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Factors associated with sustained use of improved solid fuel cookstoves: A case study from Kenya

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ABSTRACT

Improved solid fuel cookstoves have been a focus of development efforts to address health and environmental problems caused by traditional cooking practices in Kenya. However, a review of Kenya's experience in promoting improved solid fuel cookstoves shows that the focus has been on (increasing) production and dissemination of improved cookstoves, overlooking the fact that some of the disseminated cookstoves are used less regularly or even abandoned. This study examines factors that influence the usage rate of improved solid fuel cookstoves, drawing on a survey of cookstove users conducted in Kenya through a project implemented by the African Centre for Technology Studies (ACTS) and The Energy and Resources Institute (TERI). The results show that sustained use of improved solid fuel cookstoves over time is significantly predicted by awareness creation activities and reputation of the new cookstoves among community members. These insights suggest that cookstove-disseminating organisations should pay attention to these two factors to ensure sustained use of improved solid fuel cookstoves in Kenya and perhaps other developing countries.

Introduction

Lack of affordable modern energy services is a key development challenge affecting a significant percentage of the global population. As of 2014, about 2.8 billion people worldwide (41% of the world's population) depend on rudimentary and inefficient cooking stoves burning traditional fuel sources, such as unprocessed firewood, cow dung, charcoal and crop residues (Shankar et al., 2014; Kumar et al., 2016). Unmanaged use of traditional cooking fuels has been known to result in adverse health and environmental consequences. Legros et al. (2009: 34) have reported that indoor air pollution (IAP) (mainly from burning traditional solid fuels) results in 2 million deaths every year, making IAP among the leading contributors to ill health and mortality in developing countries.

One way of addressing this challenge has been through large-scale dissemination of improved solid fuel cookstoves in developing countries. Kenya has been a typical example. Improved solid fuel cookstoves development and introduction in Kenya started in the 1980s (Karekezi and Walubengo, 1989). Since then, Kenya has implemented numerous improved cookstove projects, largely assisted or funded by development assistance. Most of these projects emphasised on development, installation and dissemination of improved cookstoves, with little attention to what happens (to the stoves) after initial acceptance by households.

As such, improved cookstove research in developing countries has emphasised on identifying factors that positively or negatively influence the willingness of project beneficiaries to initially accept improved cookstoves (see e.g. Jan, 2012; El TayebMuneer and Mukhtar Mohamed, 2003; Debbi et al., 2014; Lewis and Pattanayak, 2012; Rehfuess et al., 2014). A recent example in the Kenyan context is a study by Mtsami (2010) who has detailed constraints, which hinder adoption of improved solid fuel cookstoves in Wundanyi, Mwatate and Voi districts. Project interventions have often been aimed at meeting such constraints through provision of incentives, awareness campaigns and training of stove producers, and by doing so ensure initial acceptance and dissemination of improved solid fuel cookstoves (see e.g. Silk et al., 2012).

Unsurprisingly perhaps, there has been a historical tendency of measuring the success of cookstove projects by the number of cookstoves disseminated within a specified period, assuming that activities that lead to initial acceptance will also contribute to sustained use over time (Troncoso et al., 2013; Ruiz-Mercado et al., 2013; Pine et al., 2011; Lewis and Pattanayak, 2012). However, this has been indicated to be an unsuccessful strategy, since disseminating cookstoves does not equate with stove acquisition and continued use (Shankar et al., 2014; Ruiz-Mercado et al., 2011). In support of this, Pine et al. (2011:177) have stated that "… successful dissemination leading to widespread use of such stoves is not as easy as simply distributing them throughout communities; many programs to promote these fuel-efficient technologies have failed in the long run because they did not take variations in cultural preferences, local cooking needs, patterns of household fuel use, and other social and economic factors into account."

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Recent evidence suggests that, in the best-case scenarios, households often use their new cookstoves in conjunction with their traditional cookstoves, resulting in failure to reduce exposure to hazardous indoor air pollutants (Piedrahita et al., 2016; Hanna et al., 2013; Ruiz-Mercado and Masera, 2015). Others tend to try them but then abandon them (Hanna et al., 2013).

The policy issue in question should therefore be a little different. It should not only be interested in adoption of cookstoves as measured in terms of initial purchases or take up of an improved cookstove. Instead, the key issue is the degree of sustained use over time (Yadama, 2013). Whether a disseminated stove has been regularly used or abandoned and the factors contributing to such decisions are therefore key issues that need to be explored (Kumar et al., 2016). Whereas there are studies that have monitored cookstove use intensity over time using censor-based stove use monitors (SUMs) (see e.g. Ruiz-Mercado et al., 2011, 2013), socio-economic, institutional, technology and project-related factors, which explain variations in stove usage rates across households, have rarely been investigated.

The major purpose of this study is to provide insights into improved cookstove use patterns and factors that influence cookstove usage rates. It investigates the case of improved solid fuel cookstoves disseminated in Kenya by the African Centre for Technology Studies (ACTS) in collaboration with The Energy and Resources Institute (TERI) and other local partners.

The remaining sections of the paper are outlined as follows. The succeeding section provides a brief background to the study by reviewing the central activities of major stove projects in Kenya from a historical perspective. It also highlights a stove project implemented by ACTS and TERI under which a survey of improved cookstove users is conducted. Section 3 presents the methods of data collection and analysis. Section 4 provides results of the survey that include some descriptive statistics of household socio-economic and stove use characteristics as well as quantitative analyses of factors predicting stove usage rate among Kenyan households. Finally, the last section presents a brief summary of the key results and derives some conclusions.

Background to the survey

Historical overviews on major activities of selected improved solid-fuel cookstove projects in Kenya

Major improved cookstove projects in Kenya emerged in the 1980s, following recommendations of a wood-fuel consumption study in Kenya by the Swedish Beijer Institute. The Beijer Institute's study showed that Kenya's total wood-fuel demand was about 20 million tons per year in 1980, with 7 million tons of this being drawn from unsustainable sources. It also forecast a significant shortfall in the supply of wood-fuel (about 33 million tons) by the year 2000, providing a quantitative picture of the depleting biomass resources of Kenya over time (Hyman, 1985; Karekezi and Walubengo, 1989; O'Keefe et al., 1984). Table 1 summarises key activities of major cookstove projects in Kenya since the early 1980s.

The first major project was the Kenya Renewable Energy Development Project (KREDP), launched in September 1981 by the Ministry of Energy of Kenya. It was funded by the United States Agency for International Development (USAID) and the Government of Kenya. The major goal of the KREDP was to develop and disseminate affordable and simple renewable energy and energy-efficient technologies, such as improved solid fuel cookstoves, to Kenyan households (Jones, 1988).

The KREDP developed the Kenyan ceramic jiko model by adapting the Thai Bucket stove and the Kenyan charcoal-burning traditional stove (Kimani, 1991). Following field-testing of the Kenyan ceramic jiko prototype, the project focussed its attention on large-scale production and marketing of the Kenyan ceramic jiko (Karekezi and Gathoga, 1990).

Table 1
Summary of major improved solid-fuel cookstove projects in Kenya and their major activities.

Launch year	Name of project	Major project activities
1981	Kenya Renewable Energy Development Project (KREDP)	- Improved charcoal cookstove prototype development; - Training of artisans on manufacturing Kenyan ceramic jikos; - Creating public awareness about improved solid fuel cookstoves to entice adoption (stove promotion)
1983	Special Energy Program (SEP)	- Wood-burning cookstove prototype development; - Training of women groups on wood-burning cookstove manufacturing, installation and business management; - Public awareness creation (stove promotion)
1989	Rural Stoves West Kenya project	- Developing portable Jiko/"Maendeleo", a fuel-efficient stove to be used in rural areas: - Training of women to manufacture portable wood-burning cookstoves in rural areas
1995	Upesi rural stoves project	- Manufacturing, distribution, installation and commericalisation of "Upesi stove"; - Training of women on production and installation of "Upesi stoves"
2005	Energising Development Partnership (EnDev) stove Programme in Kenya	- Manufacturing and distribution of "Jiko Kisasa" and "Rocket stoves"; - Market development for efficient cookstoves; - Public awareness campaigning (stove promotion)

It trained selected artisans on Kenyan ceramic jiko production (Hyman, 1985), and undertook publicity campaign to sensitise the public on the importance of adopting improved solid fuel cookstoves (Opole, 1985). It distributed booklets with information on the importance of improved solid fuel cookstoves. The project also sensitized policymakers, district administrators, development workers, and school-teachers through workshops (Kimani, 1991). Simultaneously, the Ministry of Energy undertook demonstrations of Kenyan ceramic jikos at farmers' training centres, agricultural shows and market places (Namuye, 1990).

Another major stove project in Kenya was the Special Energy Program (SEP) that was implemented by the German Agency for Technical Cooperation (GTZ) in collaboration with the Ministry of Energy of Kenya. The major aim of the project was introduction of fuel-efficient rural woodstoves. The project carried out design development research that ultimately resulted in "Maendeleo woodstove" (Karekezi and Ranja, 2002). The program supported women's groups for manufacturing and installation of 'Maendeleo woodstoves'. It also provided basic training to women in business management and marketing to ensure the sustainability of commercial production of improved cookstoves (Karkezi and Ranja, 2002). The project also collaborated with the Ministry of Agriculture's extension officers in home economics and agriculture to promote improved solid fuel cookstoves in rural areas (Karkezi and Ranja, 2002).

A related project with the aim of promoting improved solid fuel cookstoves in rural areas was the Upesi rural stoves project. Supported by the Intermediate Technology Development Group (ITDG), the Upesi project focussed on training women in the production, distribution and installation of 'Upesi stoves' (another name for 'Maendeleo' stoves). Additionally, cookstove promoters were trained to carry out demonstrations and establishing linkages within rural communities. The promoters visited homes, churches, marketplaces, grain milling centres, schools and other public places with the aim of increasing awareness about rural improved solid fuel cookstoves. The project also