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Behaviour Matters: Improving Energy Efficiency in Informal Settlements

Summary

By 2022, two billion people will be living in informal settlements according to the United Nations. Although *per capita* energy consumption in informal settlements is comparatively low, the benefits of energy efficiency uptake – enhanced energy system sustainability, economic development, social development, environmental sustainability, and increased prosperity (International Energy Agency [IEA], 2014) – stand to equally benefit these communities. Yet despite these benefits, informal settlement households – as so many others – have been slow in taking up energy-efficient technologies. This can be partly attributed to behavioural barriers: Consumers often do not invest in energy efficiency in an economically rational manner. Recent research findings point to effective means of implementing behavioural insights for energy efficiency in informal settlements. Building upon this precedence, governments, international organisations and implementing agencies should encourage the application of potentially low-cost behavioural insights to energy efficiency initiatives in informal settlements to improve intervention efficacy. It is easy for energy efficiency to be lost in the challenging demands of daily life in informal settlements – sourcing water, managing irregular employment opportunities, or basic health and safety concerns, compounded by risk aversion and the discounting of future-based benefits. This is why it is essential to integrate behavioural insights to facilitate energy-efficiency uptake. This may be done, for example, by making information on energy efficiency simple and meaningful, by focussing on context-specific benefits, by bringing the economic benefit of uptake closer to the consumer while spacing the cost over time, or by appealing to social norms.

While most evidence on the importance of behavioural insights for energy efficiency stems from the OECD member country context, the topic is equally relevant in the developing country informal settlement context. Here, the cost-benefit analysis of energy efficiency is further complicated by the fact that many households informally consume electricity without paying for it or by paying a flat rate. This presumably removes the traditional pecuniary motivation – electrical bill savings – upon which to influence energy-efficiency implementation. What entry points then exist for energy-efficient products which invariably have a higher upfront purchase cost when there are – *prima facie* – no financial benefits to be realised? The higher durability of energy-efficient products in the context of the instable electricity supply occurring in many developing countries could be an obscured benefit. It accrues not just at the societal level but also at the individual level, further building the economic case for energy-efficiency uptake.

Energy efficiency in informal settlements

In informal settlements, the demand of a single household may be arrestingly small, with just a single light bulb, or surprisingly substantial, including air-conditioning, television, and electric showers. Improving energy efficiency and reducing the energy bill can therefore, to different degrees, improve household welfare. On average, energy costs account for a high proportion of household expenses in poorer households, often exceeding 10%. Observed rates of household income dedicated to energy costs among informal settlers include 20-40% in Kenya, 15-25% among Brazilian and 16-29% among Thai informal settlers (Grubler et al., 2012). Energy efficiency, including that for electrical consumption, can thus have a considerable effect on income and is essential to increase the ability of the end-user to pay for energy services while reducing non-technical losses amplified by inefficient use. For households paying a flat rate or nothing at all for electricity services, monetary benefits may stem from the broader benefits of energy-efficient technologies, such as durability.

Grid-sourced electricity consumption – the focus of this paper – occurs formally (a legally established and metered connection to the electrical grid) or informally (an illegally established, unmetered connection to the electrical grid). Settlers choose to consume illegally or accept informal electricity connections for a number of reasons: to avoid payment, for lack of formal service provision, due to cumbersome procedures, the lack of a bank account or proof of address. Informal electricity consumption places additional strain on what may already be overburdened and underserviced electrical grids. Informal electricity connectors engage in potentially lethal activities to create connections to live wires. In Cape Town, drug addicts are promised their next fix of the drug Tik if they perform the potentially electrocuting function – a transaction indicating the often illicit links held between organised crime and informal electricity service providers. In Rio de Janeiro, the informal connections may be established and controlled by drug mafias or corrupt police, known as *militias*.

Informal connection rates vary among settlements. In the informal settlement of Kibera in Nairobi, it is estimated at near 90%. In a similar setting in Manila, it is roughly 60%. Measurement of informal electricity consumption is hamstrung by its illicit nature. Informal electricity costs range from perhaps free of charge for family members, below market rate for friends, to usurious fees applied by informal electricity providers. For those households sharing a legal connection (sometimes called backyarders), the increased consumption from additionally connected households pushes the electricity tariff higher. This is problematic because block tariff schedules aim to subsidise low-volume consumers by charging a lower rate. Since a higher rate is applied to households with higher consumption, this effectively inverts the intended subsidy.

In the absence of electricity meters, rates may be arbitrarily determined or an aggregate amount divided among connected households (if payment occurs at all). Households then pay a fixed amount for an undefined amount of electricity, though access may be limited to certain time windows or appliances. In some jurisdictions, low consumption may also be legally billed under a flat rate payment structure.

Flat rate payment systems shift the costs and benefits of adopting energy-efficient technologies. When electricity is metered, the payback period of an energy-efficient good as compared to an inefficient good depends on the additional product purchase price, the amount of electricity saved per period and the electricity price. The product purchase price of an energy-efficient good is usually higher than that of an inefficient good, so the savings need to balance this disadvantage. However, when electricity is unmetered, no monetary savings would accrue. For the payback period to reflect the true cost of inefficient products, it would be essential to connect settlers legally to the grid and use metering to determine electricity consumption and corresponding payment. However, until this substantial task is complete, other means of engaging informal settlers in energy efficiency are essential.

A further factor might help to tip the scale towards efficiency: product durability. Voltage fluctuation, which is typical for most developing country contexts, negatively impacts the lifespan of some end-use equipment, especially inefficient or low-quality light bulbs. The longer lifetime of efficient products speaks in their favour. However, this factor is rarely considered, although it would be economically rational. Behavioural insights may thus be called upon to increase the efficacy of energy efficiency interventions, as will be detailed below.

Behavioural insights for energy efficiency in informal settlements

Barriers to energy efficiency investments are heightened in informal settlements. The multitude of concerns introduced by poverty demand so much cognitive capacity that the mental 'bandwidth' upon which to process information is effectively reduced. This underlines the need for behavioural informed approaches to ease the decision of energy-efficiency uptake by, for example, providing simple and meaningful information and accounting for behavioural biases in decision-making. Poverty has also been evidenced to induce risk aversion and discount future benefits (Haushofer & Fehr, 2014) – two particularly cogent challenges in consideration of the purchase of potentially unknown energy-efficient technologies with an uncertain future cost benefit.

Economic behavioural theory differs from neoclassical economic thought in its consideration of economic decision-making beyond the more narrow focus of profit maximisation. The four main strands of behavioural insights focus on the impact of message framing, the constraints of bounded rationality upon decision-making, inconsistent time preferences, and pro-social behaviour. Drawing from these areas, means of implementing behavioural insights may be defined, with examples of implementation provided in Table 1. The impact of these factors on economic decision-making should be taken into account when designing energy efficiency policies and programmes.

Case study: The adoption of energy-efficient lighting in the Nairobi informal settlement of Kibera

In the informal settlement of Kibera in Nairobi, an incandescent bulb may break five times monthly whereas a high quality CFL can reach life spans of six to eight years, resulting in product cost savings as a result of enhanced durability. As illustrated in Figure 1, a randomised control trial (RCT) conducted in Kibera showed the impact of simply informing people about this fact. The combination of a voucher for CFL bulbs with a salient information flyer increased the uptake rate of efficient lighting to 84% compared to 23% when only the voucher was provided. The value of enhancing energy efficiency interventions with behavioural insights is clearly illustrated.

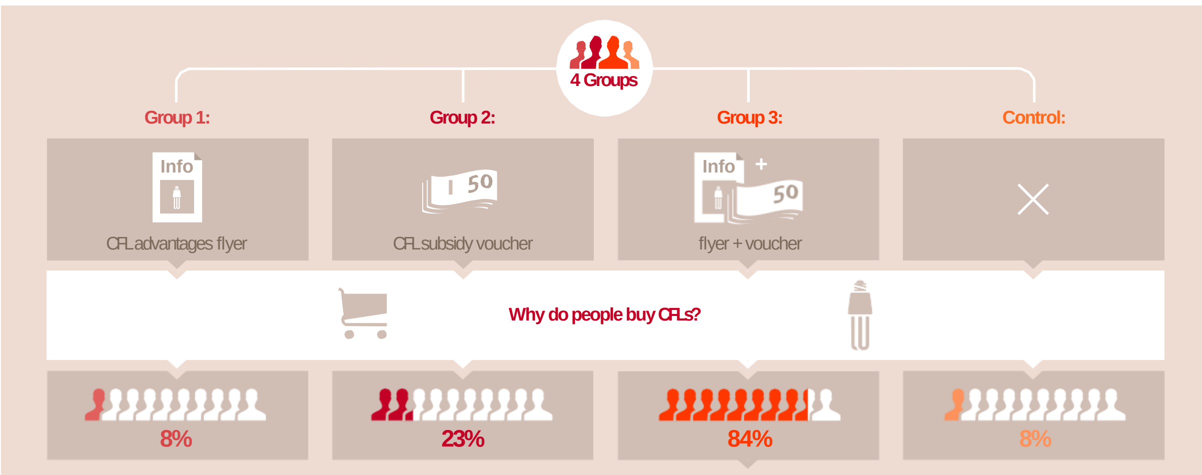
However, using behavioural insights is not a panacea. Supporting policy measures also need to be integrated to facilitate energy efficiency uptake. For example, in Kenya, substantial counterfeit CFL bulbs have reduced consumer confidence in these products, as the market is heavily populated with inferior products with higher amounts of mercury and low durability. The impact of these concerns on demand for efficient lighting was highlighted by the study mentioned above. It showed that respondents were very willing to buy a CFL bulb even at a relatively high price if they believed efforts had been made to secure a non-counterfeit, high-quality product.

Quality assurance infrastructure is thus an essential policy framework element to limit the needless erosion of market confidence in unfamiliar efficient technologies and build trust in energy-efficient innovations. In tandem to quality

Table 1: Behavioural insights for energy efficiency

Message framing	Refers to differences in decision-making induced by framing the same message in different ways. Policies should be tailored to account for the nature of electricity consumption, using salient or meaningful measures to engage the population. For example, in informal contexts, a focus on product durability or other benefits, as opposed to energy efficiency could be more cogent, dependent upon the prevalence of flat rate or non-payment for electricity.
Bounded rationality	Refers to the limited ability to process information. Given the constraints of sourcing information about energy efficiency, heightened in a context of poverty, accessible information about energy efficiency should be made available to informal settlers through popular and adapted means of communication.
Inconsistent time preferences	Refers to the potential to shift decision-making based on the timing of the reward. People frequently seek immediate rewards. Bring the benefit of adopting energy efficient technologies closer to the consumer, for example by distributing the costs of energy-efficient technologies over time, such as through on-bill financing.
Pro-social behaviour	Refers to the desire to align with social norms, or to realise fairness. People may be persuaded to adopt energy-efficient technology in order to, for example, align socially, signal wealth, or contribute to public goods. Harness these factors by, for example, making energy efficiency public, for example through visible signage or awards.

Figure 1: Compact fluorescent lamp (CFL) uptake by treatment group among informal settlers in Kibera, Nairobi



Source: Author

assurance measures, regulatory measures to remove inefficient bulbs such as incandescent bulbs from the marketplace may be undertaken, as is the case in many jurisdictions, supported *inter alia* by the United Nations Environment Programme En.Lighten initiative.

In addition to supporting policy frameworks, awareness should be raised throughout the value chain. For example, kiosk vendors could be trained to identify counterfeit models, while improved labelling and packaging schemes can facilitate consumer decision-making. Behavioural insights can inform the effective design of labelling programmes so that the information presented is more salient to the consumer. The challenges of CFL disposal must also be urgently addressed through disposal programmes, which should similarly incorporate behavioural insights into design.

Policies, global agendas and platforms such as SE4All, the post-2030 development agenda and HABITAT III must support inclusive approaches to energy efficiency

Momentum should be drawn from international agendas and platforms to implement behavioural insights and increase the efficacy of energy efficiency policies and programmes in informal settlements. The Preamble to the Paris Agreement emphasises the "intrinsic relationship that climate change actions, responses and impacts have with equitable access to sustainable development and eradication of poverty" – each of these being factors to which energy efficiency can contribute to addressing. The Sustainable Energy for All (SE4All) initiative of the United Nations and Sustainable Development Goal (SDG) 7.3 include doubling the global rate of improvement in energy efficiency by 2030 while SDG 11 focuses on inclusiveness and sustainability among human settlements and cities. At the same time, the upcoming HABITAT III conference in October 2016 offers a platform on which to integrate energy efficiency in informal settlements into an international dialogue.

Energy efficiency will be essential to deliver the co-benefits of uptake while reducing the proportion of energy costs in informal settlement household income, ever more important in a likely future of rising electricity costs and consumption in informal settlements. Behavioural insights stand to increase the efficacy of energy efficiency policies and initiatives among the substantial global population of over one million informal settlers, in particular where underlying challenges such as lower educational attainment, risk aversion, and the discounting of future benefits act as barriers to energy efficiency uptake.

However, behavioural insights present no Gordian solution to the entangled energy efficiency challenge. Indeed, research-based evidence to date points to the value of behavioural insights in sometimes dramatically increasing the efficacy of other market-based interventions rather than being an independent panacea for energy efficiency uptake. Especially challenging in the informal settlement context are flat rate and non-payment for electricity services which remove a key factor in the determination of the payback period for energy-efficient products, requiring the identification of cogent co-benefits and tailoring outreach accordingly. In the marketplace, lack of quality assurance infrastructure has in some cases resulted in low levels of trust in unfamiliar efficient technologies. Behavioural insights thus need to be integrated as an essential and low-cost element into a broader holistic approach to ease energy efficiency investment decisions.

Further momentum should be gained from global agreements and platforms though, in the end, efforts must be made by implementing agencies and human end-users, with behaviour appreciated and anticipated in inclusive intervention design to more effectively bring energy efficiency to all.

References

Grubler, A., Bai, X., Buettner, T., Dhakal, S., Fisk, D. J., Ichinose, T., ...Weisz, H. (2012). Urban energy systems. In International Institute for Applied Systems Analysis (Ed.), *Global Energy Assessment: Toward a sustainable future* (pp. 1307-1400). Cambridge, UK: Cambridge University Press and the International Institute for Applied Systems Analysis.

Haushofer, J., & Fehr, E. (2014). On the psychology of poverty. *Science 344*, 862-867.

International Energy Agency. (2014). *Capturing the multiple benefits of energy efficiency*. Paris: Author and Organisation for Economic Co-operation and Development.

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