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A review for low and middle-income countries

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Energy and social protection measures for energy poverty

A review for low and middle-income countries

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Abstract

This article examines the impact of energy-enhancing measures for the poor, such as social protection or energy-earmarked measures, on influencing energy poverty and vulnerability. It employs a literature review methodology to assess the latest twenty years of evidence in a widely scattered scholarly literature for low- and middle-income countries. The chosen conceptual framework reflects on possible implications of changes happening in energy behaviour of poor populations due to policy receipt, proposing some reasoning why social protection should not be seen separately from energy assistance in accompanying the energy transition of the poor. The review explores how social protection instruments alter energy consumption for the poor and their adoption of energy technologies, including the transition to less carbon intensive energy. It also outlines the vital role that earmarked energy assistance can play in supporting energy transitions of the poor. Finally, it reflects on the loose ends of the literature to assess any detectable effects across vulnerable and marginalised groups, like women, informal settlements and people with disability.

Keywords

Social protection, assistance, insurance, energy assistance, energy poverty, subsidies, LPG, solar, energy transition

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Résumé

Cet article explore l'impact des mesures visant à améliorer l'accès à l'énergie pour les populations pauvres, telles que la protection sociale ou les mesures ciblées sur l'énergie, sur la pauvreté énergétique et la vulnérabilité énergétique. Il utilise une méthodologie de revue de littérature pour évaluer les vingt dernières années de résultats de recherche issus d'une littérature académique largement dispersée concernant les pays à revenu faible et intermédiaire. Le cadre conceptuel choisi reflète les implications potentielles des changements de comportement énergétique des populations pauvres résultant de la mise en œuvre de politiques, et propose des arguments justifiant que la protection sociale ne doit pas être considérée séparément des mesures d'assistance énergétique dans l'accompagnement de la transition énergétique des populations défavorisées. La revue explore comment les instruments de protection sociale modifient la consommation énergétique des populations pauvres et leur adoption de technologies énergétiques, y compris la transition vers des sources d'énergie moins intensives en carbone. Elle met également en lumière le rôle essentiel que peut jouer l'assistance énergétique ciblée pour soutenir les transitions énergétiques des populations vulnérables. Enfin, elle examine les lacunes de la littérature pour évaluer les effets perceptibles sur les groupes vulnérables et marginalisés, tels que les femmes, les habitants des quartiers informels et les personnes en situation de handicap.

Mots-clés

Protection sociale, assistance, assurance, aide énergétique, pauvreté énergétique, subventions, GPL, solaire, transition énergétique

Introduction

This article seeks to examine the latest evidence linking energy-enhancing measures for the poor, such as social protection or energy-earmarked measures, to energy consumption in developing countries. Availability of energy sources and energy supply are a prerequisite and a catalyser of energy access and consumption (Agrawal *et al.*, 2020; Pelz & Urpelainen, 2020). Due to the lack of affordability and availability, most energy poor in developing economies do not have access to modern fuels and rely heavily on biomass and solid fuels (such as wood, coal, charcoal) – which are inefficient and have deleterious effects on health and on the environment (Guruswamy, 2011; Lin & Okyere, 2020). Around the globe, over 2.5 billion individuals currently depend on these types of polluting fuels as their primary sources of cooking fuel, whilst 730 million people live without access to electricity (IEA, 2023). The side effects of poor energy sourcing are often overlooked in developing countries (Ulucak *et al.*, 2021). For instance, indoor air pollution created by cooking stoves is linked to approximately 2.5 million premature deaths annually (IEA, 2023) and health costs are estimated at US$ 1.4 trillion annually (Gill-Wiehl & Kammen, 2022). As temperatures get warmer, policies have to respond to increasing energy needs (Colelli *et al.*, 2022) and to pressing issues such as cooling poverty (Feeny *et al.*, 2021; X. Li *et al.*, 2023). It is thus important to critically assess how different policies can affect energy poverty among vulnerable populations. Throughout this article, we avoid using the term "clean energy" and instead specify sources as less carbon-intensive, safer, less polluting, or modern, depending on the context. The term "clean energy" is often used in academic and policy discussions to simplify categorisations, but it is rarely used in the energy and engineering literatures, plus it has been criticised for its misleading positive imagery and for failing to account for the social and environmental consequences of energy sources (Cohn & Duncanson, 2023; Dengler & Seebacher, 2019).

While there is a growing body of literature on energy poverty, the interaction between social protection and energy insecurity in developing countries remains under-explored. The present article aims to fill this gap by exploring how social protection measures and targeted energy policies can alleviate energy poverty, particularly for low-income and vulnerable populations. Achieving and maintaining universal energy access, as outlined by SDG 7, requires understanding how poverty and

socio-economic inequalities interact with energy security. Social policies and chiefly social protection can play a big role in taming this cycle, particularly when directed towards the more vulnerable profiles of society. Social protection is often targeted to accompany poverty reduction as well as protection of individuals against life-cycle shocks and risks, and questions arise on the active role that this area of policy making can make to accompany the energy transition, in light of low-carbon emissions and climate change adaptation and mitigation measures. Our framework of analysis reflects on possible implications of changes happening in energy supply and demand, as across technological adoptions, through the analysis of various policy instruments. Our analysis focuses on the energy needs of poor and vulnerable individuals. Evidence points out that low-income and less educated households are less likely to adopt modern energy sources (Beyene *et al.*, 2024; D. D. Guta, 2018; Rahut *et al.*, 2018) and are less likely to prioritize energy expenditures when their income increases (Kettani & Sanin, 2024). Thus, as the elasticity of household's energy expenditure is lower for low-income households (Kettani & Sanin, 2024), an analysis of policy impacts addressing energy poverty should stem from policies tailored to their specific profile, reason why the present article solely inspects measures targeted as "pro-poor" or with a disproportionate impact expected for the low-income population.

This review sheds light around a scarcely researched topic on the connection between energy assistance and other forms of assistance to assess welfare of recipients (Carley & Konisky, 2020). In the post-Covid-19 years there has been a notable surge in energy and commodity prices whose burden falls disproportionately on poorer households (Amaglobeli *et al.*, 2022; Laborde & Piñeiro, 2023). Rising energy costs (among other factors) increase food prices (Kirikkaleli & Darbaz, 2021), which exacerbate food insecurity, especially in developing countries (Laborde & Piñeiro, 2023). The reliance on biomass energy contributes to land degradation and worsen food insecurity by reducing agricultural production (Assefa *et al.*, 2021). While higher-income households may allocate a larger share of their consumption budget to energy, an increase in energy prices still has a significant and harsh impact on lower-income households due to their limited capacity to absorb economic shocks. In many countries, the impact of rising international prices on domestic consumers has been mitigated through the combined implementation of energy and social protection measures, like a mix of energy and food subsidies or through reductions in taxes and tariffs (Amaglobeli *et al.*, 2022). This article explores what

channels of influence of policies that tend to be pro-poor have empirical evidence on solving some of the access or pricing burden experienced by the energy poor and vulnerable populations in low and middle-income economies. Our review is in line with the view that social welfare should be more broadly identified in innovation analysis via the cross-fertilization with different domains (Castellacci, 2023), here specifically as economics, energy and social protection research.

The issue is framed in Section 1 by examining the convergence of definitions between energy poverty and vulnerability, and the influence that energy-enhancing measures could generate for the poor. We hypothesise that, in order to affect via policy the energy dimension of poverty, both universal and energy-targeted interventions that aim at enhancing the conditions of poor populations should be considered. We explore in Section 2 which non energy-earmarked social protection interventions are appraised by scholars, with an analysis of whether empirical evidence backs the most commonly considered energy consumption theories of the energy ladder and energy stacking models. For exploring how energy policies with an assistance component affect energy poverty, we include in Section 3 energy policies that may both improve the capacity to access energy, as well as the accessibility and availability of energy services. For capacity enhancement and accessibility, we explore some enablers of economic ability to obtain energy, including those with transfers covering the needed living energy cost for poor households. For energy services availability, we include studies concerned with the diversity of energy sources, aimed to improve living energy supply or energy equipment utilization. We present how demand-side energy policies can effectively promote low-carbon energy adoption. These policies often come along with consumption policies incentivizing the use of specific energy sources. Instruments accompanying connection and access may include social tariffs or social assistance, aiming to support energy use among poor and vulnerable households. As we are concerned with the evidence for the energy poor and vulnerable, we then ask in Section 4 whether programme effects are ever analysed in relation to users' gender, belonging to informal dwellings or work, or disability status. Section 5 concludes the review with few final remarks.

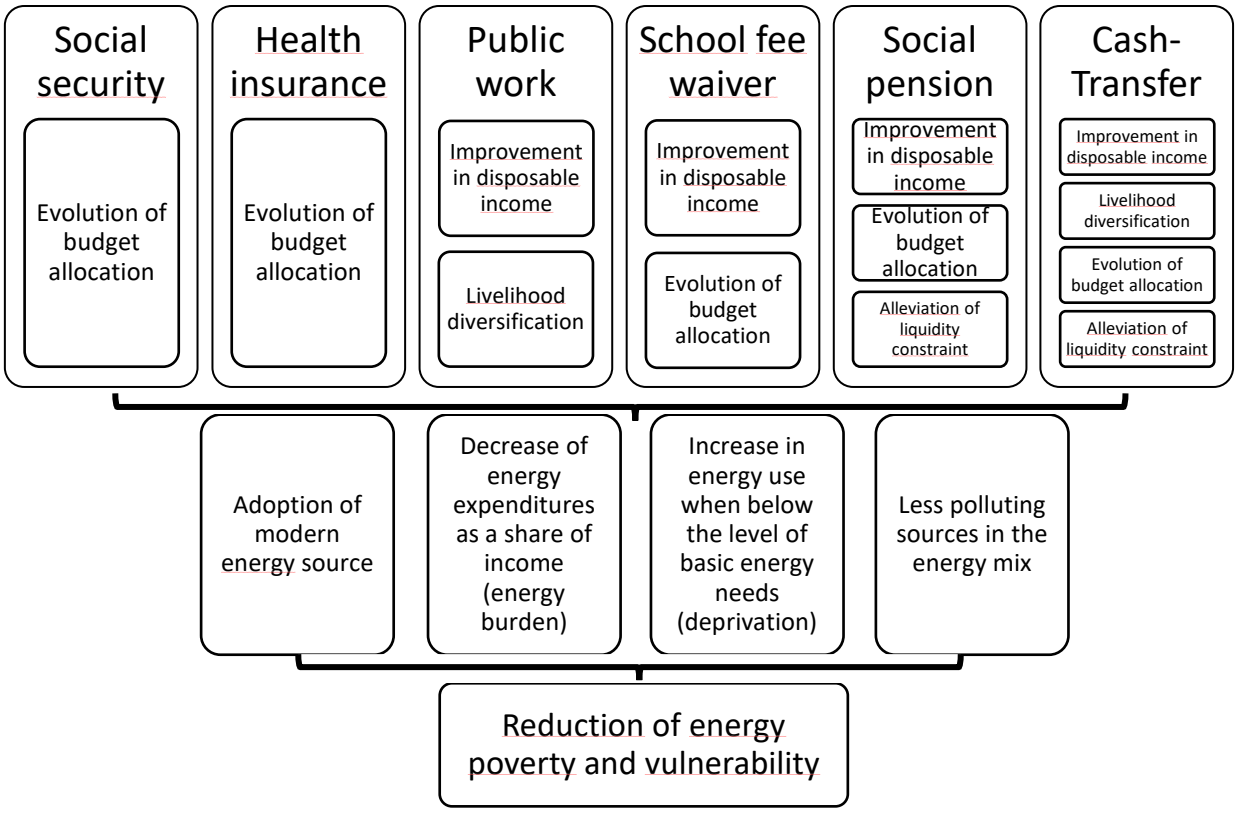
1. How are energy poverty and vulnerability affected by social protection?

In order to understand the distributional issues around energy and the role of policies to reduce them, it is relevant first to frame energy access, its reliance and equitable distribution as defining traits of energy poverty and vulnerability. The literature tends to acknowledge that energy poverty is a multidimensional concept – encompassing availability, reliability, affordability, quality, and safety (Reddy *et al.*, 2000). However, there remains a lack of consensus regarding the specific dimensions and thresholds that should be considered to measure energy poverty. **Appendix A** inspects in more details the measurement challenges around this topic. In the Global South, the emphasis is on the lack of access to modern and less polluting energy sources (Chan & Delina, 2023; Guruswamy, 2011; Nussbaumer *et al.*, 2012). Are considered energy poor those who do not have access to reliable, safe, and efficient energy and those who rely upon harmful energy sources such as biomass-generated fire (Guruswamy, 2011).

While energy poverty describes a state at a certain time, energy vulnerability emphasizes the conditions and likelihood of a household becoming energy poor (Bouzarovski & Petrova, 2015; Middlemiss & Gillard, 2015), and its ability to cope with energy related shocks (Middlemiss & Gillard, 2015). The resilience of households to shocks is central in determining if they will fall into an energy poverty trap (Gatto & Busato, 2020). Factors such as household's income, energy prices, and the energy efficiency of the dwelling are found to influence the likelihood of becoming energy poor (Middlemiss & Gillard, 2015). Beyond these, Middlemiss & Gillard (2015) identifies as challenges to energy vulnerability the characteristics of the dwelling, the energy prices and supply, households' social relation and health. Bouzarovski & Petrova (2015) suggests that energy vulnerability also may occur due to a mismatch between the energy services and the energy needs of households – for instance, when the heating or cooling system installed in the dwelling does not align with the energy service needed by the occupant household. Energy vulnerability is more often analysed for developed countries (Papada & Kaliampakos, 2019), but we assume in the present study that it may be a relevant concept to assess the indirect impact of social protection measures particularly, as household beneficiaries may not be energy poor at the time of receipt of a programme, but could be deemed vulnerable.

To guide our analysis, we define a conceptual framework linking policies, either social protection or energy measures with an assistance component, through a series of channels to support households getting out of energy poverty or vulnerability. Energy-enhancing measures for the poor can be divided into two broad categories. First, a set of social protection instruments (Figure 1) that incite indirectly adoption and actual consumption of modern energy sources – including measures such as social assistance, social pension, social security, health insurance, public work or school fee waiver. Second, energy-earmarked measures with an assistance component (Figure 2) that aim at promoting and allowing access and connection to less polluting/modern energy sources, such as connection to the grid-system free of charge or at subsidised rate, social tariffs, distribution of solar system or improved cook stove (such as LPG cylinder and fuel) free of charge or at subsidized rate. Both categories can be designed to be either universal or pro-poor targeted. By their own nature, no matter the design they are expected to have an impact on the less well-off through distinct but yet complementary channels. This type of theorization is not far from the budgeting structure applied by the Ministry of Finance of some countries in the world, where the support of capacity (e.g. poverty-targeted blocked tariffs) or accessibility (e.g. LGP provision or fuel subsidies) fall into the accounting of social assistance financing. Both earmarked pro-poor energy measures and social protection instruments can spur changes in energy behaviours. This is achieved through various mechanisms, including an enhancement in disposable income, diversification of livelihoods, changes in consumption structure and level (reflected in the evolution of budget allocation and fulfilment of basic needs), alleviation of liquidity constraints, and mitigation of budget constraints. These channels may influence the adoption of modern energy sources, a modification in energy expenditures as a percentage of income or the energy burden experienced, an increase in energy use to meet basic energy needs when households are in state of deprivation, and a shift towards less polluting sources in the energy mix. All together, the hypothesis of this study is that both these measures provide an influence to energy poverty and vulnerability. In what follows, we explore in detail the channels of influence, pleading for a complementary interpretation of these policies to accompany an energy transition of the poor.

Figure 1. How do social protection measures interact with energy poverty and vulnerability?



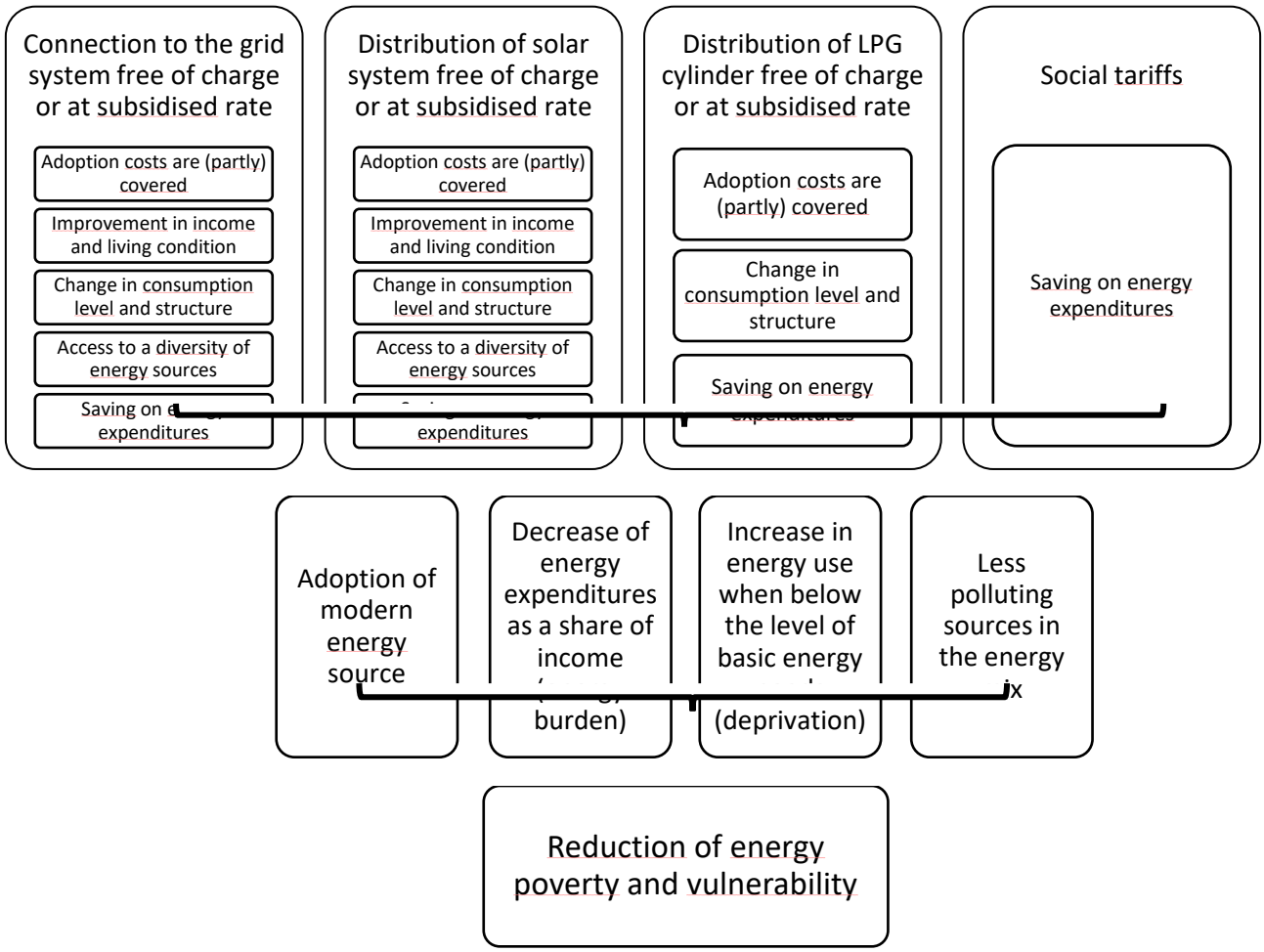
Source: Authors' own representation.

Social protection measures are expected to induce an improvement in the income stream, to alleviate liquidity constraints and eventually modify some aspects of wealth status (Figure 1). These, in turn, enable access to essential goods and services that were unaffordable before, including modern energy sources. With the increase in income, households have several choices: switching to modern energy sources – known as the energy ladder (Masera *et al.*, 2000), mixing traditional sources with modern sources – also called fuel stacking theory (van der Kroon *et al.*, 2013), increasing the consumption of traditional sources (Hanna & Oliva, 2015; Kebede *et al.*, 2002), or purchasing other goods and services besides energy (Khundi-Mkomba *et al.*, 2023). The choice is dictated by the price and availability of energy sources (Akpalu *et al.*, 2011; Lokonon, 2020), preferences (Khundi-Mkomba *et al.*, 2023), customs, and cultural factors (Mohlakoana *et al.*, 2019) among others.

The positive impact of social assistance measures on income and livelihood are well established in the literature. For instance, cash transfers are associated with an improvement in overall economic and social status and often translate into livelihood diversification. These programmes are found to increase income and reduce poverty and headcounts gaps (Tirivayi *et al.*, 2021). Furthermore, these transfers encourage investment in productive activities, generating additional income. Additionally, cash transfers allow to alleviate credit, liquidity, and savings constraints. In the same vein, social pensions generate additional income for old people and alleviate their liquidity constraint and modify their budget constraint (J. Li *et al.*, 2024; Ren & Xiong, 2023). The beneficiaries of social pension tend to forego activities that necessitate biomass collection, resulting in change in energy consumption pattern (J. Li *et al.*, 2024; Ren & Xiong, 2023). Labour market programmes including public works can also influence energy poverty. Public work programmes have a positive impact not only on beneficiaries, but generate also a spill over effect on the wider private sector (Franklin *et al.*, 2023). Furthermore, individuals who benefit from these programmes tend to take more risks and engage in activities with higher yields, leading to additional income generation (Zimmermann, 2020). This additional generated income might eventually be used to fulfil the energy needs of the beneficiaries and encourage the adoption of less polluting energy sources.

Energy poverty is known to have deleterious impact on health but also to crowd-out expenditures on daily necessities by increasing health care expenditures (Bukari *et al.*, 2021; Nie & Li, 2023). Evidence suggest that health insurance reduces health expenditures and out-of-pocket health expenditures for energy poor households (Bukari *et al.*, 2021; Nie & Li, 2023) allowing to reallocate expenditures towards basic needs - including energy. Similarly, social security and school fee waiver constitute a catalyst for change in household consumption level and structure (N. Li *et al.*, 2023). Social security comprises basic pension insurance, medical and health coverage, work-related injury or unemployment insurance, leading to a positive change in consumption levels. Moreover, covering insurance premiums for poor households can result in increased energy consumption thanks to the alleviation of the burden of social security payments and medical expenses. Similarly, school fee waiver can also influence the consumption structure and disposable income of the poor. By reducing education expenditures, it allows individuals to expand their expenditures to basic needs, including energy. In the long-run, investing in human capital through educational support empowers low-income individuals to acquire enhanced production skills, access improved job opportunities, and ultimately experience positive changes in disposable income and consumption patterns, including energy expenditures (Li *et al.*, 2023). Numerous initiatives exist to allow access to modern energy sources to vulnerable populations in developing countries (Figure 2).

Figure 2. How do pro-poor energy measures with assistance component interact with energy poverty and vulnerability?



Source: Authors' own representation.

The improvement in energy supply might not often translate into the reduction in energy poverty and energy vulnerability due to barriers (Bonan *et al.*, 2017). The role of households income and energy prices have been well documented in the literature explaining the low up-take and adoption of modern energy sources (Abbas *et al.*, 2020; Bonan *et al.*, 2017; González-Eguino, 2015). Beyond the income channel, preferences, cultural and societal factors are also found to determine the adoption of modern energy (Bonan *et al.*, 2017). Other factors that are not inherent to household's characteristics or to the energy market

conditions may also shape energy poverty (Abbas *et al.*, 2020). [1] The provision of energy sources – via connection to the grid system or through the distribution of modern energy for lighting and cooking (for e.g. photovoltaic solar panel and improved cook stove) – free of charge or at subsidized rate can reduce energy poverty. Covering adoption costs facilitate access and consumption of a diversity of modern energy sources. In particular, access to photovoltaic solar panel have been associated with an improvement in disposable income and living condition (Zhang *et al.*, 2020). Thus, a change in consumption level and structure is expected to happen (Beyene *et al.*, 2024). Furthermore, the adoption of modern energy sources will entail significant savings on energy expenditures (Andadari *et al.*, 2014). Combined together, the reduction of adoption costs, the improvement in income and the savings on energy expenditures will foster the adoption of modern energy sources and decrease the deprivation of energy and energy burden of energy poor households. However, adoption might not translate into sustained consumption if some aspects regarding the context of implementation are not considered. Long-term use is often conditional on the availability of related services in the surrounding of the beneficiaries, for instance the availability of maintenance support for photovoltaic solar panel or the availability of refill point at a short distance for LPG cylinder (Adjei-Mantey *et al.*, 2021; D. Guta *et al.*, 2024; Yadav *et al.*, 2019). Additionally, the sustained adoption of modern energy sources will depend on the availability and the prices of other energy sources (Nawaz & Iqbal, 2020). However, solar panel given free of charge tend to limit the willingness to acquire more solar power in the future for poor households due to their limited financial ability (Yadav *et al.*, 2019).

[1] For instance, inequality and poor governance hinder electricity access and exacerbate energy poverty in Sub Saharan Africa (Acheampong *et al.*, 2023; Sarkodie & Adams, 2020). Higher (lower) level of inequality is associated with a lower (higher) level of electricity across the region (Sarkodie & Adams, 2020). On the other hand, good governance, including control of corruption, government effectiveness, the rule of law, regulatory quality, and voice and accountability are found to improve access to electricity and to modern fuels (Acheampong *et al.*, 2023). Refer to **Appendix A** for more detailed considerations on governance and energy justice.

2. Social protection instruments with indirect effects on energy

We now explore the literature to assess how empirical findings align with the energy consumption theories and channels highlighted, and then assert where there are some knowledge gaps still to be filled. Most empirical evidence about social protection indicates that households often do not achieve a complete switch to modern energy sources (van der Kroon *et al.*, 2013). Instead, they tend to diversify their energy sources, using them in combination (Heltberg, 2004; Hanna and Oliva, 2015; Nawaz and Iqbar, 2020; Masera *et al.*, 2000). As household income increases, the shift towards modern energy sources tends to be partial, resulting in a mixed portfolio of energy sources, a strategy to enhance fuel security and harness the advantages offered by various fuels. Income alone does not solely dictate the choice of fuel, rather, it emerges as a complex outcome influenced by economic, social, and cultural factors (Masera *et al.*, 2000). The composition of this diversified portfolio is shaped by factors such as fuel availability, affordability, as well as socio-normative considerations encompassing preferences, culture, and tradition (Gill-Wiehl & Kammen, 2022; Heltberg, 2004; Masera *et al.*, 2000). Eventually, adoption will depend on the relative income elasticities and substitutability of different energy sources in the local area (Akpalu *et al.*, 2011; Masera *et al.*, 2000; Nawaz & Iqbal, 2020). The diversification of energy portfolios occurs via budget reallocation as well as increasing number of energy sources. First, households increase their budget for less-polluting sources such as batteries and charcoal, and decrease the resources allocated to harmful and polluting fuel like firewood. Second, the programme beneficiaries are more inclined to own modern energy sources as their income grows. The energy source diversification is linked to structural factors, like the local energy market, dependent on the availability and prices of fuels and preferences for modern energy (Akpalu *et al.*, 2011; Masera *et al.*, 2000; Nawaz & Iqbal, 2020).

1.1. Social assistance

Social assistance is a widely adopted social protection instrument aimed at mitigating poverty, and several studies have evaluated empirically its effects on energy consumption. In Mexico, Gertler *et al.* (2016) shows that the *Oportunidades* conditional cash transfer programme improved the likelihood of owning energy intensive goods and energy expenditure. In India, Hanna & Oliva (2015) explores a programme comprising assets transfer, a stipend, and weekly meetings, finding that beneficiaries increased their fuel consumption and electricity use. Gelo *et al.* (2023) investigates the effect of eligibility for the Old Age

Pension on energy demand of poor households with elderly in South Africa, finding that demand for energy services increases as income increases, with electricity spending being twice as much as the others commercial fuels.

With respect to the ultra-poor, Nawaz & Iqbal (2020) studies the impact of the unconditional cash transfer programme *Benazir Income Support Program (BISP)* on fuel choices among the ultra-poor in Pakistan, finding increased monthly per capita fuel consumption as well as the expenditure on modern fuel for beneficiaries, with a decrease in traditional fuel use. However, some evidence shows that ultra-poor beneficiaries may prefer to substitute their expenditure bundle away from energy (Khundi-Mkomba *et al*., 2023). In Rwanda, the *Girinka* programme provides dairy cows to the poorest households, while the *Vision 2020 Umurenge Programme (VUP)* is a broad programme composed of different components, including an unconditional monthly cash transfer, public works (short-term, temporary employment on community infrastructure and environmental projects) and a shock responsive social protection component. Participation to at least one of the programme arms reduces the share of income households allocated to energy expenditures including electricity, charcoals, batteries, candles, fuelwood, and kerosene, excluding energy costs for transport (Khundi-Mkomba *et al*., 2023). Khundi-Mkomba et al. (2023) suggests that households prefer to spend their additional income on other socio-economic needs, such as food or health. Nonetheless, no attempt to test the hypothesis of differential responsiveness of poor and ultra-poor was found in the literature. More evidence is thus warranted to explore how different types of programmes (and combination of them) affect the budget constraint of the ultra-poor.

Cash transfers indirectly encourage the use of less polluting sources of energy (Chakrabarti & Handa, 2023; Gelo *et al*., 2023; Ren & Xiong, 2023). In South Africa, the increased income within a household generated from the Old Age Pension increases primary reliance on electricity for lighting, heating and cooking, and reduces dependence on biomass and other polluting fuels (Gelo *et al*., 2023). Similarly, Ren & Xiong (2023) inspects how the *New Rural Pension Scheme (NRPS)* influences cooking fuel choice among rural seniors in China. The authors find that the beneficiaries rely less on biomass and adopt less polluting cooking fuels, mainly electricity. The switch is particularly notable for low-income households, thanks to the increase in income and reduction in farm works that is often associated with biomass collection. Further research is warranted to explore the implication in terms of fuel stacking (Ren & Xiong, 2023). In Mexico *Oportunidades* beneficiaries were more likely to report using electricity as their primary source of light (Gertler *et al*., 2016), whereas in India there is no evidence of differential shift toward more efficient sources (Hanna & Oliva, 2015). In Pakistan,

Nawaz and Iqbal (2020) suggests that the *BISP* beneficiaries increased their use of modern fuels such as gas and electricity as well as the use intermediate fuels like coal and kerosene. In Malawi and Zambia, unconditional cash transfer programmes are found to change fuel choices of ultra-poor households (Chakrabarti & Handa, 2023). The Malawi *Social Cash Transfer Program (SCTP)*, the Zambia *Multiple Category Targeting Program (MCP),* and the *Zambia Child Grant Program (CGP)* all address food insecurity and hunger among the ultra-poor households with different targeting criteria. Chakrabarti & Handa (2023) finds that for each programme, ultra-poor beneficiaries are less reliant on fires as primary source for lighting and to a lesser extent for cooking. This is suggestive of both poor and ultra-poor beneficiaries diversifying their energy sources towards less polluting sources without completely abandoning traditional fuels, attributable to the high costs and variability of supply of sources like electricity and gas (Aung *et al*., 2021; Chakrabarti & Handa, 2023).

1.2. Social insurance and cash-for-work programmes

Social insurance can improve energy access by addressing affordability issues. There exists a small yet growing literature exploring the interactions of social health insurance and energy. For instance, Yemtsov & Moubarak (2018) reports the case of Viet Nam where the government provides free health insurance cards, exemptions of education fees, and access to subsidized credit to alleviate energy poverty among poor households. Similarly, in Philippines, the coverage of health insurance for poor households were extended during the reform of the energy subsidy, but impact evaluations on energy use remain limited (Malerba, 2023). Usually, thanks to the fiscal space generated governments leverage these instruments along with energy subsidies reforms (Malerba, 2023).[2]

Despite energy considerations, many low- and middle-income countries find reforms of this area of policy difficult politically and financially, as the size of low earners or informal earners hinder the expansion of system enrolment, even despite the legal reforms put in place (see for instance Barsoum & Selwaness (2022) for latest evidence in Egypt). There are however growing number of evidence in support of a real protective role that expansion of social insurance could do to vulnerable groups. For instance, Antón *et al.* (2016) proposes a

[2] These include compensation for health and education budget support, health insurance for poor households, assistance to poor students, subsidised food distribution scheme for the rural poor, increase in social spending for education investment and hiring of teachers thanks to the fiscal space generated by the reforms (Malerba, 2023).

simulation of the expansion of social insurance in Mexico as a substitute to the energy subsidy, to be financed through an increase in Value Added Tax (VAT) and the removal of energy subsidies and payroll contributions to social insurance.

Labour market policies, such as cash-for-work (CfW) programmes, can indirectly affect energy poverty and energy consumption. While studies looking at the impact of CfW programmes on energy access are scarce, available evidence suggests that these initiatives can significantly contribute to improving access to reliable and affordable energy. Providing guaranteed wage employment, CfW programmes alleviate poverty and provide income sources (Giribabu *et al.*, 2019; V. Sharma & Dash, 2022). Based on the Indian experience, as households' income improve via CfW programme they become less reliant on traditional fuels (V. Sharma & Dash, 2022) and gain access to electricity but no significant impact on energy consumption is found (Ravi & Engler, 2015). India CfW programme, *National Rural Employment Guarantee Act (MGNREGA)*, offers temporary employment for up to 100 days per year for rural household. Income generated are often and mostly used to meet basic needs, including electricity consumption (Loewe *et al.*, 2020). In some case, CfW programmes are tailored to expand access to affordable and less polluting energy sources. For instance, the *MGNREGA* programme in India includes construction of biogas plant and plantation of perennial shrubs used to produce biodiesel by the beneficiaries of the programme (Giribabu *et al.*, 2019). Further research is essential to evaluate the effectiveness of CfW programmes in assisting energy poor and energy vulnerable households in accessing and affording modern and less-polluting energy sources.

As income is one of the barriers to the adoption of modern energy sources, scholars recommend to link CfW programme with modern energy sources adoption. Some researchers propose distributing modern cooking solutions directly or providing vouchers for their acquisition, in conjunction with CfW programmes, to enhance accessibility and affordability for households in need (Kelkar & Nathan, 2021; Wong *et al.*, 2022).

3. Energy measures targeted to reduce energy vulnerability/poverty

Energy markets are fast evolving in the developing world, with the declining cost of modern energy sources at the disposal of countries. Many technologies enable multiple energy services via solar and wind energy systems, such as micro-hydropower generators, hybrid systems or batteries, particularly suitable to serve dispersed rural populations (Arndt *et al.*, 2019). Adoption of renewable energies is expected to generate socio-economic and environmental benefits for middle and low-income countries, and particularly for African countries (Tiba & Belaid, 2021). Renewable energy introduction can however disfavour the poor if the development costs are passed onto the end consumers (Henry *et al.*, 2021). Depending on the abundance of renewable energy sources and the local context, supplying only renewable energies could be more costly (Henry *et al.*, 2021). The downward trend in renewable energy prices is an opportunity for developing countries to leapfrog to modern technologies (Arndt *et al.*, 2019). Energy policy measures, especially energy assistance programme, are tools that can be leveraged to reach this goal. Energy assistance programmes should be carefully tailored to align with the specific context of the intervention. If not carefully designed to reflect the needs of the beneficiaries, the programme can have unintended effects and increase energy poverty (Xie *et al.*, 2022).[3] We now inspect how energy assistance programmes have been leveraged in developing countries to advance in the quest of reducing energy poverty.

1.3. Earmarked energy assistance transfers

Energy assistance programmes aim to provide access to energy for poor and vulnerable households. Some programmes focus solely on providing connections to the grid system, while others tackle both access and consumption challenges. Supports include lifeline tariffs, cash or in-kind transfers, and subsidies given to consumers or service providers. We summarise below some characteristics of these instruments in expanding access to modern, less-polluting energy sources for lighting and cooking for low-income and

[3] For instance, in Northern China, the *Household Energy Transition Programme* required households to replace their heating fuels from coal to electricity and gas. The government offers subsidies to support households with fuel costs and equipment replacement. Xie *et al.* (2022) finds that the mandatory transition from coal to electricity and gas for heating increased energy poverty, especially among low-income households. Despite being subsidized, the prices of gas and electricity remained higher than coal, making the cost of heating weigh even more heavily on households' budgets (Xie *et al.*, 2022).

vulnerable households, with an in-depth analysis across low- and middle-income countries available in **Appendix B**. Beyond access to electricity, reaching SDG7 by 2030 will require drastic decisions and massive investment in pro-health cook stoves, otherwise energy, social, and gender justice would be hindered (Gill-Wiehl & Kammen, 2022). Hence, we also explore how social assistance instruments have been leveraged on the side of energy measures to encourage the adoption of modern and less-polluting cooking sources.

Initiatives to connect households to the grid system often include providing free or subsidized electricity connections. Notable examples can be found in Brazil and in Kenya (McGregor & Girardeau, 2020). Access alone to energy however, does not guarantee the reduction of energy poverty and actual consumption of energy. Ensuring the affordability of energy appliances and services is essential (Bezerra *et al.*, 2022; Henry *et al.*, 2021). The consumption of low-income households already connected to the grid systems can be supported via subsidies in the form of lifeline tariffs (or social tariff), implemented as increasing block tariff structure (IBT), where costs rise progressively with energy usage blocks, or as volume differentiated tariff (VDT), where the cost per unit of energy depends on total consumption, benefiting households using less energy with lower unit costs (McGregor & Girardeau, 2020). The beneficiaries are identified based on their consumption level and, in some cases, via existing social assistance databases. Some programmes try to meet specifically the needs of specific groups, such as the elderly, disabled people, and indigenous people (Mazzone *et al.*, 2020). Among the challenges of these programmes, the benefits to non-poor households may be significant, especially when the threshold is set too high beyond a contextual local energy need (McGregor & Girardeau, 2020; Klug *et al.*, 2022).

To ensure that energy assistance reaches poor and vulnerable households, some governments offer additional cash support dedicated to energy through existing national social assistance programmes (McGregor & Girardeau, 2020). To reduce the affordability gap for eligible households, the Energy and Cash Plus/*Mwangaza Mashinani* programme in Kenya integrated into the existing social assistance system, the National Safety Net Programme (NSNP) provide partial coverage for payments to off-grid solar companies (GOGLA, 2022; Zaman *et al.*, 2021). Cash transfers might also operate as standalone programmes, like in the *Pratyash Hanstantrit Labh (PaHaL)* programme for subsidizing LPG prices, in which each household receives LPG refills annually, with an advance for the first cylinder (Mittal *et al.*, 2017). Although LPG is considered as a fossil fuel, it is recognised as one of the least polluting and most efficient energy source for the transition towards the use of less polluting cooking energy (Puzzolo *et al.*, 2020). To reach the last mile energy poor, government-led programmes provide off-grid solar solutions or LPG free of charge (R. Sharma *et al.*, 2019; Zaman *et al.*, 2021). This approach could be favoured to prevent

situations where cash transfers fail to keep pace with inflation and/or increasing energy costs. Examples of target initiatives can be found in Bangladesh, where the *TR-Kabita* programme distributes free solar home systems to the poorest households as to public facilities (Cabraal *et al*., 2021), or in India where the *Saubhagya* Scheme distributes free solar systems to rural areas and the *70 Lakh Solar Lamp Scheme* (Solar Urja Lamps) free solar lamps to students (GOGLA, 2019; R. Sharma *et al*., 2019; Zaman *et al*., 2021). Some programmes do not have specific targeting criteria in their approach, like the LPG programme in Ghana and the Kerosene-to-LPG conversion programme in Indonesia (Bawakyillenuo, 2020; Dartanto *et al*., 2020) which may make it more difficult to reach the most vulnerable households (Bawakyillenuo, 2020).

To facilitate the acquisition of modern energy or cooking sources, subsidies can be provided to consumers or either private or public suppliers. In India, the *Pradhan Mantri Ujjwala Yojana* (PMUY) offers to the poor subsidies covering the first half of the LPG connection cost, while an interest-free loan assists with the remaining expenses. In Indonesia, subsidized LPG cylinder refills are provided to households registered under the BDT social assistance programme (McGregor & Girardeau, 2020). Support may be also directed towards service providers to encourage the adoption of solar technologies and modern cooking solutions. For instance, in Kenya and Nigeria, pilot programmes offer subsidies to solar service providers in underserved counties (Volkert & Klagge, 2022; Zaman *et al*., 2021). In Mexico, a general LPG price subsidy is offered through twelve government-owned stores in low-income communities, providing discounted LPG for low-income households (McGregor & Girardeau, 2020).

1.3.1. Evidence on LPG and electrification

We now briefly inspect the evidence-based knowledge on the impacts of the aforementioned programmes, for which we notice a lack of comprehensive impact evaluations, relying solely on basic statistical analyses. However, the limited evidence available indicates promising outcomes in alleviating energy poverty. Further assessments are required to fully measure the effects of these programmes.

Electrification programmes help low-income households in gaining access to electricity. Since its inception in 2004, the *Luz para Todos* programme in Brazil has successfully connected over 16.4 million people to the electrical grid (Mazzone *et al*., 2020). Similarly, slum electrification programme in Kenya provided more than one millions connections out of which 60 percent had illegal connections before (EED Advisory, 2020). However, the evidence

regarding social tariff, as a policy to accompany electrification programme and to support households consumption, are mixed and point out the inefficiency of the policy. While the policy manage to reach millions of households, the question of unfairness remains, with non-poor households receiving a major part of the benefit (Dartanto *et al.*, 2020; McGregor & Girardeau, 2020). Furthermore, evidence from Brazil suggest that social tariff is not sufficient to support the electricity consumption of poor households with higher needs of energy (Mazzone *et al.*, 2020)

Cash transfer programmes do provide opportunity for low-income households to improve their energy access and consumption. The impact evaluation of the Energy and Cash Plus/*Mwangaza Mashinani* programme conducted by UNICEF (2022) shows that the pilot project significantly improved households' access to reliable lighting and reduced their dependence on polluting and of low-quality energy sources. Beneficiaries gained in energy efficiency and observed a reduction in energy burden by decreasing energy expenses related to lighting and phone charging. Additionally, thanks to the solar devices, children can spend more time studying at home at night. Unexpectedly, households experienced improved social well-being, benefiting from enhanced security through night-time lighting, staying connected with charged mobile phones and radios, and fostering stronger social bonds within their communities (UNICEF, 2022). Similarly, cash transfer can improve greatly the uptake and use of less polluting cooking sources. India's PaHaL programme is an example of a successful large-scale initiative. The programme rapidly expanded less-polluting cooking fuel access for poor rural households (McGregor & Girardeau, 2020; Mittal *et al.*, 2017). However, as energy source prices might fluctuate, the cash supports should keep pace with the variation of energy costs to ensure effectiveness. In several cases, energy supports failed to align with the increasing prices of energy and energy sources. In Brazil, as LPG prices were increasing, the value of cash assistance received from *Bolsa Familia* was fading due to the inflation. Thus, households resorted more often to firewood, along with their use of LPG (Gioda, 2019; Mazzone *et al.*, 2020). Further analysis are essential to assess the effects of these programmes, especially over the long term.

Direct distribution of solar home system (SHS) and solar lamps appear to be an efficient way to allow households to get access to electricity. However, in each studied countries, disentangling the impact of each programme is challenging as several different programmes were distributing SHS and solar lamps at the same time. Nevertheless, evidence point out to improvement in electricity access in all settings where SHS and solar lamps were distributed free of charge (Cabraal *et al.*, 2021; R. Sharma *et al.*, 2019). Furthermore, access to more reliable and safe SHS and solar lamps induce significant savings in terms of energy expenditure (R. Sharma *et al.*, 2019). Beyond access to energy,

these programmes had positive socio-economic impacts on beneficiaries. These are: extended children's study hours thanks to the lighting; greater safety, comfort, and convenience compared to non-beneficiaries of SHS; and reduction in exposure to preventable illness (Cabraal *et al.*, 2021).

There are instances where inadequate energy earmarked policies do not solve energy poverty. Supporting the demand-side of electricity consumption through energy assistance schemes without considering the supply side and infrastructure development for power generation may not yield long-term benefits. These measures might be erroneously considered adding to the existing pressure on the supply system, especially in most sub-Saharan African countries where power generation infrastructure is already struggling to meet demand. However, some studies suggest that increasing energy demand among ultra-poor households is unlikely to put significant strain on the supply system, thus a wider consideration of the population and access characteristics must be considered. In the case of South Africa, evidence shows that supporting poor households' energy consumption via the Free Basic Electricity (FBE) scheme has only contributed to a small fraction of additional demand and may not significantly exacerbate the strain on its already limited electricity supply (PARI | Public Affairs Research Institute, 2022). Looking at program design with respect to more vulnerable populations, access and affordability concerns were not addressed for low-income households. Although consumption support policies are available via the FBE scheme, subsidizing only 50kWh is not enough to cover the Minimum Threshold Level of Consumption (MTLC) of poor south African households – thus limiting access to electricity to poor households (PARI | Public Affairs Research Institute, 2022). This situation obliges low-income households to resort to traditional energy sources along with modern energy sources (Mohlakoana & Wolpe, 2023).

1.4. Consideration regarding modern cook stoves and less-polluting fuels

The promotion of modern cook stoves entails health, environmental, and socio-economic benefits, especially for women's health and labour outcomes (Verma & Imelda, 2023). However, the adoption of LPG may have adverse health effects, as acute respiratory infections in children under five and moderate or severe anaemia among adult women found in Peru, due to transitioning from outdoor to indoor cooking (Thivillon, 2023). Policy makers should be mindful of the fact that the dissemination of a new cooking technology should account for local customs and context (Boudewijns *et al.*, 2022; Mazzone *et al.*, 2021; Mulungu & Kilimani, 2023). In a systematic review, Boudewijns *et al.* (2022) identifies the factors facilitating or hindering the adoption of improved cook stoves and less-pollution fuel.

Among several factors, the three main factors of adoption of improved cook stoves are costs, knowledge and beliefs concerning the innovation, and compatibility; while the main factors of adoption of less-polluting fuels are costs, knowledge and beliefs concerning the innovation, and external policy and incentives (Boudewijns *et al.*, 2022). Higher education level and knowledge regarding the consequences of the use of polluting and inefficient stoves and fuels are associated with a greater willingness to adopt modern energy sources. Sociocultural and dietary habits can also play a role in defining the absorption of such new technologies and fuels. For instance, the use of a specific energy source for cooking (firewood *vs* LPG) can be driven by taste preferences (Mazzone *et al.*, 2021). The role of government via financial support targeted to poor individuals, government commitment to the provision of infrastructure, and market and trade policies is also found to be crucial for the wide adoption of new technologies and less polluting fuels (Boudewijns *et al.*, 2022).

Perspectives of the implementer should also be considered to overcome barriers to the adoption of modern and less polluting cooking solutions. The *Fondo de Inclusión Social Energético* (FISE) programme in Peru provides a good example of good practices. FISE's initiative to enhance LPG access operates through a collaborative effort between public and private entities, including LPG distributors and agents. Under this programme, vouchers are distributed to low-income households, enabling them to acquire discounted LPG fuel. The success of the programme was guaranteed by the fact that beyond providing LPG to beneficiaries, the implementers train and educate beneficiaries regarding LPG usage and health consequences (Fujita-Conrads *et al.*, 2023; Williams *et al.*, 2020). When the beneficiaries were taught about the benefits of LPG they were more likely to adopt the technology.

1.5. From Energy subsidies to cash transfers

Energy subsidies, whether targeted or generalized, are still being used to support electricity and energy consumption around the globe. Generalized energy subsidies are often regressive, primarily benefiting wealthier households, whilst fossil fuel subsidies seem to crowd out public social spending, reducing investment in education and health (Arze del Granado *et al.* 2012; Ebeke & Ngouana, 2015; Couharde & Mouhoud, 2020; Vandeninden *et al.*, 2022). Social assistance schemes can better protect low-income households from energy price spikes (Groot & Oostveen, 2019; Yemtsov & Moubarak, 2018). The use of the existing system facilitates the introduction and the scale-up of new schemes (Gelb & Mukherjee, 2019). Reforming energy subsidies requires a careful consideration of the political, social, and economic consequences of the reform. Due to the regressive nature of fuel subsidies, as we argue in more detail in **Appendix C**, there is a consensus that subsidy removal along with

cash transfer is more efficient at addressing energy poverty than subsidies alone (Groot & Oostveen, 2019; Malerba, 2023). Furthermore, removing subsidies alone without any compensatory policies will increase poverty (Cockburn *et al.*, 2018). However, even when scaling up social assistance along with subsidies reform to protect the poorest households, those who consume a higher quantity of subsidized fuel – middle and high-income households - eventually experience a contraction in their purchasing power. Over the long-run, subsidies reform are found to have positive impacts on the economy despite the short-run negative impact (Njinkeu *et al.*, 2023).

Examples of effective reforms include Iran, where initial cash transfers successfully protected poor households against external factors, like sanctions impacted outcomes (Zarepour & Wagner, 2022). Success requires sustained transfers, community support, and favourable macroeconomic conditions (Atansah *et al.*, 2017). In the Dominican Republic, targeted cash transfers (*Bonogas* and *Bonoluz)* were introduced through the *Solidaridad* program to mitigate energy subsidy reforms (Mukherjee *et al.*, 2023). Similarly, Egypt expanded *Takaful* and *Karama* cash transfer programs to cover 50% of the poor during its reforms (Breisinger *et al.*, 2018; Ridao-Cano *et al.*, 2023). In Argentina, a social tariff system replaced general subsidies, effectively protecting low-income households despite some implementation challenges (Giuliano, *et al.*, 2020).

The literature though warns that cash transfers alone are not sufficient. A subsidy reform may need the scaling up or combination of different social protection programmes to reach those who become energy vulnerable and poor (Sabates-Wheeler & Devereux, 2010; Zarepour & Wagner, 2022). Existing social assistance and safety nets, social insurance and labour market programme can be leveraged to buffer the consequences of the surge in energy and commodity prices, and to target energy poor and vulnerable individuals. Digitalizing and harmonizing existing social registries and databases, along with the use of digital delivery platforms for cash transfers can contribute to the timeliness, inclusiveness, and adequacy of assistance (Aldaba & Geronimo, 2024). Additionally, communication plays a major role when reforming fossil fuel subsidies, to convince the population of the shortcomings of subsidies and the benefits of the reform for the poorest households (Arze del Granado *et al.*, 2012; Sabates-Wheeler & Devereux, 2010). Timing of implementation matters as well, as demonstrated by the case of Iran. Subsidies reform should be launched gradually and during favourable macroeconomic conditions (Atansah *et al.*, 2017).

2. Demographic analysis

This final part of the review explores what evidence exists on the influence of social protection programmes on energy poverty through a demographic lens. It reviews across all studies identified whether there is any pure characterisation of programme effects on gender, for informal dwellings or work, and for persons with special needs/disability. Although an inspection of the time-use literature shows that not many studies find differential effects in specific energy-related time-use outcomes (see for instance UNICEF-IRC, 2021), there seems to be a lack of attention about demographic traits of energy users or enablers when exploring social protection impacts on energy consumption. We explore the possible biases that make this question less relevant to research in quantitative analysis to date, pleading for further academic attention to the matter.

2.1. Gender effects

In developing countries, there may be significant energy burdens faced by households, such as the time burden of collecting firewood. While the gender of the energy burden bearer within the household is context dependant (Listo, 2018), several studies point to the feminization of energy poverty - with women and female-headed households facing energy poverty disproportionately due to their responsibilities and obligations (Abbas *et al.*, 2020; Amigo-Jorquera *et al.*, 2019; Ssennono *et al.*, 2021). In some contexts energy use and access tend to be gendered, whether for household decisions or income-generating activities (Dijk, 2020), and women bear the brunt of the health effects caused by indoor air pollution and are disproportionately affected by the time constraints and risks associated with collecting traditional energy sources (Guruswamy, 2011; Sovacool, 2012). In 2020, 3.2 million deaths were caused by household air pollution and women and children bear the greatest health burden (WHO, 2022). Gender disparities could also arise from physical injuries during fuel collection (Sovacool, 2012). While there is a growing literature on the gender-energy nexus, some authors argue that it lacks depth or understanding of the feminist analysis that it is based on (Listo, 2018; Mazzone, 2022).

Scholars from development studies or economics exploring energy issues argue that the achievement of gender equality is linked with the access to appropriate, adequate, and affordable energy (Bhatia and Angelou, 2015). The literature suggests that there exists a bi-directional relationship between energy adoption and women empowerment (Chen *et al.*, 2024; Das *et al.*, 2023; Shiradkar *et al.*, 2023). Women having higher intra-household

bargaining power and women with access to better economic resources (jobs and income), finance, education, and that are entrepreneurs in the energy sector are found to adopt modern and less polluting cooking fuels. Women's empowerment may lead to a better sharing of households chores and change in traditional gender norms which eventually influence women's energy choice (Chen *et al.*, 2024). On the other hand, women's access to energy and modern fuel is associated with better health, less time spent collecting traditional fuel, with improvement in asset ownership, control over finances, and increase in labour force participation (Das *et al.*, 2023). Similarly, advancing in the reduction of energy poverty has been found to be beneficial for gender equality. Electrification is associated with an increase in women's employment and time devoted to market work (Hermawati *et al.*, 2023; Nguyen & Su, 2021; Pueyo & Maestre, 2019; Sedai *et al.*, 2021) and with greater involvement in higher roles within their family and society (Hermawati *et al.*, 2023; Nguyen & Su, 2021). However, the findings are inconclusive on whether electrification improves women's earning, the type of jobs they occupy, and the time dedicated to unpaid work (Pueyo & Maestre, 2019; Sunikka-Blank *et al.*, 2023).

Energy poverty reduction demonstrates a positive effect on gender inequality in health, with notable improvements in women's life expectancy and a significant reduction in female mortality (Nguyen & Su, 2021). Additionally, it correlates positively to narrowing gender gaps in education (Acheampong *et al.*, 2024; Nguyen & Su, 2021). Access to energy and less-polluting cooking fuels for girls reduces the time spent on biomass collection and the exposure to pollutants. Combined together, the effects of increased time available and improved health may enable girls to dedicate more time to studying, thus improving their academic performance and employment opportunities (Acheampong *et al.,* 2024; Pradhan Shrestha *et al.*, 2023). However, these benefits may be limited when socio-cultural norms limiting women's agency are not addressed (Sunikka-Blank *et al.*, 2023).

Depending on the context, the energy-gender-entrepreneurship literature suggests that women empowerment can also be fostered by integrating women and their needs into the supply side of energy sector (Osunmuyiwa & Ahlborg, 2019). A notable example is found in India with the *SoULS* programme, which trains rural women in assembling and distributing solar lamps, as well as in business development through an entrepreneurship programme (Shiradkar *et al.*, 2023). Supporting women participation in the supply side of the energy sector is positively associated with subjective measures of empowerment such as assertiveness as measured by the confidence to express opinion in the household and in the community, or decision-making on children-related issues and economic independence, and satisfaction (Shiradkar *et al.*, 2023). However, on these studies we could

not find again any consideration of the influence on the balance between productive and reproductive work behaviour.

Across energy policies and interventions gender perspectives are often overlooked, putting aside gendered aspects of access, gendered needs for energy services, and gendered benefits (Kooijman *et al.*, 2023). This "gender-blind" or "gender-neutral" approach stems from a vision that expanding energy access will bring socio-economic development and eventually will increase gender equity (Alda-Vidal *et al.*, 2023). This view tends to consider households as one unit without considering specific energy needs within the household, leading to a lack of understanding of women's energy needs (Alda-Vidal *et al.*, 2023). Combined with the lack of women participation in energy projects and sectors due to existing social norms, men tend disproportionately to receive the benefits from energy interventions, leaving women behind. This raises concerns regarding distributional justice of the energy transition and energy-access programmes (Wiese, 2020).

It is worth noting that energy access is necessary to aid women in their pursuits by reducing the obstacles they face, but it is not a guarantee of empowerment (de Groot *et al.*, 2017; Listo, 2018; Mazzone, 2022). Moreover, there is no one size fits all solutions to address energy poverty and gender inequality. One should understand the factors driving inequality in access and energy use before providing a gendered solution (Mazzone, 2022). Assigning the role of a catalyst of gender equality to energy relieves individuals of their responsibility to challenge the structures that initially caused gender inequality (Listo, 2018; Mazzone, 2022).

A limitation in the energy poverty literature pertains to its frequent confinement within a binary framework of men versus women, neglecting the cultural determinants of gender roles (Mazzone, 2022). Often, feminist research or context-specific insights are used to create broad generalizations for policy or practice. As a result, "gender myths" or essentialist perspectives are taken towards women and gender, with applications observed within research, policy, and project development (Listo, 2018).[4] Thus, there can be instances where

[4] Listo (2018) analyses the energy-gender literature, observing that it tends to serially portray women as victims of energy poverty or burden. The author considers this vision too simplistic, as it does not reflect the heterogeneity across contexts and countries. For instance, fuel collection may be considered to systematically fall under women responsibility, and this label may be applied to a context that instead is dependent on social norms and household labour allocations. If this myth is used to justify an energy intervention, such as the distribution of modern cook stoves, the intervention is then expected to improve equality through empowerment and to enhance women's lives. Attributing women empowerment to technology access alone is inaccurate, as the vector does not alter the social norms that subordinate and marginalize women (Listo, 2018). Context-specific analysis that explains collection practice and the path of change is necessary to make a claim, see for instance Friman (2024) for an example of practice analysis in Burkina Faso.

the lack of understanding of the social, cultural, and structural factors generate harmful effects with the introduction of energy measures. Mazzone (2022) argues that the energy literature should go beyond focusing on energy access and identify if energy programmes lead to any change in gender roles and relations.

In principle, accessing electricity could also foster new knowledge and alternative gender norms, which are mediated through the exposure to new sources of information, like mobile phone or TV. The socio-cultural context may still be a barrier to women's development, causing them to have limited agency (Winther *et al.*, 2017). Winther *et al.* (2017) argues that the literature often fails to comprehend how electrification can enhance women's empowerment and alter gender norms. Thus, energy programmes will not improve gender equality unless its core drivers are addressed (Mazzone, 2022).

Social protection studies assessing the effects on household members or their time-use also seem to reflect this tendency of overlooking the mechanisms of impact that programme access may induce. For example, among the articles with time-use data assessing the effect of social assistance on the energy consumption of the poor (e.g., Aung *et al.*, 2021; Chakrabarti & Handa, 2023), we could not find any article exploring in depth gendered or intra-household time allocation. Furthermore, in general it is difficult to explore disaggregated gendered national statistics for social protection, with variability in availability across low- and middle-income countries (Gavrilovic & Palermo, 2023). An example comes from the electricity literature, where access to electricity could allow time reallocation thanks to the use of electrical appliances (Pradhan Shrestha *et al.*, 2023). However, as noted in Sunikka-Blank *et al.*, (2023), the time saved from using electrical appliances may not be consistently reallocated to other activities and might be allotted to do more unpaid housework, as they find for some urban contexts in India and South Africa.

Cooking is the gendered energy service use that receives most of scholars' attention, with a tendency to decontextualize the socio-normative factors that influence selection or bargaining into this action. Evidence on the impact of social protection measures on energy choices and uses is limited, with only a few papers documenting the gender-specific effects of these interventions. Example of social protection interventions trying to address energy poverty and to enhance women empowerment at the same time can be found in India through the *Pradhan Mantri Ujjwala Yojana* (*PMUY*) programme. The scheme explicitly targets women by subsidizing LPG connection via transfer to women within households below the poverty line. Findings suggest that the programme was efficient at prompting adoption of LPG but not sufficient to lead to a sustained change in the use of less polluting cooking fuel (Roy, 2024; Sharma & Dash, 2022). Sustained use is conditional on other factors

including socio-demographic characteristics of the beneficiaries and local energy market conditions, such as affordability and accessibility of fuels (Roy, 2024). Similar results can be found in Nigeria. Female transfer recipients of the *Household Uplifting Programme* shifted from using inefficient energy sources like firewood and kerosene to less polluting sources such as LPG stoves and solar lamps due to improved financial capacity. However, following the end of the programme and the removal of cash transfers, many reverted to their original energy sources due to increased energy costs and decreased purchasing power (Okoli, 2024), showing that local energy market dynamics play a significant role in shifting (or not) energy behaviours.

Gender-sensitive policy making research, such as on the long-term effects of social protection interventions, needs to be more thorough when extrapolating findings with respect to gender. It is important to further explore the potential role of energy-earmarked measures in addressing structural changes like gender roles and relations. Moreover, little exploration is found on the impact of women's energy access on men and children time allocation (Mazzone, 2022).

2.2. Informality effects

One in three urban dwellers live in informal settlement and do not have access to modern energy, – especially in Africa and Latin America (Butera *et al.*, 2016; Christley *et al.*, 2021) and more than two billion (61 per cent) of workers are in the informal sector globally (International Labour Office (ILO), 2018). The inhabitants of informal settlements face access issues as well as affordability constraints (Butera *et al.*, 2016; Christley *et al.*, 2021; Njoroge *et al.*, 2020). The key obstacles are the connection fee and the challenge of consistent payment due to the informal nature of the settlements (Butera *et al.*, 2016). As slums dwellers are mainly working in the informal sector (Butera *et al.*, 2016; Kovacic *et al.*, 2019) – resulting in the inability to engage in formal agreements and maintain regular payments due to their irregular incomes – they might face difficulties in connection to the grid system (Butera *et al.*, 2016). As a result, access to electricity is either through a neighbour or directly by tapping into the grid through faulty connections (Butera *et al.*, 2016; Christley *et al.*, 2021; Mimmi & Ecer, 2010). As the literature tend to pay less attention to the energy needs of the informal sector – both workers and firms - very little is known regarding their energy needs (Dramani *et al.*, 2022; Mohlakoana *et al.*, 2019). Turning to the specific food informal sector in sub Saharan Africa – where women are overrepresented – workers rely mostly on traditional sources (wood and charcoal) for their activity (de Groot *et al.*, 2017; Mohlakoana *et al.*, 2019). Despite a willingness to switch towards modern energy sources, the reliance on traditional sources is not only due to the costs but also to consumers preferences and customs (Mohlakoana *et al.*, 2019).

Access to electricity and modern and less polluting stoves enables the attainment of other SDGs in informal settlement (Christley *et al.*, 2021). Interventions in slums have shown to improve livelihoods, enhance income generating activities, and reduce exposure to harmful indoor air pollution (Christley *et al.*, 2021). Overall, the demand and the supply sides need support. Affordability concerns can be tackled through financial supports, including targeted subsidies, lifeline tariffs and prepayment methods (Christley *et al.*, 2021). For instance in Brazil, the *Conviver* project launched in 2006/07 provides access to electricity and social tariff to low-income households in Brazil informal settlement of Belo Horizonte. Mimmi & Ecer (2010) shows that providing social tariff in informal settlement encourages households to connect to the formal grid rather than resorting to illegal solutions. These findings support the idea that energy subsidy can be an effective policy to support energy poor households if the subsidies are not regressive and well targeted. This case also highlights the necessity of availability of supplier and energy solutions but also the importance of ownership of energy-efficient equipment.

Proposing payment system that suits the context of informal settlement helps to overcome affordability issues and the high upfront cost of modern technologies. For instance, Pay-as-you-go (PAYG) schemes – which are consumer finance mechanisms that allow customers to purchase LPG credits in small increments often via mobile banking facilitate household's access to less polluting cooking solution (Puzzolo *et al.*, 2020). In Kenya, the PayGo Energy Company proposes new stove, a gas cylinder, a smart meter and fire safety equipment and includes home delivery of cylinder refills particularly in *Mukuru kwa Reuben*, the largest slum in Nairobi. Consumers reported that the possibility to pay a low amount of money allowed them to sustain their consumption and their use of LPG when they were not able to fill a full cylinder - particularly during COVID-19 lockdown when households income shrank (Shupler *et al.*, 2021).

In addition to promote access to formal grid, it is necessary to encourage the use of energy efficient equipment among households in order to reduce the cost of access to energy (Butera *et al.*, 2016). As noted by Mimmi & Ecer (2010), using inadequate and low-quality equipment to provide and to use energy consistently raises the likelihood of engaging in illegal connection to the grid system. For instance in Salvador, the electricity distribution company launched a subsidy programme to equip urban poor households in informal settlements with new and more efficient refrigerators (Energy Sector Management Assistance Program, 2012).[5]

Addressing energy poverty in slums requires to take into account their specific characteristics while leaving no one behind (Anditi *et al.*, 2022; Christley *et al.*, 2021). For instance, gender dimensions and women's energy needs are again overlooked in informal settlement. Despite suggestive evidence of the positive effects of extending electricity in informal settlements on women's welfare and wellbeing (Sunikka-Blank *et al.*, 2023), policy intervention tends to pay less attention to women's needs when addressing energy issues in slums, despite women spending more time in informal urban settlement and being the main users of household energy (Anditi *et al.*, 2022; Kovacic *et al.*, 2019). Putting in place policies to bring less polluting energy in informal settlement requires cross-sector collaboration and understanding of the socio-cultural specificities of the area (Haque *et al.*, 2021; Njoroge *et al.*, 2020). Without taking into account the specificity of slums, energy policies will fail to achieve their goals. Njororobe *et al.* (2021) reports that a solar project in the informal settlement of *Enkanini*, South Africa failed to substitute the use of traditional fuels due to the lack of consideration of the context of the area. The inhabitants were reluctant to adopt solar energy due to the inadequate performance and limited capacity of solar systems in meeting their energy needs, coupled with the fluctuating supply caused by adverse weather conditions (Smit *et al.*, 2019). Furthermore, they were worried that the implementation of solar system would lead the municipality to invest less in direct electricity connections (Smit *et al.*, 2019).

[5] The objective was to replace inefficient appliances that were creating burden on energy bills. As a result, the beneficiaries of the programme observed significant savings on their energy expenditures with a reduction of 43 percent per month of their consumption (Energy Sector Management Assistance Program, 2012).

2.3. Special needs effects

People with disabilities are at a higher risk of experiencing multidimensional poverty (Pinilla-Roncancio & Alkire, 2021) as well as energy vulnerability (Bouzarovski & Petrova, 2015) and energy poverty (Ivanova & Middlemiss, 2021). Due to their higher energy needs and lower income, people with disabilities tend to face difficulty in paying for energy bills (UN, 2018). On the other hand, energy poverty leads to the development of disabilities among children (Sen *et al.*, 2023). Again, women with disabilities are more likely to be energy deprived (Okyere & Lin, 2023). Programmes that address specifically and/or solely disabled people energy needs remain rare (Ivanova & Middlemiss, 2021). Although some programmes include persons with disabilities among the beneficiaries (BISP programme in Pakistan, MCP in Zambia), researchers often overlook the effectiveness of energy assistance programmes in improving the situation of this particular group. The lack of evidence regarding the impact of social protection on the energy needs of people with disabilities could stem from the absence of consideration of their specific needs in energy policies and interventions and the lack of data regarding their needs (Bhakta *et al.*, 2024)

Most of the energy programmes for people with disabilities consist essentially of energy subsidies. For instance, Brazil has targeted marginalized individuals with the programme *Tarifa Social*. The government subsidizes the electricity bill of low income households and marginalized individuals such as people with disabilities and old people over 65, by providing a 65 percent discount if their consumption is under 30 kWh per month (Mazzone *et al.*, 2020). People with disabilities were identified under the *Benefício Assistencial ao Idoso e à Pessoa com Deficiência* (BPC) which is a non-contributory pension social assistance programme covering older and disabled people in extreme poverty (Barrientos, 2013). Similarly in South Africa, the free basic electricity programme (FBE) provides 50kWh of free electricity to energy poor households among which people with disabilities could qualify (Okyere & Lin, 2023). While specific data for people with disabilities are not provided in Brazil, aggregate consumption data reveals that households that consume small amounts of electricity increased their consumption (Mazzone *et al.*, *2020)*. However, a breakdown of the statistics shows that the *Tarifa Social* programme failed to protect low-income households with relatively high electricity consumption (101 kWh onwards). Disaggregated data from the FBE programme in South Africa shows that while the programme failed to meet the basic energy needs of the overall beneficiaries, it improved socio-economic status of women with disabilities and facilitates the adoption of less polluting energy services. As a results, women with disabilities registered in the programme were less likely to experience energy poverty (Okyere & Lin, 2023).

3. Concluding remarks

This article has reviewed the nexus between energy poverty and policies like social protection and energy measures, from the point of view of low and middle-income countries. It proposed a literature review with a majority of national programs identified across policy areas. With respect to social protection measures, there is greater skewness towards social assistance articles and a notable lack of research comparing effectiveness between rural and urban areas. Evidence suggests that these programs, predominantly in the form of cash transfers or social pensions, facilitate energy adoption but often do not achieve complete transitions to modern sources. The review reveals that the effectiveness of such initiatives varies based on local energy markets and cultural contexts. Moreover, it identifies gaps in understanding the long-term impacts of these measures and calls for more research on alternative social protection instruments beyond cash transfers, such as social insurance and cash-for-work programs.

With respect to energy measures, our review warns against overly generous subsidies that may benefit higher-income households disproportionately, and shows some promising avenues for subsidy reforms where social protection is included in the picture. It also underscores the importance of tailored energy earmarked policies, like lifeline tariffs and grid connections. Cash transfers dedicated to energy purposes exhibit efficacy in promoting both access to and use of modern energy sources. Their integration into existing social assistance programmes may facilitate the identification of the beneficiaries and ensure a prompt implementation of the programme. In case of high inflation or price volatility, in-kind transfers emerge as an alternative. However, a careful assessment of policy impact is needed to ensure the persistence of the positive outcomes over the long term. We reviewed evidence that connection alone does not guarantee consumption, and that measures without affordability assessments for the poor may eventually fail in their objective. The more inclusive policies tend to be those promoting connection and that are paired with those promoting and supporting consumption.

Finally, to understand energy poverty reactiveness to pro-vulnerable policies, the article points out that vulnerable groups are more often than not overlooked. Although variations exist across contexts and countries, women and female-headed households often bear a disproportionate burden of energy poverty, but no research was found asking if differential effects emerge once a programme is evaluated. Despite associations between women's access to energy and improved health, education, and empowerment, our review points to the need to take into account contextual heterogeneity and factors driving inequality in

access and energy use. Further to that, more efforts should be made to broaden gender statistics and disaggregated administrative data on social protection at national level (Gavrilovic & Palermo, 2023), that partially explains why we could not find much empirical evidence exploring this research angle. Beyond the criticisms of the energy-gender nexus, long-term studies and the potential role of energy in addressing structural changes in gender roles is yet to be explored by the quantitative literature. Additionally, the review identifies gaps in addressing energy needs in informal settlements and for individuals with disabilities, advocating for more inclusive policy frameworks and more data-driven analysis to better explain the role of energy-sourcing and energy-enhancing measures.

References

Abbas, K., Li, S., Xu, D., Baz, K. Rakhmetova, A. (2020)
"Do socioeconomic factors determine household multidimensional energy poverty? Empirical evidence from South Asia". *Energy Policy*, *146*, 111754. https://doi.org/10.1016/j.enpol.2020.111754

Acheampong, A. O., Opoku, E. E. O., Amankwaa, A., & Dzator, J. (2024)
"Energy poverty and gender equality in education: Unpacking the transmission channels". *Technological Forecasting and Social Change*, *202*, 123274. https://doi.org/10.1016/j.techfore.2024.123274

Adjei-Mantey, K., Takeuchi, K., & Quartey, P. (2021)
"Impact of LPG promotion program in Ghana: The role of distance to refill". *Energy Policy*, *158*, 112578. https://doi.org/10.1016/j.enpol.2021.112578

Agrawal, S., Harish, S. P., Mahajan, A., Thomas, D., & Urpelainen, J. (2020)
"Influence of improved supply on household electricity consumption—Evidence from rural India". *Energy*, *211*, 118544. https://doi.org/10.1016/j.energy.2020.118544

Akpalu, W., Dasmani, I., & Aglobitse, P. B. (2011)
"Demand for cooking fuels in a developing country: To what extent do taste and preferences matter?". *Energy Policy*, *39*(10), 6525–6531. https://doi.org/10.1016/j.enpol.2011.07.054

Aldaba, F. T., & Geronimo, J. A. U. (2024)
"Shock responsiveness of the Philippine social protection system: Three case studies". *Natural Resources Forum*.

Alda-Vidal, C., Khalid, R., Foulds, C., Royston, S., & Greene, M. (2023)
"Gender imaginaries in energy transitions: How professionals construct and envision gender equity in energy access in the Global South". *World Development*, *168*, 106258. https://doi.org/10.1016/j.worlddev.2023.106258

Amaglobeli, M. D., Hanedar, E., Hong, M. G. H., & Thevenot, C. (2022)
"Fiscal Policy for Mitigating the Social Impact of High Energy and Food Prices". International Monetary Fund.

Amigo-Jorquera, C., Guerrero-González, M. J., Sannazzaro, J., & Urquiza-Gómez, A. (2019)
"Does energy poverty have a female face in Chile?" *Tapuya: Latin American Science, Technology and Society*, *2*(1), 378–390. https://doi.org/10.1080/25729861.2019.1608038

Andadari, R. K., Mulder, P., & Rietveld, P. (2014)
"Energy poverty reduction by fuel switching. Impact evaluation of the LPG conversion program in Indonesia". *Energy Policy*, *66*, 436–449. https://doi.org/10.1016/j.enpol.2013.11.021

Anditi, C., Musango, J. K., Smit, S., & Ceschin, F. (2022)
"Addressing gender dimensions in energy innovations: A gender analysis framework for informal urban settlements in Africa". *Energy Research & Social Science*, *88*, 102476. https://doi.org/10.1016/j.erss.2021.102476

Arndt, C., Arent, D., Hartley, F., Merven, B., & Mondal, A. H. (2019)
"Faster Than You Think: Renewable Energy and Developing Countries". *Annual Review of Resource Economics*, *11*(1), 149–168. https://doi.org/10.1146/annurev-resource-100518-093759

Arze del Granado, F. J., Coady, D., & Gillingham, R. (2012)
"The Unequal Benefits of Fuel Subsidies: A Review of Evidence for Developing Countries". *World Development*, *40*(11), 2234–2248. https://doi.org/10.1016/j.worlddev.2012.05.005

Assefa, D., Wolka, K., & W/amanuel, T. (2021)
"Why quest to modern energy urge to rural household: Implication to mitigate climate change and food insecurity, Northern Ethiopia" [Preprint]. In Review. https://doi.org/10.21203/rs.3.rs-1009829/v1

Atansah, P., Khandan, M., Moss, T., Mukherjee, A., & Richmond, J. (2017)
"When do subsidy reforms stick? Lessons from Iran, Nigeria, and India". *Center for Global Development. Retrieved from* https://Www. Cgdev. Org/Sites/Default/Files/When-Do-Subsidy-Reformsstick-Lessons-Iran-Nigeria-and-India. Pdf

Aung, T., Bailis, R., Chilongo, T., Ghilardi, A., Jumbe, C., & Jagger, P. (2021)
"Energy access and the ultra-poor: Do unconditional social cash transfers close the energy access gap in Malawi?". *Energy for Sustainable Development*, *60*, 102–112. https://doi.org/10.1016/j.esd.2020.12.003

Barrientos, A. (2013)
"The Rise of Social Assistance in Brazil". *Development and Change*, *44*(4), 887–910. https://doi.org/10.1111/dech.12043

Barsoum, G., & Selwaness, I. N. (2022)
"Egypt's reformed social insurance system: How might design change incentivize enrolment?". *International Social Security Review*, *75*(2), 47–74. https://doi.org/10.1111/issr.12294

Bawakyillenuo, S. (2020)
"Energy Safety Nets: Ghana Case Study". *Vienna: Sustainable Energy for ALL*.

Beyene, A. D., Mekonnen, A., Jeuland, M., & Czakon, S. (2024)
"Socioeconomic impacts of solar home systems in rural Ethiopia". *Renewable and Sustainable Energy Reviews*, *192*, 114197. https://doi.org/10.1016/j.rser.2023.114197

Bezerra, P., Cruz, T., Mazzone, A., Lucena, A. F. P., De Cian, E., & Schaeffer, R. (2022)
"The multidimensionality of energy poverty in Brazil: A historical analysis". *Energy Policy*, *171*, 113268. https://doi.org/10.1016/j.enpol.2022.113268

Bhakta, A., Brown, E., & Groce, N. E. (2024)
"Clean cooking for every 'body': Including people with disabilities in modern energy cooking services in the global south". *Energy Research & Social Science*, *108*, 103399. https://doi.org/10.1016/j.erss.2023.103399

Bonan, J., Pareglio, S., & Tavoni, M. (2017)
"Access to modern energy: A review of barriers, drivers and impacts". *Environment and Development Economics*, *22*(5), 491–516. https://doi.org/10.1017/S1355770X17000201

Boudewijns, E. A., Trucchi, M., van der Kleij, R. M. J. J., Vermond, D., Hoffman, C. M., Chavannes, N. H., van Schayck, O. C. P., Kirenga, B., & Brakema, E. A. (2022)
"Facilitators and barriers to the implementation of improved solid fuel cookstoves and clean fuels in low-income and middle-income countries: An umbrella review". *The Lancet Planetary Health*, *6*(7), e601–e612. https://doi.org/10.1016/S2542-5196(22)00094-8

Bouzarovski, S., & Petrova, S. (2015)
"A global perspective on domestic energy deprivation: Overcoming the energy poverty–fuel poverty binary". *Energy Research & Social Science*, *10*, 31–40. https://doi.org/10.1016/j.erss.2015.06.007

Breisinger, C., Gilligan, D., Karachiwalla, N., Kurdi, S., El Enbaby, H., Jilani, A., & Thai, G. (2018)
"Impact Evaluation Study for Egypt's Takaful and Karama Cash Transfer Program". *IFPRI, Working Paper 14*.

Bukari, C., Broermann, S., & Okai, D. (2021)
"Energy poverty and health expenditure: Evidence from Ghana". *Energy Economics*, *103*, 105565. https://doi.org/10.1016/j.eneco.2021.105565

Butera, F. M., Caputo, P., Adhikari, R. S., & Facchini, A. (2016)
"Urban Development and Energy Access in Informal Settlements. A Review for Latin America and Africa". *Procedia Engineering*, *161*, 2093–2099. https://doi.org/10.1016/j.proeng.2016.08.680

Cabraal, A., Ward, W. A., Bogach, V. S., & Jain, A. (2021)
"Living in the Light: The Bangladesh Solar Home Systems Story". World Bank. https://doi.org/10.1596/35311

Carley, S., & Konisky, D. M. (2020)
"The justice and equity implications of the clean energy transition". *Nature Energy*, *5*(8), 569–577. https://doi.org/10.1038/s41560-020-0641-6

Castellacci, F. (2023)
"Innovation and social welfare: A new research agenda". *Journal of Economic Surveys*, *37*(4), 1156–1191. https://doi.org/10.1111/joes.12537

Chakrabarti, A., & Handa, S. (2023). The impacts of cash transfers on household energy choices. *American Journal of Agricultural Economics*, 1. https://doi.org/10.1111/ajae.12366

Chan, C., & Delina, L. L. (2023)
"Energy poverty and beyond: The state, contexts, and trajectories of energy poverty studies in Asia". *Energy Research & Social Science*, *102*, 103168. https://doi.org/10.1016/j.erss.2023.103168

Chen, J., Liao, H., & Zhang, T. (2024)
"Empowering women substantially accelerates the household clean energy transition in China". *Energy Policy*, *187*, 114048. https://doi.org/10.1016/j.enpol.2024.114048

Christley, E., Ljungberg, H., Ackom, E., & Fuso Nerini, F. (2021)
"Sustainable energy for slums? Using the Sustainable Development Goals to guide energy access efforts in a Kenyan informal settlement". *Energy Research & Social Science*, *79*, 102176. https://doi.org/10.1016/j.erss.2021.102176

Cockburn, J., Robichaud, V., & Tiberti, L. (2018)
"Energy Subsidy Reform and Poverty in Arab Countries: A Comparative CGE-Microsimulation Analysis of Egypt and Jordan". *Review of Income and Wealth*, *64*(s1), S249–S273. https://doi.org/10.1111/roiw.12309

Cohn, C., & Duncanson, C. (2023)
"Critical Feminist Engagements with Green New Deals". *Feminist Economics*. https://www.tandfonline.com/doi/full/10.1080/13545701.2023.2184844

Colelli, F. P., Emmerling, J., Marangoni, G., Mistry, M. N., & De Cian, E. (2022)
"Increased energy use for adaptation significantly impacts mitigation pathways". *Nature Communications*, *13*(1), Article 1. https://doi.org/10.1038/s41467-022-32471-1

Couharde, C., & Mouhoud, S. (2020)
"Fossil Fuel Subsidies, Income Inequality, and Poverty: Evidence from Developing Countries". *Journal of Economic Surveys*, *34*(5), 981–1006. https://doi.org/10.1111/joes.12384

Dartanto, T., Quarina, Q., Nasrudin, R., Putra, F. N., & Abdillah, K. (2020)
"Energy Safety Nets: Indonesia Case Study". *Vienna: Sustainable Energy for ALL*.

Das, I., Klug, T., Krishnapriya, P. P., Plutshack, V., Saparapa, R., Scott, S., Sills, E., Kara, N., Pattanayak, S. K., & Jeuland, M. (2023)
"Frameworks, methods and evidence connecting modern domestic energy services and gender empowerment". *Nature Energy*, *8*(5), 435–449. https://doi.org/10.1038/s41560-023-01234-7

de Groot, J., Mohlakoana, N., Knox, A., & Bressers, H. (2017)
"Fuelling women's empowerment? An exploration of the linkages between gender, entrepreneurship and access to energy in the informal food sector". *Energy Research & Social Science*, *28*, 86–97. https://doi.org/10.1016/j.erss.2017.04.004

Dengler, C., & Seebacher, L. M. (2019)
"What About the Global South? Towards a Feminist Decolonial Degrowth Approach". *Ecological Economics*, *157*, 246–252. https://doi.org/10.1016/j.ecolecon.2018.11.019

Dijk, A. K. (2020)
"ENERGIA's Gender and Energy Research Programme: Findings and Experience from Research for Policy". *IDS Bulletin*, *51*(1), Article 1. https://doi.org/10.19088/1968-2020.107

Dramani, J. B., Frimpong, P. B., & Ofori-Mensah, K. A. (2022)
"Modelling the informal sector and energy consumption in Ghana". *Social Sciences & Humanities Open*, *6*(1), 100354. https://doi.org/10.1016/j.ssaho.2022.100354

Ebeke, C., & Ngouana, C. L. (2015)
"Energy subsidies and public social spending: Theory and evidence". *IMF Working Paper*, WP/15/101, International Monetary Fund, Washington, DC.

EED Advisory. (2020)
"Energy Safety Nets: Kenya Case Study". *Vienna: Sustainable Energy for ALL*.

Energy Sector Management Assistance Program. (2012)
"Innovative Approaches to Energy Access for the Urban Poor: Summaries of Best Practices from Case Studies in Four Countries". World Bank. https://doi.org/10.1596/26510

Feeny, S., Trinh, T.-A., & Zhu, A. (2021)
"Temperature shocks and energy poverty: Findings from Vietnam". *Energy Economics*, *99*, 105310. https://doi.org/10.1016/j.eneco.2021.105310

Franklin, S., Imbert, C., Abebe, G., & Mejia-Mantilla, C. (2023)
"Urban Public Works in Spatial Equilibrium: Experimental Evidence from Ethiopia". *American Economic Review*. https://doi.org/10.1257/aer.20220471

Friman, J. (2024)
"Contested firewood collection in Burkina Faso: Governance, perceptions, and practices". *World Development*, *175*, 106495. https://doi.org/10.1016/j.worlddev.2023.106495

Fujita-Conrads, R., Williams, K. N., Underhill, L. J., Herrera, P., Rahman, N., Romani-Huacani, E., Flores-Flores, O., Checkley, W., & Pollard, S. L. (2023)
"Successes and challenges to implementing the Fondo de Inclusión Social Energético LPG access program in Peru: Novel insights from front-end implementers". *Energy for Sustainable Development*, *76*, 101267. https://doi.org/10.1016/j.esd.2023.101267

Gatto, A., & Busato, F. (2020)
"Energy vulnerability around the world: The global energy vulnerability index (GEVI)". *Journal of Cleaner Production*, *253*, 118691. https://doi.org/10.1016/j.jclepro.2019.118691

Gavrilovic, M., & Palermo, T. (2023)
"Mapping gender and social protection data". *Final Report*.

Gelb, A., & Mukherjee, A. (2019)
"Fuel Subsidy Reform and Green Taxes: Can Digital Technologies Improve State Capacity and Effectiveness?". *CGD Policy Paper 149*.

Gelo, D., Kollamparambil, U., & Jeuland, M. (2023)
"The causal effect of income on household energy transition: Evidence from old age pension eligibility in South Africa". *Energy Economics*, *119*, 106538. https://doi.org/10.1016/j.eneco.2023.106538

Gertler, P. J., Shelef, O., Wolfram, C. D., & Fuchs, A. (2016)
"The Demand for Energy-Using Assets among the World's Rising Middle Classes". *American Economic Review*, *106*(6), 1366–1401. https://doi.org/10.1257/aer.20131455

Gill-Wiehl, A., & Kammen, D. M. (2022)
"A pro-health cookstove strategy to advance energy, social and ecological justice". *Nature Energy*, *7*(11), 999–1002. https://doi.org/10.1038/s41560-022-01126-2

Gioda, A. (2019)
"Residential fuelwood consumption in Brazil: Environmental and social implications". *Biomass and Bioenergy*, *120*, 367–375. https://doi.org/10.1016/j.biombioe.2018.11.014

Giribabu, D., Mohapatra, C., Reddy, C. S., & V.V. Prasada Rao, P. (2019)
"Holistic correlation of world's largest social safety net and its outcomes with Sustainable Development Goals." *International Journal of Sustainable Development & World Ecology*, *26*(2), 113–128. https://doi.org/10.1080/13504509.2018.1519492

Giuliano, F., Lugo, M. A., Masut, A., & Puig, J. (2020)
"Distributional effects of reducing energy subsidies: Evidence from recent policy reform in Argentina". *Energy Economics*, *92*, 104980. https://doi.org/10.1016/j.eneco.2020.104980

GOGLA. (2019)
"Peering into the future India and the distributed standalone solar products market". *Retrieved from* https://Www.Gogla.Org/Wp-Content/Uploads/2023/05/Report_india_and_the_solar_standalone_market_sizing_in_india_web_opt.Pdf.

GOGLA. (2022)
"Conditional Cash Transfers in Kenya for Off-Grid Solar Energy Cash Plus / Mwangaza Mashinani Programme". Retrieved from https://www.gogla.org/wp-content/uploads/2022/12/case_study_-_kenya.pdf.

González-Eguino, M. (2015)
Energy poverty: An overview. *Renewable and Sustainable Energy Reviews*, *47*, 377–385. https://doi.org/10.1016/j.rser.2015.03.013

Groot, L., & Oostveen, T. (2019)
"Welfare effects of energy subsidy reform in developing countries". *Review of Development Economics*, *23*(4), 1926–1944. https://doi.org/10.1111/rode.12619

Guruswamy, L. (2011)
"Energy Poverty". *Annual Review of Environment and Resources*, *36*(1), 139–161. https://doi.org/10.1146/annurev-environ-040610-090118

Guta, D. D. (2018)
"Determinants of household adoption of solar energy technology in rural Ethiopia". *Journal of Cleaner Production*, *204*, 193–204. https://doi.org/10.1016/j.jclepro.2018.09.016

Guta, D., Zerriffi, H., Baumgartner, J., Jain, A., Mani, S., Jack, D., Carter, E., Shen, G., Orgill-Meyer, J., Rosenthal, J., Dickinson, K., Bailis, R., & Masuda, Y. (2024)
"Moving Beyond Clean Cooking Energy adoption: Using Indian ACCESS panel data to understand solid fuel suspension". *Energy Policy*, *184*, 113908. https://doi.org/10.1016/j.enpol.2023.113908

Hanna, R., & Oliva, P. (2015)
"Moving Up the Energy Ladder: The Effect of an Increase in Economic Well-Being on the Fuel Consumption Choices of the Poor in India". *American Economic Review*, *105*(5), 242–246. https://doi.org/10.1257/aer.p20151097

Haque, A. N., Lemanski, C., & de Groot, J. (2021)
"Why do low-income urban dwellers reject energy technologies? Exploring the socio-cultural acceptance of solar adoption in Mumbai and Cape Town". *Energy Research & Social Science*, *74*, 101954. https://doi.org/10.1016/j.erss.2021.101954

Heltberg, R. (2004)
"Fuel switching: Evidence from eight developing countries". *Energy Economics*, *26*(5), 869–887. https://doi.org/10.1016/j.eneco.2004.04.018

Henry, C. L., Baker, J. S., Shaw, B. K., Kondash, A. J., Leiva, B., Castellanos, E., Wade, C. M., Lord, B., Van Houtven, G., & Redmon, J. H. (2021)
"How will renewable energy development goals affect energy poverty in Guatemala?". *Energy Economics*, *104*, 105665. https://doi.org/10.1016/j.eneco.2021.105665

IEA. (2023)
"Access to clean cooking. International Energy Agency". https://www.iea.org/reports/sdg7-data-and-projections/access-to-clean-cooking

International Labour Office (ILO) (2018)
"Women and men in the informal economy: A statistical picture". *Third edition* [Report]. http://www.ilo.org/global/publications/books/WCMS_626831/lang--en/index.htm

Ivanova, D., & Middlemiss, L. (2021)
"Characterizing the energy use of disabled people in the European Union towards inclusion in the energy transition". *Nature Energy*, *6*(12), Article 12. https://doi.org/10.1038/s41560-021-00932-4

Kelkar, G., & Nathan, D. (2021)
"Cultural and Economic Barriers in Switching to Clean Cooking Energy: Does Women's Agency Make a Difference?". *Energies*, *14*(21), Article 21. https://doi.org/10.3390/en14217242

Kettani, M., & Sanin, M. E. (2024)
"Energy consumption and energy poverty in Morocco". *Energy Policy*, *185*, 113948. https://doi.org/10.1016/j.enpol.2023.113948

Khundi-Mkomba, F., Saha, A. K., & Wali, U. G. (2023a)
"Social protection schemes in rural Rwanda: A panacea for household energy burdens?". *Energy for Sustainable Development*, *74*, 91–101. https://doi.org/10.1016/j.esd.2023.03.006

Khundi-Mkomba, F., Saha, A. K., & Wali, U. G. (2023b)
"Social protection schemes in rural Rwanda: A panacea for household energy burdens?" *Energy for Sustainable Development*, *74*, 91–101. https://doi.org/10.1016/j.esd.2023.03.006

Kirikkaleli, D., & Darbaz, I. (2021)
"The Causal Linkage between Energy Price and Food Price". *Energies*, *14*(14), Article 14. https://doi.org/10.3390/en14144182

Klug, T. W., Beyene, A. D., Meles, T. H., Toman, M. A., Hassen, S., Hou, M., Klooss, B., Mekonnen, A., & Jeuland, M. (2022)
"A review of impacts of electricity tariff reform in Africa". *Energy Policy*, *170*, 113226. https://doi.org/10.1016/j.enpol.2022.113226

Kooijman, A., Clancy, J., & Cloke, J. (2023)
"Extending energy access assessment: The added value of taking a gender perspective". *Energy Research & Social Science*, *96*, 102923. https://doi.org/10.1016/j.erss.2022.102923

Kovacic, Z., Musango, J. K., Ambole, L. A., Buyana, K., Smit, S., Anditi, C., Mwau, B., Ogot, M., Lwasa, S., Brent, A. C., Nsangi, G., & Sseviiri, H. (2019)
"Interrogating differences: A comparative analysis of Africa's informal settlements". *World Development*, *122*, 614–627. https://doi.org/10.1016/j.worlddev.2019.06.026

Laborde, D., & Piñeiro, V. (2023)
"Wheat price hikes and food security in Sub-Saharan Africa". *Nature Food*, *4*(4), Article 4. https://doi.org/10.1038/s43016-023-00738-5

Li, J., Gao, J., & Liu, H. (2024)
"Reducing energy poverty by nearly universal pension coverage of rural China". *World Development*, *176*, 106524. https://doi.org/10.1016/j.worlddev.2023.106524

Li, N., Yuan, R., & Zheng, S. (2023)
"Impacts of targeted poverty alleviation on urban-rural residential energy consumption inequality: Evidence from 178 Chinese prefecture-level cities". *Urban Climate*, *50*, 101583. https://doi.org/10.1016/j.uclim.2023.101583

Li, X., Smyth, R., Xin, G., & Yao, Y. (2023)
"Warmer temperatures and energy poverty: Evidence from Chinese households". *Energy Economics*, *120*, 106575. https://doi.org/10.1016/j.eneco.2023.106575

Lin, B., & Okyere, M. A. (2020)
"Multidimensional Energy Poverty and Mental Health: Micro-Level Evidence from Ghana". *International Journal of Environmental Research and Public Health*, *17*(18), Article 18. https://doi.org/10.3390/ijerph17186726

Listo, R. (2018)
"Gender myths in energy poverty literature: A Critical Discourse Analysis". *Energy Research & Social Science*, *38*, 9–18. https://doi.org/10.1016/j.erss.2018.01.010

Loewe, M., Zintl, T., Fritzenkötter, J., Gantner, V., Kaltenbach, R., & Pohl, L. (2020)
"Community Effects of Cash-for-Work Programmes in Jordan: Effects on Host Communities' Local Economic Development, Gender Roles, and Social Cohesion". *Economic Research Forum (ERF)*. https://erf.org.eg/publications/community-effects-of-cash-for-work-programmes-in-jordan-effects-on-host-communities-local-economic-development-gender-roles-and-social-cohesion/

Malerba, D. (2023)
"The role of social protection in environmental fiscal reforms". *IDOS Discussion Paper*. https://doi.org/10.23661/IDP10.2023

Masera, O. R., Saatkamp, B. D., & Kammen, D. M. (2000)
"From Linear Fuel Switching to Multiple Cooking Strategies: A Critique and Alternative to the Energy Ladder Model". *World Development*, *28*(12), 2083–2103. https://doi.org/10.1016/S0305-750X(00)00076-0

Mazzone, A. (2022)
"Gender and Energy in International Development: Is There a Return of the 'Feminization' of Poverty Discourse?". *Development*, *65*(1), 17–28. https://doi.org/10.1057/s41301-022-00330-7

Mazzone, A., Cruz, T., & Bezerra, P. (2021)
"Firewood in the forest: Social practices, culture, and energy transitions in a remote village of the Brazilian Amazon". *Energy Research & Social Science*, *74*, 101980. https://doi.org/10.1016/j.erss.2021.101980

Mazzone, A., Rathmann, R., Lucena, A., & Schaeffer, R. (2020)
"Energy safety nets: Brazil case study". *Vienna: Sustainable Energy for ALL*.

McGregor, C., & Girardeau, H. (2020)
"Energy Safety Nets: Using Social Assistance Mechanisms to Close Affordability Gaps for the Poor". *Sustainable Energy for All | SEforALL*. https://www.seforall.org/publications/esn

Middlemiss, L., & Gillard, R. (2015a)
"Fuel poverty from the bottom-up: Characterising household energy vulnerability through the lived experience of the fuel poor". *Energy Research & Social Science*, *6*, 146–154. https://doi.org/10.1016/j.erss.2015.02.001

Middlemiss, L., & Gillard, R. (2015b)
"Fuel poverty from the bottom-up: Characterising household energy vulnerability through the lived experience of the fuel poor". *Energy Research & Social Science*, *6*, 146–154. https://doi.org/10.1016/j.erss.2015.02.001

Mimmi, L. M., & Ecer, S. (2010)
"An econometric study of illegal electricity connections in the urban favelas of Belo Horizonte, Brazil". *Energy Policy*, *38*(9), 5081–5097. https://doi.org/10.1016/j.enpol.2010.04.037

Mittal, N., Mukherjee, A., & Gelb, A. (2017)
"Fuel Subsidy Reform in Developing Countries: Direct Benefit Transfer of LPG Cooking Gas Subsidy in India". *Center for Global Development. Retrieved from:* https://Www. Cgdev. Org/Sites/Default/Files/Fuel-Subsidy-Reformdeveloping-Countries-India. Pdf.

Mohlakoana, N., de Groot, J., Knox, A., & Bressers, H. (2019)
"Determinants of energy use in the informal food sector". *Development Southern Africa*, *36*(4), 476–490. https://doi.org/10.1080/0376835X.2018.1526059

Mohlakoana, N., & Wolpe, P. (2023)
"Unbundling Eskom: How would a new distribution system impact on energy poverty". *AFD Research Papers*, *269*, 1–46.

Mukherjee, A., Okamura, Y., Gentilini, U., Gencer, D., Almenfi, M., Kryeziu, A., Montenegro, M., & Umapathi, N. (2023)
"Cash Transfers in the Context of Energy Subsidy Reform: Insights from Recent Experience". Washington, DC: World Bank. https://doi.org/10.1596/39948

Mulungu, K., & Kilimani, N. (2023)
"Does forest access reduce reliance on costly shock-coping strategies? Evidence from Malawi". *Ecological Economics*, *209*, 107827. https://doi.org/10.1016/j.ecolecon.2023.107827

Nawaz, S., & Iqbal, N. (2020)
"The impact of unconditional cash transfer on fuel choices among ultra-poor in Pakistan: Quasi-experimental evidence from the Benazir Income Support Program". *Energy Policy*, *142*, 111535. https://doi.org/10.1016/j.enpol.2020.111535

Nguyen, C. P., & Su, T. D. (2021)
"Does energy poverty matter for gender inequality? Global evidence". *Energy for Sustainable Development*, *64*, 35–45. https://doi.org/10.1016/j.esd.2021.07.003

Nie, P., & Li, Q. (2023)
"Does energy poverty increase health care expenditures in China?". *Applied Economics*, *0*(0), 1–27. https://doi.org/10.1080/00036846.2023.2210823

Njinkeu, D., Djiofack, C., Gencer, D., Beyene, L. M., & Alli, M. O. (2023)
"Macroeconomic Modeling and Energy Subsidy Reform Policy Dialogue (Energy Subsidy Reform in Action Series)".[ESMAP Technical Report]. World Bank. http://hdl.handle.net/10986/40802

Njoroge, P., Ambole, A., Githira, D., & Outa, G. (2020)
"Steering Energy Transitions through Landscape Governance: Case of Mathare Informal Settlement, Nairobi, Kenya". *Land*, *9*(6), Article 6. https://doi.org/10.3390/land9060206

Nussbaumer, P., Bazilian, M., & Modi, V. (2012)
"Measuring energy poverty: Focusing on what matters". *Renewable and Sustainable Energy Reviews*, *16*(1), 231–243. https://doi.org/10.1016/j.rser.2011.07.150

Okyere, M. A., & Lin, B. (2023)
"Invisible among the vulnerable: A nuanced perspective of energy poverty at the intersection of gender and disability in South Africa". *Humanities and Social Sciences Communications*, *10*(1), Article 1. https://doi.org/10.1057/s41599-023-01604-2

Papada, L., & Kaliampakos, D. (2019)
"Development of vulnerability index for energy poverty". *Energy and Buildings*, *183*, 761–771. https://doi.org/10.1016/j.enbuild.2018.11.033

PARI | Public Affairs Research Institute. (2022, September 19)
"Hungry for Electricity". The Public Affairs Research Institute (PARI). https://pari.org.za/hungry-for-electricity-a-new-pari-publication/

Pelz, S., & Urpelainen, J. (2020)
"Measuring and explaining household access to electrical energy services: Evidence from rural northern India". *Energy Policy*, *145*, 111782. https://doi.org/10.1016/j.enpol.2020.111782

Pinilla-Roncancio, M., & Alkire, S. (2021)
"How Poor Are People With Disabilities? Evidence Based on the Global Multidimensional Poverty Index". *Journal of Disability Policy Studies*, *31*(4), 206–216. https://doi.org/10.1177/1044207320919942

Pueyo, A., & Maestre, M. (2019)
"Linking energy access, gender and poverty: A review of the literature on productive uses of energy". *Energy Research & Social Science*, *53*, 170–181. https://doi.org/10.1016/j.erss.2019.02.019

Puzzolo, E., Cloke, J., Parikh, J., Evans, A., & Pope, D. (2020)
"National scaling up of LPG to achieve SDG 7: Implications for policy, implementation, public health and environment".

Rahut, D. B., Mottaleb, K. A., Ali, A., & Aryal, J. (2018)
"The use and determinants of solar energy by Sub-Saharan African households". *International Journal of Sustainable Energy*, *37*(8), 718–735. https://doi.org/10.1080/14786451.2017.1323897

Ravi, S., & Engler, M. (2015)
"Workfare as an Effective Way to Fight Poverty: The Case of India's NREGS". *World Development*, *67*, 57–71. https://doi.org/10.1016/j.worlddev.2014.09.029

Reddy, A. K., Annecke, W., Bloom, D., Boardman, B., Eberhard, A., & Ramakrishna, J. (2000)
"Energy and Social Issues". *World Energy Assessment*, 39–60.

Ren, J., & Xiong, D. (2023)
"Do social assistance programs promote the use of clean cooking fuels? Evidence from China's new rural pension scheme". *Energy Policy*, *182*, 113741. https://doi.org/10.1016/j.enpol.2023.113741

Ridao-Cano, C., Moosa, D., Pallares-Miralles, M., & Pinxten, J. (2023)
"Built to Include: Reimagining Social Protection in the Middle East and North Africa".

Roy, K. (2024)
"Transition to cooking with clean fuels in rural households of India: Studying the effect of policy and other factors". *Energy for Sustainable Development*, *80*, 101456. https://doi.org/10.1016/j.esd.2024.101456

Sabates-Wheeler, R., & Devereux, S. (2010)
"Cash transfers and high food prices: Explaining outcomes on Ethiopia's Productive Safety Net Programme". *Food Policy*, *35*(4), 274–285. https://doi.org/10.1016/j.foodpol.2010.01.001

Sen, K. K., Singha, B., Karmaker, S. C., Bari, W., Chapman, A. J., Khan, A., & Saha, B. B. (2023)
"Evaluating the relationship between energy poverty and child disability: A multilevel analysis based on low and middle-income countries". *Energy for Sustainable Development*, *77*, 101331. https://doi.org/10.1016/j.esd.2023.101331

Sharma, R., Choudhary, D., Kumar, P., Venkateswaran, J., & Solanki, C. S. (2019)
"Do solar study lamps help children study at night? Evidence from rural India". *Energy for Sustainable Development*, *50*, 109–116. https://doi.org/10.1016/j.esd.2019.03.005

Sharma, V., & Dash, M. (2022)
"Household energy use pattern in rural India: A path towards sustainable development". *Environmental Challenges*, *6*, 100404. https://doi.org/10.1016/j.envc.2021.100404

Shupler, M., O'Keefe, M., Puzzolo, E., Nix, E., Anderson de Cuevas, R., Mwitari, J., Gohole, A., Sang, E., Čukić, I., Menya, D., & Pope, D. (2021)
"Pay-as-you-go liquefied petroleum gas supports sustainable clean cooking in Kenyan informal urban settlement during COVID-19 lockdown". *Applied Energy*, *292*, 116769. https://doi.org/10.1016/j.apenergy.2021.116769

Smit, S., Musango, J. K., & Brent, A. C. (2019)
"Understanding electricity legitimacy dynamics in an urban informal settlement in South Africa: A Community Based System Dynamics approach". *Energy for Sustainable Development*, *49*, 39–52. https://doi.org/10.1016/j.esd.2019.01.004

Sovacool, B. K. (2012)
"The political economy of energy poverty: A review of key challenges". *Energy for Sustainable Development*, *16*(3), 272–282. https://doi.org/10.1016/j.esd.2012.05.006

Ssennono, V. F., Ntayi, J. M., Buyinza, F., Wasswa, F., Aarakit, S. M., & Mukiza, C. N. (2021)
"Energy poverty in Uganda: Evidence from a multidimensional approach". *Energy Economics*, *101*, 105445. https://doi.org/10.1016/j.eneco.2021.105445

Sunikka-Blank, M., Bardhan, R., & Mohandas, P. (2023)
"From informal to formal: Understanding gendered energy transitions through filmmaking in Cape Town and Mumbai". *Gender, Place & Culture*, *30*(12), 1785–1817. https://doi.org/10.1080/0966369X.2022.2115982

Thivillon, T. (2023)
"Saving lives with cooking gas? Unintended effects of targeted LPG subsidies in Peru". SocArXiv. https://doi.org/10.31235/osf.io/yh5xs

Tiba, S., & Belaid, F. (2021)
"Modeling the Nexus Between Sustainable Development and Renewable Energy: The African Perspectives". *Journal of Economic Surveys*, *35*(1), 307–329. https://doi.org/10.1111/joes.12401

Tirivayi, N., Waidler, J., & Otchere, F. (2021)
"Cash transfers – Past, present and future: Evidence and lessons learned from the Transfer Project". *Innocenti Research Briefs*, *2021–10*.

Ulucak, R., Sari, R., Erdogan, S., & Alexandre Castanho, R. (2021)
"Bibliometric Literature Analysis of a Multi-Dimensional Sustainable Development Issue: Energy Poverty". *Sustainability*, *13*(17), Article 17. https://doi.org/10.3390/su13179780

UNICEF. (2022)
"Evaluation of the Mwangaza Mashinani pilot project in Kilifi and Garissa counties, Kenya: Endline evaluation report: Volume I".

UNICEF-IRC. (2021)
"A Cash Plus Model for Safe Transitions to a Healthy and Productive Adulthood Round 3 Report". UNICEF-IRC. https://www.unicef-irc.org/publications/1187-a-cash-plus-model-for-safe-transitions-to-a-healthy-and-productive-adulthood-round-3-report.html

van der Kroon, B., Brouwer, R., & van Beukering, P. J. H. (2013)
"The energy ladder: Theoretical myth or empirical truth? Results from a meta-analysis". *Renewable and Sustainable Energy Reviews*, *20*, 504–513. https://doi.org/10.1016/j.rser.2012.11.045

Vandeninden, F., Grun, R., & Fecher, F. (2022)
"Energy subsidies and poverty: The case of fossil fuel subsidies in Burkina Faso". *Energy for Sustainable Development*, *70*, 581–591. https://doi.org/10.1016/j.esd.2022.08.023

Verma, A. P. & Imelda I. (2023)
"Clean Energy Access: Gender Disparity, Health and Labour Supply". *The Economic Journal*, *133*(650), 845–871. https://doi.org/10.1093/ej/ueac057

Volkert, M., & Klagge, B. (2022)
"Electrification and devolution in Kenya: Opportunities and challenges". *Energy for Sustainable Development*, *71*, 541–553. https://doi.org/10.1016/j.esd.2022.10.022

WHO. (2022)
"Fact Sheets: Household Air Pollution. Geneva: World Health Organization". https://www.who.int/newsroom/fact-sheets/detail/household-air-pollution-and-health

Wiese, K. (2020)
"Energy 4 all? Investigating gendered energy justice implications of community-based micro-hydropower cooperatives in Ethiopia". *Innovation: The European Journal of Social Science Research*, *33*(2), 194–217. https://doi.org/10.1080/13511610.2020.1745059

Williams, K. N., Kephart, J. L., Fandiño-Del-Rio, M., Condori, L., Koehler, K., Moulton, L. H., Checkley, W., & Harvey, S. A. (2020)
"Beyond cost: Exploring fuel choices and the socio-cultural dynamics of liquefied petroleum gas stove adoption in Peru". *Energy Research & Social Science*, *66*, 101591. https://doi.org/10.1016/j.erss.2020.101591

Winther, T., Matinga, M. N., Ulsrud, K., & Standal, K. (2017)
"Women's empowerment through electricity access: Scoping study and proposal for a framework of analysis". *Journal of Development Effectiveness*, *9*(3), 389–417. https://doi.org/10.1080/19439342.2017.1343368

Wong, J.C.Y., Blankenship, B., Harish, S. P., & Urpelainen, J. (2022)
"Increasing microsolar technology adoption: Efficacy of vouchers, cash transfers, and microfinance schemes". *Energy Economics*, *110*, 105952. https://doi.org/10.1016/j.eneco.2022.105952

Xie, L., Hu, X., Zhang, X., & Zhang, X.-B. (2022)
"Who suffers from energy poverty in household energy transition? Evidence from clean heating program in rural China". *Energy Economics*, *106*, 105795. https://doi.org/10.1016/j.eneco.2021.105795

Yadav, P., Davies, P. J., & Sarkodie, S. A. (2019)
"The prospects of decentralised solar energy home systems in rural communities: User experience, determinants, and impact of free solar power on the energy poverty cycle". *Energy Strategy Reviews*, *26*, 100424. https://doi.org/10.1016/j.esr.2019.100424

Yemtsov, R., & Moubarak, A. (2018)
"Assessing the Readiness of Social Safety Nets to Mitigate the Impact of Reform: Households". *Energy Subsidy Reform Assessment Framework (ESRAF)* Good Practice Note no. 5 Washington, D.C. : World Bank Group.

Zaman, R., van Vliet, O., & Posch, A. (2021)
"Energy access and pandemic-resilient livelihoods: The role of solar energy safety nets". *Energy Research & Social Science*, *71*, 101805. https://doi.org/10.1016/j.erss.2020.101805

Zarepour, Z., & Wagner, N. (2022)
"Cash instead of subsidy: Assessing the impact of the iranian energy subsidy reform on households", *Energy Policy*, Volume 168, Ed. Elsevier, September 2022. https://doi.org/10.1016/j.enpol.2022.113145

Appendices

APPENDIX A. What are energy poverty and energy vulnerability?

Energy access goes beyond the simplistic view of availability or connection to energy sources. It rather has a multidimensional facet. In order to understand the distributional issues around energy and the role of social policies to reduce them, it is relevant to frame energy access, its reliance and equitable distribution as defining traits of energy poverty and vulnerability. Many indicators (simple and composite)[6] have been suggested in the literature to define and measure energy access. Earliest definitions of energy access tend to focus on the supply side by emphasizing the availability of energy services (Pachauri, 2011). However, this approach does not account for affordability, quality and reliability of energy. Later, energy access was measured via thresholds for consumption and minimum standards to attain. While the literature acknowledges that the inability to meet basic energy needs have a negative impacts on households welfare (Phoumin & Kimura, 2019), defining a universal minimum level of basic energy needs remains an open question. For instance, among the wide range of available standards, the Practical Action (2010) standards, coined "Total Energy Access (TEA)", identify a minimum level of energy for lighting, cooking and water heating, space heating, cooling, connection to Information and Communication technology and for earning a living[7]. As most measures are arbitrary and might not be relevant for some context, measures of energy

[6] There exists four types of metrics to measure energy access: 1) *binary metrics* based on a single minimum threshold of energy supply, services, consumption, or fuel and equipment use; 2) *dashboard of indicators* that captures the multiple dimension of energy access; 3) *composite indices* that compile several variables into a single metrics; and 4) *multitier indices* that determine intermediary stages of energy access, capturing the continuum of improvement that various technologies provide (Bhatia & Angelou, 2015).

[7] Total Energy Access standards, there are minimum standards to meet. For lighting: 300 lumens for a minimum of 4 hours per night at household level; for cooking and water heating: 1 kg woodfuel or 0.3 kg charcoal or 0.04 kg LPG or 0.2 litres of kerosene or biofuel per person per day, taking less than 30 minutes per household per day to obtain, Minimum efficiency of improved solid fuel stoves to be 40% greater than a three-stone fire in terms of fuel use, Annual mean concentrations of particulate matter (PM2.5) < 10 µg/m3 in households, with interim goals of 15 µg/m3, 25 µg/m3 and 35 µg/m3; for space heating: Minimum daytime indoor air temperature of 180C; for cooling: Households can extend life of perishable products by a minimum of 50% over that allowed by ambient storage, Maximum apparent indoor air temperature of 300C, and information and communications: people can communicate electronic information from their household, people can access electronic media relevant to their lives and livelihoods in their household.

access should be tailored for each specific context, accounting for the institutional context, policy priorities, and the quality and availability of data (Tait, 2017). Following Reddy *et al.* (2000) seminal paper, most measures acknowledge the need for energy services to take into account affordability, reliability, user adequateness and environmental considerations. One example is the mutli-tier framework designed by the Energy Sector Management Assistance (ESMAP, 2015). The indicator measures energy services capacity, availability, reliability, quality, affordability, legality, convenience, and health and safety.

Similarly, there is no consensus on the definition of energy poverty and vulnerability. Most energy poverty definitions point out the insufficient level of energy consumption to meet basic needs. The concept of energy poverty differs in the Global North and in Global South (Chan & Delina, 2023). In its first and most common definition in the global North, energy poverty was understood as the 10 percent threshold – where one spending more than 10 percent of her income on energy expenses is considered energy poor (Boardman, 1991). This definition places affordability as the core determinant of energy poverty. In the Global South, the emphasis is on the lack of access to modern and less polluting energy sources (Chan & Delina, 2023; Guruswamy, 2011; Nussbaumer *et al.*, 2012). Are considered energy poor those who do not have access to reliable, safe, and efficient energy and those who rely upon harmful energy sources such as biomass-generated fire (Guruswamy, 2011). The literature tends to acknowledge that energy poverty is a multidimensional concept – encompassing availability, reliability, affordability, quality, and safety (Reddy *et al.*, 2000). However, there remains a lack of consensus regarding the specific dimensions and thresholds that should be considered to measure energy poverty. In a systematic literature review on energy poverty indicators, Siksnelyte-Butkiene *et al.* (2021) identifies at least 71 indicators for evaluating energy poverty. Although, understanding how energy access, poverty, and vulnerability have been measured in the literature is critical, a complete review of existing indicators is outside the scope of this paper.

The measurement of energy vulnerability applied to developed countries have recently emerged in the literature (Papada & Kaliampakos, 2019). While energy poverty describes a state at a certain time, energy vulnerability emphasizes the conditions and likelihood of an household of becoming energy poor (Bouzarovski & Petrova, 2015; Middlemiss & Gillard, 2015), and the ability to cope with energy related shocks (Middlemiss & Gillard, 2015). The resilience of households to shocks is central in determining if they will fall into an energy poverty trap (Gatto & Busato, 2020). Similarly to energy poverty, household's income, energy prices, and the energy

efficiency of the dwelling are factors influencing energy poverty (Middlemiss & Gillard, 2015). Beyond these factors Middlemiss & Gillard (2015) identifies challenges to energy vulnerability including characteristics of the dwelling, energy prices and supply, and households social relation and health. Bouzarovski & Petrova (2015) suggests that energy vulnerability also occurs due to a mismatch between the energy services and the energy needs of households – for instance when the heating or cooling system installed in the dwelling does not align with the energy service needed by the occupant household. However, despite numerous claim of the potential benefits of energy-efficient house, very few evidence support their efficiency in reducing energy poverty and energy burden in developing countries (Davis *et al.*, 2020). The main barrier to the reduction of the energy burden is not the technology itself but the lack of appropriation and assimilation of the solutions. In Mexico, Davis *et al.* (2020) finds that improving insulation and passive cooling systems did not reduce the energy burden of beneficiary household due to misuse of the proposed technology.

Numerous initiatives have tried to bring access to electricity and modern energy sources in underserved and remote areas in developing countries. However, the improvement in energy supply might not often translate into the reduction in energy poverty and energy vulnerability due to barriers (Bonan *et al.*, 2017). The role of households income and energy prices have been well documented in the literature explaining the low up-take and adoption of modern energy sources (Abbas *et al.*, 2020; Bonan *et al.*, 2017; González-Eguino, 2015). Energy poverty in South Asia is frequently associated with households characterized by low incomes, restricted educational achievements, and those headed by women (Abbas *et al.*, 2020). Beyond the income channel, preferences, cultural and societal factors are also found to determine the adoption of modern energy (Bonan *et al.*, 2017). Other factors that are not inherent to household's characteristics or to the energy market conditions may also shape energy poverty (Abbas *et al.*, 2020). For instance, inequality and poor governance hinder electricity access and exacerbate energy poverty in Sub Saharan Africa (Acheampong *et al.*, 2023; Sarkodie & Adams, 2020). Higher (lower) level of inequality is associated with a lower (higher) level of electricity across the region (Sarkodie & Adams, 2020). On the other hands good governance, including control of corruption, government effectiveness, the rule of law, regulatory quality, and voice and accountability are found to improve access to electricity and to modern fuels (Acheampong *et al.*, 2023).

The rapid development of renewable energies and the energy transition are an opportunity for policy makers in low and middle income countries to combat energy poverty and energy vulnerability via measures that go beyond access and provide sustainability to it (such as dealing with solar energy high up-front costs). Bennear (2022) identifies four dimensions related to the low-carbon transition that explore the concept of energy justice: production of energy, energy insecurity/energy poverty, access to less-carbon intensive energy technologies, and impacts of policy instrument choices. For some of these dimensions, the literature is already clear on the positive effects that policy making will provide, such as the positive distributional impacts of renewable energy production on health outcomes, expected to provide significant health benefits due to the reduction of particulate matter (Bennear, 2022). However, the question of energy justice in developing countries has made the object of debate among scholars only recently (Lacey-Barnacle *et al.*, 2020). While low-income households have been showing willingness to pay to access electricity – notably via renewable sources (Sievert & Steinbuks, 2020), scholars warn that poor and marginalized households might not benefit from the energy transition due to uneven distribution and capture of the benefits by elites (Lacey-Barnacle *et al.*, 2020; Yenneti & Day, 2016). It is mainly the case when renewables projects do not take into account the needs of poor and marginalized communities resulting in the benefit to be captured only by better-off households (Yenneti & Day, 2016). Both in developed and developing countries, those suffering from the most injustices appear to be those who lose their land and activities for the expansion of renewables (Bennear, 2022; Yenneti & Day, 2016).

The process of decarbonisation carries the risk of increasing energy poverty among low-income households due to the anticipated rise in energy prices associated with the transition (Bennear, 2022; Bhattacharya *et al.*, 2017). To mitigate the regressive impact of decarbonisation policies, several strategies have been proposed, including carbon taxes and financial assistance or energy subsidies for households. However, the effectiveness of these approaches is uncertain. Some studies indicate that the additional costs imposed on lower-income families by carbon taxes are not fully compensated by the benefits (Lee, 2011). Additionally, energy subsidies have shown only limited effectiveness in significantly improving the situation for households facing severe energy insecurity (Murray & Mills, 2014).

APPENDIX B. Review of the characteristics of energy measures across low- and middle-income countries

Initiatives to connect households to the grid system often include providing free or subsidized electricity connections. For example, in Brazil, the *Luz Para Todos* programme offers free electricity connections to low-income families, ethnic minorities, and vulnerable populations residing in protected areas (Mazzone *et al.*, 2020; McGregor & Girardeau, 2020). In Kenya, connection to the grid system is highly subsidized for low-income households living in urban informal settlements via the *Slum Electrification Project* launched by the Kenya Power and Lighting Company (KPLC) with the support of the Global Partnership on Output-Based Aid (GPOBA) and the World Bank (de Bercegol & Monstadt, 2018). Both programmes have allowed millions of individuals to be connected to grid electricity with over 1 million connections established in Kenya and 3.4 million connections benefiting 16.4 million people in Brazil (McGregor & Girardeau, 2020).

Access alone to energy does not guarantee the reduction of energy poverty. Ensuring the affordability of energy appliances and services is essential (Bezerra *et al.*, 2022; Henry *et al.*, 2021). The consumption of low-income households already connected to the grid systems can be supported via subsidies in the form of lifeline tariffs (or social tariff), designed to ensure basic energy access affordability. They can be implemented as increasing block tariff structure (IBT), where costs rise progressively with energy usage blocks, or as volume differentiated tariff (VDT), where the cost per unit of energy depends on total consumption, benefiting households using less energy with lower unit costs (McGregor & Girardeau, 2020). The beneficiaries are identified based on their consumption level and, in some cases, via existing social assistance database. Some programmes try to meet specifically the needs of specific groups, such as the elderly, disabled people, and indigenous people, like for instance in Brazil under the *Tarifa Social* (Mazzone *et al.*, 2020). The eligibility thresholds for subsidies vary among countries, ranging from 50 kWh in Ghana to as high as 220 kWh in Brazil. While there is an overall improvement in electricity access across these settings, the challenge of subsidies benefiting non-poor households remains significant, especially when the threshold is set too high (Klug *et al.*, 2022). For example, in Kenya, with a threshold of 100 kWh, a significant portion of the subsidies goes to non-poor households (McGregor & Girardeau, 2020). Mohlakoana *et al.* (2019) suggests that the lifeline tariff should be set to cover the basic energy needs of households – which would be around 30kWh. However, as stated earlier, the definition of basic energy needs is still lacking. Some studies argue that subsidies should instead be redirected to lowering connection costs, which is found to be more effective at targeting the poor (Klug *et al.*, 2022).

To ensure that energy assistance reaches poor and vulnerable households, some governments offer additional cash support through existing social assistance programmes. Notably, Brazil and Mexico have integrated specific components aimed at enabling energy consumption and the acquisition of energy assets within their cash transfer initiatives. In Brazil, the *Auxílio Gás* (later *Vale Gas*) programme, initially conceptualised standalone, became part of *Bolsa Familia*, enabling households to buy and refill LPG cylinders (Mazzone *et al*., 2020). Similarly, in Mexico *Oportunidades Energéticas* was launched as a distinct programme between 2007 and 2011. Later it was operated within the broader *Oportunidades* cash transfer programme, to help registered households to cover their energy expenses (McGregor & Girardeau, 2020). In both countries, the distinct identity of the energy component was discarded after their integration into broader social assistance programmes. In Kenya, the Energy and Cash Plus/*Mwangaza Mashinani* programme launched initially as a two year pilot programme in 2018, and then extended for a second phase, is designed to reduce the affordability gap for eligible households by providing partial coverage for payments to off-grid solar companies (GOGLA, 2022; Zaman *et al*., 2021). Implemented by Energy 4 Impact (E4I) and UNICEF, with key involvement from the Ministry of Energy and the Ministry of Labour and Social Protection, the programme targets the poorest and most vulnerable households in regions with low electricity access and high poverty rates. Funded by international actors, the Energy and Cash Plus/*Mwangaza Mashinani* programme in Kenya is integrated into the existing cash transfer system, the National Safety Net Programme (NSNP). Under the *Mwangaza Mashinani* Program, specific NSNP beneficiaries receive a conditional bi-monthly cash top-up, empowering them to acquire solar home systems (GOGLA, 2022; UNICEF, 2022). Cash transfers might also operate as standalone programmes. For instance, the *Pratyash Hanstantrit Labh* (PaHaL) programme is an initiative in India initially aimed at subsidizing LPG prices. Since 2013, the initiative provides subsidies directly to the bank accounts of the 177 million subscribers enrolled with the three state-owned petroleum product-marketing companies. Each household can receive up to 12 LPG refills annually, with an advance for the first cylinder (Mittal *et al*., 2017).[8]

[8] Although PaHaL is connected to *Aadhaar*'s unique identity number system, during programme roll-out there were gaps in *Aadhar* coverage, which called for flexibility in the enrolment and receipt of cash transfers without this identity (Mittal *et al*., 2017). For a review of *Aadhar* design, and on the challenges of its use for welfare programmes, particularly for the poor, see for instance Khera (2017, 2019).

To reach the last mile energy poor, government-led programmes provide off-grid solar solutions or LPG free of charge (Sharma *et al.*, 2019; Zaman *et al.*, 2021). This approach could be favoured to prevent situations where cash transfers fail to keep pace with inflation and/or increasing energy costs. In India and in Bangladesh, the governments distributed solar home systems, or solar lamps, or LPG cylinders to eligible households. The *TR-Kabita* programme in Bangladesh distributes free solar home systems to the poorest communities and households. It also supplies PV systems public facilities such as streetlights, schools, and clinics *(Cabraal et al.*, 2021). In the same vein, India distributes free solar systems via the *Saubhagya* Scheme and free solar lamps via the *70 Lakh Solar Lamp Scheme* (Solar Urja Lamps) *(GOGLA, 2019; Sharma et al.*, 2019; Zaman *et al.*, 2021). While the solar home systems are dedicated to households in rural areas, the solar lamps are targeted to students in rural areas (Sharma *et al.*, 2019). *R. Sharma et al.* (2019) suggests that access to solar home system led to significant savings and reduced energy expenditures. Some programmes do not have specific targeting criteria in their approach. For instance, the LPG programme in Ghana and the Kerosene-to-LPG conversion programme in Indonesia distribute LPGs to households without considering the characteristics of the beneficiaries (Bawakyillenuo, 2020; Dartanto *et al.*, 2020). This approach may, therefore, fail to reach the most vulnerable households, as it lacks specific targeting (Bawakyillenuo, 2020).

To facilitate the acquisition of modern energy or cooking sources, subsidies can be provided to either suppliers or consumers. In India, the *Pradhan Mantri Ujjwala Yojana* (PMUY) offers subsidies covering the first half of the LPG connection cost, while an interest-free loan assists with the remaining expenses. This programme targets individuals below the poverty line and identified through socio-economic indicators in the caste census database, as well as beneficiaries of other schemes. In Indonesia, subsidized LPG cylinder refills are provided to households registered under the BDT social assistance programme (McGregor & Girardeau, 2020). In certain countries, support is directed towards service providers to encourage the adoption of solar technologies and modern cooking solutions. For instance, in Kenya and Nigeria, pilot programmes funded by the World Bank offer subsidies to solar service providers. These initiatives aim to bolster private sector enterprises in underserved counties, fostering the establishment of sustainable businesses in the renewable energy sector via the Kenya Off-grid Solar Access Project (KOSAP) in Kenya and the Nigeria Electrification Project (NEP) (Volkert & Klagge, 2022; Zaman *et al.*, 2021). In Mexico, a general LPG price subsidy is offered through twelve government-owned stores in low-income communities, providing discounted liquefied petroleum gas for low-income households (McGregor & Girardeau, 2020).

APPENDIX C. Empirical review of energy subsidies and substitutability of cash transfers

Despite a lack of consensus regarding the definition and computation of energy subsidies, the International Monetary Fund (IMF) estimates that fossil fuel subsidies reached US$7 trillion globally in 2022 (Black *et al.*, 2023). These subsidies imply several fiscal, social, and environmental costs (Sovacool, 2017), and as we argue in the main body of this article, little evidence back their efficiency – especially when not well targeted (Couharde & Mouhoud, 2020). Empirical evidence show that generalized energy subsidies fail to support the poor and are mostly regressive – since they benefit mostly wealthiest households (Couharde & Mouhoud, 2020; Ebeke & Ngouana, 2015; Vandeninden *et al.*, 2022). Arze del Granado *et al.* (2012) shows that, for a panel of 20 developing countries in Africa, Asia, the Middle East, and Latin America, only 7.2 per cent of the fossil fuel subsidies went to the poorest between 2005 and 2009. In Africa, the poorest 20 per cent received only 7.8 per cent of these subsidies (AfDB, 2012). The primary reason for the disproportionate concentration of subsidies in favour of the wealthiest households lies in the universal nature of fossil fuel subsidies (Couharde & Mouhoud, 2020). Since the wealthiest households tend to consume more of the subsidized products compared to poorest households, they become the primary beneficiaries of these subsidies (Couharde & Mouhoud, 2020). Furthermore fossil fuel subsidies are found to crowd out public social spending and reduce investment in education and health (Ebeke & Ngouana, 2015).

The complexity of energy subsidies reform lies in its political and distributional implications. Although energy subsidies are regressive in nature, they constitute a substantial portion of low-income households overall income (Arze del Granado *et al.*, 2012). If subsidy reforms are expected to be beneficial for developing countries, the change in energy prices – and the resulting inflationary spiral - may have detrimental effects on the short-run (Couharde & Mouhoud, 2020; Groot & Oostveen, 2019). The overall increase in price comes from the direct and the indirect effect of the reform. The direct effect is the result of the increase of fuel price per se, while the indirect impact is the increase of the goods using fuel. The effect will depend on the type of subsidized fossil fuel, its importance in household budgets, and its linkages with other goods and services (Couharde & Mouhoud, 2020). Social protection, notably cash transfer, has proven to be an effective way to mitigate the detrimental effects of energy subsidies reforms (Vandeninden *et al.*, 2022). Social protection measures can help low-income households mitigate the impact of price spikes, enhancing their consumption and well-being, while high-income households may experience a notable reduction (Groot & Oostveen, 2019). However, the poorest households might also experience a welfare loss (Arze del Granado *et al.*, 2012).

For instance, a universal unconditional cash transfer to registered households in Iran replaced energy subsidies. The amount of the transfer was intended to be similar to the income loss due to the increase in energy price (Zarepour & Wagner, 2022). The reform resulted in significant reductions across various expenses, particularly in health, food, education, and clothing to offset the income loss (Zarepour and Wagner, 2022). Unsurprisingly, those that consume more energy (middle-class households) would be more affected by the reforms, while those with low energy consumption (poor households) are spared thanks to the cash transfer (Zarepour & Wagner, 2022). This highlights the importance of the size of the amount received to be sufficiently high to protect poor households, as well as the importance of the timing of implementation of the reform.[9]

Similarly, along with its energy subsidies reform, the government of Egypt expanded its social protection scheme via the conditional cash transfer programmes *Takaful* and *Karama* - covering 50 percent of the poor (Breisinger *et al.*, 2018; Ridao-Cano *et al.*, 2023). Although analysis regarding specific energy expenditures are not present, Breisinger *et al.*, (2018) finds improvement in beneficiaries' total expenditures and consumption due to an increase in food expenditures. However, no significant impact on non-food expenditures is observed. When a universal approach is not feasible, government can leverage existing social assistance to support the most vulnerable. In Dominican Republic, as part of its energy subsidies reform the government ceased generalized price subsidies. Instead, targeted energy cash transfers – *Bonogas* and *Bonoluz* – were introduced by leveraging existing cash transfer programme infrastructure – *Solidaridad* (Mukherjee *et al.*, 2023). The use of the existing system facilitates the introduction and the scale-up of new schemes in a prompt way. Furthermore, in many other contexts and countries, social transfers have been implemented and facilitated by the use of digital identification and payments systems (Gelb & Mukherjee, 2019).

[9] Following the reform, the utility and fuel price index increased more than twice as much as the overall price index in Iran (Zarepour & Wagner, 2022). Price increases caused expenditures on home heat, electricity, and fuel to grow in absolute and relative term (Salehi-Isfahani *et al.*, 2015). This spike in prices and the economic and geopolitical contexts resulted in transitioning from energy subsidies to cash transfers, effectively decreasing overall household expenditures (Zarepour & Wagner, 2022) with no adverse effect on the labour market (Salehi-Isfahani & Mostafavi-Dehzooei, 2018). In the early phase of the cash transfer programme, low income households received more in cash transfer than they spent on energy expenditures (Salehi-Isfahani *et al.*, 2015).

Despite the lack of available of empirical evidence, economic simulations suggest that over the long run the reforms will have positive impact on the economy as a whole (Breisinger *et al.*, 2019) and the adverse effects would be limited as fuel subsidies appeared to be highly regressive (Vandeninden *et al.*, 2022)**.** Breisinger *et al.* (2019) studies the impact of the energy reforms in Egypt on the economy and households with a DCGE model. Despite overall gain and positive impacts on several sectors, the reforms are expected to have a negative impact on household consumption. Virtually all households experience welfare loss in the short and long run and rural households would be hit the most (Bresinger *et al.*, 2019). However, without the increase of food subsidies and the introduction of the cash transfer programmes, the welfare loss could have been even worse. Preventing the adverse effects of the spike of energy price require the establishment of social safety nets (Groot & Oostveen, 2019). Investing the savings from the removal of energy subsidies into cash transfer would buffer the adverse impacts of the increase in prices. However, cash transfers alone are not sufficient, it is necessary to accompany the reforms by scaling up or combining different form of social protection programmes (Sabates-Wheeler & Devereux, 2010; Zarepour & Wagner, 2022). Additionally, communication plays a major role when reforming fossil fuel subsidies to convince the population of the shortcomings of subsidies and the benefits of the reform for the poorest households (Arze del Granado *et al.*, 2012; Sabates-Wheeler & Devereux, 2010).

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