Utilising Electricity Access for Poverty Escape

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Agenda

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- Research Questions
- Underlying concepts:
  - *causal chains*
  - *levels of electricity access*
- Study Components
- Literature review
- Case Studies
- Key Messages

Research Questions

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What level of electricity access is required to enable and sustain poverty escape?

What constraints, despite increased access to electricity, mean that people are not able to use that electricity productively?

How can they be removed?

Causal Chains

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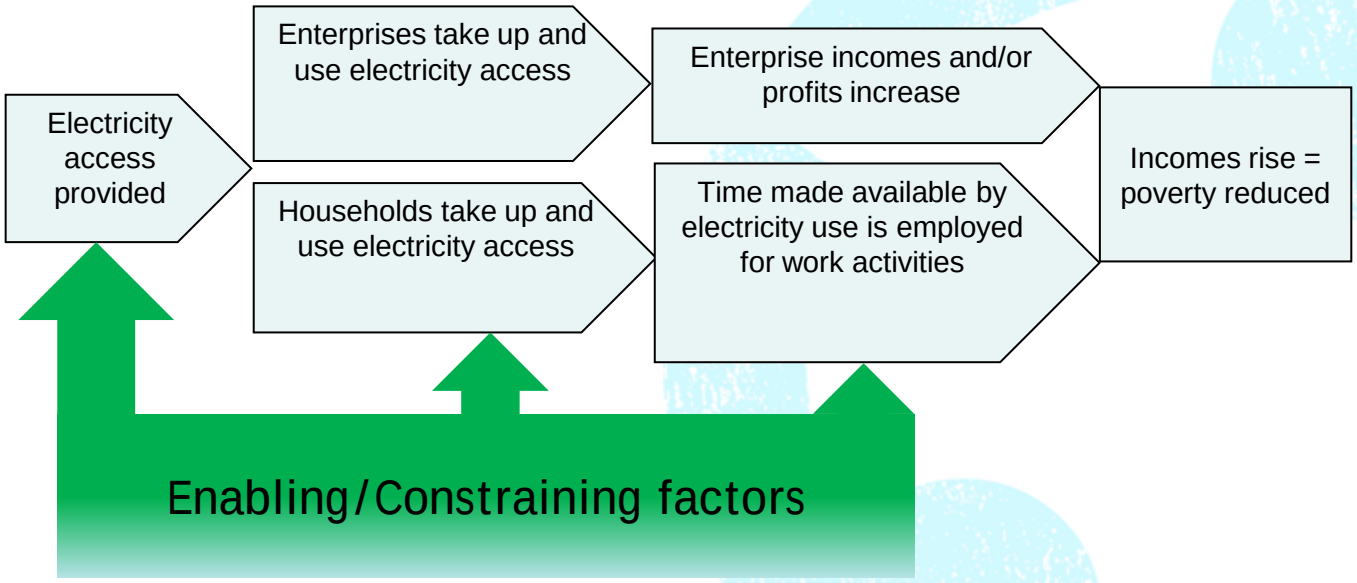
Electricity
- Access/No Access
- Level of Access

Enterprise Impacts

Poverty Impacts

Causal chains:



Electricity access levels:

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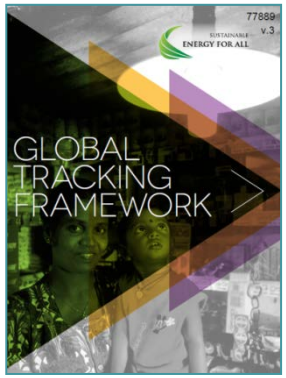
SE4ALL initiative Global Tracking Framework
Multi-tier Assessment of Energy Access
(being developed by WB/ESMAP)



Tier 0	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5

No electricity

Adequacy of all attributes:
capacity, duration, reliability,
quality, affordability,
convenience, safety and legality

Household electricity access assessed as a single tier

Productive use access assessed across six applications:

- Lighting
- ICT/Entertainment
- Motive Power
- Space Heating
- Water Heating
- Product Heating

Study components

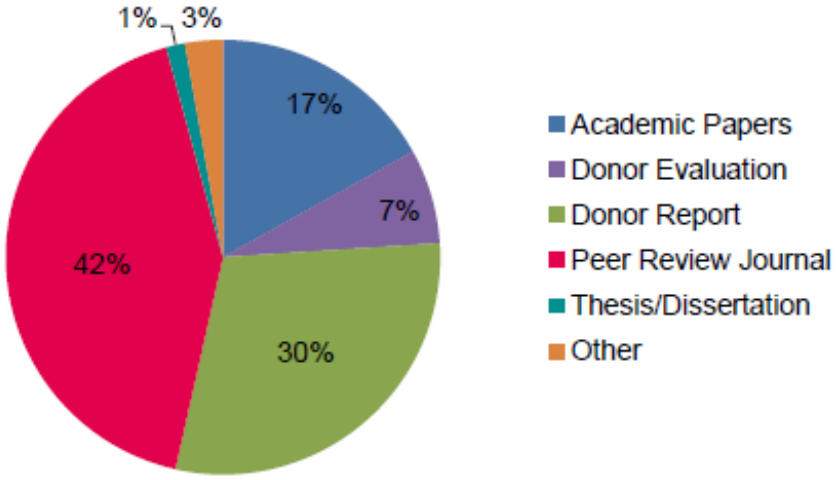
- Literature review

- Case Studies - Kenya India
  - Policy and regulation reviews
  - Stakeholder consultations
  - Field research: surveys and focus group discussions

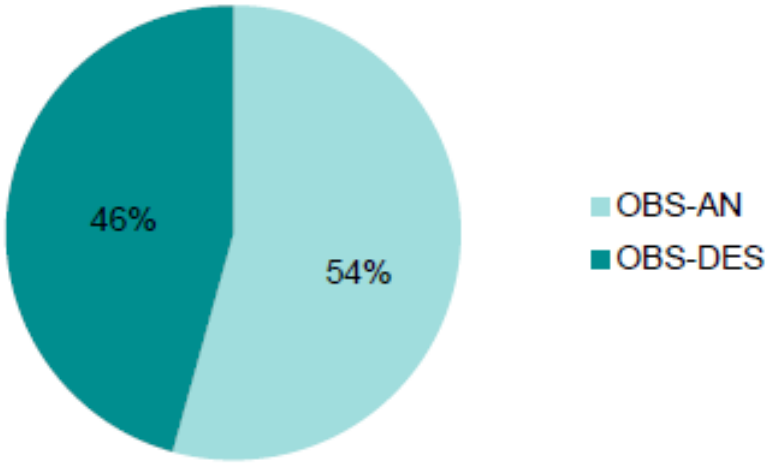
Literature Review

- Systematic search of literature on income related poverty impacts of electricity- **73 studies** reviewed
- Only **primary and empirical** studies. Observational studies, as no experimental studies available. Both analytical and descriptive studies
- **High quality** studies given more weight – 27% of studies are considered high quality
- Quality assessment according to DfID principles. Distinguish correlation and causation, avoid selection bias.

Studies per type of publication



Studies per research design



Literature review- Research methodologies

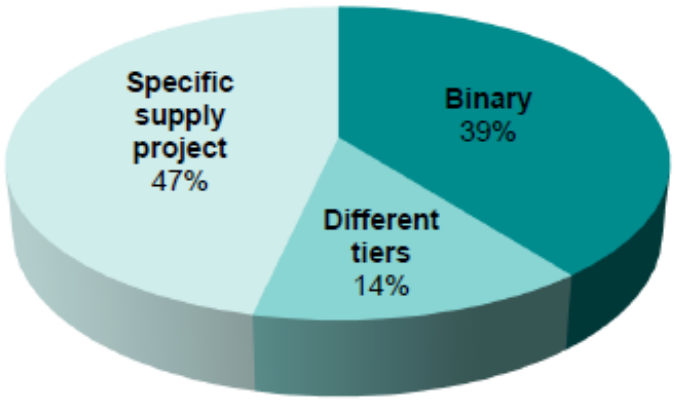
- Key failing of existing literature is **selection bias-** communities or enterprises with higher income generation potential can afford higher levels of electricity access and hence deliver better income generation outcomes, even though this could not be attributed to electricity
- Recommendations: Use of **appropriate controls** (similar starting conditions), good matching techniques, use of panel data or instrumental variables, use of before and after surveys instead of cross-sectional analysis.
- **Challenges:**
  - Very difficult to find two "similar" communities with one obtaining electricity and another not during a long enough period of time for impacts to happen in the treated community.
  - Very difficult to attribute income related impacts to electricity. Need to look at the joint impact of integrated development programs including also market creation, access to finance and skills.

Literature Review- Different levels of access

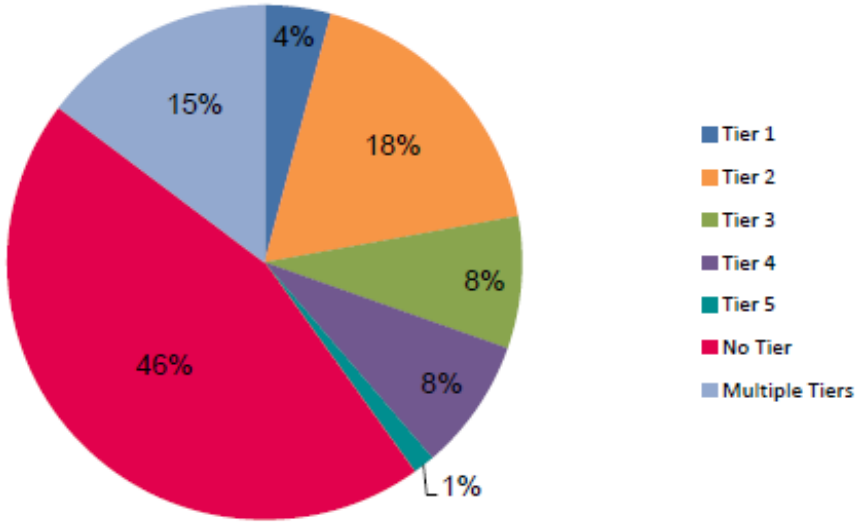
Literature classified according to how it considers different levels of access:

- **Binary**- Electricity considered as a binary variable: yes or no access. Analysis based on large surveys or multiple case studies that mix population with different levels of access
- **Project or community specific**. Electricity access is considered binary, but all the characteristics of supply are homogeneous for all the target population. The tier of access can sometimes be inferred from information in the paper
- **Different tiers**. Acknowledges that different levels of access can achieve different poverty impacts and describe or quantify these.

Studies per treatment of tier of access



Tiers identified from papers reviewed



Literature Review- Results

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- A consistent relationship between different levels of access to electricity and poverty reduction (income terms) not proved by this literature review
- Lighting is still the main use of electricity
- For papers looking at impacts in specific communities, we could not link higher poverty impacts to better quality of supply
- Some reported impacts of access to electricity (binary) are:
  - Shift in **time use and increased employment, for women** in particular. But some papers contest this showing no impact on work opportunities for women and a use of time saved in leisure and social activities
  - Low **quality of employment** for women: informal, precarious and with limited potential to generate income for the community as a whole
  - **Wages** decrease for women and increase for men
  - Inconclusive results of impact of electricity on **household income, business' income and enterprise creation**. Papers tend to agree that, by itself, electricity achieves minimal or no impact.

Literature Review- Highlights of the literature that acknowledges the impact of different tiers of access

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- **Rural incomes**
  - Effect of quality much higher than the effect of a simple connection- A grid connection increases non-agricultural incomes of rural households by 9%. A grid connection and a higher quality of electricity (fewer outages and more hours per day) increases non agricultural incomes by 29% (Chakravorty et al, 2014)
  - Increasing average availability at the village level by one hour increases the rate of household adoption by 2.7% and electricity consumption by 14.4% (Khandker et al, 2012)
  - HH in villages which never suffer blackouts have more NFE and the share of rural income from NFE is 27% higher than in villages with blackouts (Gibson and Olivia, 2008)
  - Gains happen predominantly up to 16 hours of available supply per day and are smaller for higher availability (Rao, 2013)

Literature Review- Highlights of the literature that acknowledges the impact of different tiers of access

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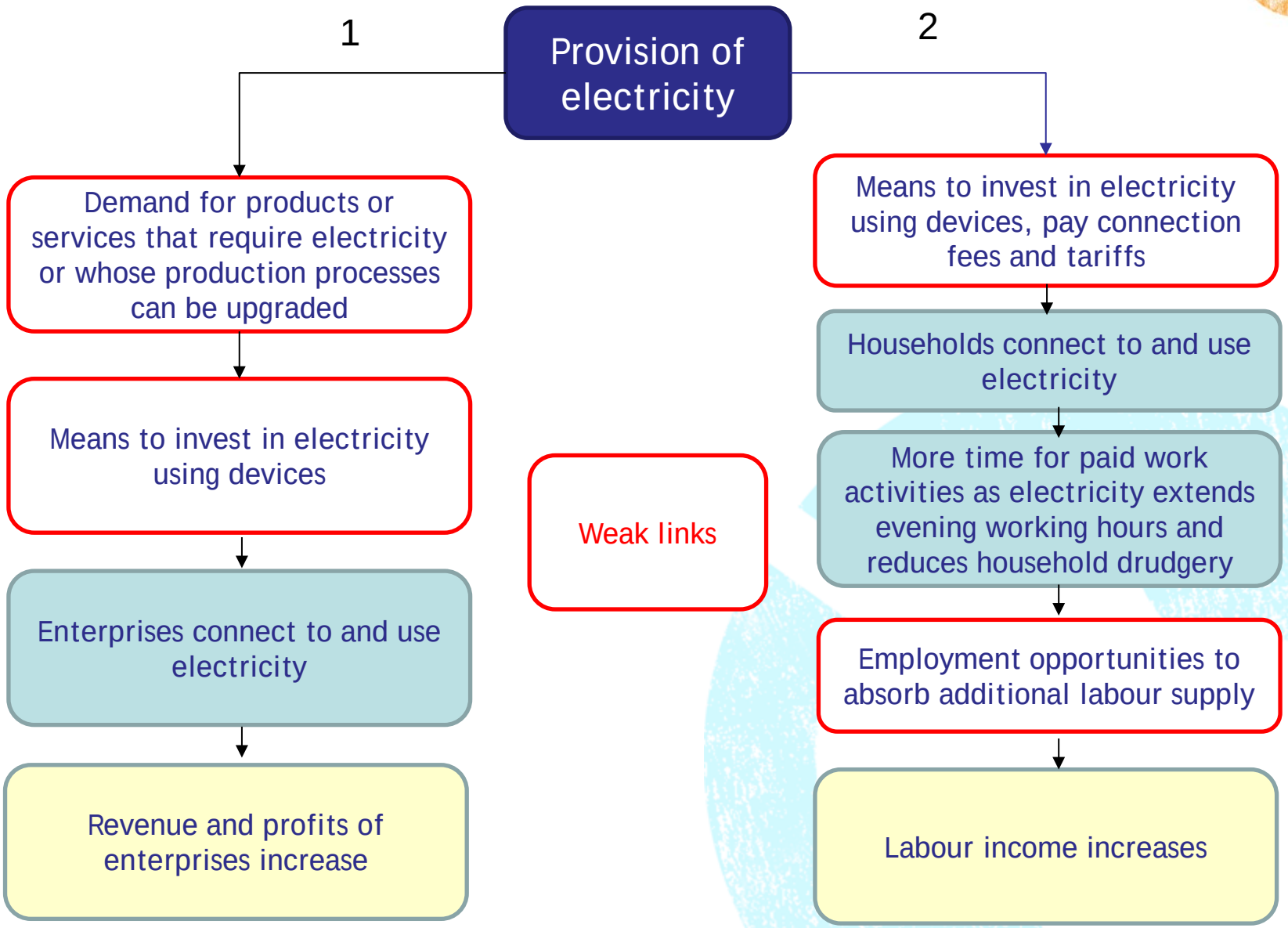
- **Productivity.**
  - Electricity shortages affect productivity much less than revenue because most of the inputs can be flexibly adjusted during power shortages. A 1% increase in power shortages decreases revenues by 0.7% but marginally affects productivity. Effects are different for plants with and without generators. Revenues decrease more for firms without generators and costs increase more for firms with generators (Alcott et al, 2014).
  - Unscheduled outages lead to production losses- 3-7% of total sales in African countries (Eifert et al, 2008) and electricity supply interruptions considered as the major constraint to growth of business by most high growth industries in Africa
  - Electricity access supplemented with the possession of a generator increases the average enterprises growth by 2% (Goedhuys and Sleuwaegen, 2010)

Literature Review- Causal chains



Case Studies - Methodology

- Policies and Regulations reviewed against RISE framework
- Interviews with Energy Access provision stakeholders
- Four Recently Implemented Energy Access Programmes in each Country identified:
  - Grid Extension
  - Minigrid
  - Solar Lantern
  - Solar Irrigation
- Beneficiary and Non-beneficiary community chosen for each programme (16 in total)
- 560 HH and enterprises in chosen communities interviewed for quantitative research and community focus group discussions held

Case Studies - Methodology

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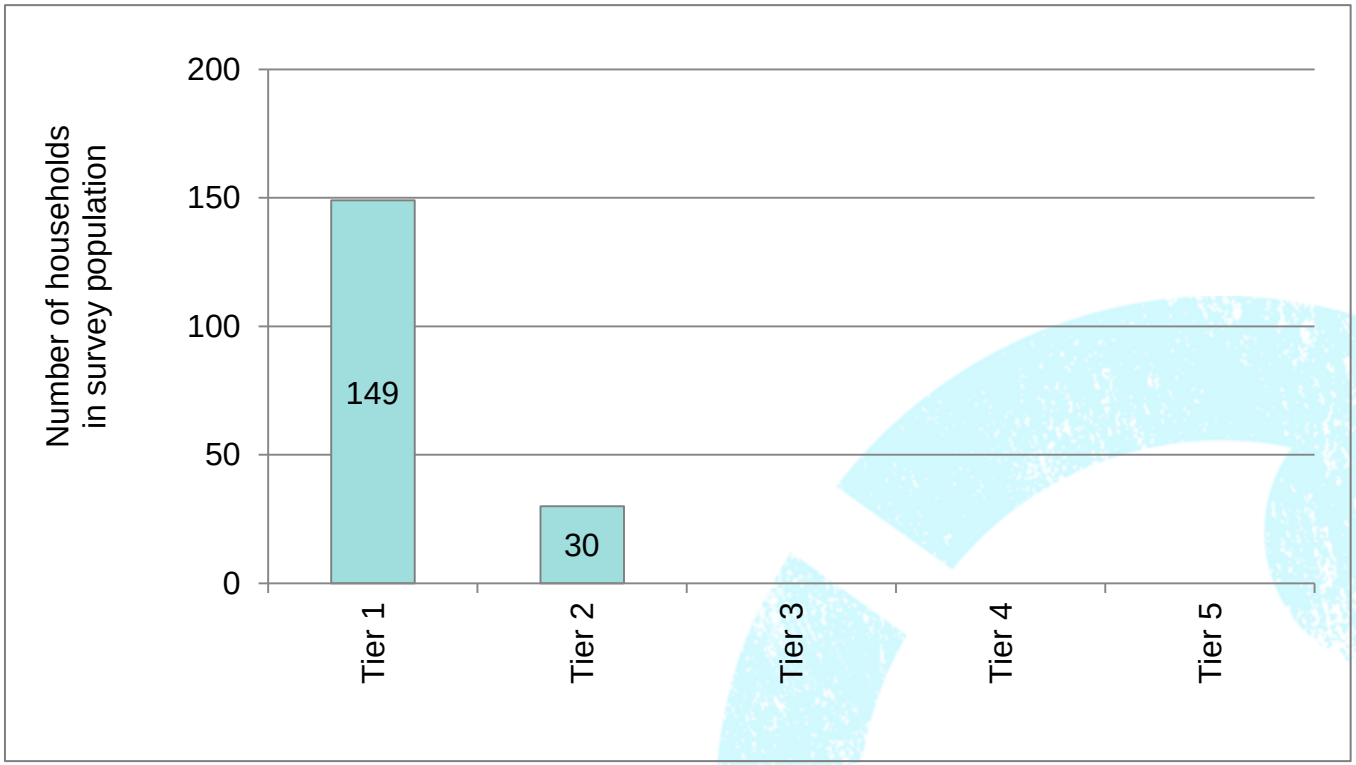
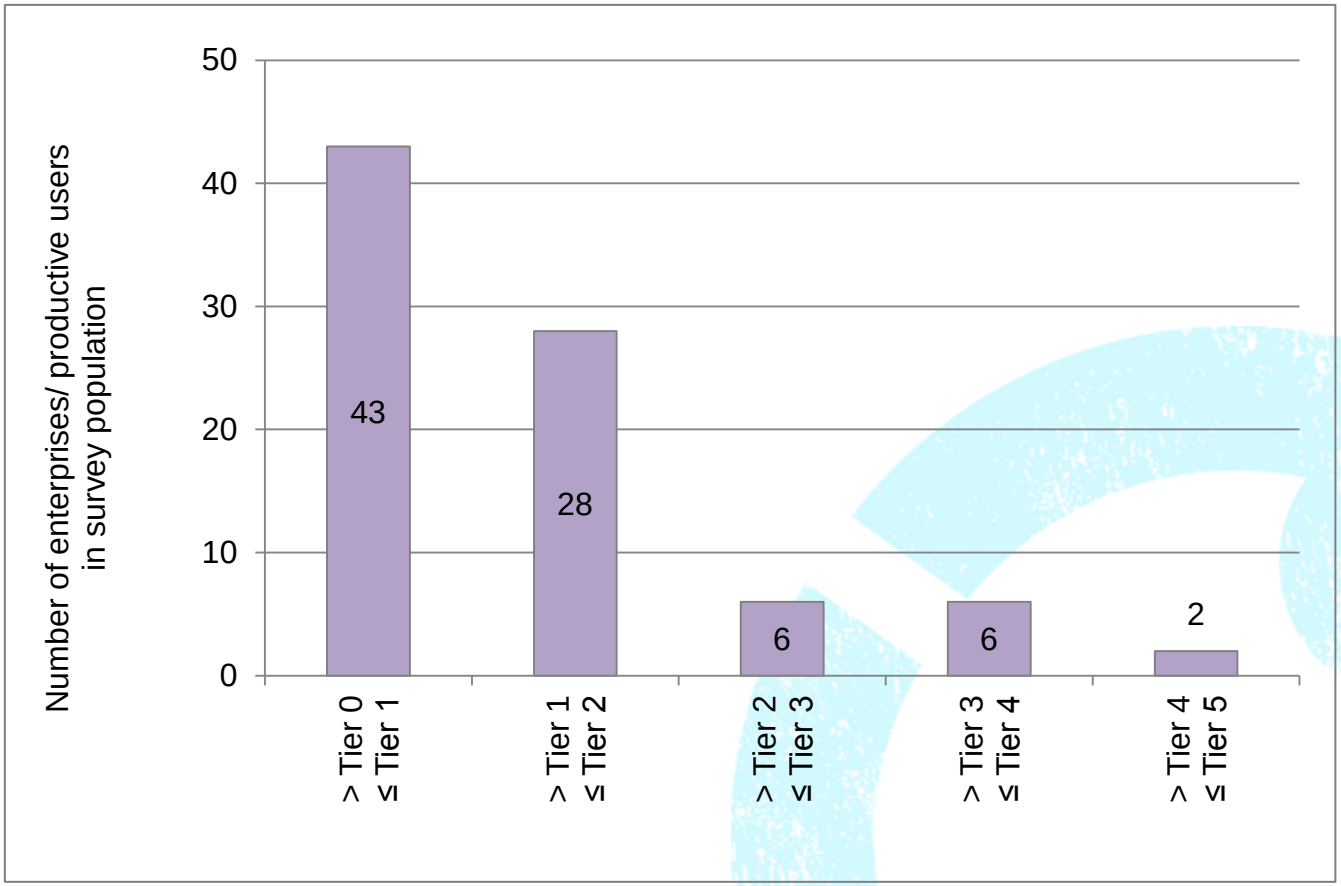
- Data from surveys analysed to identify electricity access-impact relationships:
  - Comparison of mean value between two subgroups;
  - *e.g. mean household income for beneficiaries in Community A compared to the mean household income for beneficiaries in Community B*
  - Comparison of the proportions of two subgroups that meet a certain criterion;
  - *e.g. proportion of beneficiary enterprises compared to proportion of non-beneficiary enterprises that were created after the electricity access programme*
  - Correlation between two variables as recorded for each individual in the sample or a subgroup
  - *e.g. correlation of productive use electricity access tier and enterprise profits within Community A*

Levels of HH Electricity Access:



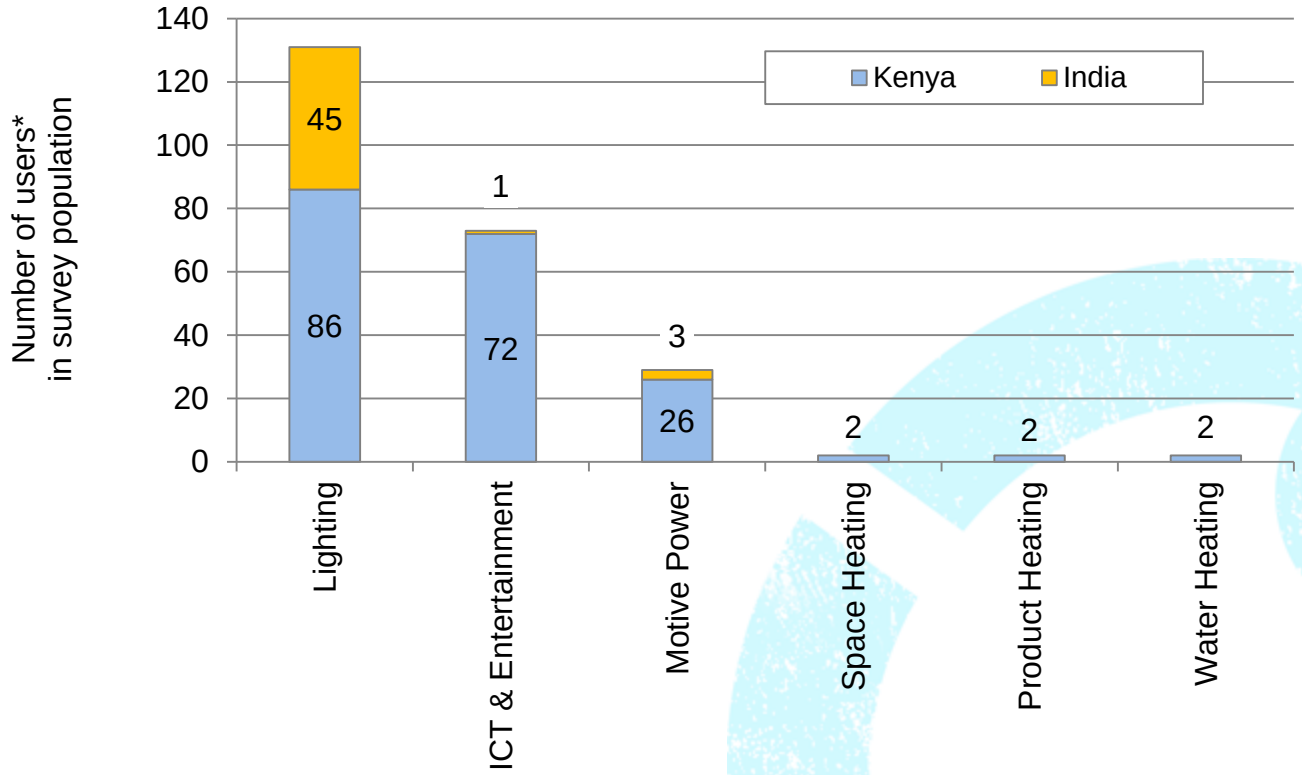
Tiers of electricity access amongst the households surveyed (only those with access)

Levels of Enterprise Electricity Access:



Tiers of electricity access amongst the productive users surveyed (only those with access)

Productive Uses of Electricity:

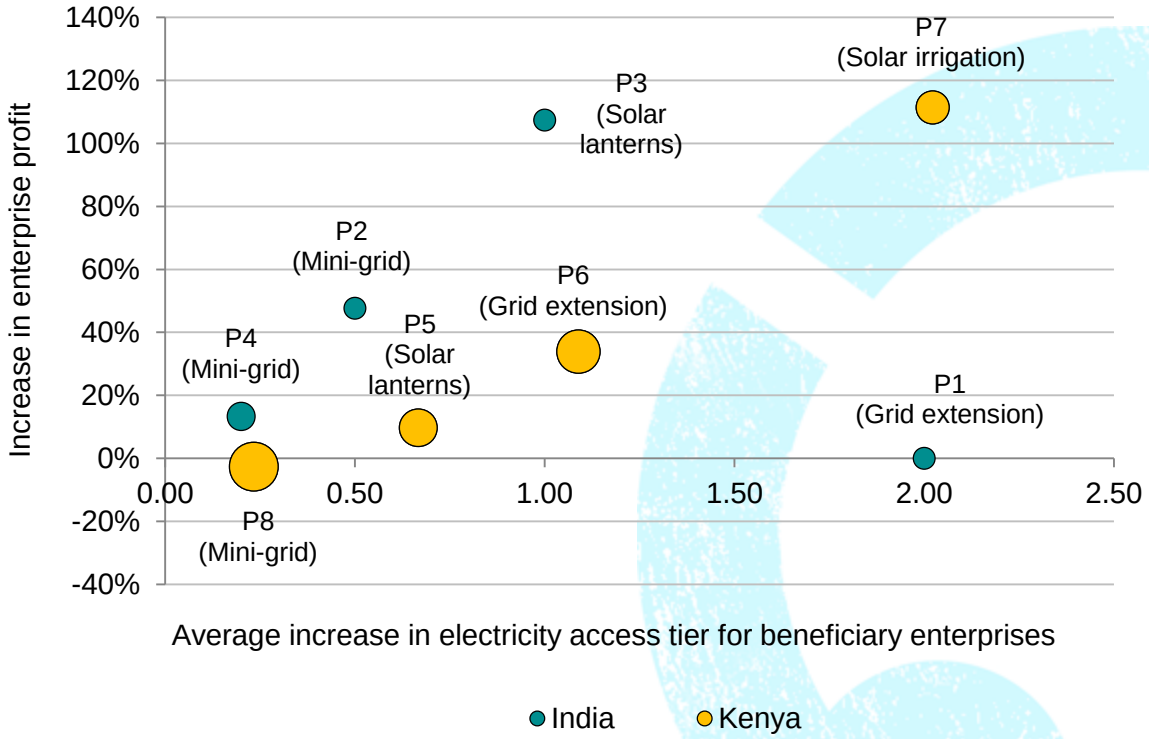


Number of users in survey population of each application of electricity for productive uses

Enterprise Impacts:

- ***Enterprise creation apparently enabled in India but not Kenya. No discernible relationship between level of creation and level of access.***

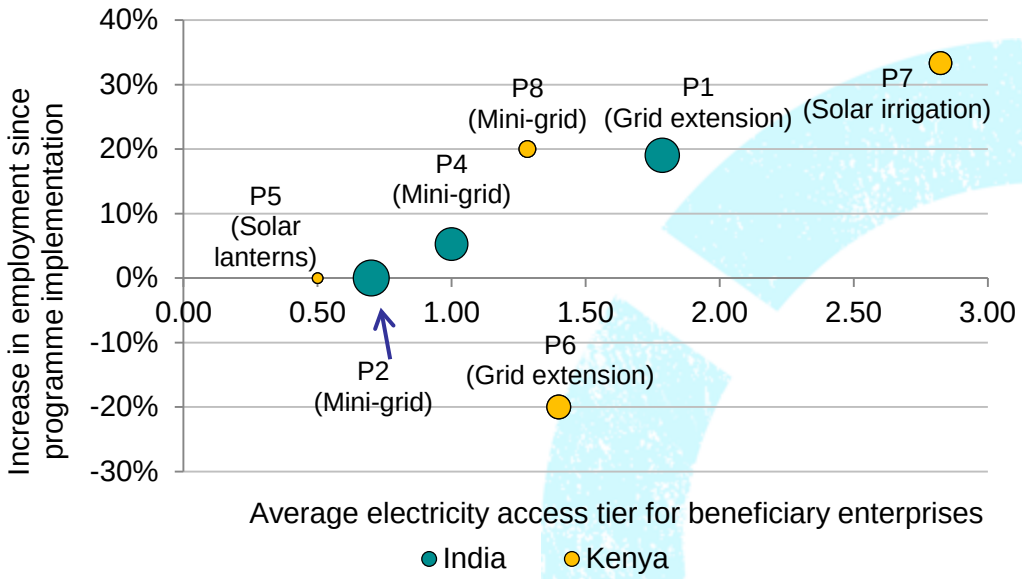
- ***Some apparent correlation between (change in) access tier and (change in) revenues or profits, but relationship not clear or consistent.***



Impacts - Employment:

Similar /higher levels of, and increases in, employment amongst those who had <u>not</u> benefited from improved HH access as those who had.

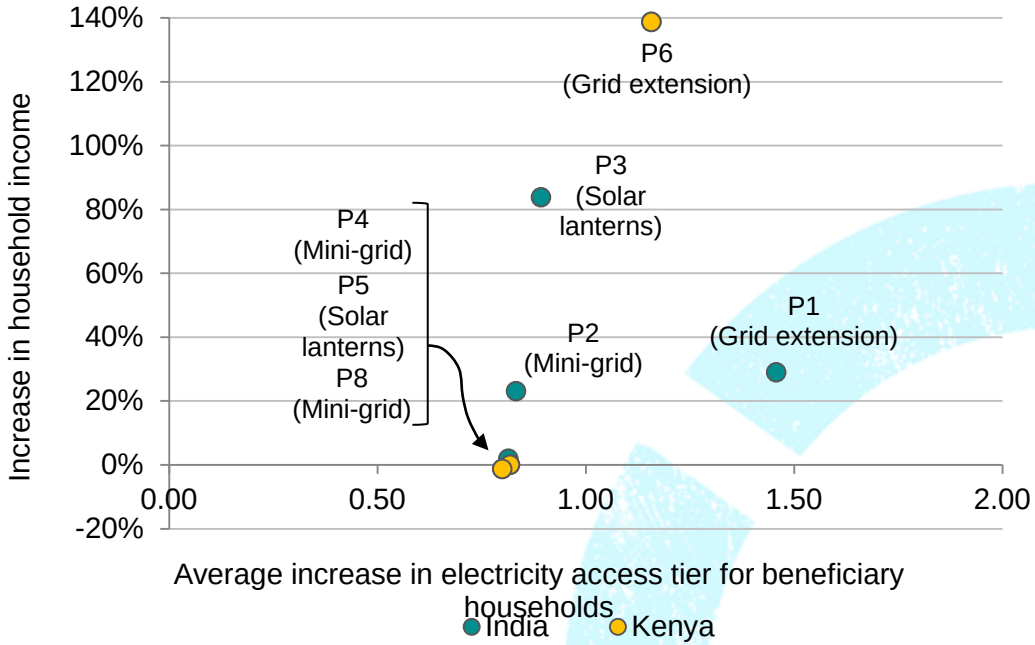
<u>Possible</u> positive relationship between level of electricity access for productive use and increases in employment.



Gendered impacts? - female employment rose in beneficiary and non-beneficiary communities, while male employment rose in beneficiary but fell in non-beneficiary

Impacts - Poverty:

No pattern found between level of either household or enterprise electricity access and the increase in household income:



Reported improvements in education and health services were attributed to electricity access.

Policy and Regulation

Common themes

- **Lack of focus on productive uses** in electricity policies
- Regulatory provision for **off-grid access** remains theoretical
- Need for information on **grid expansion plans** and **provision for mini-grids** overtaken by grid expansion
- **Subsidies should be rebalanced** recognising higher cost of provision in remote rural areas and cross-subsidy effects inherent in grid systems

Country-specific findings:

Kenya

- Off-grid suppliers prevented from charging **tariffs** that reflect **costs** of electricity provision in remote rural areas
- **Permitting and licensing process** for off-grid projects unwieldy
- The **Rural Electrification Programme Fund** and **Feed in Tariff** policy seen as missed opportunities to support off-grid electrification

India

More favourable environment than Kenya?

- Mini-grid developers able to operate in designated rural areas **without licence** and free to set their own **tariffs**
- Rural grid electricity tariffs **actively subsidised** in contrast to off-grid supplies
- **Subsidies** assist with **capital costs** but do not address financial challenges during **operation** of off-grid projects

Other Enabling/Constraining Factors:

- **Electricity supply performance – capacity, availability, reliability and quality** all reported by users (especially in India and by enterprises) as barriers to take-up and use
- **Community engagement –** an enabler, but seen by providers as a transaction cost obstructing scale provision and replication
- **Costs and access to finance** – highlighted as key barriers to provision, take up and use in rural areas, particularly in Kenya
- **Access to external markets** – vital for electrified enterprises to increase production and employment and so reduce poverty (rather than simply displacing non-electrified enterprises)
- **Knowledge and skills** – needed to participate in provision and productive use and to access markets and identified by stakeholders (though less by users), particularly in Kenya, as a key enabler for securing electricity access benefits
- **Infrastructure and security –** seen by stakeholders in both India and Kenya as one of the biggest hurdles to provision and use of electricity

Key Messages:

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- Relationship between level of electricity access and poverty reduction not clear
- Poverty impact of access highly dependent on context and other factors
- Vital to combine electricity access with access to finance, skills and markets
- Even low levels of access can, in right circumstances, have significant impact

Thank you

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