



Evaluation of SDG #7 Evidence from RCTs in Energy

Sohini Mookherjee
CLEAR/J-PAL SA

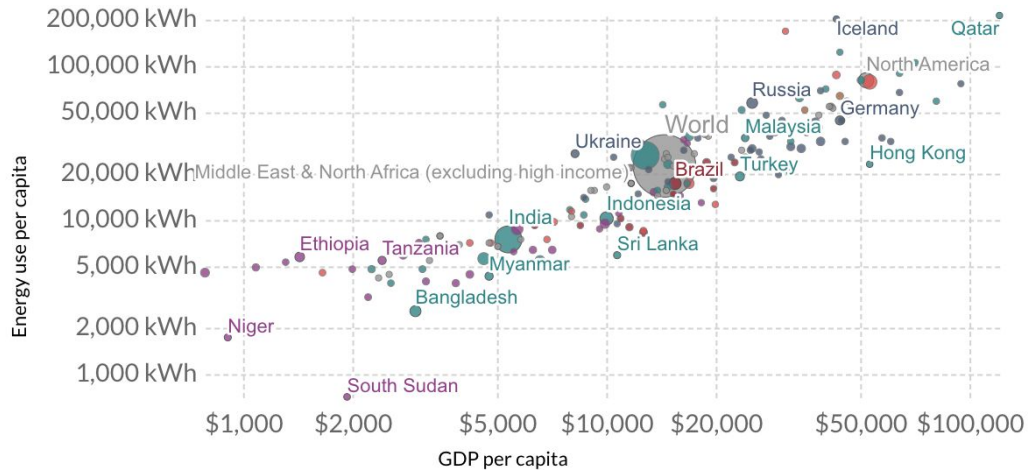
Energy Evaluation Asia Pacific



Structure

1. Policy challenge in the sector
2. Evidence from RCTs in energy- global trends on energy access
3. J-PAL's value proposition, Why RCTs are an useful tool to understand progress towards SDGs
4. Evidence from ongoing RCTs in energy access- Evaluation of policies in India
5. Key takeaways for policymakers implementing policies on energy

Globally, 770 million people still lack access to electricity and energy is critical to growth.



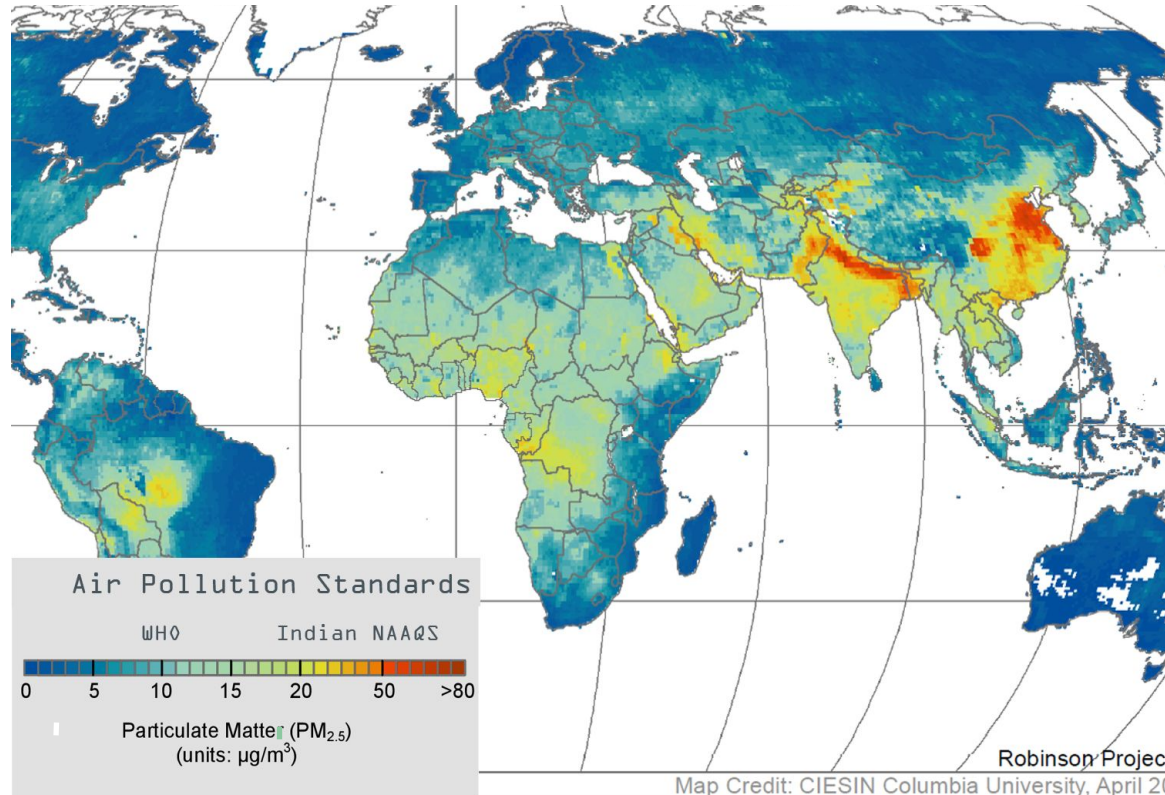
Source: International Energy Agency (IEA) via The World Bank
OurWorldInData.org/energy-production-and-changing-energy-sources/ • CC BY

X and Y axis are in Log

There are no historical examples of high level living standards without high energy consumption.

Continued growth in energy demand per capita is critical for improving quality of life in emerging economies.

Fossil fuels increase pollution that shortens people's lives.



Fossil fuels are causing climate change, which disproportionately harms people living in poverty.



Source: [EPA, IPCC](#)

Relative vulnerability of coastal deltas as shown by the population potentially displaced by current sea-level trends to 2050 (Extreme = >1 million people displaced; High = 1 million to 50,000; Medium = 50,000 to 5,000).



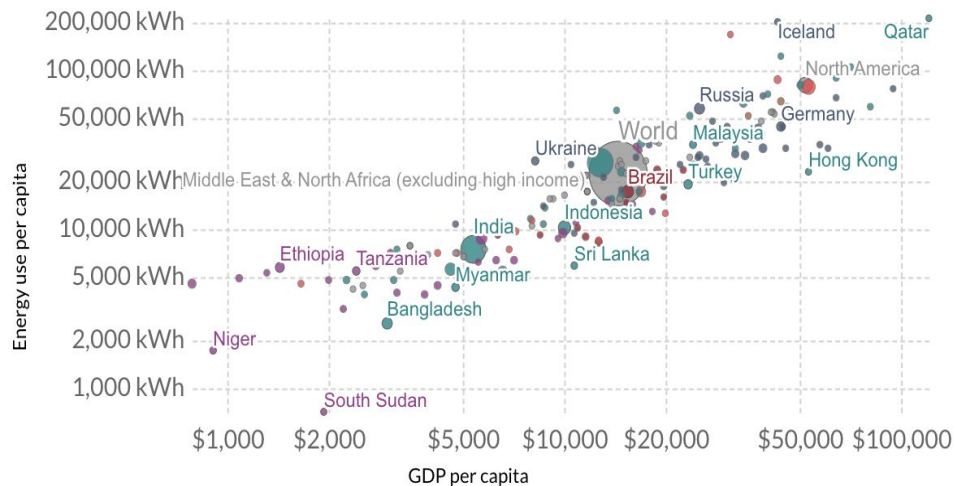
The Global Energy and Environment Challenge

How can we ensure that people around the world have access to the reliable, affordable, energy needed for economic growth and human development without putting the environment and climate at risk?

Increasing energy access (grid expansion)

Grid expansion had positive impacts on people's lives in several contexts, but impacts are dependent on households' ability to make use of the energy made available.

How do we unpack the relationship between electricity and well-being?



Source: International Energy Agency (IEA) via The World Bank
OurWorldInData.org/energy-production-and-changing-energy-sources/ • CC BY

X and Y axis are in Log

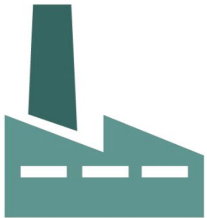
- Electricity requires complementary investments in other goods to improve lives
- Impact of gaining electricity is likely to vary by 1) the amount of energy households/firms can afford; 2) complementary investments; 3) reliability
 - Small amounts of power may not be transformational.
 - Lower-income households have fewer resources to invest in appliances

In theory, how could access to electricity improve lives?

Energy access literature has primarily focused on: **connections** as opposed to **use** and **households** as opposed to **firms**



- **Labor:** Increase returns to home production, leisure, work
- **Education:** Increase study time □ increase school participation □ learning
- **Health:** Displace solid fuels or kerosene □ improve home air quality □ improve health
- **Firms:** Improve productivity □ increase firm and/or economic growth
- **Income:** Increase labor or productivity □ increase wages/earnings □ increase incomes and/or reduce poverty.



Energy Access: Grid expansion

- **Several quasi-experimental studies and one RCT suggest that grid expansion generates broad welfare improvements** ([South Africa](#), [India](#), [Brazil](#), [El Salvador](#)*)
- Some RCTs and quasi-experimental studies suggest smaller and more mixed results ([Kenya](#)*, [Ethiopia](#)*, [India](#))
 - Macro and long-run evidence more promising than short-run evidence, especially for last-mile and low-income households
 - Reliability, price, and quality of service matters
 - More evidence is needed on the impact of energy on firms.

[Dinkelman](#) 2011; [Khandker et al.](#) 2014; [Lipscomb et al.](#) 2013; [Barron and Torero](#)* 2017; [Lee, Miguel, and Wolfram](#)* 2020; [Bernard and Torero](#)* 2015; [Burlig and Preonas](#) 2022

Increasing energy access (off-grid)

Off-grid sources provide small amounts of power that are unlikely to be transformational on their own, but may serve as important stop-gap technologies where grid access is unavailable.

Energy Access: off-grid solar

- **Off-grid solar products** provided small amounts of power that can support lighting but have generally small welfare impacts. (Bangladesh [2015*](#), [2017*](#), [India*](#), [India*](#), [Kenya*](#))
- Grid power and *small-scale* off-grid solar power provide very different levels of energy access.
- Current off-grid solar products won't allow low-income households to leapfrog the grid because they provide very small amounts of power, however off-grid solutions may improve welfare when grid connection is unavailable or unreliable
- More evidence is needed on larger-scale solar (mini-grid and above)

[Kudo et al.*](#) 2015; [Kudo et al.*](#) 2019; [Burgess et al.*](#) 2020; [Aklin et al.*](#) 2017; [Hassan and Lucchino*](#) 2016; [Grimm et al.*](#) 2020; [Meriggi et al.*](#) 2021

There is great opportunity to provide policy makers with better information about the **real-world effects of policies** using rigorous impact evaluations.

J-PAL's value Proposition

Evaluation both cutting edge technologies and policy innovations in real-world settings

What works and what doesn't using RCTs

J-PAL's researchers include 3 Clark Medalists, 4 MacArthur Genius Awardees, 3 Infosys Prize Winners, 3 Nobel Laureates



J-PAL Co-founders Abhijit Banerjee and Esther Duflo, with longtime J-PAL affiliate Michael Kremer, were jointly [awarded](#) the 2019 Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel. The prize was awarded “for their experimental approach to alleviating global poverty.”

J-PAL started at MIT (USA) and is now a network of more than 900 researchers and invited researchers around the world



DARTMOUTH



विद्याविनियोगाद्विक्रमः



Northwestern



UC San Diego

Yale

Sectors and policy lessons



Agriculture



Crime,
Violence, &
Conflict



Education



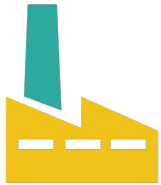
Environment, Energy,
& Climate Change



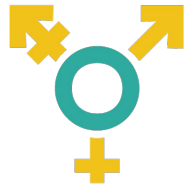
Finance



Social
Protection



Firms



Gender



Health



Labor
Markets



Political Economy
& Governance

Centre for Learning on Evaluation and Results (CLEAR)

Coordinated by
World Bank
Independent
Evaluation Group

Mission: Strengthen
M&E systems and
capacities and use
of evidence

Partner of the Global
Evaluation Initiative



Long term partnerships with governments to institutionalize use of evidence

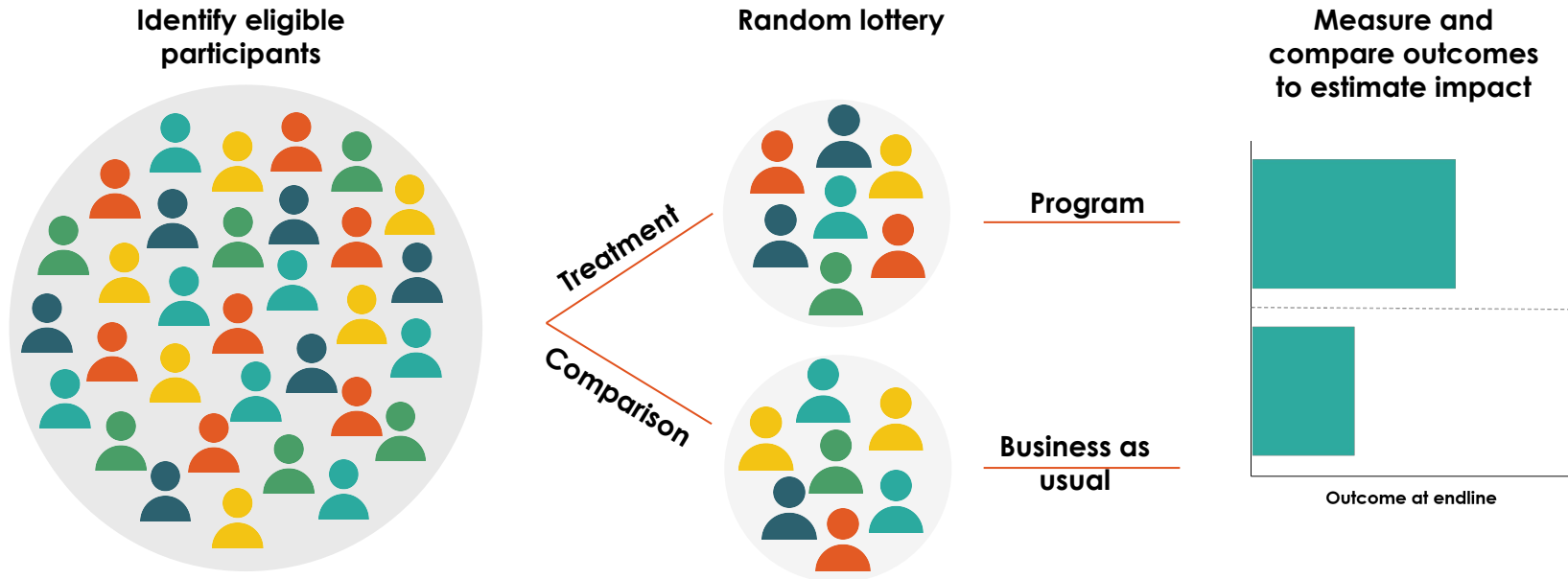


Building capacity of development practitioners on M&E



Knowledge sharing for evidence use

Randomized evaluations use random assignment to mimic the counterfactual and estimate a program's impact

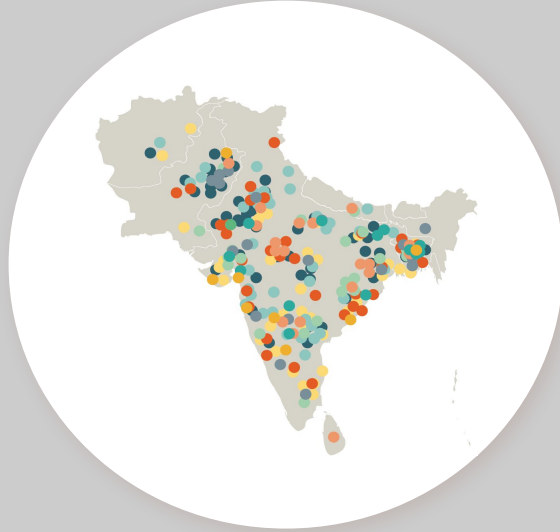


Key advantage of randomized evaluations (or RCTs): Due to random assignment, members of the treatment and comparison groups do not differ systematically at the outset of the evaluation. Thus, any difference that subsequently arises between them can be attributed to the program, rather than to other factors.

Why does results from RCTs provide valuable lessons on SDG (including SDG 7) evaluations?

1. **High internal validity**- Provide rigorous evidence of the causal impact of specific interventions or programs- helps assess progress towards related SDGs.
 - a. Evidence based decision making
 - b. Efficient resource allocation and policy targeting- Policymakers can use these results to inform and shape policies aligned with SDGs, ensuring that resources are directed towards strategies that have proven impact.
2. **Learning from failures**- RCTs also offer valuable insights when interventions do not produce the desired outcomes. Example- Odisha improved cookstoves study on IAP.
3. **Identifying scalable solutions**-
4. **Contributing to global knowledge base**- Cumulatively, the results from various RCTs contribute to a better understanding of what works and what doesn't across diverse settings, supporting a collective effort towards achieving SDGs.

Evidence from India



Policy challenge faced by India

1. Seen as a global force in energy
2. Energy and climate change are in a vicious cycle of interdependence

A. Energy Access: Service provider performance in Bihar, India

Problem:

1. Lack of quality electricity and its implications to economic growth
2. In areas that do have electricity, theft and other power loss can account for nearly 50 percent of the energy distributed to consumers.
3. High upfront costs in setting up grid, low payment of bills
4. Bihar context: Companies only manage to collect revenues for 35% of power delivered

A. Energy Access: Service provider performance in Bihar, India

Intervention:

1. J-PAL partnering with **Government of Bihar to test the effectiveness of group payment incentive** (i.e. collective action) for revenue collection
2. A large-scale experiment leveraging admin data involving 28 million consumers to enact such a scheme.
 - a. Under this initiative, **the hours of electricity provided by the utility to a feeder were explicitly linked to bill collection rates** via a transparent and heavily publicized schedule.
3. Communication of the benefits of paying for electricity. In Bihar, bill inserts, posters, text messages, and public announcements were used to relay how communities paying more would receive longer hours of electricity.

Study mechanism: Policy implications for developing countries

How can treating electricity as a right undermine the aim of universal access to reliable electricity?

Step 1: As electricity is a right, subsidies, thefts, non payments tolerated

Step 2: Distribution companies lose money

Step 3: Budget constraints kick in, in the long run even if govts provide some support initially. Limited options available to distribution companies in these situations, ration their supply, restricting hours of supply

Step 4: Power supply not governed by market conditions

B. Energy access and conservation: Impact on smart and prepaid metering

Policy issue

1. Expansion to electricity access in developing countries- introduce new challenges to service providers
 - a. In a standard model, electricity is purchased on a credit basis: households consume electricity throughout the month and receive a bill for consumption- may not work in developing countries
2. South Africa early adopter to pre-paid meter in the world
3. Late 2014- Cape Town initiated a program to **convert households that remained on a credit payment system to prepaid meters in low-income neighborhoods.**
 - a. In these neighborhoods, prior to installation of prepaid meters, over half of electricity bills were **paid late**, and 26 percent of customers had **multiple outstanding unpaid bills.**
 - b. 20% had been **disconnected** at some point as a result of delinquent bills.

Evaluation in Cape Town (contd)

Results:

1. The utility company was able to recover more of its costs-greatest improvements in profitability when poorer customers, and those with a history of delinquent payment behavior
2. **Electricity Usage:** Household electricity use declined under prepaid meters- this decrease persisted for at least 12 months.

Evaluation in Cape Town (contd)

Results:

3. The utility company **avoided the costs associated with meter reading**, bill preparation- the cost reductions to the utility company outweighed the reductions in customer payment levels on average, making the switch to prepaid meters profitable overall.

- a. **Profitability of a prepaid meter system depends on the context in which it is introduced.**
 - i. The utility company experienced **higher returns from the prepaid meters among lower-income customers and those who had previously failed to pay their bills.**
 - ii. Experienced **negative returns among customers who had paid all of their previous bills.**

The Effect of Smart Metering on Revenue Collection, Electricity, Access, and Supply in Jammu and Kashmir (ongoing)

1. India recently launched one of the largest roll-outs of new metering, with a target of installing about 250 million new meters by 2025.
2. In partnership with the state of Jammu and Kashmir, researchers will partner with the government utility to carry out an evaluation of different metering features that are currently being rolled out by the Indian government, including remote disconnections, online monitoring, and pre-paid metering.
3. This study will also explore whether smart meters impact high- and low-consuming households differently

Conclusion

Key takeaways for policy makers

Examples illustrate how data and rigorous evidence can shed light upon these policy challenge

There are two takeaways:

- 1) Couple the rollout of programs, policies, or innovations with sound, rigorous evaluation to understand impacts along the way, before scaling
- 2) Draw from and adapt existing evidence from other areas, to inform policy design effectively- “generalizability framework” i.e. leveraging causal pathways from global evidence on human behavior

The King Climate Action Initiative: combating climate change and poverty with evidence



Mission: Innovate, test, and scale evidence-informed climate solutions with policymakers worldwide



Launched in 2020

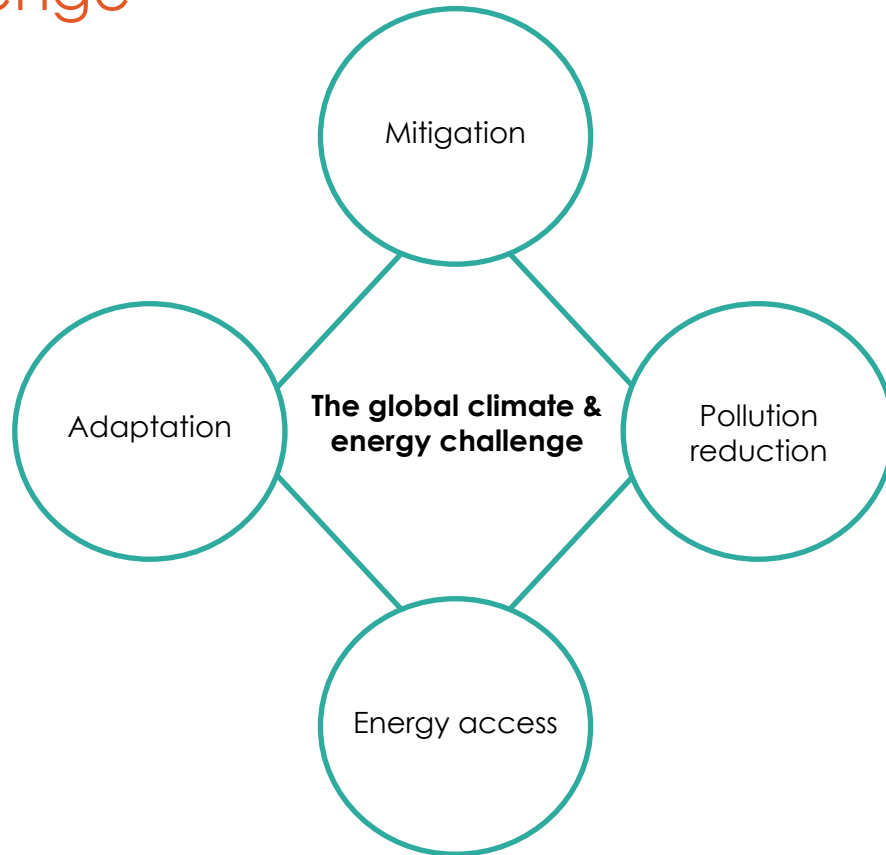
Goals: Raise the standard for evidence of effectiveness in climate policy

Reach at least 25 million people in poverty with effective mitigation and adaptation solutions by 2030

Cut emissions equivalent to \$125M



K-CAI focuses on four pillars of the global climate and energy challenge





Thank you!

smookherjee@povertyactionlab.org

