Examining Development Interventions: Are Cook-stoves a win-win-win?

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ECONOMICS & THE ENVIRONMENT

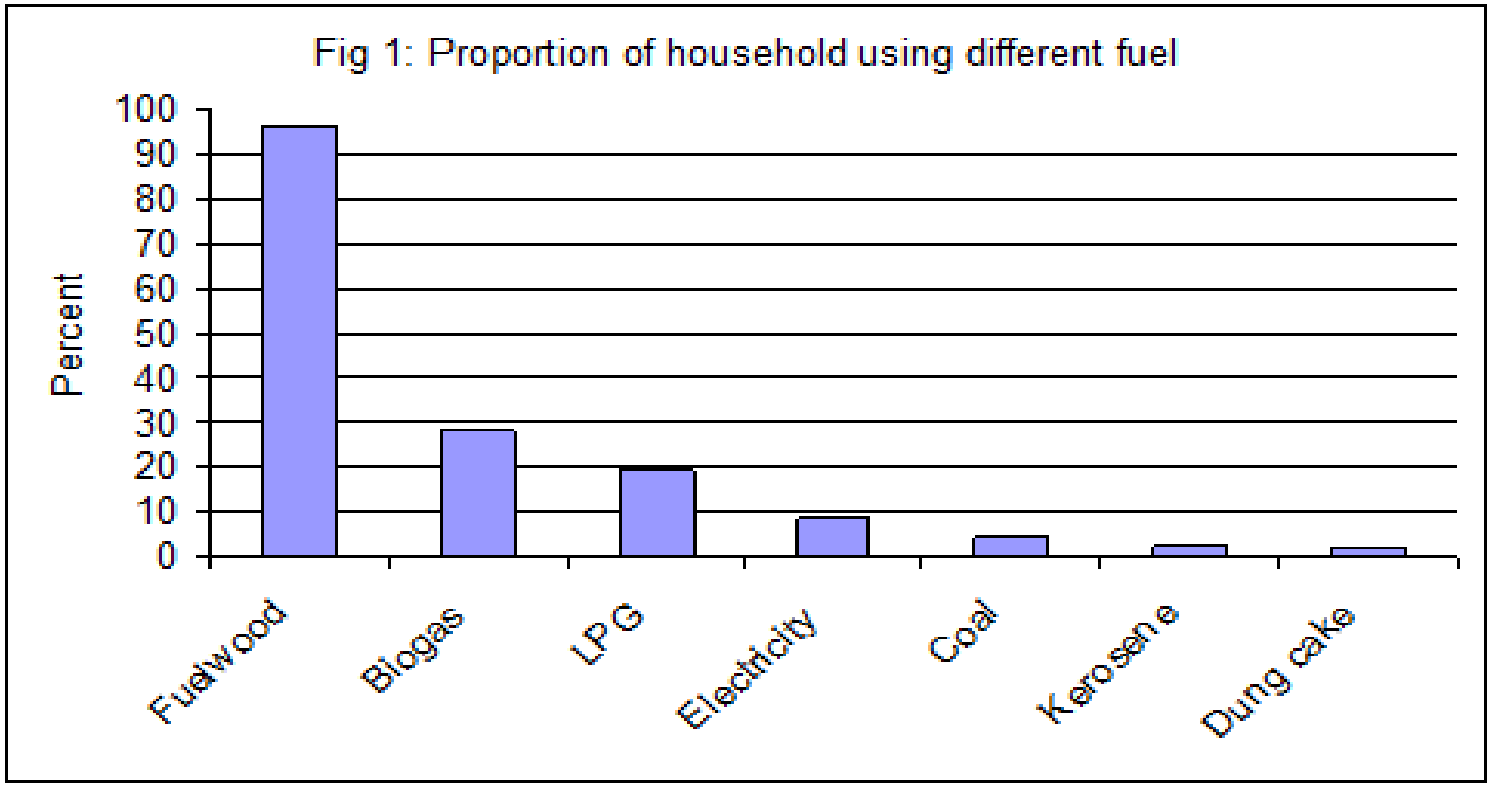
Issues to be covered

- Is there any link between **Green Development** and **Cook-stoves?**
- If yes, what are the main adoption and other issues related to cook-stoves technology?
- How one can evaluate the program?

Global & Local Scenario

- Half of the global population relies on solid fuel as primary source of household energy (WHO 2006)
    - biomass (firewood, agriculture residue, leaf & litters, dung)
    - coal
- In rural area of developing countries, solid fuel's contribution is up to 90%

Sample Surveys – Nepal & India



(Pant, 2008)

Indian Example:	
Wood Share	86%
Dung Share	11%
Kerosene Share	4%

Source: Gregory and Stern, 2012

Solid Fuel & Green Development – The Link

Why solid fuel is a serious issue?

Use of biomass is not a cause of concern,

What concerns more are:

- **Inefficient combustion** (new issue)
- **Unmanaged Extraction (**old issue**) –**
- **Efficient combustion –**
  - **Less IAP/Better Health outcome**
  - **Higher productivity**
  - **Less GHGs**
- **Managed extraction –**
  - **less deforestation**

Indoor Air Pollution - Issues

- Health hazards – respiratory illness

  →reduced labor productivity

  Sri Lanka Case Study: Women tea-pluckers living in different (healthy vs. unhealthy housing environment -

  Healthy workers 80-120% more productive, (Kalyanaratne, 2012)

- Unequal burden of diseases

  – women and children are affected more

First Best Solution

- Use clean fuel, e.g.,
  - LPG, Kerosene (mostly imported & non-renewable)
  - hydorelectricity, Biogas, Solar, wind (renewable)
- But these alternative clean fuels are
  - costly compared to solid fuel &
  - not available in most of the rural areas
  - unreliable supply

Second Best Solution: Improved Cook-stoves

When designed appropriately, ICS provides

- Private benefits
- Community benefits
- Global Benefits

Before Intervention

After Intervention

24 hours PM10 in Kitchen (Malla, 2009)

Local Needs & Uses of Stoves

HH Energy Use Distribution	%
Cooking	64
Animal feed	17
Heating	8
Lighting	2

How to Evaluate ICS Intervention?

- RCT – with and without ICS intervention
  - the most desired method that avoids sample selection bias
- Natural Experiment
  - Before and after introducing any policy (requires before and after intervention data)
- Propensity Score Matching
- Simple CBA of Intervention (NPV>0)

Case Studies - CBA

C&B over 10 years (US$ per HH)				
		Kenya	Sudan	Nepal
Cost				
	Invesment (total)	38.5	80.08	70.84
	Maintenance(annual)	1.54	12.32	1.54
Health Benefits (Annual)				
	Cost Saving	0.03	0.41	0.08
	Time Saving	0.1	0.29	0.23
Fuel Savingsl	(Annual)			
	Cost Saving	20.64	46.2	0
	Time Saving	9.12	0.45	11.27
Cooking Time saved (Annual)		136.86	15.92	6.14

Source: Malla et al, Energy Policy, 2011. (Intervention: Kenya – ICS& LPG cooker; Nepal – Smokehood ICS, Sudan- LPG Stove+gas bottle)

Some Observations

- Kenya & Sudan: LPG related intervention
  - Costly and not possible to replicate in many countries due to unavailability of LPG
- Nepal: ICS intervention
  - Health benefits is $0.30 (is it visible? Who cares?)
  - Time benefits: $16.41 (Is it noticeable?)
- Nepal: Only 500,000 disseminated so far (AEPC, 2012) <10% of the HHs.

Case Studies: Bangladesh

- Cluster-randomized trial in two sub-districts of Bangladesh (Hatiya and Jamalpur):
- Demand for ICS is highly price elastic: non essential good
  - At market price adoption was 2%
  - 50% reduction in price led ONLY 5% to 12% adoption of ICS
- Price per stove was not high (<Tk500) and liquidity constraint are two important deterrents for low adoption

(*Mobarak et al, 2011 (PNAS)*

- No fuel or time saving in Chimney CSs compared to traditional CS (Global Alliance for Clean Cookstoves, 2012)

ICS & Firewood Use

Improved stoves user HHs tend to use more firewood (Nepal et al. 2011). Why?

- Rebound Effect: Improved Stoves → requires less firewood → Shadow Price↓→ firewood use for alternatives ↑ → HHs firewood use ↑
- Income has no effect on firewood consumption → No close substitute available

Main Challenges

- **Very low adoption rate** despite the triple benefits (health, costs saving, and environment).
- Why? Possibly:
  - **Insignificant Health benefits** & **low priority**
  - **Don't meet households** needs & **not available** locally
  - **No guarantee** that ICS is efficient & Supply driven
  - **Totally different** from what HH have been using
  - **Unaffordable** – **High start-up costs**

  <u>Alternative is FREE & Known for ages</u>

Take-home Messages

- **Financing is necessary** but **not sufficient**
  - Competing needs and **lack of cash** on hand
  - **High initial price** discourages adopters even if subsidy or credit is available
  - **Buying ICS is strange** to many villagers since alternative is free of cost
  - Technology that is **not perceived better** or **doesn't meet demand** will not be adopted
  - **Locally produced technology** will have much more chance of success
- **What is needed?**
  - **Coordinated consumer awareness** could help stimulate demand for new technology
  - Maintaining **national standard** and **efficiency testing**
  - C**oordinated policy** to address barriers to **access, affordability** and **supply** & making this as a part of boarder development strategies
  - Need more kitchen-based tests since most of the testing are done in labs.