Research Article

Social and Behavioural Determinants of Energy Efficiency amongst Children and Young People in Zimbabwe: A Qualitative Study

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Abstract

Background: **Household energy consumption is a major contributor to global emissions. In Zimbabwe, heavy reliance on traditional fuels and limited electricity access makes understanding youth energy-saving behaviours critical for public health and environmental interventions. This study explored the social and behavioural determinants of energy efficiency amongst Zimbabwean children and young people.**

Materials and Methods: **A qualitative formative assessment was conducted in four diverse districts, guided by the social ecological model and theory of planned behaviour. Data were collected via 64 focus groups (ages 4–24), 20 key informant interviews and 40 in-depth interviews. Transcripts were thematically analysed. The manuscript was prepared in accordance with the COREQ 32-item checklist.**

Results: **Energy literacy was functional but lacked technical depth, varying significantly with age. Behaviour was dictated by structural constraints, not choice. Prohibitive electricity costs described by respondents as 'like paying lobola' and persistent power cuts were dominant barriers, forcing reliance on firewood despite awareness of environmental impacts. Economic necessity frequently superseded cultural norms regarding fuel use.**

Conclusion: **Energy behaviours amongst Zimbabwean youth are shaped by systemic barriers and socio-economic status, which override individual intentions. Interventions must move beyond knowledge-based approaches to tackle structural inequalities in energy access and affordability. We recommend age-appropriate education and policy actions that improve infrastructure and support affordable alternatives like residential solar.**

Keywords: **Behavioural change, energy efficiency, health promotion, youth, Zimbabwe**

Introduction

Climate change presents an urgent global challenge, demanding transformative actions across all sectors. Energy efficiency is a critical level for reducing greenhouse gas (GHG) emissions and achieving Sustainable Development Goal 7 (SDG 7), which aims to ensure access to affordable, reliable, sustainable and modern energy for all.[1,2] The international community has recognised the central role of energy efficiency, with a landmark agreement at COP28 calling for a doubling of the global average annual rate of improvement by the year 2030.[1] However, a significant gap exists between this ambition and current reality; recent analyses show that global progress in energy intensity improvement has slowed, and sub-Saharan Africa is particularly off-track in meeting its SDG 7 targets.[1,3] This global context underscores the importance of understanding the specific, on-the-ground barriers that impede progress.

Domestic energy consumption contributes significantly to total GHG emissions, making the promotion of energy-saving behaviours at the household level a critical area for sustainability interventions.[4] In Zimbabwe, the energy landscape is complex. While conventional sources such as biofuels, coal and petroleum products are used, fuel wood remains the predominant energy source for approximately

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68% of the population.[3] Stark disparities exist in electricity access: while overall access was reported at 62% in 2022, this figure conceals a deep urban-rural divide.[5] The problem is further compounded by a lack of reliability for those who are connected. Frequent and prolonged power cuts, often lasting 12–14 h a day, impose a significant burden on the economy estimated to cost 6.1% of GDP annually and force even grid-connected households to maintain parallel energy systems, reinforcing dependency on traditional fuels.[6]

Energy literacy, defined as an interdisciplinary understanding of the nature and role of energy in the world and daily life, is fundamental for fostering sustainable practices and enabling informed decision-making.[7] Despite their demographic significance, with young people under the age of 25 years constituting 62% of Zimbabwe's population, the energy behaviours of children and youth have been largely overlooked in research.[8] Previous studies indicate that energy-saving behaviours are influenced by a combination of individual knowledge, cultural beliefs, values and household norms.[9,10] For instance, personal norms and self-efficacy are known to influence energy-saving intentions.[11] Situational factors such as household income also play a significant role,[10] while national policies and strategic frameworks are pivotal in driving energy efficiency at a macro level.[12]

However, for the youth demographic, these behaviours are formed within a context of limited decision-making autonomy, where household economic status and national infrastructure dictate available energy options. In Zimbabwe, national initiatives such as the National Energy Policy and the National Climate Change Response Strategy emphasise energy conservation.[13,14] However, structural determinants such as urbanisation and environmental governance, alongside household gender dynamics, add further layers of complexity, with gendered power structures often constraining equitable access to clean energy.[15] Given this context, there is a clear need to explore the social and behavioural determinants of energy efficiency amongst young people. This study, informed by the social ecological and behavioural drivers models, aims to fill this knowledge gap, providing evidence to inform targeted social and behavioural change interventions essential for a sustainable and healthy energy future.

Materials and Methods

Study design

This study employed a qualitative formative assessment to explore the social and behavioural determinants of energy efficiency amongst children and young people in Zimbabwe. The research was guided by the social ecological model[16] and the theory of planned behaviour (TPB),[17] facilitating an in-depth exploration of influences at the individual, household, community and policy levels. The formative approach allowed for the identification of key contextual factors and behavioural drivers to inform the development of targeted social and behaviour change strategies.

Study sites

Data were collected from four strategically selected districts: Mbire, Mutare, Masvingo and Beitbridge. These districts were chosen to represent diverse geographic and socio-economic conditions, including both urban and rural settings. Mbire and Masvingo represent rural contexts with high reliance on traditional energy sources, while Mutare and Beitbridge provide a contrast with semi-urban and urban dynamics. This purposive selection ensured a comprehensive understanding of energy use practices across different community settings.

Participants and sampling

Participants were purposively selected to ensure representation from various age groups and community roles. A total of 64 focus group discussions (FGDs) were conducted, each consisting of 5–12 participants. FGDs were stratified by age and gender, including groups of children (ages 4–9 and 10–15 years), adolescents (16–24 years) and adults (25 years and above). In addition, 20 key informant interviews (KIIs) were held with local government officials, community and religious leaders, and representatives from non-governmental organizations. Furthermore, 40 in-depth interviews were conducted with 'doers' and 'non-doers' of energy-saving practices to capture contrasting behaviours. This multi-pronged sampling approach ensured the triangulation of data from various perspectives.[18,19]

Data collection and instruments

Data were collected using multiple qualitative instruments. Standardised guides were developed for FGDs, KIIs and in-depth interviews, including a specific guide adapted for children aged 4–9 years to capture detailed insights into energy understanding, perceptions and practices. These instruments were pre-tested and refined for clarity and cultural relevance.[20] Data collection was facilitated using KoboToolbox (Harvard Humanitarian Initiative, Cambridge, MA, USA), which enabled real-time electronic capture of responses, audio recordings and field observations.[21] Daily debriefing sessions were conducted with the research team to ensure consistency and address any emerging challenges.

Ethics

Ethical approval for this study was obtained from the institutional ethics committee. All procedures were performed in accordance with the ethical standards of the responsible committee on human experimentation and with the Helsinki Declaration of 1975, as revised in 2013.[22] All participants provided informed consent before participation. For participants under the age of 18, consent was obtained from their parents or legal guardians, along with assent from the children themselves. Participants were informed about the study's purpose, confidentiality measures and their right to withdraw at any time without repercussions. Data were anonymised and stored securely to ensure privacy.

Data analysis

Audio recordings were transcribed verbatim and complemented by field notes. Thematic content analysis was performed using an iterative process. A coding framework was developed based on the social ecological model and the behavioural drivers model.[16,17] The qualitative data analysis software QDA Miner 6 (Provalis Research, Montreal, QC, Canada) was used to manage the data and generate visual representations, including word clouds, bar charts and dendrograms, to identify recurring themes and patterns.[23] Triangulation across the different data sources (FGDs, KIIs and in-depth interviews) was used to enhance the validity and reliability of the findings.[24] Recognising the broad developmental continuum of the 4–24 age range, the analysis was further stratified to explore age-specific distinctions in energy literacy, agency and behaviour. Findings for younger

children (4–9 years) were analysed through a lens of social learning and imitation, while findings for adolescents and young adults were examined in the context of emerging decision-making autonomy and their responses to systemic constraints.

Results

The analysis revealed a multi-layered set of determinants influencing energy behaviour amongst children and young people. The findings are presented thematically, beginning with the conceptual understanding of energy, moving to the systemic challenges of the energy landscape and concluding with the socio-cultural dynamics that shape practices.

Participants' understanding of energy was overwhelmingly functional rather than technical. When asked to define energy, they consistently conceptualised it in two primary ways: as 'power' and as 'heat'. As illustrated in Figure 1 and Table 1, these two concepts were cited with near-equal frequency, indicating a practical grasp of energy's utility for daily tasks rather than a deeper technical or scientific knowledge of concepts like energy efficiency.

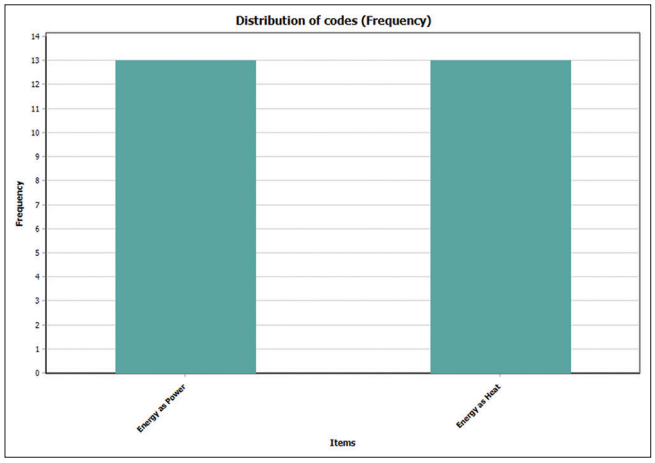

Figure 1: Bar chart showing the equal frequency of participants conceptualising energy as either 'power' or 'heat', indicating a functional rather than technical understanding of energy concepts. Source: Authors' analysis

This functional knowledge was deeply intertwined with perceived risks. Gas, while valued for its speed and convenience, was widely feared for its potential to explode. One participant recounted, 'there are many cases of burnt houses due to gas', while another added, 'we have houses burnt, families dying because of gas'. This fear was internalised even by the youngest participants, with a 5-year-old child stating, 'gas rinogona kuputika'. (Gas can explode). Similarly, while firewood was seen as affordable, participants noted the health risks from smoke, particularly for children, and the physical dangers involved in its collection.

The primary energy sources available to participants formed a mixed-fuel landscape comprising firewood, gas, electricity and solar power, with firewood being the most prominent term in discussions, particularly in rural contexts [Figure 2]. Rural households reported a predominant and often exclusive reliance on firewood, sourced from local mountains and forests. In contrast, semi-urban households utilised a broader array of sources, frequently toggling between them based on availability and cost.

However, the choice of energy source was overwhelmingly dictated by severe systemic barriers rather than personal preference. The prohibitive cost of modern energy and the challenges of alternatives like solar were dominant themes, together accounting for over two-thirds of the coded responses related to energy conceptualisation [Table 2 and Figure 3]. One key informant described electricity as so expensive that many households with access could only afford it for lighting and

Table 1: Frequency distribution of codes related to participant's perceptions of energy

Item	Frequency	Correct identification rate (%)
Energy as power	13	46.4
Energy as heat	13	35.7

Source: Author's analysis

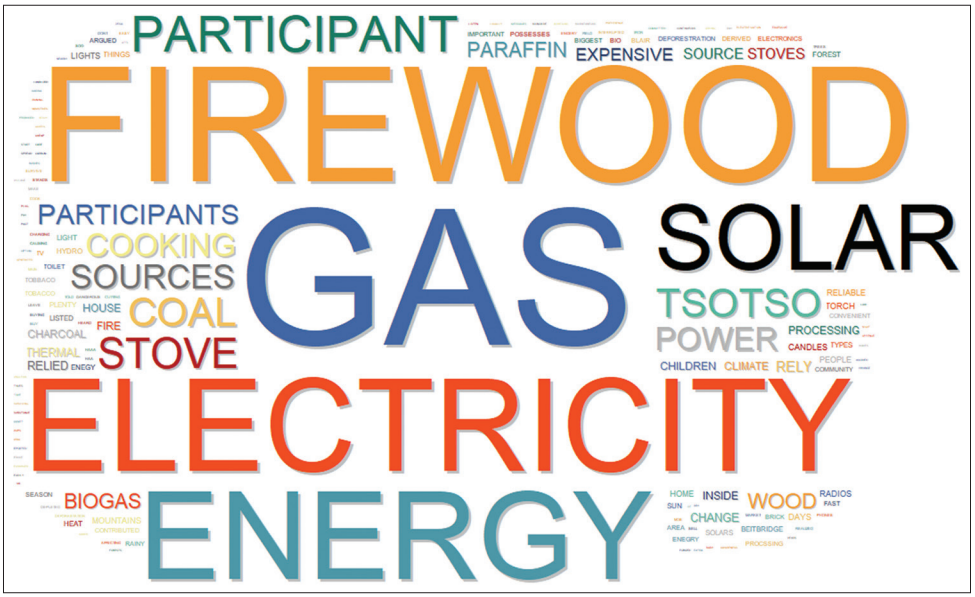

Figure 2: Word cloud illustrating the most frequent terms used by participants when discussing energy sources. The size of each word is proportional to its frequency in the transcripts, highlighting the prominence of firewood, gas, electricity, and solar energy. Source: Authors' analysis

Table 2: Distribution of codes for participant conceptualisation of energy

Code	Responses (%)
Importance of energy	21 (51.2)
Challenges with solar energy	7 (17.1)
Perception of energy use	3 (7.3)
Perception of energy laws	3 (7.3)
Benefits of firewood	2 (4.9)
Role of teachers and schools	1 (2.4)
Role of councillors and chiefs	1 (2.4)
Perception of deforestation	1 (2.4)
Benefits of electricity	1 (2.4)
Energy laws	1 (2.4)
Total	41 (100)

Source: Authors' analysis

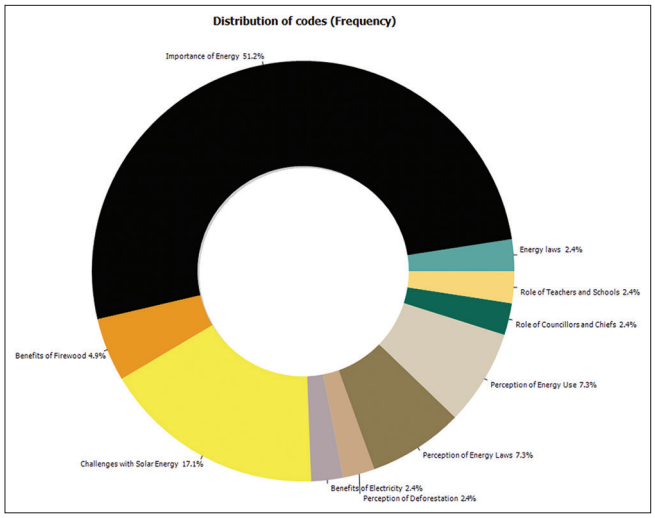

Figure 3: Doughnut chart showing the distribution of participant perceptions and discussion themes related to energy. The chart indicates that the 'Importance of Energy' (51.2%) and 'Challenges with Solar Energy' (17.1%) were the most significant topics of discussion. Source: Authors' analysis

refrigeration, not for high-consumption activities like cooking. This sentiment was powerfully echoed by a focus group participant who stated that paying for electricity is now 'like paying lobola'. Frequent and unscheduled power cuts ('load shedding') further compounded these challenges, rendering electricity an unreliable primary source. As one respondent noted, 'Electricity is so expensive and also too much load shedding. You could have bought it but they go in the morning and comes back at 9 probably after supper'.

While solar energy was widely seen as a desirable alternative, its high initial installation cost and the pervasive threat of theft were cited as major deterrents. One participant explained, 'Solar we can't have the opportunity to use them because we have plenty of thieves. As you install a solar and go inside the house you will not find it when you come out'. These financial barriers are deeply rooted in the participants' socio-economic realities; demographic data shows many households subsist on extremely low incomes, with some reporting 'USD 20 per month or less', from occupations like 'peasant farming' or informal vending, making the upfront investment in solar panels unattainable.

Energy management practices were strongly embedded in social structures. At the household level, fathers were typically identified as the providers who financed energy purchases, while mothers and elders were the primary managers who regulated its use and taught conservation practices to children.

At the community level, local leadership plays an instrumental role in environmental governance. A close conceptual association was found between the roles of councillors, chiefs, teachers and schools in managing energy-related issues. These leaders, alongside agencies like the Environmental Management Agency, enforce local conservation rules, such as levying a fine (e.g., a goat) for cutting green trees. However, participants noted that these rules are often subverted out of necessity. The complex interplay between affordability, fuel choice and community leadership forms the core of local energy conservation strategies, as illustrated in the conceptual map in Figure 4. While cultural beliefs such as sacred trees that should not be burned (mutobhi, mufhaladzamakole) were mentioned, their influence was often

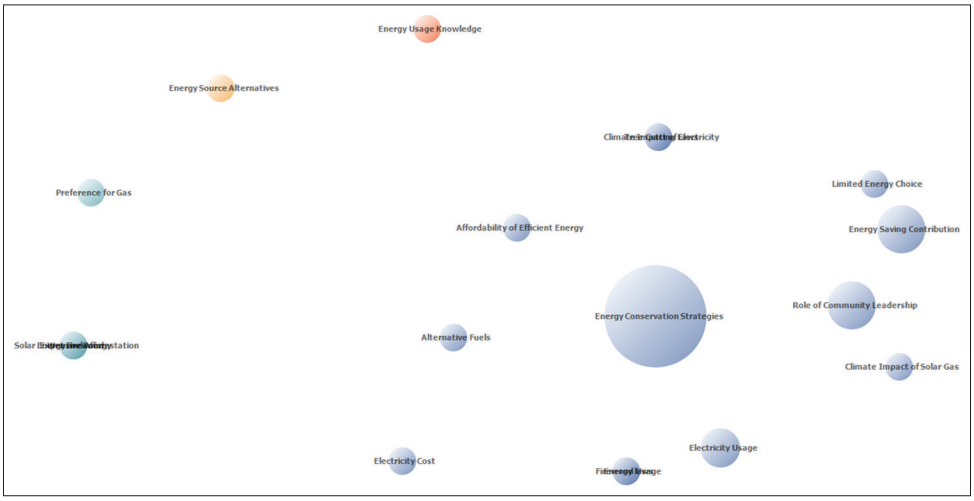

Figure 4: A two-dimensional map of coded themes showing the conceptual proximity between different community energy management strategies. The central cluster around 'Energy Conservation Strategies' connects to related issues such as affordability, fuel choice, and the role of community leadership. Source: Authors' analysis

secondary to survival. As one participant stated, when you need to cook, 'even a stick you pick from the street' will be used, indicating that economic pressures frequently override cultural norms.

Discussion

This study provides a comprehensive exploration of the determinants of energy use among Zimbabwean youth, revealing a landscape where behaviour is overwhelmingly dictated by systemic constraints rather than individual choice. Our findings, analysed through the social ecological model, demonstrate how distal factors such as national infrastructure and economic policy profoundly shape and often override proximal (individual) and intermediary (household) determinants. This aligns with a growing body of literature asserting that energy poverty in sub-Saharan Africa is a structural issue, where a lack of access and affordability creates a 'locked-in' dependency on traditional biomass, irrespective of individual desires for cleaner alternatives.[25] The experiences of our participants reflect the broader challenges of what Sovacool describes as the lived reality of energy poverty, where daily life is a constant negotiation of unreliable and expensive energy options.[26]

A central finding is the significant limitation of theoretical frameworks like the TPB in this context. The TPB assumes that behaviour is intentional and that individuals possess a reasonable degree of control over their actions.[17] However, our data consistently show that for most participants, energy use is a matter of necessity and adaptation, not deliberate choice. The intention to use clean energy is rendered moot by prohibitive costs memorably described as being 'expensive like lobola' and an unreliable electricity supply. This finding resonates with critiques of behavioural models that fail to adequately account for the profound impact of poverty and infrastructural deficits on agency.[27] When a model's core construct, such as perceived behavioural control, is fundamentally absent in the lived reality of a population, its predictive power collapses. This demonstrates the inapplicability of a choice-based framework to a choice-less situation. As research in neighbouring Zambia confirms, when households face such severe constraints, their energy choices are adaptive strategies for survival, not expressions of planned behaviour.[28] Furthermore, for the younger children (4–9 years) in our study, energy-related actions were largely imitative and shaped by household routines, a finding that underscores the need for age-differentiated analysis in energy studies.

Our study also refines the concept of 'energy literacy'. We move beyond a deficit framing of 'poor conceptual understanding' to identify a specific disconnect: while participants possess strong functional and environmental knowledge (e.g., linking deforestation to climate change), their technical knowledge of energy efficiency is limited. This suggests that interventions should build upon existing local knowledge validating what people already know about their environment rather than focusing solely on abstract scientific concepts. This approach is supported by recent work emphasizing the importance of co-designing energy education programs with communities to ensure they are culturally relevant and address tangible, everyday challenges.[29]

The role of culture also emerged as more nuanced than often presented. While cultural norms regarding traditional fuel use exist, they are flexible and frequently subordinated to the immediate need for fuel. This finding challenges the overemphasis on culture as a primary barrier and instead highlights that the persistence of traditional fuel use is sustained more by a lack of viable alternatives than by deep-seated cultural preference. This aligns with studies showing that while culture shapes practices, economic pressures are often the ultimate arbiter of fuel choice in resource-scarce settings.[30]

Finally, our findings point towards specific, actionable interventions. The strong desire for alternatives like solar is consistently thwarted by high upfront costs and security concerns. This highlights a clear policy opportunity for government and partner-supported programmes for residential solar installations, potentially coupled with community-based security arrangements as suggested by participants. Such interventions are critical for overcoming the initial investment barrier, which remains the single greatest obstacle to solar adoption in many parts of Africa.[31] Furthermore, participants identified trusted local communication channels such as local radio stations, community leaders (chiefs and councillors) and schools as the most effective conduits for information. Interventions should therefore be channelled through these established and trusted community structures to ensure relevance, reach and impact, a strategy supported by evidence showing radio remains the leading source of news for most Zimbabweans, particularly in rural areas.[32]

Conclusion

This study concludes that for children and young people in Zimbabwe, energy behaviour is overwhelmingly shaped by systemic barriers of affordability and accessibility, which constrain individual agency and often override cultural norms. The critical takeaway is that interventions focused solely on individual behaviour change are destined to fail if the structural determinants remain unaddressed. To foster a transition to sustainable energy, policy must prioritise improving national energy infrastructure, ensuring reliable supply, and implementing targeted subsidies or financing models that make clean energy sources like solar a viable option for low-income households. Such structural changes are the necessary foundation for achieving long-term energy efficiency and its associated public health benefits.

Relevance to preventive medicine:
These findings inform prevention-oriented policies and social and behaviour change (SBC) programming that can reduce household air pollution exposure and climate-related health risks by promoting clean energy uptake and energy-efficient practices among children and youth.

Implications for clinical practice:
Clinicians and primary care teams should consider screening for household energy poverty (eg, reliance on biomass fuels and limited access to electricity) during routine visits, counsel families and young people on the health risks of household air pollution and on safer cooking/heating practices, and signpost households to available clean-energy or energy-assistance programmes where applicable.

Authorship contribution
Concept and design: D.M. Data acquisition: P.M., R.M., S.Z.T., L.M. Analysis and interpretation of data: P.M., R.M., L.G. Drafting the article: D.M., L.G. Revising it critically for important intellectual content: D.M., P.M., R.M., T.M., L.G., S.Z.T., L.M. Final approval of the version to be published: All authors. Guarantor: D.M. accepts full responsibility for the integrity of the work as a whole, from inception to published article.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author, D.M. The datasets are not publicly available due to participant privacy and confidentiality concerns.

Adherence to reporting guidelines

This study was reported in adherence to the Consolidated Criteria for Reporting Qualitative Studies (COREQ)- 32 items checklist for reporting of qualitative study, as recommended by the EQUATOR Network, to ensure transparency, completeness, and methodological rigor in reporting.

Use of AI in drafting of manuscript statement

The authors declare that generative AI (ChatGPT-5, OpenAI, San Francisco, CA, USA) was used only for language editing to improve clarity, grammar, and readability. The AI tool was not used to generate original scientific content, interpret results, create or modify data/analyses, or generate tables, figures, or references. All edits were reviewed and approved by the authors, who take full responsibility for the final manuscript.

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Conflicts of interest

There are no conflicts of interest.

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