ECONOMICS OF ELECTRIC COOKING IN NEPAL

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Overview

The residential sector accounts for more than 60% of the total final energy demand in Nepal, and cooking is one of the main energy-end uses in the residential sector (WECS, 2023). More than half of Nepalese households still use traditional biomass (fuelwood, animal dung, and agriculture residue) for cooking on inefficient stoves (MOHP et al., 2023). In 2019, the World Health Organization (WHO) estimated that 25,000 Nepalese died prematurely from illnesses attributable to household air pollution (WHO, 2023). It is happening despite Nepal's electricity supply being entirely renewables (hydropower and solar). In urban areas, LPG is the primary cooking fuel imported from neighbouring India, and its imports accounted for about 4% of the total import bill in 2023 (MOF, 2023). Currently, electricity supply exceeds demand in Nepal, and the Nepal Electricity Authority is exploring new avenues to absorb the excess supply. It is an irony that the country has an excess clean energy supply on one hand, whereas it depends on health-hazardous indoor air-polluting biomass and imported LPG to meet its cooking energy requirements, on the other hand. This study aims to bring the attention of policymakers to address this critical policy failure through the assessments of the economic feasibility and environmental benefits of electric cooking in Nepal.

Methods

The study first assesses the patterns of cooking energy use based on geography (provinces, rural/urban), physical access (infrastructures such as electricity distribution system, LPG supply networks), affordability (fuel prices and household income), and reliability (quality of supply networks). This is followed by economic analyses of fuel choices from private and social perspectives. From a private standpoint, the useful energy supply cost of each fuel is based on its capital costs, fuel costs, operation and maintenance costs. The analysis accounts for the type of cooking devices and fuels (to capture devices' thermal efficiency and fuels' heat values), household's heating events (e.g., number of meals prepared per day), number of members in the household, and geographical locations. The analyses are carried out at three topographical levels (Tarai, hill, and mountain) and Kathmandu valley for both urban and rural areas. On top of the private costs, we estimated and added environmental damage costs caused by biomass and fossil fuels to determine the total or social costs of fuel choices. Several secondary and primary sources are used for data, including the National Population and Housing Census (NSO, 2023), peer-reviewed articles, and reports from governmental and non-governmental organizations. The data and their sources are well documented in the appendices of the full version of the paper.

Results

Table 1 presents the private costs we estimated for different regions in Nepal. The results show that, on average, biomass cookstoves are relatively economical for cooking in Nepal. Interestingly, electric cookstoves are the next economically attractive options. These are cheaper than stoves using petroleum fuels (e.g., LPG, kerosene). Traditional biomass is the most affordable option in rural areas because of zero fuel costs (freely available fuelwood from natural forests). Still, they are not necessarily the cheapest option in the urban areas where the market supplies fuelwood. Using hydrogen for cooking is still under the experimental phase and is the most expensive option.

We also estimated the total costs (private and social) of cooking with commonly used cooking fuels and technology (Figure 1). The social costs include health damage associated with PM2.5 and environmental damage related to CO_2 emissions. When social costs are quantified, the total costs of cooking using fuelwood increase by, on average, 7 times as compared to their private costs in Nepal. Likewise, the total costs of cooking using LPG increase by 10% to 15% across the regions compared to their private costs. In contrast, total and private cooking costs for renewable-based electricity remain unchanged. Thus, when total costs are considered, cooking with electricity becomes the most economic choice for households.

Table 1: Average levelized cost of cooking from private perspective (thousand NRs/household/year)

	Mountain		Hill		Tarai		Kathmandu valley	Nepal
	Rural	Urban	Rural	Urban	Rural	Urban		
Traditional cookstove	0	12	0	8	0	11	19	7
Improved cookstove	<0.3	6	<0.3	4	<0.3	6	10	4
Biogas	8	8	8	8	8	8	8	8
Kerosene	28	27	22	17	23	20	17	22
LPG	23	22	18	14	19	16	14	18
Electric (Induction)	11	11	11	10	13	12	10	11
Hydrogen	34	32	27	20	28	15	20	25

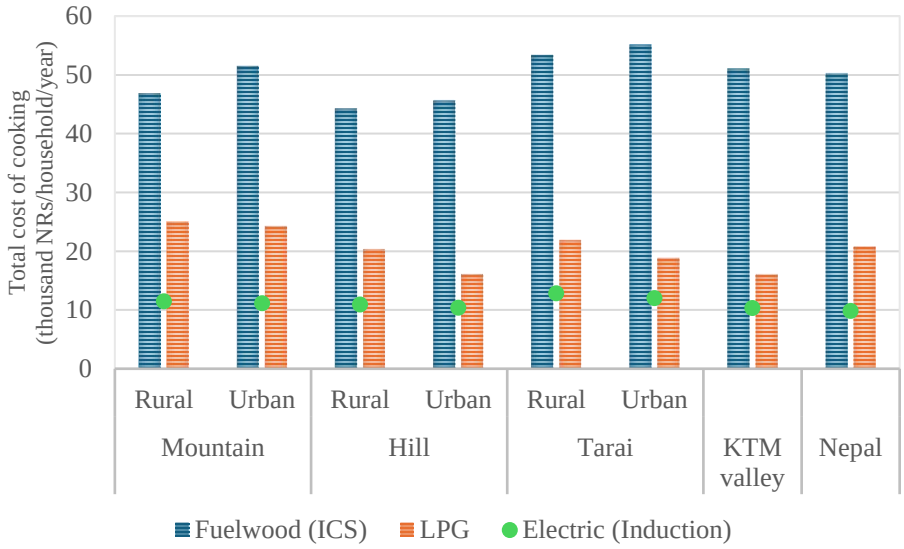

Fig. 1. Total (private and social) cost of cooking (thousand NRs/household/year)

Conclusions

Nepal is forgoing economic and environmental opportunities for not rapidly adopting electric cooking. Our study finds that electricity cooking is 29% cheaper in Kathmandu and 39% cheaper throughout Nepal (on average) than cooking with LPG, which is entirely imported. If other benefits such as domestic economic spillovers (increased jobs, income, economic outputs) of hydropower expansion and economic benefits of substitution of imported LPG are accounted for, economics of electric cooking would be further promising. However, electric cooking faces some key challenges (e.g., lack of quality supply infrastructures for electricity, higher upfront investment costs for electric stoves, and other cultural and behavioral factors). Reduction of these barriers through various policy interventions, such as information campaigns highlighting the economics of electric cooking, fiscal incentives to reduce high-upfront costs, and marketing emissions reductions, are essential to encourage the wider adoption of electric cooking in Nepal.

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