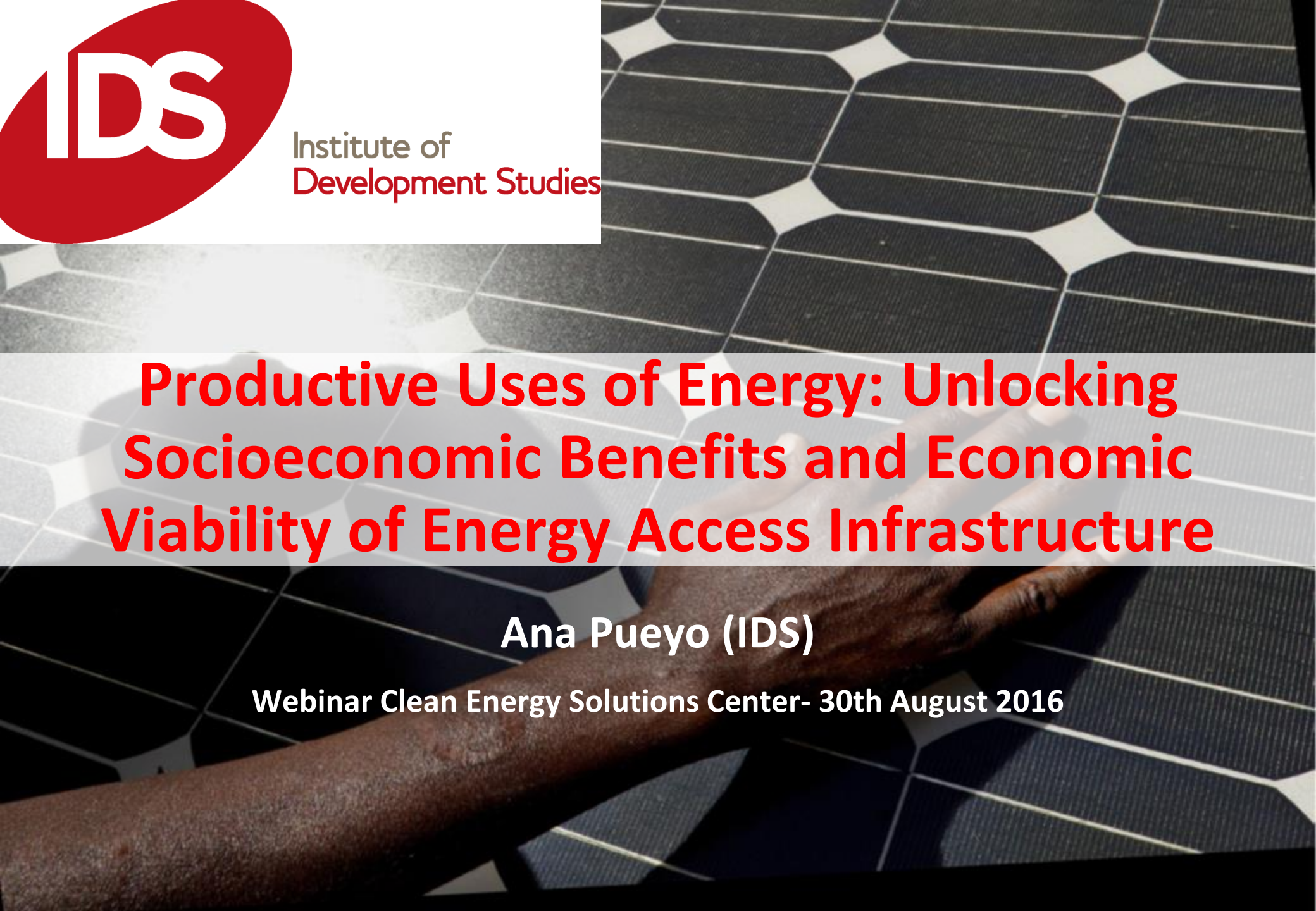


Institute of Development Studies

Productive Uses of Energy: Unlocking Socioeconomic Benefits and Economic Viability of Energy Access Infrastructure

Ana Pueyo (IDS)

Webinar Clean Energy Solutions Center- 30th August 2016

Renewed interest in financing access to electricity

Dec 08, 2015 at 8:59am

Africa receives 10 billion dollar boost to help build renewable energy sources

PUBLISHED 08:01 DECEMBER 8, 2015 UPDATED 08:01 DECEMBER 8, 2015

The UN and partners launched the $5 billion Africa Renewable Energy Initiative aiming to expand renewable capacity by 2020

By NEOnline/GK

7 AFFORDABLE AND CLEAN ENERGY

Learning from the past

Electricity as “a magical force that would transform poor areas into highly productive regions” (Barnes, 2014)

Rural electrification uneconomical and unproductive, contributing little to poverty reduction and creating a massive debt burden

Quest for Universal Access to Sustainable Energy: energy is necessary but not sufficient to achieve development goals

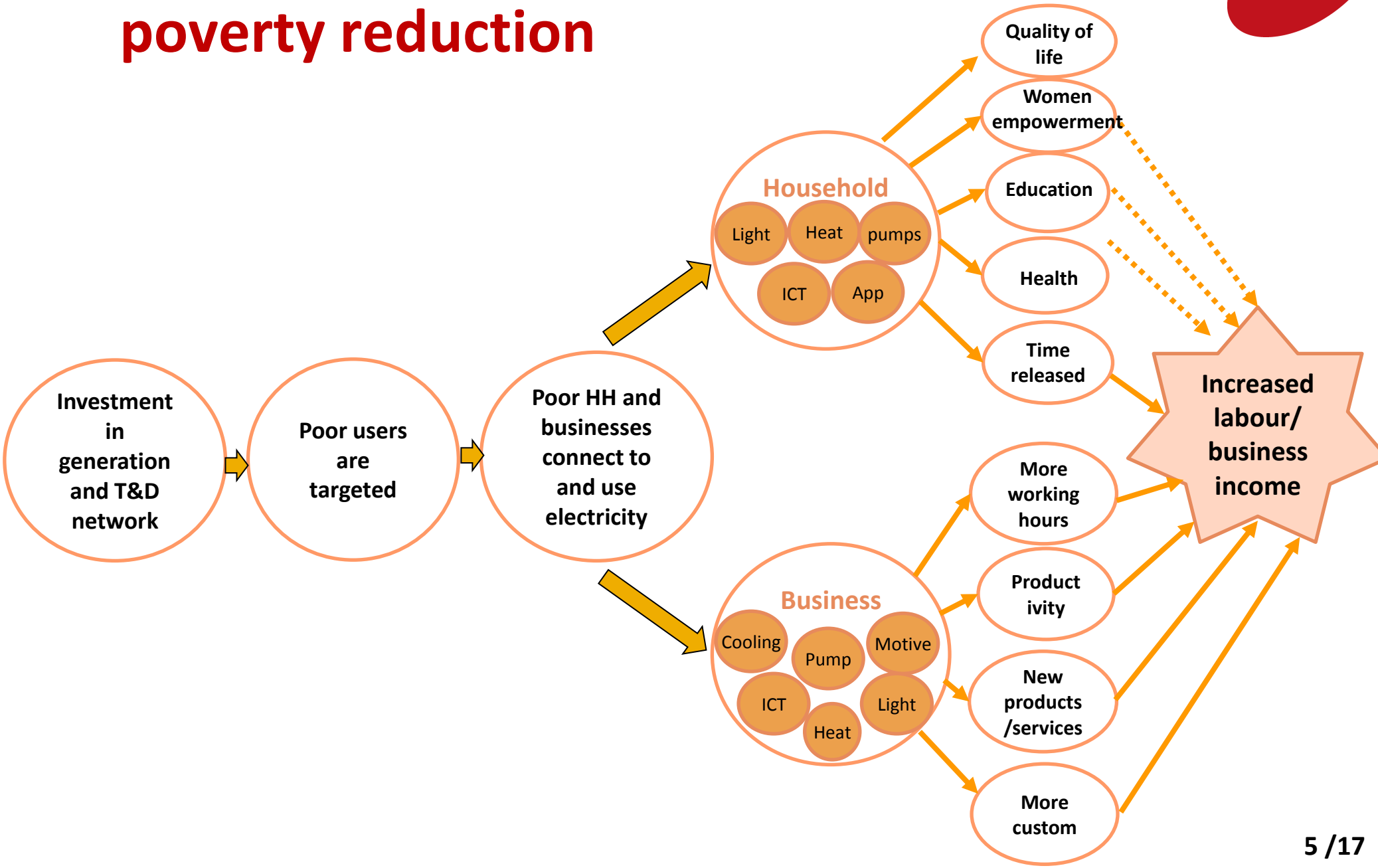
What went wrong?

- Grid extension projects too costly for the weak rural demand
- Load concentrated in a few hours of the evening for lighting
- Subsidised tariffs damaged the financial viability of the utility and targeted the wealthy
- Lack of productive uses that increase and spread the load
- Financial strain of the utility- poor quality of supply
- Hard energy paths, emphasis on infrastructure investment: bring the grid and someone will use it

What is different now?

- Technological breakthroughs
  - Dramatic reduction of RE costs
  - ICTs:
    - Demand for mobile charging
    - Enable remote control of off-grid facilities
    - Enable cashless business models
- Donor and government readiness for soft energy paths: match energy use to energy source
  - Scaleable models
  - Anchor load
  - Low cost basic services
  - Integrated grid and off-grid planning

Causal links from electricity to income poverty reduction



Poor users are targeted

What is the evidence?

Selection criteria for grid extension and private off-grid initiatives

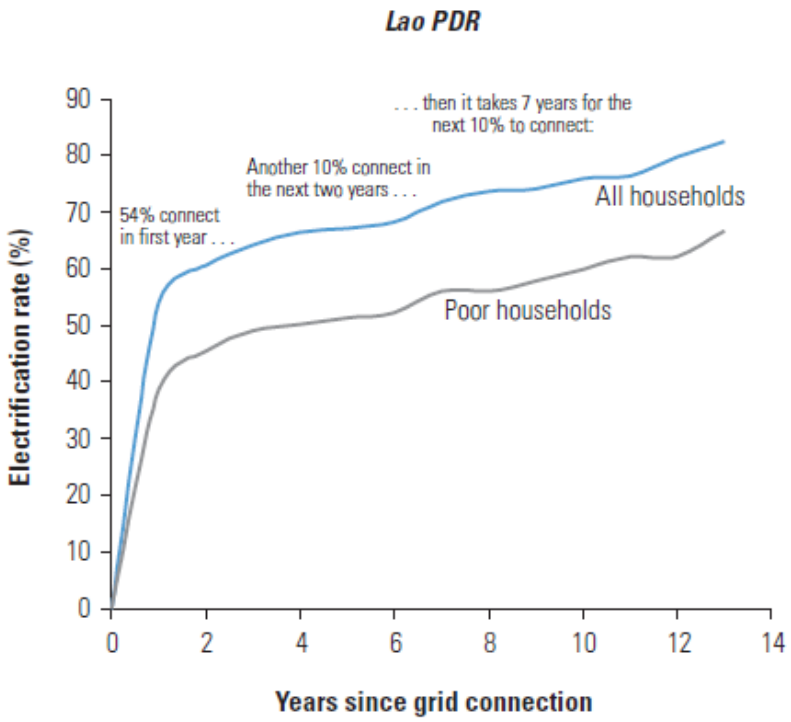
- Cost-recovery is key
- Proximity to the grid (grid extension) or poor people in grid connected areas (grid intensification). For offgrid, distance communities score higher
- Logistics: terrain, road access, mobile network, distance to nearest town, business clustered
- Demand: high density, high average income, total population, existing anchor load (schools, health centers, institutions, businesses, mobile transmitters, grain mills)
- Productive potential (agriculture, cottage industries, tourism, market town…)
- Ability to pay: cost of current energy services as compared to cost of electricity alternative

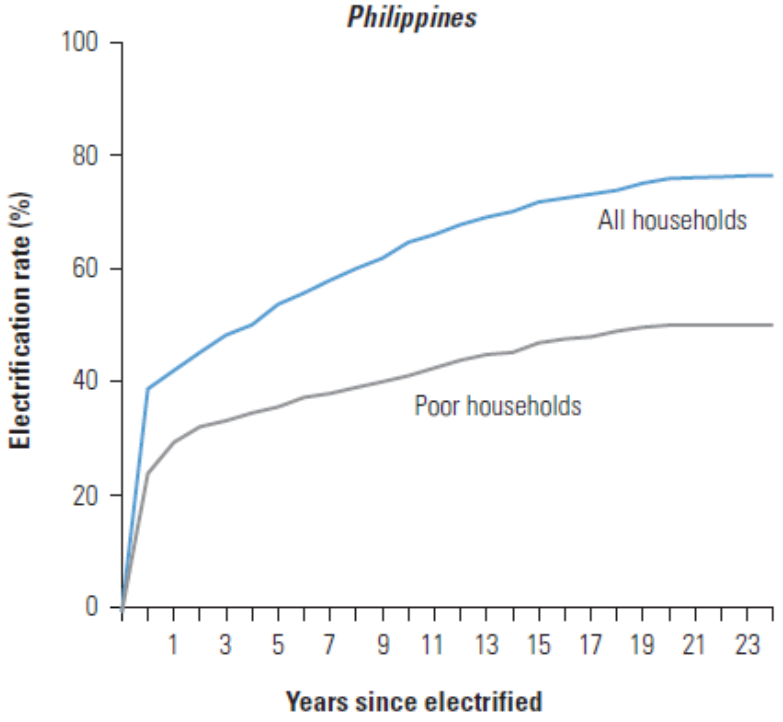
Without policy intervention (subsidising the service or increasing demand for it), the poor are unlikely to be targeted

Poor HH and BIS connect to and use electricity

What is the evidence?

- Connection rates remain low even years after provision (WB, 2008)
- Final use may remain disappointingly low, as lighting and mobile charging remain the main uses of electricity
- This makes cost recovery extremely difficult





Poor HH and BIS connect to and use electricity

What is the evidence?

- Key barriers to increased connection and use:
  - Affordability of upfront costs: connection and appliances. i.e. connection fees in Kenya represents three times the monthly budget at the poverty line
  - Affordability of cost-recovery tariffs. i.e. the potential market for electrification via private mini-grids in Kenya is approximately 5%-10% in off-grid, rural areas.
  - Low quality and affordability of supply- particularly important for productive uses. Linked to financial weakness of the supplier or lack of maintenance skills
  - Lack of productive uses: lack of markets, skills, finance, supporting infrastructure

The affordability gap that needs to be covered with: progressive subsidies, new business models, lower cost of finance for developers

Household and business impacts

What is the evidence?

- Strong evidence for direct short-term non-income benefits for HH: education; time release for leisure, care or paid work.
- Weak evidence for income related impacts: whether or not time released is use for paid work depends on employment opportunities. When employment increases it is usually casual and self-employment.
- Weak evidence of impact of electricity in business income and profits. Main reasons: low usage beyond lighting, low quality of supply, lack of sufficient production scale that makes investments in electricity worthwhile, limited market, crowding out effects.

On its own, electricity cannot increase the income of communities and reduce poverty. Employment opportunities and access to markets need to be promoted through integrated development programs

Methodological challenges

- Key is to **avoid selection bias**: communities with higher income generation potential are the ones getting electricity and hence more likely to do well than those not getting electricity
- How to find a valid **counterfactual**?
  - Experimental methods: Randomise across eligible communities; phased-in randomisation
  - Quasi-experimental methods:
    - Difference-in-differences or fixed effects- compares changes over time between a treated and non-treated community
    - Instrumental variables, accounting for non-random assignment of access to electricity
    - PSM- treated and non-treated users are matched based on their similarity with regards to those attributes that make users likely to be connected

ESCoBox: Providing smart micro-grids for the developing world

Does this really happen?

Under what circumstances?

Intervention

- Solar micro-grids of up to 5kW
- Private-led, priced for cost-recovery
- Smart system: cashless payments and remote control of performance
- Small connection fee but consumption tariffs three times as high as grid
- Tariffs- Designed to recover costs and matching ability to pay

Outcome variables

- Opening hours
- Employees
- Profits
- Costs
- Revenues
- Assets
- Number of enterprises

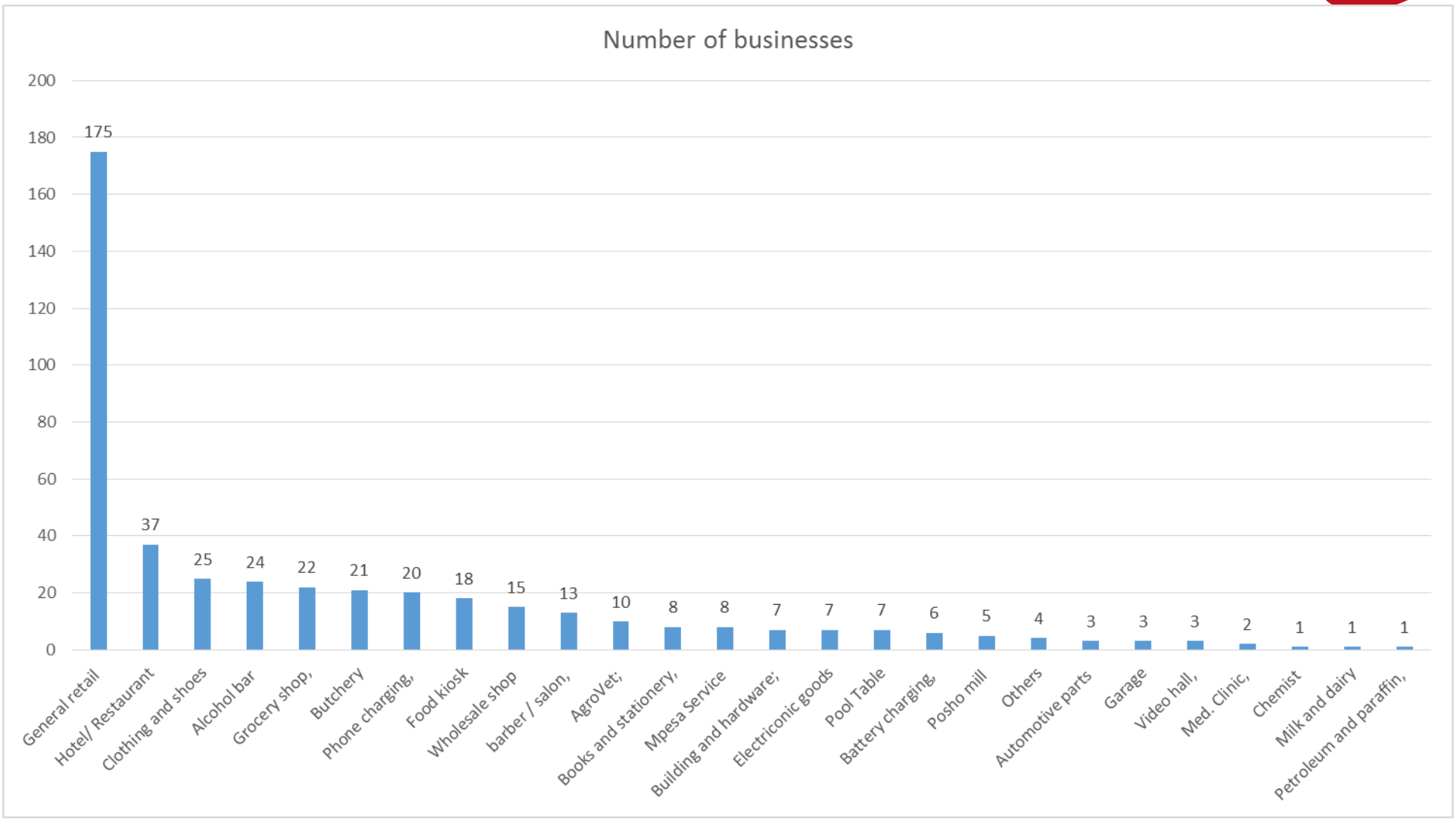
Method

- Baseline Sept 2014-July 2015: 346 businesses surveyed
- Endline July 2016 -388 businesses surveyed
- Difference-in-differences to compare before and after outcomes for businesses with and without minigrids
- Matching to improve robustness of results: businesses connected to minigrids matched with those in control communities that have a similar probability to be connected
- Risks:
  - Pre-existing electricity sources: widespread SHS
  - Small sample size: not enough businesses for some business types

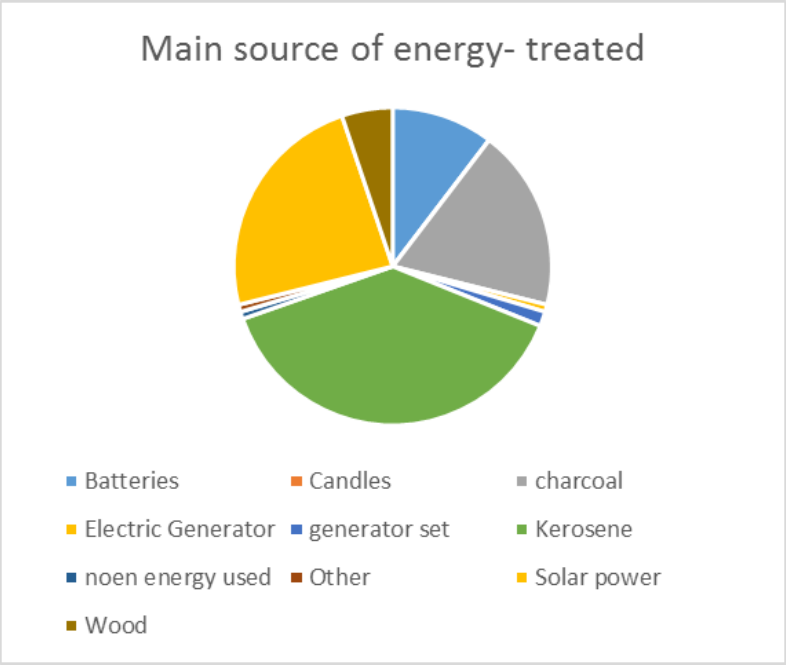
Surveyed communities

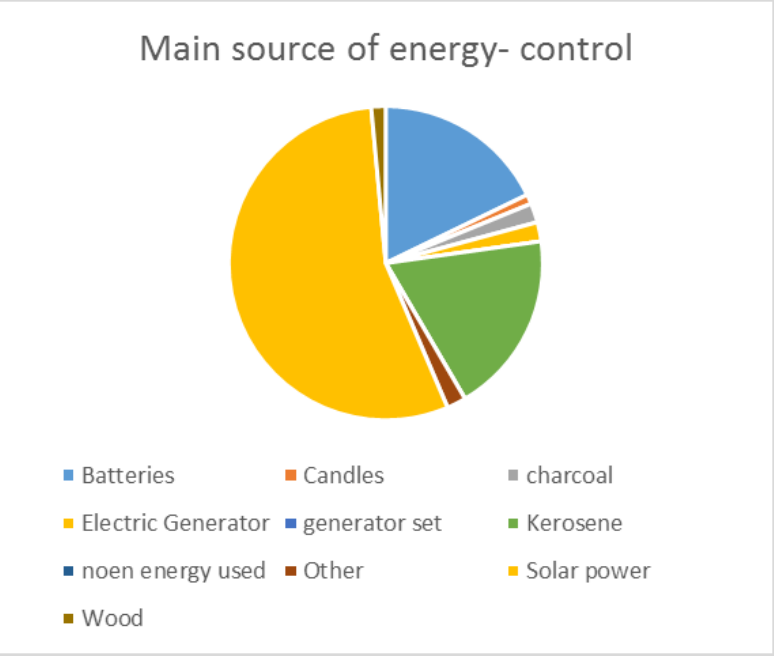
- 6 treated (with minigrids) and 6 control (without) communities
- Project developer ranked potential sites according to a logistics score, demography score, economics score, impact score and community score.
- Shortlist of 25 potential communities Investor selected 9 sites at its discretion, not the top ranked.
- We used the remaining 14 shortlisted communities as potential controls. We used covariates to compare the 14 communities to the 9 treated communities

Types of businesses

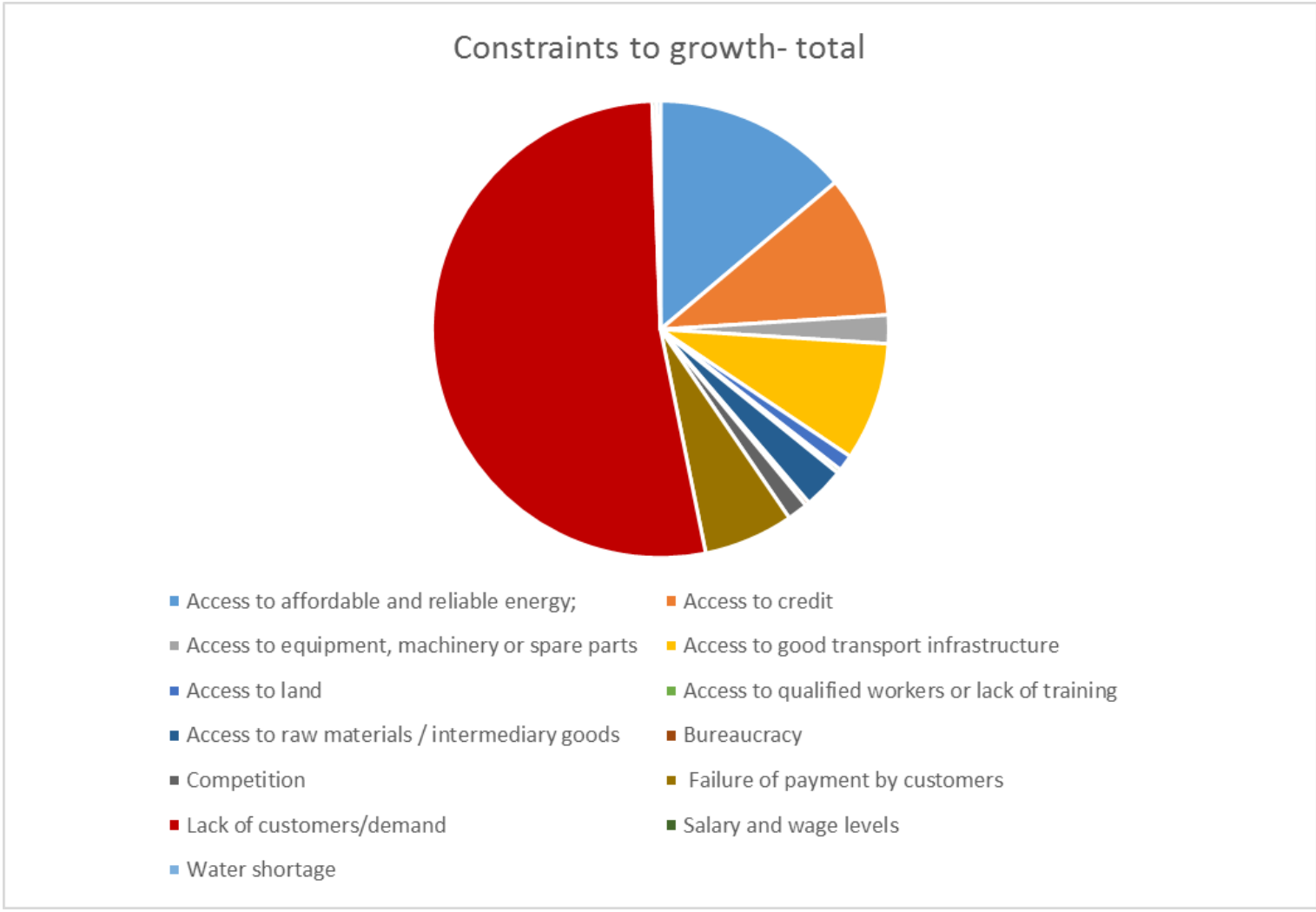


Baseline sources of energy





Constraints to growth



Preliminary feedback

- Cost of minigrids is too high for businesses
- But supply is reliable and enables many uses
- Higher impact could be achieved if electricity supports the livestock sector
- Stocking perishables could reduce transport costs
- Energy for community services

Next steps

- Analysis of endline data
- Analysis of difference in differences in outcome variables
- Impact assessmet

Resources

- Pro-poor access to green electricity in Kenya http://www.ids.ac.uk/publication/pro-poor-access-to-green-electricity-in-kenya
- Maximisation of benefits for the poor of investments in renewable electricity http://www.ids.ac.uk/publication/maximisation-of-benefits-for-the-poor-of-investments-in-renewable-electricity-a-policy-tool-for-project-planning
- The Evidence of Benefits for Poor People of Increased Renewable Electricity Capacity: Literature Review http://www.ids.ac.uk/publication/the-evidence-of-benefits-for-poor-people-of-increased-renewable-electricity-capacity-literature-review
- ESCOBOX http://www.dmu.ac.uk/research/research-faculties-and-institutes/institute-of-energy-and-sustainable-development/research-projects/escobox.aspx and http://www.ids.ac.uk/project/esco-box-smart-monitoring-billing-and-control-for-pro-poor-access-to-energy-services

Thank you

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