



Access to modern fuels and satisfaction with cooking arrangements: Survey evidence from rural India[☆]



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ABSTRACT

Subjective satisfaction is a central element of technology adoption, but scholars have not analyzed the determinants of households' satisfaction with their cooking arrangements. Drawing on an original survey of 8568 households across six Indian states, we uncover the predictors of such satisfaction. Households do not find firewood collection inconvenient, but they are dissatisfied if they have to travel long distance to purchase firewood. Among sub-components of subjective satisfaction, reduction in smoke, speed of cooking, and quality of meals dominate over others (difficulty, cost, and safety). Moreover, we identify access to LPG – a modern cooking fuel – as a strong and robust predictor of high subjective satisfaction, mostly through reduction in smoke and increase in speed of cooking. Rural households ascribe a lot of value to access modern cooking fuels that reduce indoor air pollution, and beneficiaries of interventions to improve such access would value it. Thus, efforts to reduce reliance on cooking with traditional biomass are not just paternalistic top-down interventions but contribute to significantly improve households' satisfaction with their cooking arrangements.

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Introduction

The lack of access to modern cooking fuels is a major obstacle to socio-economic development (Masera et al., 2000; Mobarak et al., 2012; Bansal et al., 2013; Yadama, 2013; Cheng and Urpelainen, 2014). According to the International Energy Agency (2015), 2.7 billion people in the world continue to rely on traditional biomass for their cooking needs. The costs of traditional biomass are both economic and health-related. Women and children in developing countries spend a lot of time collecting firewood, with a high opportunity cost from forgone earning opportunities (Heltberg, 2004). Indoor air pollution from traditional biomass also causes 3.8 million premature deaths every year.¹ As Meera Subramanian put it in a recent *Nature* commentary, the “deadly dinners” cooked with traditional biomass cookstoves take a “terrible

toll” (Subramanian, 2014). According to Parikh et al. (2001), housing in rural India is such that not only is the main cook vulnerable to indoor air pollution while cooking with biomass, but the rest of the family also suffers from a “passive cooking effect”.

For the 2.7 billion people who continue to rely on traditional biomass, a key issue is their subjective satisfaction with their current cooking arrangement. Indeed, regardless of the social cost of the continued use of traditional biomass cookstoves, people base their cooking technology choices on their own experience. If households consider their traditional cooking arrangement satisfactory, they have little incentive to make investments in modern alternatives. In this context, how can social scientists and rural energy researchers evaluate and assess the determinants of subjective satisfaction with cooking arrangements?

As shown in Lewis and Pattanayak's (2012) meta-analysis, most studies on the determinants of the adoption of improved fuels and cookstoves examine demographics, income or geographic variables, while ignoring subjective components of satisfaction. For instance, Pandey and Chaubal (2011) highlight the role of education and income in the adoption of clean fuels for cooking in rural India. Some studies go further and include product-related characteristics such as reduction in smoke, speed of cooking, ease of use, and taste of the food in their assessment of the factors of LPG adoption (Budya and Arofat, 2011; Terrado, 2005). However, to our knowledge, none of them offers a framework to study the determinants of satisfaction

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¹ See <http://www.who.int/mediacentre/factsheets/fs292/en/> (accessed February 18, 2016).

with cooking arrangements. We propose a new analytical approach to explain variations in subjective satisfaction with cooking activities and focus on rural households that rely on traditional biomass. We conceptualize rural households' subjective satisfaction as depending on four dimensions of the cooking experience: convenience, cost, access to alternatives, and perceptions of different dimensions of cooking activities. Using original data from the world's largest energy access survey to date (8568 rural households in six major states of rural India), we then estimate regression models to see how overall satisfaction with one's cooking arrangement depends on these different dimensions. We estimate these models separately for the full sample, for households that use firewood, and for households that regularly collect their own firewood.

The analysis shows that access to modern fuels has a strong positive association with subjective satisfaction. When households with and without LPG are compared, the predicted difference in satisfaction is strongly in favor of those with LPG at home. It accounts for approximately 73% of a standard deviation of our dependent variable, and the result is robust to focusing only on households that use and/or collect firewood. Households with LPG also consider it a much higher policy priority for the government, suggesting that access to modern cooking fuels is something that rural households value greatly. Another notable finding is that while households do *not* seem to find firewood collection inconvenient, their subjective satisfaction does decrease if they have to purchase firewood from markets. The coefficient is much smaller than that for LPG, however. The fact that collection does not seem to be a source of dissatisfaction is in agreement with Masera et al.'s (2000) criticism of the "energy ladder" model. As they claim, cooking practices and cultural preferences play a crucial role in the choice of cooking fuel. When we focus on households that do collect firewood regularly, the dissatisfaction caused by purchases is more related to distance to the nearest firewood market than to the price of firewood. A possible explanation is that regular collectors adapt their collection pattern to market prices. Although they do not study satisfaction with cooking arrangements but the adoption of modern fuels, Das and Srinivasan (2012) also find a negative correlation between distance to market for modern fuel and their adoption rate. It is in agreement with our finding that distance to market is an important source of dissatisfaction, which can in turn drive one's choice of cooking fuel.

These results are important both academically and for practitioners. Academically, our key contribution is to identify access to modern cooking fuels and distance to firewood markets as factors predicting subjective satisfaction. Our results from a large original survey show that improving access to LPG can greatly increase subjective well-being in rural households through reduction in indoor pollution and increase in speed of cooking. Our findings also suggest that some sub-components of subjective satisfaction such as reduction in smoke, speed of cooking, and quality of meals are more correlated to overall satisfaction than difficulty, cost, and safety of the cooking arrangements. Practitioners, in turn, can learn from this result that households ascribe a lot of value to modern cooking fuels. Going further, problems associated with selling technologies such as efficient cookstoves probably reflect issues with their design, efficiency or price.

Modern cooking fuels: access and satisfaction

While the importance of access to modern cooking fuels is by now acknowledged and understood, scholars have made much less progress in understanding how households in developing countries assess the costs and benefits of access to modern cooking fuels. Most of the relevant studies such as Takama et al. (2012) focus on willingness to pay for alternatives, such as LPG and efficient cookstoves. Results from these studies suggest that preferences for traditional

solutions, affordability, liquidity constraints and asymmetric information are all major obstacles to higher sales (Levine et al., 2012; Mobarak et al., 2012; Cheng and Urpelainen, 2014; Sehgal et al., 2014).

However, these studies do not specifically address the question of subjective perceptions. Willingness to pay does not always amount to profound dissatisfaction with one's cooking arrangement. It may instead reflect disposable income (Masera et al., 2000; Cheng and Urpelainen, 2014) or interest in exploring new technologies (Dercon and Christiaensen, 2011). An analytical framework for household demand for modern cooking fuels would have to account for the household members' subjective satisfaction with the conventional alternative. In the absence of subjective dissatisfaction with traditional biomass and cooking methods, it is hard to see why households would spend their often scarce income on modern alternatives.

Our analysis of satisfaction with respect to cooking fuels draws on a broader literature on subjective well-being. A main contribution is Diener et al.'s (1985) satisfaction with life scale aiming at assessing people's satisfaction with their life as a whole. On the other hand, the "Scandinavian approach" of Erikson and Uusitalo (1986) is based on measuring indicators of various components of well-being. Many studies have followed this methodology, including Bookwalter and Dalenberg (2004) who conducted a survey in South Africa to assess subjective well-being of households based on various dimensions such as housing, sanitation, and transportation. We anchor our measure of satisfaction with cooking arrangements in this literature by combining the latter two schools of thought. On the one hand, we measure different components of satisfaction such as cost, access to modern fuel, and convenience. On the other hand, we also include indicators of the following subjective sub-components: satisfaction with smoke and cost, quality of meals, speed of cooking, and ease of use.

The World Bank's Global Tracking Framework (GTF) for the United Nations Sustainable Energy for All is one important effort to measure the quality of access to modern cooking technologies (SE4ALL, 2014). Under this framework, cookstoves are evaluated based on generation of indoor air pollution, convenience of fuel collection and use, and adequacy of the cooking solution for the household's needs. However, the GTF approach has important limitations. Most importantly, it automatically classifies any household with a traditional cookstove as having a low level of cooking energy access, regardless of the reported subjective level of satisfaction. As such, the GTF framework does not distinguish between varying levels of satisfaction among that vast majority of households that rely on traditional biomass for their daily cooking needs. We suggest here a more complete framework aimed at studying demand for cooking fuels.²

Although many frameworks to measure satisfaction with electricity have been suggested, rigorous approaches to measuring the quality of cooking arrangements remain scarce. Indeed, the contrast to the numerous approaches to measuring the quality of rural electricity access is striking. As an important component of demand, subjective satisfaction with the quality of electricity supply plays a major role in the literature on rural electrification (Parikh et al., 2012; Barnes, 2014; Dugoua and Urpelainen, 2014; Aklin et al., 2016b). While the role of subjective satisfaction has been largely neglected in the study of cooking arrangements, scholars have proposed analytical approaches and provided data on the determinants of satisfaction with domestic electricity supply. We believe that such

² In Practical Action's Total Energy Access (Practical Action, 2014, 48), the quality of cooking energy supply depends only on the stove and the fuel, and thus does not capture subjective perceptions.

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