Sustainable energy transitions

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dukeenergyhealth.org
Household: health & developmental outcomes

The carbon footprint of traditional woodfuels

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Over half of all wood harvested worldwide is used as fuel, supplying ~9% of global primary energy. By depleting stocks of woody biomass, unsustainable harvesting can contribute to forest degradation, deforestation and climate change. However, past efforts to quantify woodfuel sustainability failed to provide credible results. We present a spatially explicit assessment of pan-tropical woodfuel supply and demand, calculate the degree to which woodfuel demand exceeds regrowth, and estimate woodfuel-related greenhouse-gas emissions for the year 2009. We estimate 27-34% of woodfuel harvested was unsustainable, with large geographic variations. Our estimates are lower than estimates from carbon offset projects, which are probably overstating the climate benefits of improved stoves. Approximately 275 million people live in woodfuel depletion ‘hotspots’—concentrated in South Asia and East Africa—where most demand is unsustainable. Emissions from woodfuels are 1.0–1.2 Gt CO₂e yr⁻¹ (1.9–2.3% of global emissions). Successful deployment and utilization of 100 million improved stoves could reduce this by 11-17%. At US$11 per tCO₂e, these reductions would be worth over US$1 billion yr⁻¹ in avoided greenhouse-gas emissions if black carbon were integrated into carbon markets. By identifying potential areas of woodfuel-driven degradation or deforestation, we inform the ongoing discussion about REDD-based approaches to climate change mitigation.
Compared to GWC research on GHG, too little on other GHPs

- particularly, aerosols – black carbon (or soot)
  - more potent in the near term (10-50 years)
  - stay low, and create local pollution and warming

- ~ 40% of GHPs attributed to biomass burning largely because of incomplete combustion and inefficient cooking technologies
  - 30% each from fossil fuel and open burning
  - big concern in Asia because firewood and crop waste is a major energy source ...

- Biogas/gasifiers 3-20 times lower GWC compared to traditional stoves using biomass fuels
Energy poverty is a humanitarian crisis

Global energy poverty

- Million people without electricity
- Million people without clean cooking facilities

Latin America:
- 31 million people without electricity
- 85 million people without clean cooking facilities

Sub-Saharan Africa:
- 585 million people without electricity
- 653 million people without clean cooking facilities

China:
- 8 million people without electricity
- 423 million people without clean cooking facilities

India:
- 289 million people without electricity

Other:
- 836 million people without electricity
- 379 million people without clean cooking facilities
- 661 million people without clean cooking facilities
90:10 Conundrum

- Pachauri et al. (2004). *World Development*
- Sagar et al. (2005). *Vt. J. Envtl. Law*
- Sovacool et al. (2012). *Energy Policy*
- Pachauri et al. (2011). *The Global Energy Assessment*
- Focus investment & attention on
  - energy efficiency & oil security concerns of rich countries
  - commercial energy sector in developing countries
- Even rural energy programs
  - rural industries, healthcare facilities, lighting
- Numerous barriers to developing and disseminating
- Ironical: “polluter gets paid” by research
  - major emitters focus of science
  - low emitters: ignored
Externalities: Triple impacts of dirty energy for cooking

- Short lived, local climate forcer
- Impacts on glaciers
- Regional air quality (ABC)
- Unsustainable harvesting
- Forest ecosystem damage
- Drudgery of fuel wood collection
- Health of women & children

- Some unknowns regarding **impacts** – uncertain costs & benefits
- Many many more unknowns regarding implementation – the **gap between knowing and doing**
Ans1. What do we know?

- Of stacks and ladders!
  - preference for and access to clean energy related to SES
  - *risk averse, myopic (impatient), illiquid and otherwise constrained households lack confidence to switch and step up the ladder*

- Drivers of transitions ....
  - *explained by opportunity set, proxied by hh characteristics*
  - *urban, educated and well off households have made transition*

- Given importance of preferences & choices, surprising
  - bias towards engineering, science, public health
  - lack of interdisciplinary and LMIC authors
Ans2. What do we not know?

- How decision context & external env influence?
  - social marketing, MFIs, NGOs
  - subsidies, sector policies, dam the Nile

- Impact of renewables and green energy
  - on forests & local environment
  - on regional air quality and climate

- Prospects for rural households
  - severe data constraints on anticipatory policies
Duke1: building multidisciplinary team

**Lewis, JJ et al. 2015. In submission**

- **lower firewood extraction**
- **lower air pollution** (PM2.5 and PAHs)
Duke2: RCT electric stoves

Jueland, MA et al. 2015. Revision requested
Duke2: results - large purchase response

It does appear possible to achieve high ownership in low income settings!

Pattanayak, SK et al. 2015. In prep.
Duke2: microinstitutions make matter

- Sales ~10% higher; people seem more likely to listen
- Greater fuel collection savings, and greater use of stoves
- Also likely to be important for long-term maintenance
Analysis

Improving stove evaluation using survey data: Who received which intervention matters

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RESPIRATORY DISEASE

Demonstrating bias and improved inference for stoves' health benefits

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Ans3. What should we do?

- Make energy studies more socially oriented, interdisciplinary, plurastic, diverse
- Leverage SDGs (proposed #7) & mainstream
  - integrate energy interventions with development priorities
- Develop a new narrative around energy access, not rights to emissions
  - Gridlock from blame game
  - History to guide energy rights
  - Energy intensity of consumption and production
- Learn lessons from rural electrification & off-grid expansion
No one says this is going to be easy