THE GENDER PERSPECTIVE OF SOCIOECONOMIC DETERMINANTS OF HOUSEHOLD COOKING ENERGY CONSUMPTION IN LESOTHO

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Abstract

Unveiling gender dynamics in household energy consumption is a viable pathway to sustainable development in developing countries, as socially assigned cooking roles often place unequal burdens on women and reinforce inequality. Thus, this study examines the determinants of fuel consumption shares between female- and male-headed households in Lesotho during different seasons, utilising the 2017 Household Energy Consumption Survey (HECS) data and the Tobit regression model. The findings reveal that although grid-connected households generally prefer modern fuels in summer, female-headed households revert to cheaper, polluting fuels in winter. Moreover, the use of dirty fuels increases with age, particularly in female-headed households. Additionally, families with labour for wood collection, especially children, exhibit a high reliance on polluting fuels and limited adoption of modern fuels. Conversely, improving the education level and other socioeconomic standards (geographic location, financial status or other wealth measures) fosters the reduction of polluting fuels in the household energy mix and promotes clean energy adoption. Therefore, targeted educational and economic empowerment programmes can enhance the use of clean energy and improve the well-being of Basotho, especially in female-headed households.

Keywords: Household energy consumption; Gender perspective; Polluting fuels; Modern fuels; Tobit regression; Lesotho.

1. Introduction

The contribution of energy to social development and household welfare necessitates adequate energy access for all, as anticipated by the United Nations' Sustainable Development Goal (SDG) 7. With approximately 72% of the global greenhouse gas (GHG) emissions reported to emanate directly or indirectly from the residential sector (Küfeoğlu, 2024; Connolly *et al*., 2022; Dubois *et al*., 2019), the use of clean fuels and improved cooking devices is reportedly a low-hanging fruit to achieve SDG 7. In developing countries, however, 2.1 billion people, particularly in African and Asian countries, lack access to clean cooking fuels and technologies as of 2024 (IEA, 2024; SEforALL, 2024). Meanwhile, about 90% of the energy consumed in households in these countries is mainly for cooking (Aminu *et al*., 2025; Mperejekumana *et al*., 2021). Therefore, the type of cooking energy consumed in households is a critical aspect that predominantly affects and is affected by households' living conditions.

Nevertheless, as Aminu *et al*. (2025) and Matsumoto *et al*. (2022) contended, the household cooking energy consumption choices and patterns, as well as their respective triggers, vary across regions and remain largely unknown in some developing countries. This hinders the implementation of the much-needed energy sector reforms. Owing to the low economic standards, households in developing economies, such as Lesotho, rely heavily on low-cost and/or freely available polluting fuels, especially traditional fuels like wood, animal dung and coal, to meet their daily energy requirements (Mothala *et al*., 2022; Connolly *et al*., 2022; Zou and Luo, 2019). This pattern, however, can vary significantly between female- and male-headed households in countries where social and cultural norms have handed women the primary responsibility of daily household management, including cooking and fuel collection (Zhang *et al*., 2023; Mperejekumana *et al*., 2021; Nwaka *et al*., 2020).

To promote gender equality in clean energy adoption, it is imperative to assess whether there are any differences in the socioeconomic determinants of household energy use between female- and male-headed households. Thus, this paper aims to analyse the determinants of the shares of cooking fuels among female- and male-headed households during summer and winter seasons in Lesotho using the 2017 HECS dataset. The paper contributes to the literature on the drivers of household energy consumption by employing the Tobit regression model to obtain unbiased and consistent estimators for its censored sample (Zou and Luo, 2019). It also integrates the effects of seasonality on the dynamics of household energy consumption of female- and male-headed households. Lastly, the findings of this study point to the critical aspects that need to be tackled to promote just and inclusive energy transition within households in Lesotho.

Accordingly, the study is guided by the following research questions:

RQ1. *How does the gender of the household head influence the household's share of fuel consumption in Lesotho?*

RQ2. *How do these gender-based effects vary across different seasons of the year?*

The remainder of the study is organised as follows. It provides a critical review of the literature on household energy consumption, followed by a presentation of the data and methodology. The subsequent sections present and discuss the empirical results, and the study concludes with key insights and policy recommendations.

2. Literature Review

Household energy consumption is shaped by the preferences, constraints and decision-making processes of household members. Because households function as collective units, energy choices emerge from the interaction of individual preferences, shared responsibilities and intra-household bargaining. Behavioural economics emphasises that such decisions are influenced not only by income and prices but also by bounded rationality, social norms, risk perceptions and identity-driven preferences, making household energy consumption a multidimensional behavioural process. This aligns with the interdisciplinary perspective that stresses the need to integrate psychology, sociology or behavioural science into economic decision-making (Musso, 2019).

Building on this foundation, traditional explanations of household energy transition rely on the energy ladder model, which assumes that households move linearly from traditional to modern fuels as income rises (Leach, 1992). However, empirical evidence shows that households rarely abandon traditional fuels entirely, even when modern fuels are accessible. For example, only 3% of households in Ethiopia, Uganda, Tanzania and Malawi used electricity for multiple end-uses despite electrification (Rahut *et al*., 2017). This reflects bounded rationality, where households simplify complex decisions, rely on heuristics and avoid unfamiliar technologies. Thus, in line with Sürücü (2014), individuals reduce cognitive load by categorising information and making satisficing rather than optimising choices.

Consequently, the fuel stacking model provides a more realistic behavioural explanation. Households often combine multiple fuels due to cost considerations, cultural preferences, perceived reliability and risk aversion (Yadav *et al*., 2021). Even financially capable households may continue using biomass because modern appliances are perceived as costly or unsuitable (Wassie and Adaramola, 2021). In Kenya, households stack fuels to manage time constraints and cooking needs (Ochieng *et al*., 2020). These patterns are also consistent with findings from Aminu *et al*. (2025), who show that households' adoption of liquefied pretroleum gas (LPG) in Nigeria is shaped by availability, income, education and perceived effectiveness, reinforcing the behavioural nature of fuel choice.

Extending this behavioural perspective, gender dynamics further shape household energy decisions. This is not because of inherent differences in rationality, but because of social norms, division of labor and access to resources. In some developing contexts, men hold greater authority over major household purchases. In rural China, 40% of households reported male-dominated energy decisions compared to 19.1% female participation (Wang *et al*., 2021). In Rwanda, 77% of male-headed households reported that men made all energy decisions, with women participating only after consultation (Muza and Thomas, 2022). These patterns reflect norm-driven decision structures, where women's preferences may be underrepresented, leading to outcomes such as reported thermal discomfort among women (Sintov *et al*., 2019). Nevertheless, the importance of gendered decision-making is also reflected in Sentuti (2017), who shows that women's leadership styles emphasise cooperation, communication and shared decision-making, which are traits that influence household-level choices, including energy use.

Unlike in other developing economies, existing evidence from Lesotho indicates that 88% of women participate in major household equipment purchases (UNFCCC, 2020). This may be linked to differences in household roles, as men often spend more time outside the home and may undervalue domestic appliances (Fingleton-Smith, 2018). Some studies suggest that men may invest less effort in appliance selection and may not prioritise household comfort needs (Johnson *et al*., 2019). Conversely, women may resist adopting certain technologies if they increase domestic workload or reduce shared responsibilities (Muza and Thomas, 2022). Taken together, these dynamics support intra-household bargaining as a key mechanism through which gendered preferences, responsibilities and power relations shape household energy choices.

Additionally, income disparities between men and women contribute to unequal access to modern energy technologies. Men often occupy higher-paying jobs, placing male-headed households in a better position to adopt clean energy (Phogole *et al*., 2022; Johnson *et al*., 2019; Pearl-Martinez and Stephens, 2016). In Turkey, female-headed households showed significantly lower willingness to pay for renewable electricity, largely due to income constraints (Muza and Thomas, 2022). Likewise, in Bhutan, reliance on polluting fuels was similar across male- and female-headed households (22%), but rose to 26% among de jure female-headed households, reflecting limited employment opportunities for single mothers (Aryal *et al*., 2019). These findings highlight structural energy injustice, where gendered income gaps restrict access to clean energy. Similar patterns are observed in Aminu *et al*. (2025), who show that household income is a major determinant of LPG adoption.

Furthermore, energy conservation involves both efficiency choices (purchasing efficient appliances) and curtailment behaviour (reducing consumption through daily habits). Although male-headed households often adopt modern energy technologies due to higher income, women frequently demonstrate stronger conservation behaviour. Women tend to purchase higher-quality, energy-efficient appliances (Wang *et al*., 2021; Mottaleb *et al*., 2017) and consume less energy overall, which is 1.2 to 1.5 times less in China (Wang *et al*., 2019) and 13% less electricity in the United Kingdom (Grünewald and Diakonova, 2020). These differences reflect pro-social and sustainability-oriented preferences. Women's stronger orientation toward responsible consumption is often linked to caregiving roles and long-term household well-being (Du and Pan, 2022; Arachchi and Managi, 2021). This shows that perceived consumer effectiveness and sustainability attitudes can strongly influence household purchasing behaviour (Taracakti and Aminata, 2024), and similarly shape household energy-use decisions.

Finally, cultural norms can restrict women's ability to adopt or use modern energy technologies. In Rwanda, women avoided improved cookstoves because cultural norms prohibited cooking while standing (Muza and Thomas, 2022). Women also carry disproportionate domestic responsibilities even when engaged in productive work (Johnson *et al*., 2019). These constraints, combined with limited employment opportunities, increase women's vulnerability to energy poverty, resulting in emotional and physical strain (Petrova and Simcock, 2021; Shrestha *et al*., 2021). These socio-cultural constraints echo the broader behavioural insights, which highlights how norms and cognitive limitations shape economic behaviour (Musso, 2019).

Overall, household energy consumption is shaped by a complex interplay of behavioural, socioeconomic and cultural factors. Existing studies consistently show that women often demonstrate stronger conservation behaviour and greater interest in energy efficiency when they have decision-making power, while men's higher income facilitate adoption of modern energy technologies. Education further enhances clean energy adoption across genders. However, previous research remains fragmented, with most studies focusing on hot and humid regions, overlooking contexts where heating needs dominate. Moreover, empirical studies seldom compare female- and male-headed households directly, and almost none analyse how seasonal changes alter gendered energy choices. These gaps underscore the need for a more integrated, theory-driven analysis of how gender and seasonality jointly shape household energy behaviour in colder climates such as Lesotho.

From a behavioural economics perspective, gendered preferences, intra-household bargaining and seasonal thermal needs are expected to influence fuel choices and consumption patterns. Guided by this theoretical framing, the study tests two hypotheses using the Tobit regression model: i) there are significant gender-based differences in the socioeconomic determinants of cooking energy use between female- and male-headed households in Lesotho, reflecting gendered differences in bargaining power, preferences and resource access; and ii) seasonal variation (summer vs winter) significantly alters the shares of cooking fuels consumed by female- and male-headed households, consistent with behavioural responses to changing thermal comfort needs and perceived fuel reliability.

To the best of the authors' knowledge, only Mothala *et al*. (2022) have contributed to the empirical literature using the case study of Lesotho through an econometric analysis of the determinants of choice of household energy consumption, employing the multinomial logistic model. Nevertheless, the study did not incorporate gendered behavioural differences or seasonal dynamics. By integrating these dimensions, the present study fills a key empirical gap in understanding household energy behaviour in colder developing-country contexts.

3. Data and Methodology

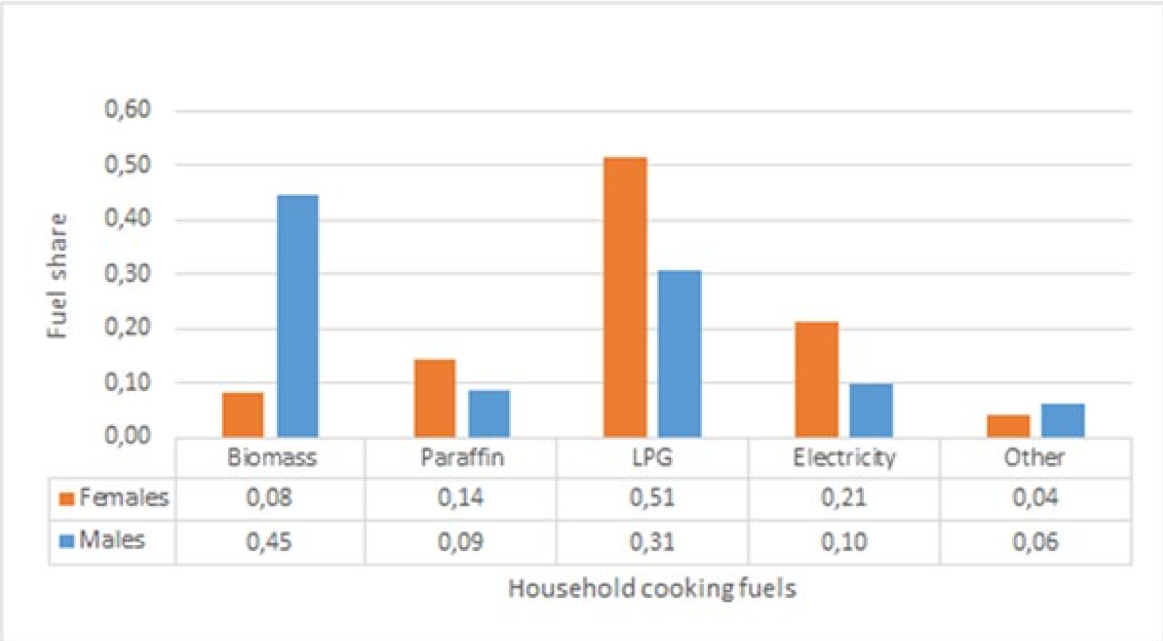
3.1 Data Description

The data employed in this study was collected by the Lesotho Bureau of Statistics (BoS) in partnership with the government's Department of Energy (DoE) during the 2017 Household Energy Consumption Survey (HECS) as a baseline for household energy consumption in Lesotho. The survey was undertaken in two phases. Phase 1 was during the winter months from April to July 2017, and Phase 2 was from September to November 2017, covering the summer months from October to December. A total of 2877 households were randomly sampled in winter, with a follow-up in summer attaining a 93% response rate (Bureau of Statistics, 2017).

A broad spectrum of variables with a direct or indirect relationship to household energy consumption was included in the questionnaire. These are categorised into household location demographics, housing, economic characteristics, available cooking and kitchen utensils, ease of access to an automobile, as well as traditional and modern energy sources, including fossil fuels and solar energies used for cooking, lighting, heating and/or cooling. The household consumption of shares of the most prominent cooking fuels in Lesotho, namely: traditional biomass, paraffin, LPG, and/or electricity, is the regressand (dependent variable) whose distribution across families under different genders of the household head is presented in Figure 1 (for summer) and Figure 2 (for winter). Since the shares of other fuels such as cloth and aloe cumulatively account for less than 10% of the fuels consumed in households, they are not taken into consideration in this study.

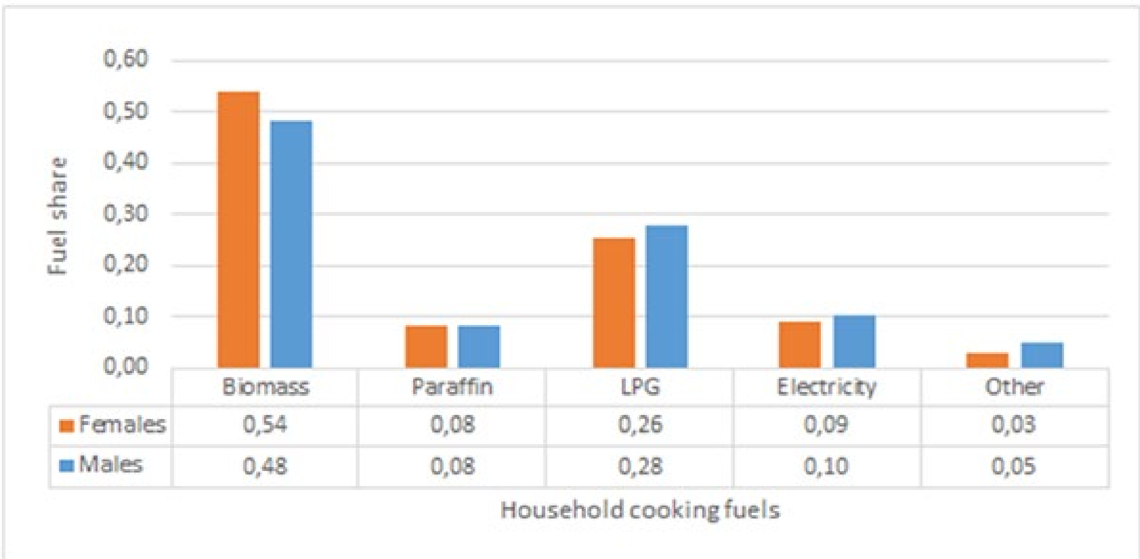
Figure 1 shows that female-headed households have a significantly higher share of cleaner fuels than male-headed households in summer. The bulk of energy consumed in female-headed households is LPG (51%) and electricity (21%), whereas biomass (45%) and LPG (31%) are dominant in male-headed households. On the contrary, biomass is the least consumed energy in female-headed households (8%), showing substantial variance in energy consumption patterns based on the gender of the household head.

Figure 1 – The shares of fuels consumed in male and female-headed households in summer



Source: Own using the Lesotho BoS 2017 HECS data.

Figure 2 – The shares of fuels consumed in male and female-headed households in winter



Source: Own using the Lesotho BoS 2017 HECS data.

However, there is a somewhat similar consumption pattern in female- and male-headed households for all fuels in winter, as depicted in Figure 2. Biomass stands out in both female-headed (54%) and male-headed (48%) households. Despite the similarity in consumption patterns, female-headed households recorded a slightly higher share of biomass and slightly lower shares of paraffin, LPG, and electricity than male-headed households.

The regressors (independent variables) utilised in this study are presented in Table 1, spanning the socioeconomic characteristics of the sampled households. Female household heads make up 38% of the survey respondents, and they are on average 10 years older than males, with more females (94.2% compared to 83%) having received a certain level of education. For both female- and male-headed households, over 50% of the households are in rural areas, and the majority of households fall in the lower income class, regardless of the gender of the household head. Moreover, female-headed households are larger than male-headed households. Comparatively, male-headed households have higher wealth indices, including the share of appliances, access to a private car, ownership of solar systems and ownership of a generator. The majority of sampled households (64% females and 65% males) did not have any member primarily responsible for the wood collection; thus, they mostly consumed other energy sources.

3.2 Model Specification and Estimation

This study assesses the socioeconomic factors that determine the shares of household energy consumption, in terms of biomass, paraffin, LPG and electricity, for cooking in Lesotho. Following Zou and Luo (2019), the Tobit regression model is employed. This approach is preferred because the dependent variables are censored proportions with zero observations, and Tobit appropriately models this limited-dependent structure by maximising the likelihood of both the continuous shares and the mass at zero (Afaifia *et al*., 2021). Alternative approaches such as ordinalry least squares, logit or probit do not account for censoring and would yield biased or inconsistent estimates. A known limitation of the Tobit model is its strong distributional assumptions, which may affect inference. However, the estimated results remain reliable when the model specification aligns with the data-generating process, the censoring mechanism is correctly identified and the socioeconomic variables behave consistently across all fuel-share equations. To enhance interpretability, the study further reports marginal effects to show the practical magnitude of each socioeconomic factor on fuel shares, ensuring that the findings are transparent and policy-relevant.

The energy consumption patterns between female- and male-headed households vary substantially, though ideally, households are expected to transition linearly from polluting low-end fuels to higher-end fuels with improvement in the economic standards as postulated by the energy ladder model (Leach, 1992). Instead, a substantial body of literature backs the fuel stacking model proving the significance of various social, economic and cultural factors in influencing household energy consumption traits (Rahut *et al*., 2017; Yadav *et al*., 2021). Of these, income streams, education, gender and age of the household head are the most popular determinants in both theoretical and empirical literature.

Table 1 – The representation of respondents by gender for listed regressors

Variables		Gender	
		Females (%)	Males (%)
Household head		38	62
Average age of household head (years)		56	46
Education of household head	None	6	19
	Non-formal	0.2	1
	Primary	61	47
	High school	24	25
	Vocational training	1	1
	Tertiary	8	9
Household settlement type	Rural	54	53
	Peri-urban	11	9
	Urban	36	38
Household income	Lower	68	54
	Middle	26	36
	Upper	6	11
Household remittances	None	67	75
	Lower	20	14
	Middle	13	10
	Upper	1	2
Household size (number)		5	4
House class	Lower-middle	95	93
	Upper	5	7
House ownership	Household	75	74
	Free private	3	4
	Rented private	19	20
	Government	1	1
Grid connection	Not connected	49	50
	Connected	51	50
Average electrification period (years)		2	3
Share of electrical appliances		5	7
Private car	Accessed	5	11
	No access	95	89
Solar system	Own	8	10
	Do not own	92	90
Generator	Own	2	3
	Do not own	98	97
Wood collector	None	64	65
	Household head	17	12
	Children	9	9
	Spouse	8	12
	Relative	0.5	1

Source: Own using the Lesotho BoS 2017 HECS data.

Although the influence of increasing age on the uptake of modern fuels over traditional fuels remains ambiguous, improvements in education and income commonly favour the adoption of modern energies (Mothala *et al*., 2022; Mottaleb *et al*., 2017). Moreover, given that males have considerably higher economic privileges compared to females (ILO, 2023), male-headed households are anticipated to have higher wealth indices, including ownership of cars, modern houses and a large array of appliances that can potentially encourage clean energy adoption.

The model to be estimated is expressed mathematically as equation (1) to account for various household dynamics that influence the observed patterns.

$$Y_i = \beta_1+\beta_2' X_i+\mu_i \tag{1}$$

where Yi represents individual shares of the cooking fuels consumed in households (biomass, paraffin, LPG or electricity), herein referred to as the dependent variable; β_1 represents the constant parameter; β'_2 is a vector of the estimated slope coefficients that indicate covariance with the dependent variable; X_i is a vector representation of all independent variables utilized in the analysis of this study; and μ_i is an independently and identically distributed error term.

Now, following Gujarati (2008) and the definitions established in equation (1), the Tobit regression model is specified as follows:

$$Y_i = \begin{cases} Y_i^*, & if\ Y_i^* > 0 \\ 0, & otherwise \end{cases} \tag{2}$$

$$Y_i^* = \beta_1 + \beta_2' X_i + \mu_i \tag{3}$$

where Y_i^* is the latent (unobserved) variable, capturing the underlying true level of the outcome (fuel share) observed if there is no censoring in the data. The observed variable (Y_i) is censored to the left, that is, it takes on all positive values, but it is set to zero for all zero (or non-positive) values of the dependent variable. This allows for a reliable estimation of the relationship between the shares of household energy consumption and their determining variables, as presented in Table 1.

To ensure the adequacy of the estimated model that determines the relationship between household cooking fuel consumption and the established explanatory variables, the chi-square (χ^2) statistical test is conducted (Adkins, 2010). This test is used to determine the model's fitness by establishing the statistical significance of variance between observed and expected data. The model is said to be a good fit when the test gives a small p-value, often benchmarked at the 1%, 5% or 10% significance level, proving that the relationship between the household fuel shares and the independent variables is statistically significant.

4. Results

The households in Lesotho consume numerous fuels for cooking, and these comprise both dirty (or polluting) fuels, such as biomass and paraffin, as well as clean (or modern) fuels, such as LPG and electricity. Determinants of shares of these cooking fuels consumed in female- and male-headed households in summer and winter are presented in Table 2 (for polluting fuels) and Table 3 (for modern fuels). All the Tobit estimated models are statistically significant, as the p-values of all chi-square tests are below the 1% significance level; hence, the estimated parameters sufficiently describe the dependent variable.

4.1 Determinants of Household Consumption of Polluting Fuels

Table 2 and Table 3 highlight the drivers of polluting fuels' consumption within Lesotho's households, namely, biomass and paraffin, respectively, while Table 6 and Table 7 in the appendix provide their corresponding marginal effects. According to the main results, the effect of the age of the household head on the share of biomass in both female- and male-headed households is positive and significant in summer, and a similar effect is observed but only for female-headed households in winter. Age, however, has no significant impact on the share of paraffin despite the gender of the household head in both seasons. This suggests that households headed by older citizens are the most prominent biomass consumers.

In comparison to household heads with no education, female-headed households with non-formal education experience a higher share of biomass in winter, but a lower share of paraffin in both seasons. On the other hand, male-headed households with primary and high school education exhibit higher biomass shares in summer. Generally, households whose female heads have at least received primary education exhibit lower biomass shares in both seasons. This denotes that, as the education status of female heads improves, their households tend to reduce their share of polluting biomass. This proves the significance of providing education to females, which empowers them and their households to transition from traditional fuels.

In observing the contribution of the household geographic location on fuel shares, the findings reveal that both female- and male-headed households in peri-urban and urban areas, compared to those in rural areas, experience lower shares of biomass, but higher shares of paraffin in both summer and winter. This suggests that rural households are the most prominent biomass consumers. Moreover, in comparison to households in the low-income class or those that do not receive remittances, households with income sources generally exhibit lower shares of dirty fuels in both seasons despite the gender of the household head. Thus, as the financial status of households improves, they tend to consume less polluting fuels.

Additionally, both female- and male-headed households that reside in rented private and government-owned houses, compared to those in household-owned houses, exhibit lower shares of biomass in both seasons. On the contrary, male-headed households experience lower paraffin shares in families that dwell in government-owned houses, but higher paraffin shares for privately rented homes. Thus, families living in household-owned houses are a target group to be helped with strategies that affect energy transition.

Only female-headed households that are grid-connected, compared to non-electrified households, experience higher shares of biomass and paraffin in summer and winter, respectively, but lower shares of paraffin in summer. However, both female- and male-headed households generally reduce the shares of dirty fuels in both seasons as they increase the share of their electrical appliances.

Alternatively, when there is no member designated for wood collection, households exhibit lower shares of biomass. However, when a child is responsible for wood collection in both female and male-headed households, the shares of biomass generally increases for such households in both seasons. This conveys that children are subject to drudgery; hence, such families ought to be empowered to transition to cleaner fuels.

Table 2 – Household consumption results for polluting fuels (biomass)

		Biomass			
		Summer		Winter	
		Female	Male	Female	Male
Constant		0.78 ***	0.68 ***	0.97 ***	0.97 ***
Age (years)		0.003 **	0.005 ***	0.002 **	0.002
Education: *None*	Non-formal	-0.12	-0.18	0.64 ***	0.15
	Primary	-0.02	-0.10 ***	-0.05	-0.07 **
	High school	-0.15 *	-0.23 ***	-0.27 ***	-0.22 ***
	Vocational training	-3.70 ***	-0.26	-0.39 ***	-3.36 ***
	Tertiary	-0.63	-0.67 ***	-0.52 **	-0.40 ***
Settlement: *Rural*	Peri-urban	-0.22 ***	-0.28 ***	-0.05	-0.23 ***
	Urban	-0.62 ***	-0.63 ***	-0.58 ***	-0.58 ***
Income: *Lower*	Middle	-0.32 ***	-0.16 ***	-0.26 ***	-0.15 ***
	Upper	-0.12	-0.45 ***	-0.27	-0.34 ***
Remittance: *None*	Lower	0.03	-0.001	-0.13 ***	0.01
	Middle	-0.06	-0.05	-0.08	-0.06
	Upper	-2.15 ***	-0.51 **	-0.55 **	-0.36 **
Household size (number)		-0.01	0.001	0.01	-0.01
House class: *Lower-middle*	Upper	-0.20	-0.35 ***	-0.05	-0.18
House ownership: *Household*	Free private	-0.03	-0.13	-0.09	-0.22 **
	Rented private	-0.84 ***	-1.08 ***	-0.70 ***	-0.81 ***
	Government	-2.92 ***	-3.12 ***	-0.47 **	-0.02
Grid: *Not connected*	Connected	0.21 **	-0.05	-0.16	0.04
Electrification period (years)		-0.01	-0.02	-0.004	-0.02 **
Share of appliances		-2.92 ***	-1.53 **	-2.47 ***	-1.66 ***
Private car: *Accessed*	No access	-0.15	-0.01	-0.09	-0.08
Solar system: *Own*	Don't own	0.04	0.004	0.10 *	0.04
Generator: *Own*	Don't own	0.04	0.001	-0.20	-0.05
Wood collector: *Household head*	No member	-0.10 *	-0.13 **	-0.13 ***	-0.22 ***
	Children	0.10	0.13 **	0.16 ***	0.08 *
	Spouse	0.01	0.09	0.03	0.01
	Relative	0.06	-0.04	0.09	-0.15
Chi-square statistic		1653 ***	2224 ***	789 ***	2322 ***

Source: Own results.

Notes: ***, **, and * represent 1%, 5%, and 10% statistical significance levels, respectively. The base variables for all categorical variables are listed in italics for each variable.

Table 3 – Household consumption results for polluting fuels (paraffin)

		Paraffin			
		Summer		Winter	
		Female	Male	Female	Male
Constant		-2.41***	-2.20 ***	-3.80 ***	-2.41 ***
Age (years)		0.01	0.002	0.002	0.003
Education: *None*	Non-formal	-5.16 ***	0.39	-5.73 ***	0,08
	Primary	0.31	0.29 **	0.16	0,25
	High school	0.04	0.36 **	0.30	0,11
	Vocational training	-0.03	0.77	0.75	-6,27 ***
	Tertiary	-0.16	-0.04	0.76	0,13
Settlement: *Rural*	Peri-urban	0.40	0.80 ***	0.50 *	0,16
	Urban	1.28 ***	0.80 ***	1.48 ***	1,08 ***
Income: *Lower*	Middle	0.001	-0.06	-0.05	-0,15
	Upper	-6.09 ***	-0.66 **	-1.45 **	-0,79 **
Remittance: *None*	Lower	-0.19	0.07	-0.01	-0,22
	Middle	0.20	-0.50 **	0.06	-0,001
	Upper	-6.16 ***	0.02	-7.27 ***	-0,42
Household size (number)		0.04 *	-0.01	0.05	0.03
House class: *Lower-middle*	Upper	0.54	-0.01	-0.07	-0,53
House ownership: *Household*	Free private	0.70 **	0.04	-0.02	0,49 *
	Rented private	0.27	0.42 **	0.27	0,71 ***
	Government	0.06	-6.03 ***	-0.49	-6,15 ***
Grid: *Not connected*	Connected	-0.60 **	0.25	1.02 ***	0,28
Electrification period (years)		0.01	-0.02	0.01	0.03
Share of appliances		-5.57 ***	-7.20 ***	-4.01	-5.97 ***
Private car: *Accessed*	No access	-0.05	0.09	0.84 *	-0,13
Solar system: *Own*	Don't own	-0.16	-0.25	-1.40 ***	-0,13
Generator: *Own*	Don't own	-0.57	0.52 *	-6.79 ***	-6,08 ***
Wood collector: *Household head*	No member	0.01	0.44 **	0.32	-0,04
	Children	-0.21	-0.31	-0.09	-0,09
	Spouse	-0.18	0.32	0.37	0,02
	Relative	-5.93 ***	0.96	-5.43 ***	-0,19
Chi-square statistic		793 ***	1221 ***	845 ***	1220 ***

Source: Own results.

Notes: ***, **, and * represent 1%, 5%, and 10% statistical significance levels, respectively. The base variables for all categorical variables are listed in italics for each variable.

4.2 Determinants of Household Consumption of Modern Fuels

Table 4 and Table 5 display the determinants of household consumption in terms of shares of LPG and electricity, respectively, while Table 8 and Table 9 in the appendix report their corresponding marginal effects. Though the impact of age is insignificant in the household share of LPG, despite the gender of the household head, it is negative and marginally significant for female-headed households in both seasons. This implies that as female heads age, their households tend to reduce their share of electricity, possibly falling back to traditional fuels.

Contrary to households whose heads received no education, households headed by females with non-formal education generally experience lower shares of LPG and electricity in both seasons. Nonetheless, households headed by females or males with at least primary education mostly exhibit higher shares of LPG in both seasons. Thus, the formal education status of the household head improves the use of modern fuels, especially LPG.

Additionally, both female- and male-headed households with the following characteristics predominantly experience higher shares of LPG in both seasons: i) those in the peri-urban and urban areas compared to those in the rural areas; ii) those in the middle and upper-income classes as opposed to those in the lower class; and iii) those in the middle and upper remittance classes compared to those that do not receive any. This suggests that certain norms and low-income streams prohibit the adoption of some clean cooking technologies amongst underprivileged social groups like rural communities.

Both female- and male-headed households that are grid-connected, compared to non-electrified households, exhibit higher shares of LPG and electricity in summer, but lower ones in winter. Moreover, on the basis of the household wealth indices, households with bigger shares of electrical appliances experience higher shares of electricity in both seasons, but only lower shares of LPG in male-headed households in summer. Ownership of a solar system and generator, on the other hand, generally increases shares of LPG in both seasons, while it reduces shares of electricity.

Lastly, both female- and male-headed households with no member designated for wood collection, compared to those where the household head is designated, experience higher shares of LPG in both seasons. However, having a child or relative as a designated wood collector generally reduces the shares of both LPG and electricity. The implication is that having any household member other than the head as a primary wood collector triggers less preference for clean fuels and possibly spurs increased dirtier fuel consumption.

5. Discussion

Household energy consumption, as described by fuel stacking models, is multifaceted, with households combining fuels in ways that reflect both socioeconomic constraints and bounded rationality, where decisions are shaped by habits, limited information and satisficing rather than optimisation. These fuel combinations differ across households because each fuel contributes a certain share to the final energy-use structure.

According to the results presented in Table 2 (for polluting fuels) to Table 3 (for modern fuels), as the female or male household heads age, their households tend to use polluting fuels, reducing the use of some of the clean fuels. This pattern is consistent with Oyeniran and Isola (2023), who show that older people have deeply rooted biomass-use habits. Such persistence reflects habit formation and the tendency to maintain familiar practices even when cleaner options exist. However, this contradicts Elasu *et al*. (2023), who argue that older people may prefer clean fuels due to reduced physical capacity for wood collection.

Table 4 – Household consumption results for modern fuels (LPG)

		LPG			
		Summer		Winter	
		Female	Male	Female	Male
Constant		-1.22 ***	-1.45 ***	-1.50 ***	-1.48 ***
Age (years)		-0.003	-0.002	-0.003	-0.001
Education: *None*	Non-formal	-5.16 ***	0.22	-4.39 ***	0.14
	Primary	0.12	0.43 ***	0.58 **	0.44 ***
	High school	0.48 **	0.55 ***	0.76 ***	0.51 ***
	Vocational training	0.81 **	0.11	0.84 **	0.46
	Tertiary	0.22	0.33 **	0.57 **	0.31 **
Settlement: *Rural*	Peri-urban	0.59 ***	0.45 ***	0.39 ***	0.74 ***
	Urban	0.78 ***	0.70 ***	0.66 ***	0.74 ***
Income: *Lower*	Middle	0.45 ***	0.41 ***	0.50 ***	0.40 ***
	Upper	0.49 ***	0.48 ***	0.68 ***	0.38 ***
Remittance: *None*	Lower	0.06	-0.06	0.36 ***	0.02
	Middle	0.36 ***	0.34 ***	0.36 ***	0.32 ***
	Upper	0.15	0.62 ***	1.04**	0.62 ***
Household size (number)		0.01	0.01	-0.01	-0.04 **
House class: *Lower-middle*	Upper	-0.15	0.36 ***	-0.01	0.17
House ownership: *Household*	Free private	-0.49 **	-0.21	-0.46 *	0.06
	Rented private	-0.09	-0.12	-0.12	-0.21 **
	Government	-0.08	-0.50	0.54 **	0.17
Grid: *Not connected*	Connected	0.32 **	0.23 **	-0.14	-0.34 ***
Electrification period (years)		0.002	0.01	-0.01	-0.002
Share of appliances		-0.70	-1.19 **	-0.24	-0.92
Private car: *Accessed*	No access	-0.04	0.07	-0.39 *	0.10
Solar system: *Own*	Don't own	0.04	0.24 **	0.22	0.21 *
Generator: *Own*	Don't own	0.55 **	0.09	0.83 ***	0.50 ***
Wood collector: *Household head*	No member	0.07	0.35 ***	0.46 ***	0.45 ***
	Children	-0.25	-0.01	-0.36 *	-0.17
	Spouse	-0.03	-0.15	0.02	0.04
	Relative	-5.67 ***	0.65	-5.02 ***	0.38
Chi-square statistic		1519 ***	825 ***	1433 ***	1502 ***

Source: Own results.

Notes: ***, **, and * represent 1%, 5%, and 10% statistical significance levels, respectively. The base variables for all categorical variables are listed in italics for each variable.

Table 5 – Household consumption results for modern fuels (electricity)

		Electricity			
		Summer		Winter	
		Female	Male	Female	Male
Constant		-3.50 ***	-7.06 ***	-0.90	-1.68 ***
Age (years)		-0.01 *	-0.01	-0.01 *	-0.003
Education: *None*	Non-formal	1.92 ***	-6.13 ***	-5.24 ***	0,48
	Primary	0.49	0.15	-0.26	0,12
	High school	0.43	0.13	0.01	0,18
	Vocational training	0.26	0.80 *	-6.15 ***	0,95 **
	Tertiary	0.41	0.43	-0.31	0,45
Settlement: *Rural*	Peri-urban	0.43	-0.07	-0.03	0,05
	Urban	0.38	0.30	0.24	0,17
Income: *Lower*	Middle	0.19	0.07	-0.04	0,12
	Upper	-0.07	-0.14	-0.05	0,01
Remittance: *None*	Lower	0.11	0.12	0.30	-0,26
	Middle	0.004	0.18	-0.35	-0,17
	Upper	0.39	-0.64	-5.82 ***	0,15
Household size (number)		0.02	-0.03	-0.01	0.01
House class: *Lower-middle*	Upper	0.57 **	-0.32 *	0.08	-0,16
House ownership: *Household*	Free private	0.004	0.24	0.13	-0,13
	Rented private	0.39 **	0.11	0.48 **	0,52 ***
	Government	0.49	0.60 *	-6.97 ***	-0,42
Grid: *Not connected*	Connected	1.62 ***	6.11 ***	-5.41 ***	-1,38 ***
Electrification period (years)		0.01	-0.001	0.03 **	0.01
Share of appliances		2.50 ***	4.00 ***	4.78 ***	5.35 ***
Private car: *Accessed*	No access	-0.16	-0.1	0.29	-0,24
Solar system: *Own*	Don't own	-3.51 ***	0.17	-3.86 ***	-5,73 ***
Generator: *Own*	Don't own	-5.47 ***	-0.45	-5.39 ***	0,03
Wood collector: *Household head*	No member	0.47	-0.29	-0.31	-0,31
	Children	-5.51 ***	-0.82 *	-0.48	-0,59
	Spouse	0.03	-1.37 ***	-0.30	-0,36
	Relative	1.78 ***	0.19	0.66	-6,03 ***
Chi-square statistic		825 ***	2031 ***	834 ***	1601 ***

Source: Own results.

Notes: ***, **, and * represent 1%, 5%, and 10% statistical significance levels, respectively. The base variables for all categorical variables are listed in italics for each variable.

As the formal education status of the household head improves, female-headed households tend to reduce their share of dirty fuels and opt for modern fuels even in summer, while male-headed households are generally observed to also reduce the share of dirty fuels but instead settle for transition fuels like paraffin and LPG. These results corroborate Rahut *et al*. (2019), who reveal that women put higher consideration into clean energy services since they bear the cooking responsibility in their homes. Education also improves employment opportunities as well as health and environmental awareness, which promotes clean fuels adoption (Aminu *et al*., 2025; Wassie and Adaramola, 2021; Mahmood, 2020; Swain and Mishra, 2020). These findings support bounded rationality arguments that better-informed households make more efficient choices. They also reflect gendered preferences, where women's stronger orientation toward responsible consumption (Du and Pan, 2022; Arachchi and Managi, 2021) leads to greater interest in clean fuels.

In both seasons, both female- and male-headed households in the peri-urban and urban areas, compared to those in the rural areas, reduce the share of dirty fuels and rely more on the transition and high-end fuels such as paraffin and LPG, but their behaviour towards electricity is inconclusive. This is supported by the findings of Muza and Thomas (2022) that certain social norms and low-income streams prohibit the adoption of clean cooking technologies in rural areas. The reluctance of rural dwellers to upgrade their energy consumption is also said to stem from their ownership of animals and farms, which are the sources of abundant dung, straw and other combustible residue (Rahut *et al*., 2019). This illustrates how context-specific norms and resource availability shape household energy-use decisions.

As household financial status improves, both female- and male-headed households reduce their shares of dirty fuels and shift toward cleaner fuels, especially LPG, regardless of season. This aligns with the energy ladder model (Aminu *et al*., 2025; Wang *et al*., 2021; Yadav *et al*., 2021; Dogan and Muhammad, 2019; Rahut *et al*., 2019). Behaviourally, rising income relaxes constraints and increases households' perceived ability to adopt cleaner fuels, consistent with the argument that perceived consumer effectiveness influences sustainable choices (Taracakti and Aminata, 2024).

The findings also show that both female- and male-headed grid-connected households generally reduce their shares of cleaner fuels in winter and opt for dirtier fuels. This is consistent with Mpholo *et al*. (2020), who observe declining electricity consumption despite the increasing number of grid-connected households in Lesotho due to the affordability issues. This seasonal shift reflects bounded rationality and risk-averse behaviour, where households avoid high winter electricity costs by reverting to cheaper biomass. However, increasing the share of electrical appliances or ownership of other energy sources reduces dirty-fuel shares and increases modern-energy use, consistent with intra-household decision-making where access to appliances expands feasible energy choices.

Lastly, households with no primary wood collector reduce their share of dirty biomass and increase cleaner alternatives such as paraffin and LPG. In contrast, households where another family member collects wood tend to increase dirty-fuel use, regardless of gender or season. This reflects intra-household bargaining dynamics, where the availability of unpaid labour lowers the perceived cost of biomass collection and reinforces existing consumption patterns. As Kyayesimira and Muheirwe (2021) note, this may jeopardise the safety of wood collectors, especially children, since biomass collection often occurs in distant veld or forest areas.

6. Conclusions

In The inaccessibility of electricity in some communities in Lesotho promotes perpetual biomass consumption, which exacerbates gender inequality due to the social norms and culture that hold women mostly accountable for time-consuming unproductive activities such as wood collection and cooking. This study, therefore, analysed the determinants of variation in the shares of dirty and modern fuels consumed in female versus male-headed households. The Tobit regression model was employed to establish the statistical significance of the influence of socioeconomic variables on the household shares of biomass, paraffin, LPG and electricity using the 2017 BoS HECS data.

The main findings of the study suggest that households headed by older individuals, particularly females, were prominent biomass consumers. Contrariwise, improving the education level of the household head, especially females, fosters the reduction of polluting fuels in the household energy mix and promotes clean and efficient energy adoption. The shares of dirty fuels, especially biomass, also decline while shares of cleaner fuels, such as LPG, increase in households as the socioeconomic standard improves, either because they are situated in the urban or peri-urban areas compared to rural areas or due to improving financial status, regardless of the gender of the household head. Hence, the inclusion of policies that promote education and economic empowerment programmes targeted at marginalised societal groups like the elderly can potentially steer clean energy adoption by improving affordability and awareness of the health and environmental implications of polluting fuel consumption.

The inclusion of robust policy provisions that promote income-generating skills and community-based commercial projects, particularly in areas targeted for energy rollout, is essential to achieving just energy access, affordability and sustainable consumption. Grid-connected households tend to prefer modern fuels over polluting alternatives; however, during winter, many shift to cheaper, more polluting fuels. Paraffin use increases notably among female-headed households, while electricity consumption declines across both male- and female-headed households due to affordability constraints. Expanding the use of electrical appliances within homes can help reduce reliance on polluting fuels and encourage electricity consumption. Likewise, adopting other indicators of household wealth, such as solar systems and geysers, can support greater use of cleaner fuels, particularly LPG. Crucially, targeted support must be provided to poorer households, especially families with children engaged in wood collection. These households are more dependent on polluting fuels and less likely to adopt modern alternatives, exposing children to drudgery, time poverty and severe risks from household air pollution.

To ensure a comprehensive understanding of household energy consumption behaviour in Lesotho, further exhaustive studies can be undertaken to investigate the level of energy access and affordability in different regions of Lesotho post the major international shocks like the COVID-19 pandemic and the Ukraine-Russia war. An additional research area could also involve evaluating the impact and economic advantages of energy efficiency measures within Lesotho households, with a focus on their role in promoting renewable energy adoption and energy conservation. Lastly, further research could involve the investigation of adoption rates of improved cookstoves in Lesotho rural households, the driving factors and the impact assessment of fuel demand and air quality in comparison to conventional stoves.

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Appendix

Table 6 – Marginal effects of household consumption for polluting fuels (biomass)

		Biomass			
		Summer		Winter	
		Female	Male	Female	Male
Age (years)		0.001 **	0.002***	0.001 **	0.001
Education: *None*	Non-formal	-0.06	-0.08	0.46	0.08
	Primary	-0.01	-0.05 **	-0.03	-0.04 *
	High school	-0.08 *	-0.10 ***	-0.16 ***	-0.11 ***
	Vocational training	-0.53	-0.11	-0.21 *	-0.53 ***
	Tertiary	-0.08 ***	-0.25 ***	-0.27 ***	-0.19 ***
Settlement: *Rural*	Peri-urban	-0.12 ***	-0.13 ***	-0.03	-0.12 ***
	Urban	-0.29 ***	-0.25 ***	-0.30 ***	-0.27 ***
Income: *Lower*	Middle	-0.16 ***	-0.07 ***	-0.14 ***	-0.08 ***
	Upper	-0.06	-0.18 ***	-0.15 **	-0.16 ***
Remittance: *None*	Lower	0.02	-0.001	-0.07 ***	0.003
	Middle	-0.03	-0.02	-0.04	-0.03
	Upper	-0.43	-0.19 ***	-0.27 ***	-0.17 ***
Household size (number)		-0.004	0.00	0.004	-0.01 *
House class: *Lower-middle*	Upper	-0.10	-0.14 ***	-0.03	-0.09 *
House ownership: *Household*	Free private	-0.02	-0.06	-0.05	-0.11 ***
	Rented private	-0.33 ***	-0.33 ***	-0.32 ***	-0.32 ***
	Government	-0.51	-0.47	-0.24 **	-0.01
Grid: *Not connected*	Connected	0.12 **	-0.02	-0.09 *	0.02
Electrification period (years)		-0.01	-0.01 *	-0.002	-0.01 **
Share of appliances		-1.56 ***	-0.69 ***	-1.45 ***	-0.86 ***
Private car: *Accessed*	No access	0.08	0.01	0.05	0.04
Solar system: *Own*	Don't own	-0.02	-0.001	0.06 *	-0.02
Generator: *Own*	Don't own	-0.02	-0.001	0.11	0.03
Wood collector: *Household head*	No member	-0.05 *	-0.06 **	-0.08 ***	-0.12 ***
	Children	0.06	0.06 *	0.10 ***	0.05
	Spouse	0.01	0.04	0.02	0.01
	Relative	0.03	-0.02	0.06	-0.08

Source: Own results.

Notes: ***, **, and * represent 1%, 5%, and 10% statistical significance levels, respectively. The base variables for all categorical variables are listed in italics for each variable.

Table 7 – Marginal effects of household consumption for polluting fuels (paraffin)

		Paraffin			
		Summer		Winter	
		Female	Male	Female	Male
Age (years)		0.001	0.00	0.00	0.001
Education: *None*	Non-formal	-0.30	0.06	-0.45 ***	0.01
	Primary	0.05	0.06	0.02	0.04
	High school	0.01	0.06	0.04	0.02
	Vocational training	-0.005	0.14	0.12	-0.35
	Tertiary	-0.02	-0.01	0.12	0.02
Settlement: *Rural*	Peri-urban	0.06	0.13	0.07	0.02
	Urban	0.23 *	0.13	0.24 ***	0.18 *
Income: *Lower*	Middle	0.00	-0.01	-0.01	-0.02
	Upper	-0.36	-0.10	-0.17 ***	-0.11
Remittance: *None*	Lower	-0.03	0.01	-0.001	-0.03
	Middle	0.35	-0.08	0.01	-0.001
	Upper	-0.35	0.004	-0.49 ***	-0.06
Household size (number)		0.01	-0.001	0.01	0.01
House class: *Lower-middle*	Upper	0.10	-0.001	-0.01	-0.08
House ownership: *Household*	Free private	0.13	0.01	-0.002	0.04
	Rented private	0.05	0.07 **	0.04	0.12 *
	Government	0.01	-0.38	-0.06	-0.33
Grid: *Not connected*	Connected	-0.09	0.04	0.15 ***	0.04
Electrification period (years)		0.002	-0.004	0.001	0.004
Share of appliances		-0.90	-1.20	-0.61 *	-0.96 *
Private car: *Accessed*	No access	0.01	-0.01	-0.15	0.02
Solar system: *Own*	Don't own	0.03	0.04	0.17 ***	0.02
Generator: *Own*	Don't own	0.08	0.10	0.39 ***	0.37
Wood collector: *Household head*	No member	0.001	0.07	0.05	-0.01
	Children	-0.03	-0.04	-0.01	-0.01
	Spouse	-0.03	0.05	0.06	0.004
	Relative	-0.36	0.18	-0.45 ***	-0.03

Source: Own results.

Notes: ***, **, and * represent 1%, 5%, and 10% statistical significance levels, respectively. The base variables for all categorical variables are listed in italics for each variable.

Table 8 – Marginal effects of household consumption for modern fuels (LPG)

		LPG			
		Summer		Winter	
		Female	Male	Female	Male
Age (years)		-0.001	-0.001	-0.001	-0.001
Education: *None*	Non-formal	-0.39	0.06	-0.30	0.03
	Primary	0.03	0.12 ***	0.13 ***	0.12 ***
	High school	0.13 **	0.16 ***	0.18 ***	0.14 ***
	Vocational training	0.26 *	0.03	0.21	0.12
	Tertiary	0.06	0.09 **	0.13 **	0.08 **
Settlement: *Rural*	Peri-urban	0.15 ***	0.13 ***	0.10 **	0.21 ***
	Urban	0.21 ***	0.21 ***	0.18 ***	0.21 ***
Income: Lower	Middle	0.13 ***	0.12 ***	0.14 ***	0.18 ***
	Upper	0.14 **	0.15 ***	0.20 ***	0.11 ***
Remittance: *None*	Lower	0.02	-0.02	0.10 ***	0.01
	Middle	0.11 ***	0.11 ***	0.10 ***	0.10 ***
	Upper	0.04	0.23 ***	0.37 **	0.21 ***
Household size (number)		0.003	-0.002	-0.01 **	0.01
House class: *Lower-middle*	Upper	-0.04	0.12 ***	-0.003	0.05
House ownership: *Household*	Free private	-0.12 **	-0.06	-0.11 *	0.01
	Rented private	-0.02	-0.04	-0.03	-0.06 **
	Government	-0.02	-0.13 **	0.18	0.06
Grid: *Not connected*	Connected	0.09 **	0.07 **	-0.04	-0.10 ***
Electrification period (years)		0.00	0.002	-0.002	-0.001
Share of appliances		-0.20	-0.37 **	-0.07	-0.27
Private car: *Accessed*	No access	0.01	-0.02	0.10	-0.03
Solar system: *Own*	Don't own	-0.01	-0.08 **	-0.06	-0.07 *
Generator: *Own*	Don't own	-0.19 *	-0.03	-0.29 **	-0.17 **
Wood collector: *Household head*	No member	0.02	0.10 ***	0.12 ***	0.13 ***
	Children	-0.07	-0.004	-0.07 *	-0.04
	Spouse	-0.01	-0.04	0.005	0.01
	Relative	-0.45	0.22	-0.37	0.10

Source: Own results.

Notes: ***, **, and * represent 1%, 5%, and 10% statistical significance levels, respectively. The base variables for all categorical variables are listed in italics for each variable.

Table 9 – Marginal effects of household consumption for modern fuels (electricity)

		Electricity			
		Summer		Winter	
		Female	Male	Female	Male
Age (years)		-0.001	-0.001	-0.001	-0.001
Education: *None*	Non-formal	0.34	-0.21	-0.21	0.07
	Primary	0.06	0.02	-0.03	0.02
	High school	0.05	0.01	0.001	0.02
	Vocational training	0.03	0.10	-0.22	0.16
	Tertiary	0.05	0.05	-0.03	0.07
Settlement: *Rural*	Peri-urban	0.05	-0.01	-0.002	0.01
	Urban	0.05	0.03	0.02	0.03
Income: Lower	Middle	0.03	0.01	-0.004	0.02
	Upper	-0.01	-0.02	-0.005	0.003
Remittance: *None*	Lower	0.01	0.01	0.03	-0.04
	Middle	0.00	0.02	-0.03	-0.02
	Upper	0.06	-0.06	-0.20	0.02
Household size (number)		-0.003	-0.002	0.001	0.002
House class: *Lower-middle*	Upper	0.08	-0.03	0.01	-0.03
House ownership: *Household*	Free private	0.001	0.03	0.01	-0.01
	Rented private	0.05	0.01	0.05	0.07 **
	Government	0.07	0.08	-0.19	-0.05
Grid: *Not connected*	Connected	0.19	0.39	-0.31	-0.18 **
Electrification period (years)		0.00	-0.001	0.003	0.001
Share of appliances		0.33	0.46	0.49	0.77 ***
Private car: *Accessed*	No access	0.02	0.01	-0.03	0.03
Solar system: *Own*	Don't own	0.20	-0.02	0.16	0.29
Generator: *Own*	Don't own	0.24	0.05	0.19	-0.004
Wood collector: *Household head*	No member	0.06	-0.04	-0.03	-0.05
	Children	-0.22	-0.09	-0.05	-0.09
	Spouse	0.003	-0.14	-0.03	-0.06
	Relative	0.32	-0.01	0.03	-0.34

Source: Own results.

Notes: ***, **, and * represent 1%, 5%, and 10% statistical significance levels, respectively. The base variables for all categorical variables are listed in italics for each variable.