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People's decisions matter: understanding and addressing energy poverty with behavioral economics

Nives DellaValle*

Eurac Research - Institute for Renewable Energy, Via A. Volta 13/A, Bolzano 39100, Italy

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ABSTRACT

Insufficient access to affordable, safe and reliable energy services deprives individuals of the essential means to live a good, satisfactory and just life. This problem is becoming more and more urgent in urban areas, in particular in low-income neighborhoods, in which the inability to meet energy costs reflects social segregation and distributional inequalities. Making cleaner technologies available for all homes and providing financial aid are strategies that would combat energy poverty. However, understanding people's everyday decisions that affect their energy use is also crucial. A careful examination of the underlying mechanisms that drive decisions is required, above all in contexts characterized by conditions of scarcity. Living in a context of scarcity depletes people's available cognitive resources, thus rendering their decisions more susceptible to cognitive biases. As an example, contexts of scarcity trigger a tendency to prefer immediate smaller rewards to delayed larger ones. However, studies demonstrate that this can be mitigated by allowing individuals to build community trust. This study taps into recent findings from behavioral sciences regarding the role that scarcity conditions have on decision-making, with the aim to (i) review certain cognitive biases that might arise in energy poverty contexts, and (ii) devise strategies to unlock individuals' potential to make decisions that result in better outcomes for themselves and their surroundings.

1. Introduction

In the European Union, more than 50 million households experience energy poverty conditions, which means they lack some of the most basic features of ordinary life: adequate warmth, cooling, lighting and energy required to power normal appliances [1]. These services are not only essential to satisfy basic human needs and guarantee a decent standard of living and health [2], but also to overcome social segregation and increase perceptions of agency [3]. Individuals who live in energy poverty are usually vulnerable consumers who have low incomes, face high-energy costs and live in energy inefficient dwellings [4]. Living in conditions of energy poverty has adverse consequences not only for physical health and for wellbeing 'with increased likelihood of obtaining or exacerbating respiratory and cardiac illnesses due to uncomfortable temperatures' but also for mental health, due to stress associated with the inability to pay energy bills [5]. Therefore, addressing energy poverty might result not only in lowering individual and governmental expenditures on health and in bettering environmental outcomes, but also and more importantly, in assuring positive results for vulnerable households in terms of comfort, wellbeing, and cost savings allowing for protection of available resources. For this reason, the European Commission has recognized tackling energy poverty as a policy priority in Europe in the 'Clean Energy for All Europeans'[1] legislative package. Several initiatives promoting the exchange of good practices, such as the European[2] and the Italian[3] Energy Poverty Observatories, have been launched. Moreover, energy poverty has received increasing attention by scholars from different fields who have proposed new concepts, frameworks and approaches [6,7]. However, there remain few studies attempting to capture the varieties of factors affecting energy poverty in a more holistic way [8]. Additional conceptual vectors would contribute not only to understanding better, but also to addressing better, the complex combination of drivers of energy poverty.

So far, Member States have adopted several measures to address energy poverty and protect vulnerable consumers, which can be divided in four main categories: (i) financial interventions; (ii) con-

* corresponding author.
E-mail address: nives.dellavalle@eurac.edu

[1] *Source:* Clean Energy for All Europeans.
[2] *Source:* EU Energy Poverty Observatory.
[3] *Source:* Osservatorio Italiano sulla Povertá Energetica.

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sumer protection measures; (iii) energy efficiency measures, and iv) information provision measures.

Financial interventions support payment of energy bills of targeted, vulnerable, households. These include the direct government support for the cost of energy either via general social welfare payments or through direct payments. They also include negotiations with utilities, which are required to offer vulnerable consumers a fair price in order to allow them to have access to energy [9]. However, two issues might prevent individuals from receiving this financial aid: targeting and active choice. In particular, individuals belonging to vulnerable categories might fail to benefit from the programs because (i) identification is costly [10], and (ii) hassle factors or fear of being stigmatized might discourage program take-up [11,12].

Consumer protection measures are implemented by the regulator and utility companies to prevent the risk of disconnection due to unpaid bills. These result in debt management, customer engagement and disconnection prohibition (i.e. disconnection safeguards), when disconnection would result in personal injuries (i.e. in winter) [9]. These measures, similarly to financial ones, adopt a top-down approach to alleviate in the short-term some of the negative consequences associated to vulnerable individuals' inability to afford energy and pay the bills.

Energy efficiency measures, on the other hand, enable the decrease of energy costs in the long-term by improving the efficiency of building materials, construction methods, and appliances. The high-energy costs in Europe are particularly due to the low refurbishment rate of buildings and the low rate of replacement of appliances [13]. Moreover, the share of income spent on energy costs is much higher for vulnerable individuals than for high-income ones [14]. Therefore, efficiency measures, like those that improve the insulation capacities of walls, might be effective at lowering energy bills [15]. This is especially true when the split incentive problem faced by vulnerable renters is sufficiently addressed [16]. In addition to energy cost savings, energy efficiency measures may result in numerous other positive externalities. In particular, living in deprived environments not only has adverse effects on health, but also on a community's capacity to develop the social capital [17] necessary to enforce desirable behaviors through informal social control [18]. Therefore, by improving the environment in which vulnerable individuals live, these structural measures might improve the quality of life of the whole neighborhood, by for example, reducing the crime rate [19]. Overall, energy efficiency measures offer enormous potential for addressing energy poverty. However, these may fail to reduce energy poverty [20], that is they might fail to achieve greater energy efficiency in buildings and related long-term energy savings [21]. This can occur due to reliance on wrong or invalid assumptions about individual behavior (i.e. energy efficiency gap [22]). What determines the efficacy of these measures is the behavior of the individuals who daily interface with those interventions [23]. Therefore, it is crucial to take into account the underlying factors that affect behaviors before these measures are implemented [24].

Information provision measures take into account the role of individual behavior. These measures play a significant role in improving not only vulnerable consumers' awareness of their rights and available market tariffs, but also in enhancing their understanding of energy-related problems in the context of everyday life and awareness of energy efficiency [25]. These measures are usually implemented in the form of information campaigns, advice provision, and increased information on bills and tariffs, by making billing more transparent, and by providing price comparisons or energy saving tips [9]. Similar to energy efficiency measures, information provision measures have the potential to bring economic benefits to vulnerable individuals. As an example, providing information on how to save energy might promote better energy consumption behaviors and, thus, cost savings [26]. This is especially crucial for vulnerable consumers who, by saving more energy costs, will have more financial resources available for other necessary goods that they usually cannot afford [14]. Compared to other measures, information provision and education measures acknowledge that individual behavior is central to addressing the complex problem of energy poverty. However, while they acknowledge that individual behavior is crucial to reach better outcomes, they may result to be insufficient in changing behaviors [27,28]. And the opportunity cost associated with failing to motivate individual actions is especially high when individuals live in conditions of scarcity. In particular, by being motivated to engage in useful behaviors, vulnerable individuals might strengthen intentions to enact more [29] and, thus, increase their sense of self-efficacy [30], this latter being usually decreased by the social exclusion [31] resulting from the location in peripheral and polluted areas [32].

So far, most attention to the behavior of vulnerable individuals has been devoted in terms of how this affects the effectiveness of energy efficiency interventions [24,33,34]. Only recently, with the introduction of consensual indicators of energy poverty [35] has individual behavior been considered a driver of energy poverty, in addition to energy efficiency, energy prices and income [20]. This study adds to the stream of research that highlights the importance of human agency in affecting energy poverty, by proposing behavioral economics as a causal pathway to identify which behavioral aspects can be leveraged to understand energy poverty, and to complement traditional interventions aimed at tackling it. In particular, it integrates studies on individual decision-making that are the backbone of behavioral economics, with studies that specifically address individual decision-making under scarcity conditions. The aim is not to provide a comprehensive review of the relevant literature, but to highlight how behavioral economics can provide a complementary conceptual vector to understand and address the complex issue of energy poverty. In doing so, it is hoped that it will help inform the design of interventions that leverage also individual decisions to address energy poverty.

The article is structured as follows. Section 2 introduces the theoretical background. Section 3 presents a short (non-exhaustive) description of cognitive biases that are relevant in energy poverty contexts. Section 4 proposes some practical insights for how policy makers can apply behavioral economics to address energy poverty. Finally, Section 5 offers conclusions.

2. Energy poverty from a behavioral economic perspective

While several measures have been adopted to address the structural conditions of energy poverty from a top-down perspective, only a few, such as those related to information provision, acknowledge that an understanding of the behavior of vulnerable individuals offers a crucial contribution in reaching better outcomes for themselves and their surroundings. However, these measures are implicitly based on the *rational actor* model of human behavior.

This theory, which can be traced back to [36] and formalized in the Expected Utility Theory (EUT) [37], has for decades served as the basis for economic modelling and policy making, as it allows the easy prediction of how much the available instruments are conducive to achieving policy goals. In particular, this theory assumes that individuals' behavior is not affected by the surrounding context and results in decisions that are based on an analytical comparison of the costs and benefits associated to alternative options, and would change only by changing economic incentives and providing more information [38]. For this reason, policy makers have always adopted taxes and subsidies, restrictions and information campaigns, in order to promote behaviors resulting in better outcomes for the individual and the whole society. This the-

ory has been a reference model for policymaking, because it can be translated well in mathematical formulae and allows for straightforward predictions about behavior. However, starting from [39,40], this theory has been confronted with the evidence that people exhibit systematic and predictable patterns of decision-making that deviate from its assumptions [41]. By drawing from psychology, the field of behavioral economics describes these "irrational" patterns of behavior. This way, it provides more realistic insights on individual decision-making to economic analysis and policy makers. In particular, it not only equipped policy makers with additional policy tools to influence collective behavior, but also with additional lenses to predict more accurately the impacts of existing policies [42].

This field rests on the prevailing view that individual decision-making, i.e. the human architecture, is made of a dual system, wherein System 1 leads to more automatic and intuitive decisions, and System 2 allows making more reflective, controlled and analytical ones [43]. However, due to limited cognitive capacity [44], System 1 often prevails over System 2, leading to decisions that are made according to cognitive shortcuts and are likely to display errors (i.e. cognitive biases) in the framework of rational choice theory [45].

Primarily, behavioral economics acknowledges the crucial role that context has on behavior. In particular, the features characterizing the decision problem affect the extent according to which decisions are likely to display cognitive biases [46]. The implication is that individuals are rational, but some situational factors lead them to display more automatic and error-prone decisions. Since the works of [39,40] on limited cognitive capacity, several studies have shown that decisions are less effective when individuals are under cognitive load, that is when they perform tasks that require mental effort [47]. And many situational factors - such as listening to music [48], sleep deprivation [49], and external stress [50] - can inhibit individual cognitive capacity, leading to less effective decisions.

A fundamental situational factor that taxes individual cognitive capacity is living in scarcity conditions or poverty. Experimental studies [51,52] have shown that when individuals face a gap between their needs and the resources available to fulfil them, they have fewer cognitive resources available to make optimal decisions. What these studies highlight is that vulnerable individuals are not less capable of making optimal decisions than individuals living in normal conditions, but that the context of scarcity taxes their cognitive capacity. In particular, given the limited financial resources, vulnerable individuals think about financial tradeoffs more often [53]. These tradeoffs, complemented by other taxing factors – such as chronic stress, lack of other basic services, unsafe neighborhoods and unstable social relations [54] - deploy cognitive resources, at the cost of the quality of other decisions that also require mental effort [51].

3. Some key cognitive biases

This section reviews some relevant deviations from rational choice theory (i.e. cognitive biases) that not only result from facing energy poverty, but also predispose vulnerable individuals to corroborate energy poverty by affecting the quality of their decisions. While the field of behavioral economics has provided evidence of several cognitive biases, in this section I limit the focus to those that are particularly relevant in energy poverty contexts.

3.1. Loss aversion and framing effect

The tendency to perceive the prospect of losses as more painful than equivalent gains (i.e. *loss aversion*) is at the cornerstone of *Prospect Theory* [55], and helps explaining many deviations from rational decision-making. As an example, this tendency results in decisions that are affected by whether an option is presented as a gain or as a loss (i.e. *framing effect*, [56]). One implication is that individuals take more risk in the prospect of a certain loss, than compared to a prospect of an equivalent uncertain gain. This sensitivity to losses and the assessment of risk can be shaped by situational factors. In particular, individuals under acute stress take more risk in the prospect of a loss [57], and in order to decrease the likelihood of facing further negative consequences [58]. As an example, individuals might overcome their risk aversion resulting in choosing energy inefficient technologies [59], when the choice of the more energy efficient (and more risky)[4] technology is presented as a way to avoid losses, rather than to make gains [61,62]. Cognitively taxing contexts, such as those characterized by resource scarcity, exacerbate the tendency to react more strongly to the prospect of further losses [63]. Therefore, when presented with the prospect of facing further certain negative events, vulnerable individuals might tend to take riskier decisions, such as in health care [64] and gambling [65], and these decisions can further worsen the poor conditions in which they live. At the same time, they might forego switching to new convenient tariffs as they fear facing unexpected high bills [66]. Therefore, to enable vulnerable individuals to overcome their risk aversion, they should be guaranteed they will avoid extra costs in the bill, if they choose to take up energy efficiency measures or switch to a new tariff.

3.2. Present bias

One of the most prominent deviations from rational decisions is present bias, i.e. the tendency to place attention on objectives that are close in time and disregard those that are distant in time. In economic terms, this tendency results in decisions that are guided by a preference for options that provide immediate benefits, even if other options providing higher benefits in the future are available [67]. Starting from the work of [68], the ability to delay gratification, i.e. the tendency to prefer options that provide higher but delayed benefits, has been identified as a strong predictor of decisions providing better outcomes in an individual's life (such as education and financial outcomes). However, this ability is not an innate trait, but rather shaped by social and economic backgrounds [69]. As an example, having a higher income, lower liquidity constraints and longer life expectancy [70], perceiving a higher sense of financial stability [71] and living in an environment that people perceive trustworthy [72] are situational conditions that cause individuals to prefer larger delayed rewards to smaller immediate ones. On the other hand, when people live in conditions of stress, they display a preference for earlier rewards and habitual behaviors [73]. Similarly, when people live in contexts in which resources are scarce, they prefer options that provide more immediate rewards than delayed higher ones [74]. This tendency results in individuals making poor financial decisions, such as not saving enough and/or borrowing too much.[5] As an example, living in scarcity conditions may cause individuals to be unable to manage their finances and energy bills [34], leading to poor financial decision-making reflected not only by energy poverty, but also in their poor living conditions. In particular, vulnerable individuals might be forced to cut energy consumption to save resources for other primary goods (e.g. food) [75], or to cut these other primary expenditures to prioritize energy under the fear of cut-off [76]. Similarly, they might fail to take up an energy efficiency technology, because pressing budgetary concerns cognitively

[4] A risky decision is a decision "characterized by coupling between alternatives and outcomes that are probabilistic and therefore cannot be predicted with certainty" [60].

[5] *Source:* aecf.

constrain them to fully appreciate the delayed benefits associated to the technology [77].

3.3. Social norms

Rational choice theory assumes that decisions are unaffected by the surrounding social context. However, extensive evidence shows that decisions are affected by what others do [78]. In particular, given that individuals have limited cognitive capacity, they make use of simplifying heuristics to process information [79]. And a powerful cognitive shortcut is social norms [80,81]. Social norms are injunctions to act or to abstain from acting that are sustained by other people's approval and disapproval [82]. In small groups, social norms can often inspire cooperation [83] and affect behavior on large scale. As an example, they can be effective at decreasing energy consumption [84]. That is the reason why social norms can be leveraged to solve large-scale societal challenges [85]. However, social norms are context-specific [86]. Thus, they might also prescribe undesirable behaviors that reinforce detrimental outcomes. As an example, individuals might fail to take action against their poor conditions, because they interpret certain behaviors as socially accepted [6,87], such as engaging in inefficient energy consumption behavior (e.g. leaving appliances on) [88], or being disengaged with climate change mitigation [89].

4. Interventions

Insights from behavioral economics not only allow describing individual behavior in a more realistic way, by acknowledging the systematic influence that context and cognitive biases have on decisions. They can also be leveraged by policy makers to address the behavioral drivers of energy poverty, like the ability to manage energy bills, consume energy and adopt energy efficiency measures. In this section, I propose practical implications of some behavioral economic insights that can be used to promote better energy efficiency decisions, energy consumption behavior and budgeting capacity.

4.1. Defaults

An implication of loss aversion is status quo bias. In their prospect theory, [55] not only show that decisions are affected by loss aversion, but also that the way individuals perceive an outcome as a loss or gain depends on the reference point provided. Because of loss aversion, individuals experience more regret when a decision changes the status quo than when it maintains it. Therefore, they tend to prefer to do nothing and stick to the default or given option [90]. While this tendency might result in decisions that are against individual interest, such as in retaining bad habits, it can be leveraged to save cognitive resources and promote better decisions.

Status quo bias can be leveraged by providing "smart default" options [91]. As an example, individuals might forego applying for a subsidy program, or switching to a more convenient utility contract or to using a thermostat setting that saves more energy, because searching for information to change the status quo requires some effort. To reduce individuals' cognitive demand, policy makers can thus provide the "right" default, make the use of a technology more straightforward, or make it easier to enroll in a program or switch to a better contract. For example, changing the default from grey to green energy has been proven to be an effective strategy to increase the percentage of customers buying green electricity [92]. Similarly, changing the default temperature from 20^o to 19^o has been proven to decrease energy use in the winter season at the OECD offices. However, when the reduction in the default setting was too large, officers actively changed the setting, thus cancelling out the positive effect on energy consumption from the lower default [93].

Some defaults have already been used for automatic enrolment to financial programs targeted to individuals living in energy poverty. In Malta, households were required to actively require energy benefits. However, under this scheme €500,000 of vouchers every year were not claimed. This was probably due to the fact that individuals were required to be proactive to change their status quo. Therefore, a change in the scheme was promoted: while eligibility criteria for receiving energy benefits did not change, the way benefits were provided changed. Individuals identified as belonging to vulnerable categories are now automatically enrolled in the voucher program and receive a credit to their bill through their service provider.[6] Recently, also the Italian Regulatory Authority for Energy, Networks and Environment has advanced a proposal to make the energy poor automatically enrolled in a subsidy program.[7]

Changing defaults may lead to accusations of paternalistic manipulation [94,95]. This suggests that it is always crucial to inform individuals that they have the possibility to opt-out from the default, especially when it is not easy to identify the right default and when the targets are vulnerable individuals. This might increase perceived ability to control one's environment – ability that is usually lower in vulnerable individuals, that in turn might enhance skills for coping with discomfort [96].

Overall, when it comes to individuals who are already cognitively taxed by the poor conditions in which they live, changing defaults (like those relating to thermostat settings or the enrolment to subsidy programs) might be helpful, since it might allow to save their cognitive resources for other daily decisions that require mental effort.

4.2. Commitment devices and reminders

Commitment devices can be a potential strategy to overcome present bias. A commitment device is a mechanism that helps individuals carry out plans, by laying out negative consequences, such as social or financial sanctions, if they do not stick with the plan [97]. Commitment devices have been proven to be effective at improving the conditions of vulnerable individuals, by promoting more farsighted decisions, such as saving [98]. In particular, while low-income individuals wish to commit to saving money, they generally use very expensive and ineffective lay-away schemes. Therefore, one way to improve saving and budgeting capacity would be the creation of "dedicated accounts", promoted by bank or community groups, offering concrete targets with mild commitment (like a penalty for early withdrawal) [12]. Another way to improve vulnerable individuals' savings would be the use of public commitments. As an example, [99] conducted a field experiment in Chile to test the effect of allowing individuals to announce publicly both their savings goals and their weekly savings deposits into their (private) account. This intervention was effective at increasing savings by 65%.

In addition to commitment devices, another mechanism that encourages individuals to follow up on a previously committed plan laying out positive future consequences are *reminders*. In particular, reminders are effective at increasing people's attention to the long-term. As an example, [100] showed that simple reminders to save (via letters or text messages) are as effective at increasing saving rates as access to commitment savings products. These insights can also be leveraged to design interventions in the context of energy poverty, especially for what concerns disconnection safeguards.

[6] *Source:* Malta Independent.

[7] *Source:* Autoritá di Regolazione per Energia Reti e Ambiente.

Some reminders have already been used to protect households from being completely disconnected from energy, like in a pilot study in Germany. First, after receiving three reminders, households not able to pay their bills had their power demand reduced to 1000 W. Then, after receiving the fourth reminder, energy demand was reduced and an offer for a debt consultation was offered.[8]

The insights presented here can be exploited not only to protect vulnerable consumers from disconnection risk, but also to enable better budgeting decisions. Being reminded to or using a dedicated account that commits to save financial resources, might result in empowering individuals to pay the energy bills on time, without needing to cut other primary goods.

4.3. Social norms

Individuals might fail to take decisions in their best interest, because not only scarcity conditions exacerbate the influence of cognitive biases on decisions, but also because they adjust their behavior based on what they think similar individuals do. In particular, individuals might fail to adopt efficient behaviors, because they think these deviate from the prevailing and socially accepted behaviors taken in their reference group. As an example, they might be reluctant to take up an energy efficiency technology, because they fear to be stigmatized by their reference group as pretentious [101]. Similarly, individuals might fail to engage in certain energy saving practices, like turning down the thermostat, when these would carry a greater risk of being stigmatized as vulnerable [102].

Thus, to counter this vicious cycle and support the emergence of virtuous practices, norms have to be created. As an example, providing information about what most individuals do – for example that most individuals use fans instead of air conditioning to keep cool in summer [103] or that use a compact fluorescent bulb instead of a traditional incandescent one [101] - can be an effective strategy to promote energy saving behaviors. However, compared to other behaviorally informed interventions, those that leverage social norms should be designed more carefully, given that individuals might draw different inferences on the type of information provided. As an example, a *boomerang effect* might arise when individuals are simply provided with information about others' energy consumption behavior, resulting in a positive effect on individuals who before the intervention were using energy above the suggested norm, and a negative effect on those who before the intervention were using energy below the suggested norm [104]. This insight is especially relevant when individuals perceive that the behavior prescribed by the normative message restrains their personal freedom (e.g., low-income individuals might perceive that they are supposed to buy unaffordable energy efficient technologies to conform to the social norm): in this case, they might react by ignoring the social norm [105].

Therefore, for norm-based interventions to be effective, it is not only essential to diagnose carefully the behavior to change, but also to specify the reference group and to rely on trusted sources of information [106]. First, making salient membership in a social group (such as gender, ethnicity, nationality, neighborhood) [107] can increase conformism to a newly provided descriptive norm. Second, exogenous agents can play a substantial role in changing beliefs about what the behavior to follow should be and promote the emergence of new norms [108]; but the positive effect is stronger when those who help spreading messages are trusted local advisors [109]. Similarly, institutions that are perceived as fair can also contribute to spreading new positive practices from the bottom up by developing community trust. As an example, [110] conducted a two-year study in which community volunteers helped residents gain access to public services and get them involved in community-level decisions. This intervention was designed to boost community trust in low-income areas and resulted to be effective at reducing present-biased decision-making. Community trust is also crucial for the enforcement of positive norms, since actions are more effective than words in spreading beliefs about how to behave [111]. This implies that if individuals see that similar others display less myopic behaviors in their community, they might adjust their behavior accordingly. This insight might have implications not only on vulnerable consumers' perceptions of their own agency, who usually perceive they do not have enough capacity and power for acting upon their conditions [6,87], but also on their fear of stigmatization when the prevailing behavior is the absence of action [112].

5. Conclusions and policy implications

Tackling the problem of energy poverty is one of the most urgent challenges that policy makers are currently facing. So far, several measures aimed at addressing the structural roots of energy poverty have been proposed and adopted, like those aimed at refurbishing and making dwellings more energy efficient. Other measures have been adopted to alleviate energy poverty in the short-term. These include protection measures from disconnection. Other measures acknowledge that individual behavior is also essential to addressing energy poverty, such as information provision and education measures. However, these measures implicitly rely on the rational choice model of decision-making: individuals are assumed to make rational decisions that are unaffected by the surrounding context, but only change in response to changes in information and economic incentives. However, extensive evidence has shown that individual decisions systematically deviate from rational choice assumptions and that cognitive capacity to make rational decisions can be impaired by situational factors. The field of behavioral economics not only allows identifying systematic irrational patterns in decision-making, but also offers insights to policy makers to design additional interventions to tackle policy challenges [113].

In this study, I also highlighted how the challenge of energy poverty can benefit from insights from behavioral economics. In particular, this field enables us to shed light on some behavioral factors that may drive energy poverty by affecting the quality of individual decisions, such as those that relate to the budgeting ability, energy consumption and energy efficiency adoption. Understanding energy poverty under the behavioral economic lens highlights that living in scarcity conditions imposes a tax on cognitive resources that will be less available for other decisions requiring mental effort [51]. Therefore, it stresses that it is not that vulnerable individuals are responsible of their poor decisions, but rather it is living in conditions of scarcity that makes them more exposed to poor decision-making. In addition, behavioral economics offers insights on how to account for the influence of cognitive biases on decisions and leverage them to promote better ones. As an example, conditions of scarcity lead individuals to react more strongly to the prospect of further loss. This might lead to inaction in situations that require changing the status quo, such as applying for a subsidy program. However, policy makers can address the behavioral drivers of energy poverty by designing interventions that acknowledge that individuals are not always rational decision makers, especially when the poor conditions in which they live deplete the cognitive resources necessary for rational decision-making.

As an example, policy makers can use insights from behavioral economics by improving the environment (i.e. "choice architecture") in which individuals make their everyday decisions [114]. In particular, they can design energy poverty measures in a way

[8] *Source:* Bund der Energieverbraucher.

that do not tax vulnerable individuals' cognitive capacity further, since this is already taxed by the mere fact of living in scarcity conditions, and that leverage behavioral factors to unlock individuals' potential to make decisions resulting in better outcomes for themselves and their surroundings. These behaviorally informed interventions can aim to not only mitigate the factors that deplete cognitive capacity, but also to create the conditions to make better decisions. In this way, in addition to addressing the structural determinants of energy poverty, policy makers might also be equipped with tools to address the behavioral factors that discourage individuals from contributing through their own behavior to addressing energy poverty, such as by engaging in better saving and energy-related decisions.

Exemplary interventions might result in exploiting (i) default options (i.e. introduction of automatic enrolment to existing subsidy programs); (ii) commitment devices or reminders (i.e. committing to pay the bills within a certain time frame and publicly announcing it, or receiving text message reminders about saving money to pay the bill); and (iii) social norms (i.e. building community trust to create new positive socially accepted rules of behavior).

Notwithstanding, for policy makers to decide whether the behaviorally informed intervention has been effective at promoting better decisions and outcomes at larger scale, whether it has to be improved or whether it can be scaled up or replicated in other places, relying only on behavioral economic insights is not enough. To rely on the best evidence, they should also leverage impact evaluation insights [115]. This field of research suggests that the best evidence can be provided by *Randomized Control Trials* (i.e. the random assignment to an intervention and a control groups), since these allow creating the right conditions to quantitatively evaluate the impact of an intervention [116,117]. This is especially crucial for behaviorally informed interventions, for which it is difficult to estimate the effect before they are implemented.

While promising, such an approach is by no means deficient of limitations. As an example, behaviorally informed interventions might result in being paternalistic when individuals fail to recognize they could have acted differently in the absence of the intervention. Moreover, those who design behaviorally informed interventions might not always be benevolent or aware of target individuals' goals [118]. As a result, behaviorally informed interventions should be promoted only if they are designed in a way that they are transparent to the target individuals, if policy makers are certain about people's goals and needs, and if they prevent the private sector from designing manipulative interventions. In particular, some firms might leverage individual vulnerability to cognitive biases to promote decisions that increase their profits. This results in firms engaging in a range of activities that "can discourage behavior that is in a person's best interest such as claiming a rebate of tax credit, and it can encourage self-defeating behavior such as investing in a deal that is too good to be true" (i.e. *sludging* [119]). As an example, firms might engage in aggressive marketing campaigns targeted at vulnerable individuals to promote decisions that are not in their interest, but rather in the firms' own interests, such as promoting the purchase of predatory mortgages and payday loans [120]. Therefore, policy makers can also leverage insights from behavioral economics to design better consumer protection and awareness measures, so as to prevent firms from taking advantage of vulnerable individuals' cognitive fallibility.

Overall, this paper proposed that behavioral economics offers an additional vector to understand and address the complex problem of energy poverty: by acknowledging that scarcity contexts impair the quality of individual decisions, behavioral economics can inform the design of interventions that enhance more cognitive resources. This way, vulnerable individuals will be enabled to take better decisions for themselves and their surroundings. Likewise, they will no longer be passive receivers of top-down measures, but protagonists of the process of betterment of the poor conditions in which they live.

Declaration of Competing Interest

The author declares that she does not have any financial or nonfinancial conflict of interests.

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