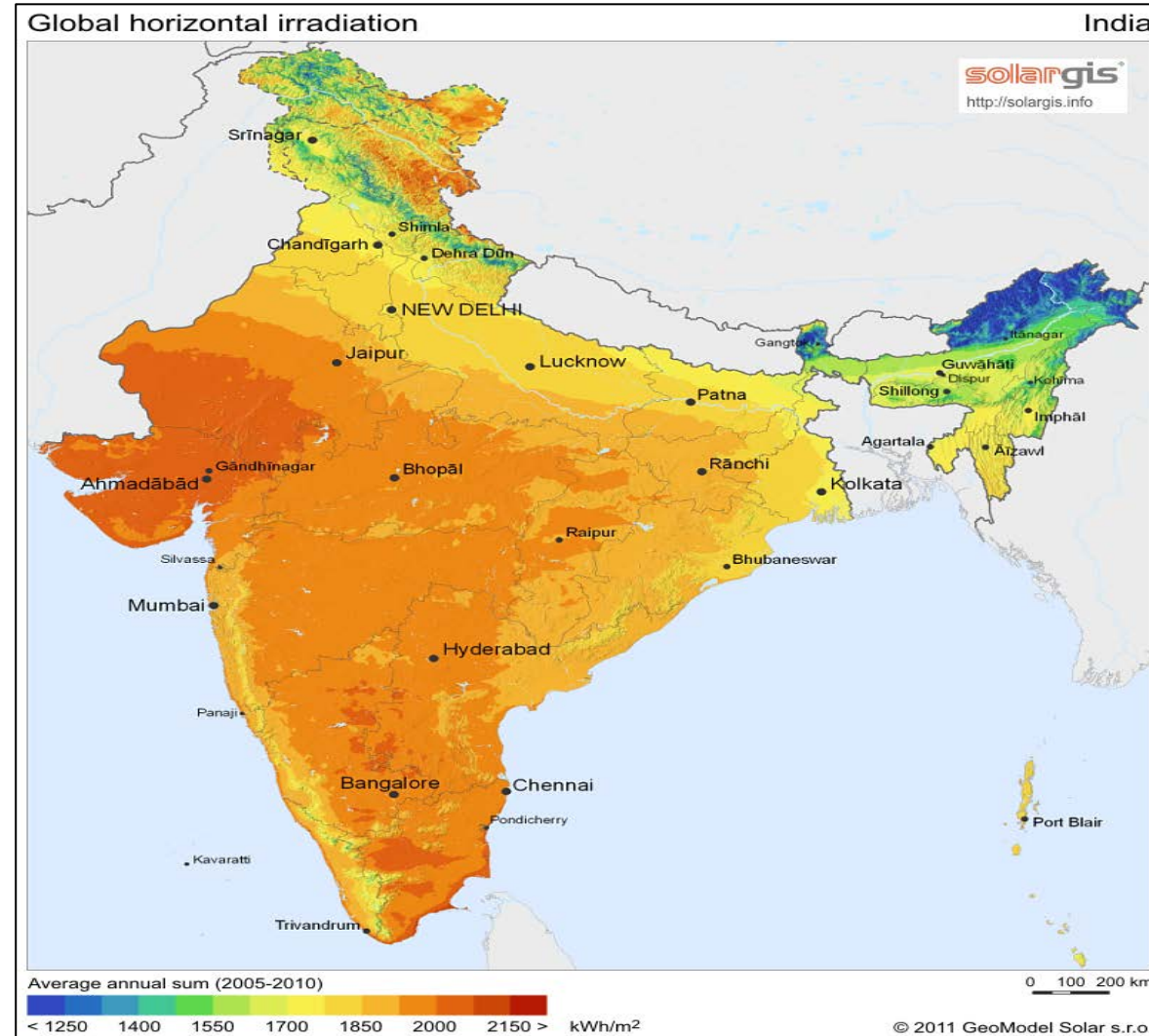


India has the largest population of people without access to electricity: 300 Million

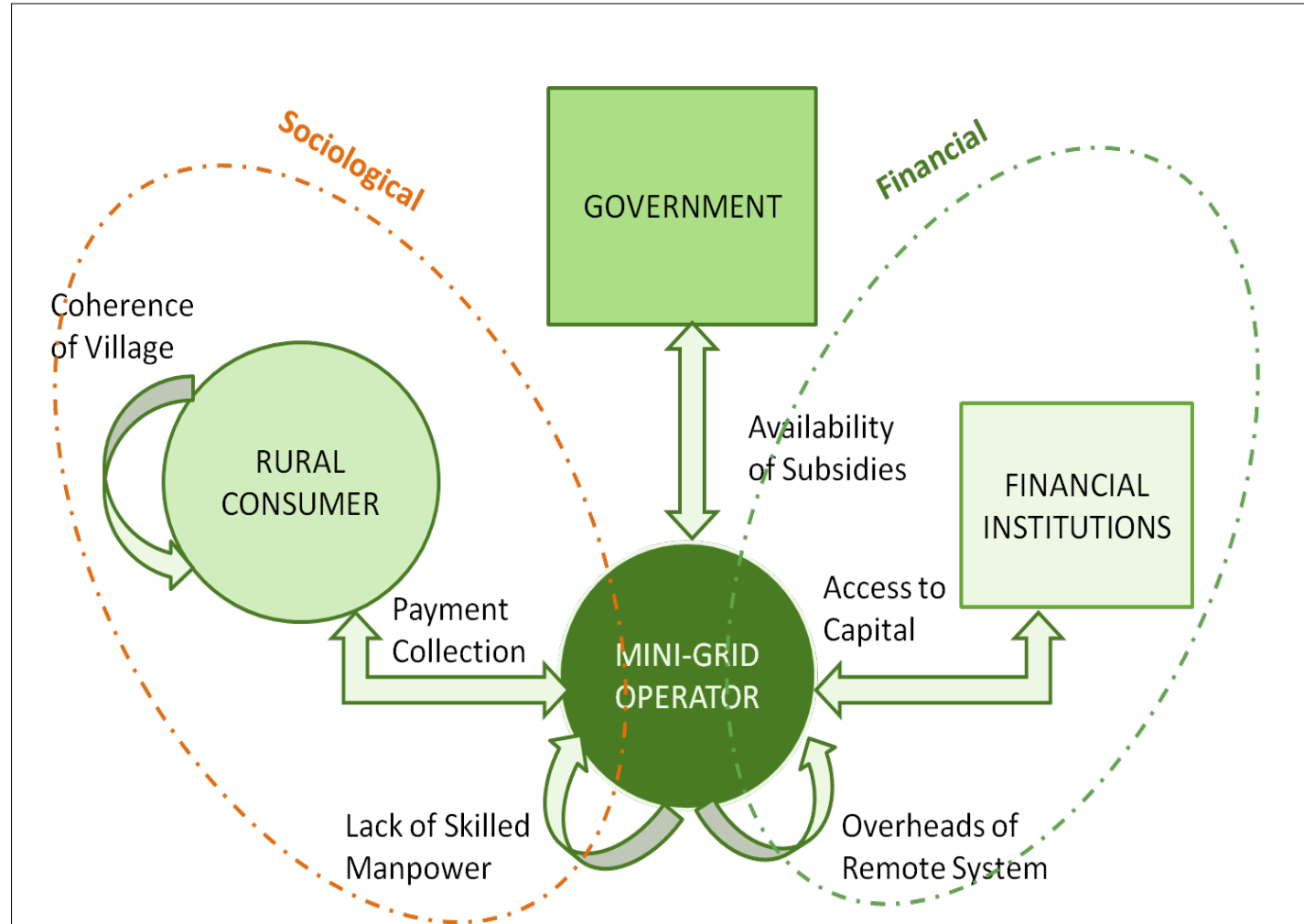


Over 90% of these people are in villages that are *on-paper* “electrified”; about 10 million in remote areas where grid unlikely to reach in next 10 years

Abundant solar resources- Solar Photovoltaic based Mini-grids can help tackle the energy access problem.



Challenges of deploying and scaling Solar PV mini-grids*



* Community level systems, typically of size 1-100 kWp



Biggest challenges are on policy and financial fronts



- Policy still leaves small entrepreneurs out
 - Several schemes, each with its shortcomings:
 - ❖ **Decentralized Distributed Generation (DDG) scheme of Ministry of Power (MoP) has under-delivered and suffers from a variety of issues, including unsustainable tariff design**
 - ❖ **In the past, overlapping of schemes from Ministry of New and Renewable Energy (MNRE) and MoP have created confusion**
- Mini-grids need high upfront investment, but lack business viability for standard debt financing => capital must come from the government

The case of Darewadi- a 9.36 kWp Solar PV mini-grid running for 20 months



Salient learning from Darewadi can be applied to thousands of Villages



1. Setting the stage: Interaction with the Community
2. Designing to meet future aspirations
3. Devising a sustainable tariff
4. Minimizing Battery backup
5. Meeting safety and quality standards: grid-ready installation
6. Closing the loop: complete transfer of ownership



1. Setting the stage: deep interaction with the community

- ❖ Assess the needs and willingness of the TG.
- ❖ Inherent leadership in the community, if any, comes to the forefront.
- ❖ Get the women on-board.
- ❖ Building trust and goodwill is essential.

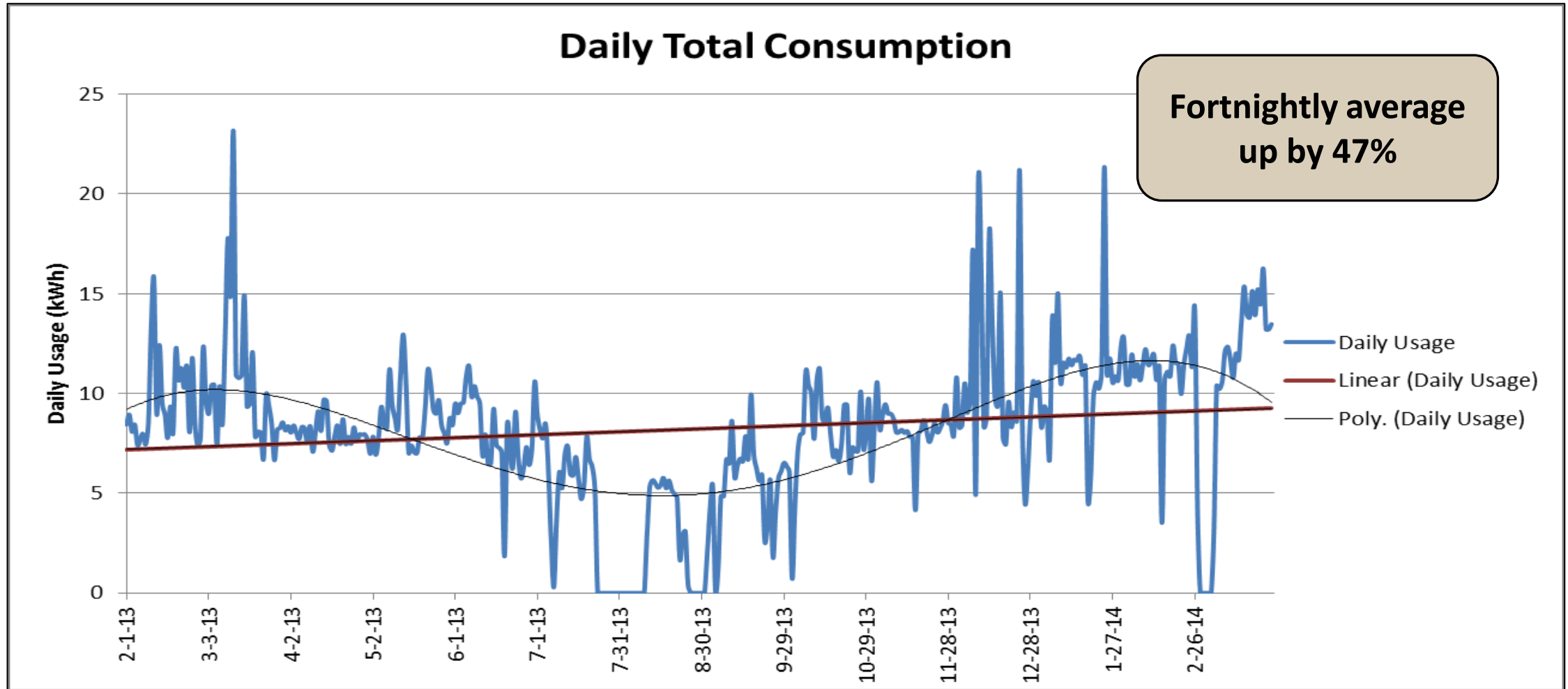
This stage could be the most significant cost apart from hardware.



2. Designing to meet future aspirations

- ❖ Once on-demand power is provided, people discover and add new use for electricity.
- ❖ Utilization of the system steadily increases.
- ❖ Lifestyle changes and livelihood opportunities warrant high loads that must be planned for
 - In Darewadi, a flour mill, two Computers and a Water Pump account for ~16-18 units per day.
 - Water Pumps have transformed the lives of women by eliminating 4-5 hours of work during dry months.
 - Water pumps will enable some farmers to graduate from an annual crop to two crops per year.

Total consumption trending up, steadily

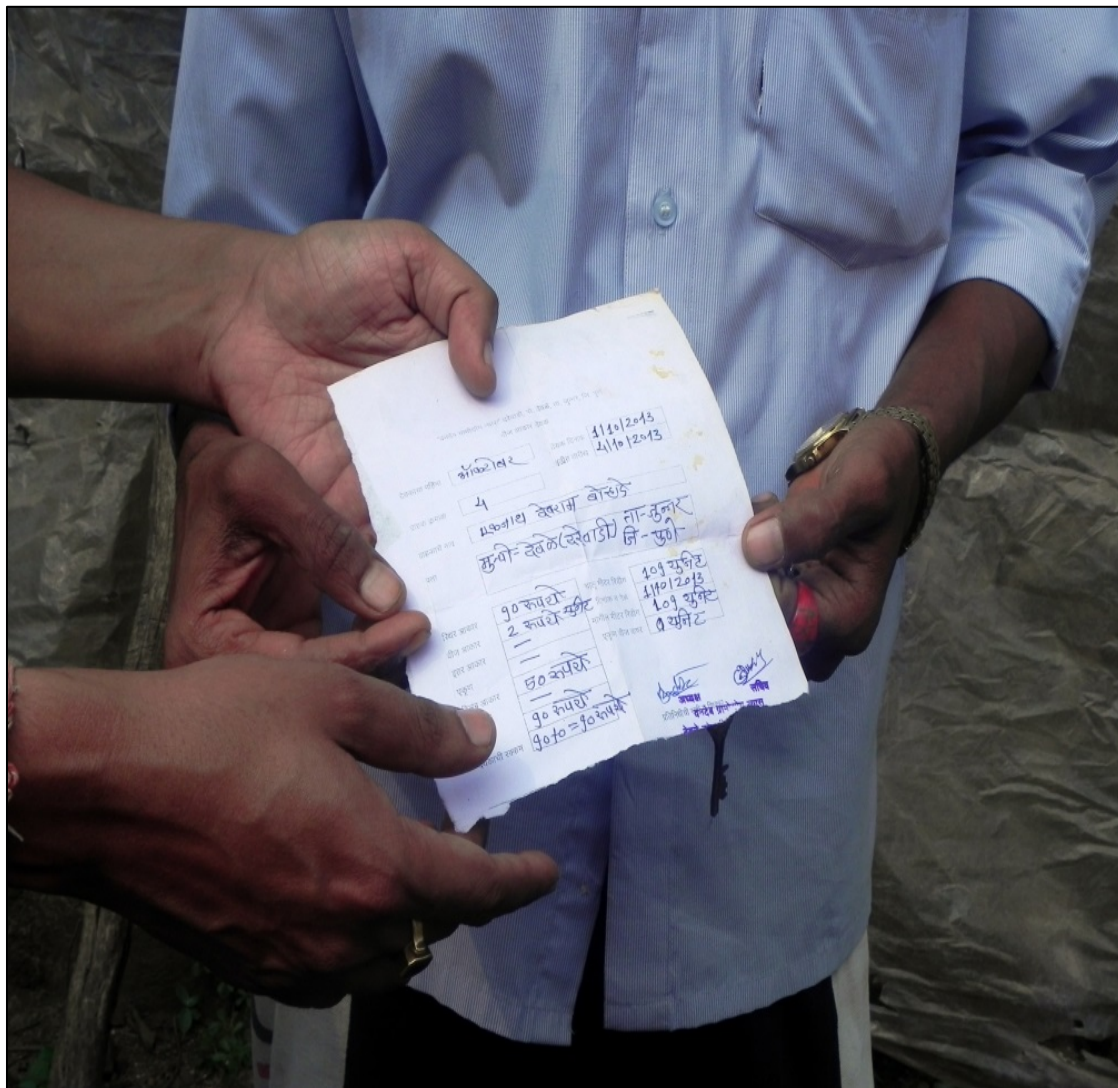




3. Devising a Sustainable Tariff

- Metered consumption based charging is essential for
 - Accountability
 - Discipline
 - Load Management
- Creating a Corpus with billing collections is essential for
 - Battery Replacement
 - Day-to-Day O&M
- DDG tenders prescribe low fixed tariffs irrespective of consumption- failure of CREDA mini-grids





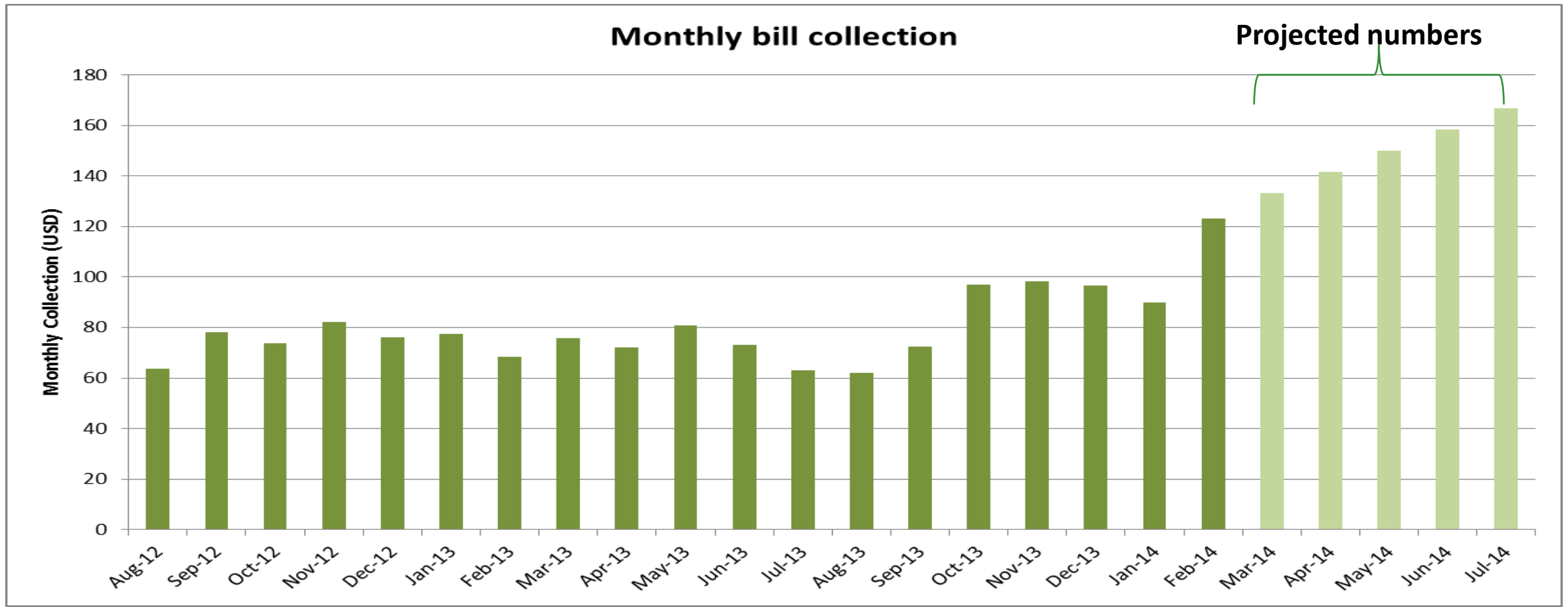
Example of Monthly Electricity Bill (in Darewadi)



Battery Bank (in Darewadi)

100% Collection Rate

Beyond the tipping
point





4. Minimizing battery backup: through feeder-line separation

- ❖ Minimizing battery storage has several advantages
 - Reduced upfront investment
 - Reduced Battery replacement costs
 - Minimizing environmental impact
- ❖ Manual optimization through separate feeder lines for household, commercial and street-lighting loads
 - Enables better management during periods of low generation



Feeder line circuits



Darewadi during Monsoons

5. Meeting Safety & Quality standards: a grid-ready installation



- ❖ The installations should meet safety standards as per utility specifications
 - Higher upfront investment but longer term sustainability
 - Possibility of interconnection with the grid, depending on future policy
 - Ensures safety of people and cattle
 - Helps meet the psychological need of being connected to the world

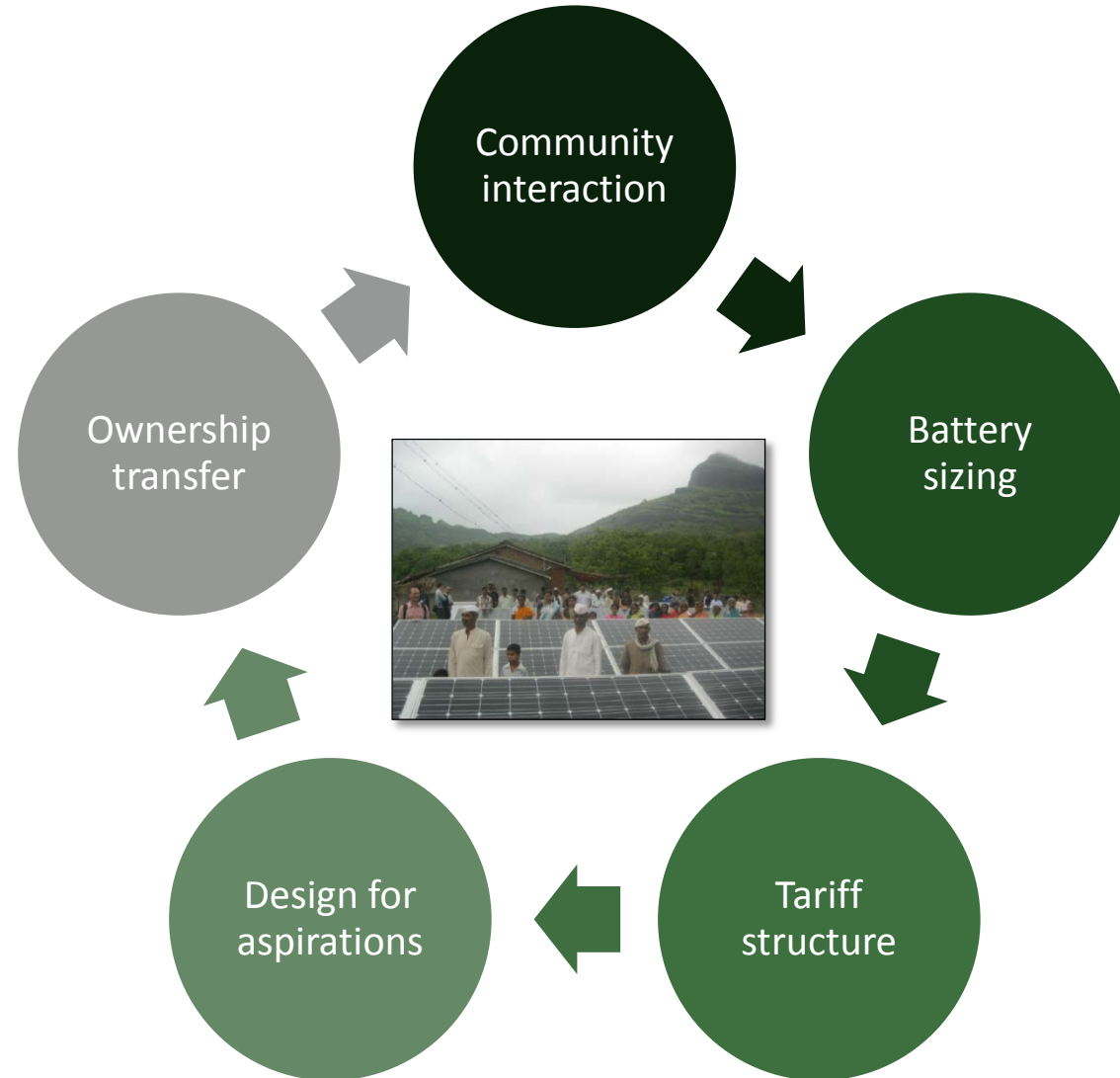




6. Closing the loop: complete transfer of ownership

- ❖ Entrepreneurs cannot stay engaged indefinitely for day-to-day management, resolving disputes etc.
- ❖ A representative Trust or Village Council plays a critical role in the success of the project .
- ❖ People more likely to maintain if they feel like owners.
- ❖ Anecdotal evidence from Darewadi.

Ensuring Sustainability





Mini-grids should be considered as infrastructure rather than as business

- ❖ Mini-grids are essentially infrastructure solutions for remote locations and deprived communities.
- ❖ Payback on several fronts— development, ecology, internal security, agriculture and migration to urban centres.

Darewadi shows a solar PV mini-grid can be self-sufficient once installed

A Village that is transforming from darkness to development





Darewadi: 9.36 kWp

Viral: 5 kWp →

**A new picture of
development of
rural areas is
emerging**

**Thousands of such
mini-grids can bring
about an
*Energy Revolution***





Thank You!

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