Evaluating EDF's Low Carbon Development Programs in Southern India

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Motivation

- For significant emission reductions in developing countries, low carbon technologies need to have development effects
- While emissions reductions can be measured, economic effects are less easy to pin down in a rapidly changing environment
- We thus aim to show and quantify economic and development effects of some of EDF's programs in Southern India
- To achieve this aim, we plan to implement some large scale randomized controlled trials (biogas stoves; LCF)
- We also plan to follow households over several (5-6) years, to understand long term usage patterns and economic effects
- Global approach to development: interactions between individual characteristics and success of intervention, try to relax some constraints (credit, insurance)

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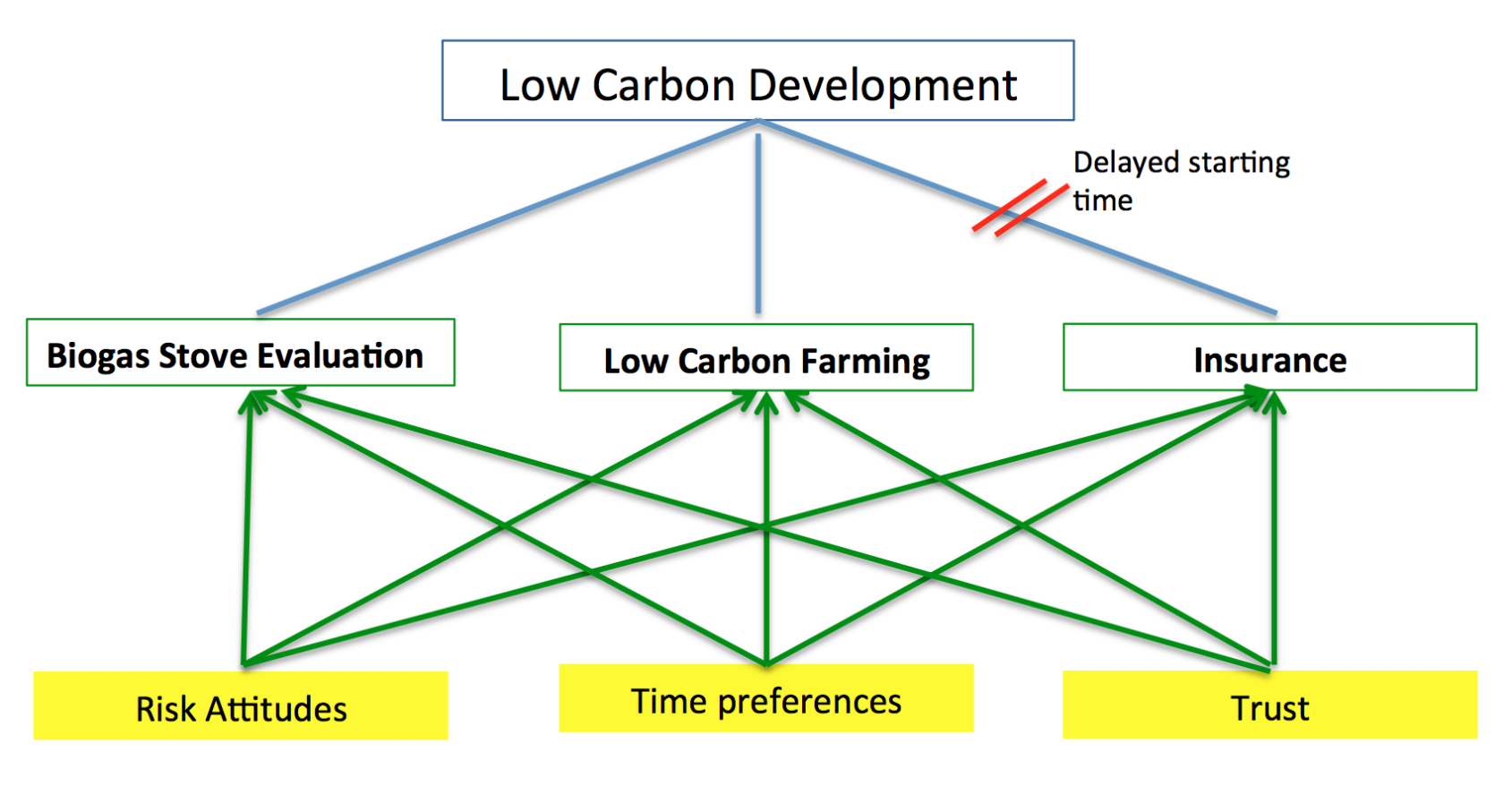
Project Overview



LCF and Biogas: Adoption and Economic Effects

- Recent papers conclude that stoves mostly do not work in the field: poor design, parallel use of old stoves, limited health benefits, defect units are not repaired
- The challenge thus is to show that a) households readily adopt stoves even at a (small) cost; b) households keep using the stoves and make necessary repairs; and c) traditional stoves are not used in parallel
- Two elements to the study:
  - adoption behavior; who adopts and who does not adopt when offered the stove, and why? How does this behavior change over time?
  - economic effects; what are the economic effects of the interventions, i.e. do they have economic (and/or health, happiness) effects beyond emissions reductions?
- Final goal: show effects beyond reasonable doubt OR show where problems may occur; get policymakers to roll out functioning programs at large scale

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Effects of biogas

- For biogas especially, the challenge is to quantify a variety of effects spanning very different aspects:
  - Uptake decisions, their relation to demographics, risk and time preferences (can we predict uptake?)
  - Uptake and usage patterns over time (do people learn about and adopt technologies that they see are working, and what is the time frame)
  - Economic effects: time freed up, increased productivity, etc.
  - Effects on nutrition and diet, following up on an initial study (plus school attendance and performance of children, etc.)
  - Ambient exposure to CO and PM2.5 in biogas versus control households
  - Health effects beyond household exposure
  - How do these effects evolve over longer time spans?
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Sample size and randomization issues

- Detecting some of the effects requires large samples and crucially relies on randomized allocation to treatments
- Give long-term nature and relations with NGOs, randomization needs to take place between villages
- Sample size of 3000-4000 households to just investigate treatment versus control, with no additional tweaks possible
- To get a global view, both adopting and non-adopting households within villages ought to be followed
- Beyond the RCT, it is important to look into individual behavior to understand *why* any intervention may work
- To achieve this, we need to look at household demographic characteristics, preferences (risk, time, beliefs), and constraints
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- Risk and time preferences are both likely to play a role in farming decisions and biogas adoption (technology adoption)
- Traditional methods measure time preferences in a risk-less context, and risk preferences at present (resolution and payout)
- We are developing an integrated measurement method, that mixes risk and time to obtain more realistic measurements
- We are also developing methods that can be framed in a farming-investment context for added realism
- The idea is to obtain rich measurements that allow for the estimation of structural models and stochastic choice (errors)
- Challenges: obtain complex measurements with very simple choices; filter out noise; substantial incentives
- Next step: measurement of subjective beliefs about natural uncertainties (rainfall), and attitudes towards such uncertainties $\rightarrow$ basis for crop insurance

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Preferences versus Constraints

- Preferences have often to be indicated to create 'behavioral poverty traps' (e.g., risk aversion or impatience resulting in suboptimal investment, holding back technology adoption)
- However: recent papers show that investments go up when crop insurance is available (e.g. Mobarak & Rosenzweig, 2012)
- Problem more likely extreme risk *exposure*: absence of credit, saving and insurance mechanisms (no consumption smoothing)
- An integrated development program thus needs to offer such mechanisms at low transaction costs
- Eventually interventions offering (index) insurance, small credit lines, saving programs, etc. need to be added
- Additional RCTs planned on these issues in subsequent years, household level (conditional on partners and funding)

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Relaxing constraints

- Arguably most important constraint is extreme exposure to weather uncertainty (getting worse)
- Small scale of farms and long delays in damage assessment render traditional insurance unworkable
- Index insurance proposed as a solution: quick payouts, no moral hazard, low transaction costs (low premia!)
- Uptake has been disappointing so far: limited coverage of official rainfall stations, novelty of product
- Upshot: providing cover against the worst downside risks needed for switch from subsistence to cash crops
- Need better understanding how beliefs, preferences, liquidity constraints, trust etc. play into insurance purchase

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- Ambitious in scale, scope, and duration: involvement of many researchers and partner organizations across 3 continents; following 4000+ households over 5-6 years, frequently repeated visits, a variety of measurements (surveys, experiments, heat, emissions, health effects, etc.)
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