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Operationalising Capability Thinking in the Assessment of Energy Poverty Relief Policies: Moving from Compensation-based to Empowerment-focused Policy Strategies

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ABSTRACT

This study examines a broader application of capability thinking in energy justice research, especially in the assessment of energy poverty relief policies. We review two emerging topics in energy research—energy justice and the capability approach—and connect them at the conceptual level. We then use both Sen's and Nussbaum's versions of capability theory to define three categories of 'energy capabilities' related to (a) biological and physical needs, (b) intellectual and emotional needs, and (c) social and political needs. The two primary evaluation criteria, compensation-based and empowerment-focused policy strategies, are distinguished using capability language. We apply this assessment framework to the case of U.S. energy poverty programs to examine whether current policy interventions address energy poverty in a systemic manner. Based on a review of the LIHEAP and WAP programs, we find that compensation measures have been at the centre of U.S. policy strategies for energy poverty alleviation. While financial aid can help at-risk households meet their urgent energy needs, bill assistance cannot be a long-term solution to the frequency and intensity of energy affordability challenges. Without solving the root cause of energy poverty, families may remain reliant on short-term financial assistance. Empowerment measures, in contrast, can create lasting improvement in all three categories of energy capabilities. We call for placing more emphasis on implementing energy-saving measures and developing community-based energy options for at-risk households.

Introduction

Since their emergence in the 1980s, capabilities frameworks of justice have been applied to many subsets of social justice research, including welfare, health,

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environmental, and gender justice. Energy justice scholarship, which has seen remarkable growth in recent years, is also developing a capability-based understanding of the energy-environment crisis and its justice implications (Mathai 2009; Damgaard, McCauley, and Long 2017; Hillerbrand 2018; Melin and Kronlid 2019; Samarakoon 2019).

One important goal of energy justice is to provide people with a safe, affordable, and sustainable energy system from production through consumption processes (McCauley et al. 2013). Energy injustice, in this sense, can be created and experienced at any stage of the life cycle of energy production and use. This paper focuses on the challenge of energy poverty, a widespread form of energy injustice related to residential energy use. We illustrate a way of operationalising capability perspectives in this dimension of energy justice research. While we use the case of energy poverty as a subset of energy justice concerns, our assessment framework discussed in this paper can also be applied to other types of energy injustice (e.g., energy facility siting issues, energy-sourced pollution issues, etc.).

The term 'energy poverty' refers to an inability to access affordable and reliable energy services that are essential for a normal life.[1] Related terms, such as fuel poverty, energy burden, energy deprivation, and energy precariousness, refer to similar but subtly different states of energy insecurity. In this paper, we use 'energy poverty' as a general term to indicate the challenges of accessing the basic energy services required to maintain a normal life. This definition is in line with the concept of 'energy vulnerability' discussed in Bouzarovski and Petrova (2015).[2]

Energy justice scholarship distinguishes two types of energy poverty hardships (Bouzarovski and Petrova 2015). One is the *availability challenge*, which is experienced when people have difficulty finding and accessing reliable energy services for their daily life. This type of hardship is often observed in developing nations. The other hardship is the *affordability challenge*, which is frequently experienced by low- and moderate-income households when they have a limited budget for essential energy services. Also known as 'fuel poverty' or 'energy burden,' the affordability challenge is found in both developing and developed countries.

The capability approach offers new insights into the framing of energy poverty by perceiving energy services as a vital enabler of human functioning and well-being. From a capability perspective, the inability to afford energy needs is considered as a 'deprivation of freedom' (Day, Walker, and Simcock 2016) in addition to being an income barrier. Capability thinking embraces diverse types and conditions of energy poverty that require more than one-size-fits-all solutions. While energy poverty studies have begun to adopt the capability approach to redefine the issue of energy vulnerability, its utilisation as a tool to assess existing policies has been limited. This study examines the potential of the capability approach as an assessment framework for energy

policies. We pay particular attention to the efficacy of U.S. policy strategies for addressing shortfalls in people's energy-related capabilities.

Research Questions

This paper addresses two research questions: (a) whether energy poverty relief programs in wide use in the U.S. and other parts of the world are able to contribute to achieving 'capabilitarian' energy justice and (b) what further policy efforts are needed to enhance people's energy capabilities and eradicate energy poverty in the long term. U.S. energy poverty programs offer a concrete case for the investigation of these questions. We first review two emerging topics in energy research—energy justice and the capability approach—and connect them at the conceptual level. Benefiting from the fertile literature on the capability approach, we identify three categories of essential capabilities that are related to energy use in the modern world. We then distinguish compensation-based and empowerment-focused policies for energy poverty mitigation as workable assessment criteria. Based on this evaluation framework, we conduct a policy review of two U.S. programs, the Low Income Home Energy Assistance Program and the Weatherization Assistance Program. Finally, we discuss future policy directions that can empower low-income communities to escape from the condition of energy poverty and enhance their energy capabilities in the long term.

Connecting Energy Justice to the Capability Approach

Capability Approach: A People-centred Understanding of Justice

The capability approach is an alternative to the conventional conception of human development, well-being, and justice. It was first contemplated by Sen (1985a, 2004, 2005) and then expanded by a wide range of philosophers and social scientists (e.g., Nussbaum 2003; Alkire 2005; Robeyns 2005). Unlike utilitarianism- or resourcism-based theories of justice, the capability framework illuminates a tight relationship between human freedom and well-being (Sen 2009). Two constitutive arguments of the approach are: (a) all humans have a right to live a life they have reason to value by achieving functionings ('beings' and 'doings') and (b) people can achieve valued functionings when they have the capabilities (effective freedoms and opportunities) to do so.

From a capability perspective, traditional standardised indicators of human development (e.g., gross domestic product) are inadequate for fully representing quality of life and well-being (Ponce, Cancio, and Sánchez 2018). Therefore, a (re)distribution of wealth or resources alone is not sufficient for achieving an equitable and just society. Instead, people-oriented metrics like capabilities should be weighed in the assessment of human well-being (Wood and

Roelich 2020). The widely referenced Human Development Index is an example of applying capability thinking to the assessment of human thriving. On this point, Schlosberg (2007) rightly argued, '[w]hether we can function fully is the key test of justice' (34) and emphasized that '[j]ustice then is not simply about distribution, but also about all that it takes—recognition, participation, and more—to be able to fully live the lives we design' (34). Compared to distributive justice, the recognitional and procedural dimensions of justice require a deeper understanding of the people who will be affected by social issues, policies, and changes. Capability theorists recognise human diversity (physical, socio-economic, environmental, etc.) as a central element of the enhancement of individual well-being and social justice (Middlemiss et al. 2019). Therefore, the capability approach to social welfare and equality is primarily focused on how to ensure and restore people's freedom to pursue a valuable life on their own terms (Holland 2008).

Compared to conventional frameworks, the capability approach embraces many moving elements that create space for broadly defining and conceptualising human well-being. However, the dynamic and pluralist characteristic of the capability framework has attracted criticism from other justice theorists (Sugden 1993; Rawls 1999; Pogge 2002). A common argument against capability thinking is that the framework does not provide workable criteria of social justice and, therefore, is not able to produce on-the-ground policy suggestions. In reply, some capability advocates underscore that the focus of the capability approach is not on explaining social injustices (e.g., poverty, inequality, or ill-being) solely in theoretical terms, but on providing a normative basis for conceptualising and evaluating social injustice as a phenomenon (Robeyns 2006). With respect to the operationalisation challenge, capability scholars have taken split paths. Sen (2004) firmly believed that capabilities and functionings can only be determined through the exercise of participatory democracy (e.g., public discussion and reasoning) with a context-specific understanding. Nussbaum (2001), on the contrary, suggested a defined set of central capabilities that are essential for one to live with full human dignity, regardless of cultural or social contexts. The debate around how to mobilise capability theory in practice is ongoing.

Energy Justice: How Can Energy Problems be Examined as a Question of Social Justice?

Built upon the philosophies of social and environmental justice, energy justice is a fast-growing topic in the realm of energy social sciences (Sovacool 2014; Heffron and McCauley 2017). One strand of energy justice scholarship has tried to conceptualise modern energy problems as a concern of social injustice (Heffron and McCauley 2014; Jenkins et al. 2016; Sovacool et al. 2017). The other strand has been committed to analysing real-world cases of energy

injustice based on empirical data and specific focus groups (Ahmad, Mathai, and Parayil 2014; Snell, Bevan, and Thomson 2015; Chard and Walker 2016; Bartiaux et al. 2018; Boemi and Papadopoulos 2019). Some studies have contributed to expanding both conceptual and analytical frameworks for assessing energy justice problems (Lee and Byrne 2019; Wood and Roelich 2020).

Despite the accumulating work in the field, developments in theoretical discussions of energy justice (independent of social and environmental justice) have lagged behind advances in conceptual and analytical research on the topic (Bouzarovski and Petrova 2015; Jenkins et al. 2020). For instance, studies often leave out underlying reasoning for why modern energy struggles need to be understood from a social justice perspective. Expanding the theoretical discussion in energy justice studies can help researchers produce more compelling and principle-based suggestions for energy decision-makers (Sovacool 2014; Pellegrini-Masini, Pirni, and Maran 2020; Wood and Roelich 2020).

In the context of energy poverty, an essential question is whether people have a right to affordable and reliable energy services. If so, should the right to energy services be perceived in the same way as the right to liveable environments (e.g., clean air or green spaces)? A rich history of environmental justice movements and scholarship has established theoretical and conceptual understandings of why ecological problems can be a matter of human rights and social justice (Bullard 1994; Byrne, Glover, and Martinez 2002). A similar dialogue is forming in the field of energy social sciences (Sovacool, Sidortsov, and Jones 2014). Focusing on the case of electricity, Löfquist (2020) characterised access to energy mainly as a derived human right, a right necessary for protecting other basic rights (e.g., health, housing, and education). The paper emphasises that the right to energy cannot be interpreted universally but should be understood in its cultural, social, and personal contexts. Walker (2015) discussed the complexity of 'rights talk' about energy due to its natural and socio-technical elements, which is distinguished from resources like water. Learning from the above literature on various rights, we use the term 'right to energy' to describe an ethical, in addition to a legal, right.

The distinction of energy problems from environmental problems is partly predicated on the industrialist understanding of energy as a 'commodity' rather than a 'commons' (Byrne, Martinez, and Ruggero 2009). This representation of energy tends to separate our entire energy system (including primary energy sources and human-made energy infrastructures) from the domain of socio-ecological commons. The non-commons image of energy was shaped and manifested in industrial societies during the process of promoting massive energy production and consumption for the pursuit of 'growth without end' (Byrne, Martinez, and Ruggero 2009). Large-scale infrastructure investment (e.g., energy facilities and technologies) and institutionalised top-

down management (e.g., energy regulations and markets) have sustained this modern energy path.

As a result, energy decision-making has become the preserve of governments, experts, and industries. Energy bureaucrats tend to perceive energy-sourced social conflicts as a matter of technical management and compensation rather than that of social justice, reducing the issues to 'unfortunate' externalities (Lee and Byrne 2019). As such, governing groups often delay the implementation of policy measures that demand fundamental shifts in the conventional policy approach to energy justice issues, including energy poverty, creating path dependence and policy inertia barriers to action (Freed and Felder 2017; United Nations 2018; Sareen et al. 2020). We regard theoretical strengthening as an essential step to developing and operationalising innovative policy strategies for energy poverty alleviation.

In this exploratory study, we offer a framework for assessing energy justice policies using capability language and demonstrate the application of the framework with U.S. policy interventions to tackle energy poverty. In what follows, we review the concept of 'energy capabilities' used in the literature and utilise them as key criteria for our assessment framework. In so doing, we rely on both Sen's and Nussbaums' stances on human development and well-being (Nussbaum 2001; Sen 2005).

A Capabilitarian Framing of Energy Justice

Conceptualising Energy Capabilities

Energy services are essential for maintaining a normal life and realising one's goals and values. Indeed, the relationship between energy use and human thriving (often expressed in material terms) has been empirically examined in many studies (Martínez and Ebenhack 2008; Pasten and Santamarina 2012; Ouedraogo 2013).

In recent years, a growing number of studies have investigated the relationship between energy use and human well-being in capability terms. Bartiaux et al. (2018) empirically evaluated people's capabilities in relation to their level of household energy consumption using data surveyed in European countries as proxy measures of Nussbaum's basic capabilities. The results showed that energy use was correlated with a wide range of essential capabilities, from maintaining health to developing intellectual skills and social relations. Day, Walker, and Simcock (2016) suggested a new conceptual framework to demonstrate how energy is involved in the actualisation of one's capabilities. They rethought the relationship between energy consumption and human capabilities using the concept of 'secondary capabilities,' which refers to specific and demonstrable abilities people need to develop their essential capabilities.

Capability thinking has also been applied in a broader space of energy justice research. Melin and Kronlid (2019), for example, utilised capability domains associated with Nussbaum's material well-being as criteria for assessing the differential impacts of Sweden's energy-mix scenarios on future generations. Hillerbrand, Milchram, and Schippl (2019) conducted a scenario analysis on future energy technologies—smart grids and autonomous driving—using the capability framework as a basis for technology impact assessment. Hillerbrand and Goldammer (2018) defined a set of energy capabilities based on Nussbaum's list that could be used to assess how changes in energy production systems affect individuals' future well-being. The concept of energy capabilities was also adopted in de Wildt et al. (2020) for analysing conflicts between people's capabilities during the roll-out of decentralised energy systems.

We find two research gaps in the literature on capability and energy justice. First, the utilisation of the capability approach for assessing existing policies and programs has been under-explored. Previous studies were primarily committed to articulating the key role of energy in the enhancement of human capabilities and how much energy is needed for a normal life. However, the quality and integrity of people's energy capabilities that would be realised through policy interventions are little discussed in the literature. For instance, we need to distinguish the quality of energy capabilities that can be enhanced with 1 kWh of electric power generated with carbon-intensive energy sources from that enhanced with 1 kWh of electricity savings through energy conservation or efficiency improvement measures. Second, previous studies tend to rely on a fixed definition of energy capabilities. We seek a more flexible assessment framework that can accommodate a context-based and localised characterisation of energy capability challenges under different cultural and climate conditions.

To incorporate more of Sen's approach, we propose an assessment framework with three categories of energy capabilities. Nielsen and Axelsen (2017), in their paper, defined typological categories of core capabilities that are essential in discussing social justice by combining Sen's and Nussbaum's approaches. Each of the three categories represents a broadly defined bundle of capabilities relating to: (a) biological and physical human needs, (b) fundamental interests of a human agent, and (c) fundamental interests of a social being (Nielsen and Axelsen 2017, 50).

Table 1 presents these three categories of capabilities interpreted in an energy context. The first category encompasses capabilities related to maintaining health for one's biological and physical well-being. Energy consumption can directly influence one's health because it allows one to maintain a liveable environment and stay nourished. We connect this category to Nussbaum's first three capabilities—*life; bodily health;* and *bodily integrity*. The second category includes capabilities related to the fundamentals of human agency. The use of energy can help one develop intellectual and emotional capacities and

Table 1. Defining categories of energy capabilities for policy assessment.

Categories of capabilities	Categories of energy capabilities	Relevant capabilities from Nussbaum's list
A. Capabilities related to biological and physical human needs	**Energy capabilities related to biological and physical needs**. Being able to access affordable and safe energy services that enable one to secure biological and physical well-being.	(1) life (2) bodily health (3) bodily integrity
B. Capabilities related to fundamental interests of a human agent	**Energy capabilities related to intellectual and emotional needs**. Being able to take advantage of essential energy services to develop intellectual and emotional capacities and exercise individual autonomy.	(4) senses, imagination, and thought (5) emotions (6) practical reason (7) affiliation
C. Capabilities related to fundamental interests of a social being	**Energy capabilities related to social and political needs**. Being able to have control over energy-related decisions that affect one's ability to pursue valuable ends and live with human dignity.	(10) control over one's environment

Sources: Categories of capabilties are borrowed from Nielsen and Axelsen (2017, 50); relevant capabilities are based on Nussbaum's list of central human functional capabilities (2001, 78–80).

exercise individual autonomy in society. From Nussbaum's list, four basic capabilities are considered to correspond to this category: *senses, imagination and thought; emotions; practical reason;* and *affiliation.* Finally, the third category highlights human capabilities related to the fundamental interests of a social being. In the energy context, capabilities in this domain empower people to have a certain level of control over energy-related decisions that affect their ability to pursue valuable ends and live with human dignity. The most relevant capability from Nussbaum's approach to this category is *control over one's environment.* To make the proposed framework more functional in energy policy assessment, we adopt a dimension of secondary energy capabilities corresponding to each category when we present the U.S. case study (see Table 4).

Each domain of energy capabilities suggests what kind of questions should be asked to assess social justice and human well-being in relation to energy consumption. Compared to the Nussbaum-style framing of energy capabilities, our approach offers more room to incorporate local contexts and needs into assessment criteria, which was emphasised in Sen's capability theory. It is important to note that our assessment framework is a preliminary effort to operationalise capability thinking in energy policy analysis. We invite more studies to substantiate a capability-based assessment framework that can provide nuanced implications for energy policymakers.

Enhancing Energy Capabilities: Two Policy Approaches

In this capability-based assessment of energy justice policies, we shed light on the concept of 'human agency' as a working criterion for distinguishing compensation-based and empowerment-focused policy strategies. The capability approach literature suggests multiple ways to evaluate quality of life (Gasper 2007). We focus on Sen's four criteria for assessing human life—well-being

achievement, agency achievement, well-being freedom, and agency freedom—as useful dimensions in our assessment (Sen 1985b, 1992). The term 'agency' refers to the ability to make decisions and act on one's own behalf. Different from personal well-being, agency concerns the realisation of one's values, regardless of their connection to the agent's own well-being (Gasper 2007; Hart and Brando 2018). As illustrated in Table 2, Sen's conception of a valuable life is more than merely pursuing personal well-being. An expansion of agency is also deemed a core element of human thriving.

Understood as a sub-dimension of agency (Alkire 2005), 'empowerment' expands the agency of the less privileged by elevating their capacity to control decisions at personal and community levels (Ibrahim and Alkire 2007). In the context of energy justice, Damgaard, McCauley, and Long (2017) aptly noted that 'a concern with quality of capabilities transcends questions of access to energy as a 'good' or a service, to include also a focus on individuals' freedoms and functioning in terms of agency' (2). To paraphrase, policy measures for energy justice issues should be designed to improve people's access to safe, affordable, and reliable energy services and empower at-risk households to control their energy situations. While short-term energy capabilities can be achieved through compensation-based policy assistance, empowering policy measures can better expand freedom to exercise one's ability to make decisions on energy matters (as shown in the last row of Table 2). In this light, Charlier, Legendre, and Risch (2019) pointed out that '[p]rice-based and income-based policies are palliative measures as such policies reduce ex-post exposure to fuel poverty but do not eradicate the phenomenon' (5370) while framing energy-efficiency policies as 'curative measures designed to tackle fuel poverty ex ante' (5370). Learning from the discussion of Tornaghi (2017) on the topic of urban food justice, we emphasise that establishing 'a politics of engagement, capability, and empowerment' (798) is vital to reconstruct people's control over energy production and consumption.

Empowerment can also be actualised beyond individual levels. Instead of perceiving capability development solely as an individual process, Ibrahim

Table 2. Four capabilitarian criteria for human life assessment.

	Well-being	Agency
Achievement	**Well-being achievement** Evaluated by the actual attainment of one's own valued functionings	**Agency achievement** Evaluated by the outcomes in terms of one's goals and values, for oneself and other people
Freedom	**Well-being freedom** Evaluated by whether one has effective opportunities to achieve one's own well-being	**Agency freedom** Evaluated by whether one has effective opportunities to pursue one's goals and values, for oneself and other people
Relevant policy type	Compensation, empowerment	Empowerment

Sources: Adapted from Sen (1992, 56-57), Gasper (2007, 341), Hart and Brando (2018, 294); the last row added by the authors.

(2006) highlighted 'collective capabilities' as an effective way to widen people's functioning combinations. These new bundles of functionings become available to individuals only when they work together. At a high level of collectivity, the public is seen 'not merely as 'the patient' whose well-being commands attention, but also as 'the agent' whose actions can transform society' (Drèze and Sen 1989, 279). Likewise, community-level, bottom-up energy action can make a transformative change in the picture of energy poverty.

Policy Review: U.S. Policy Approaches to Energy Poverty Challenges

Applying the Capabilitarian Energy Justice Framework: The Case of Energy Poverty

When it comes to addressing energy poverty, conventional remedies are often constructed around a technical understanding of how much energy is needed for a person (or household) to live a normal life. Until recent years, policymakers in many countries adopted a fixed energy expenditure-income ratio to determine people's eligibility for policy benefits despite socio-cultural and climatic differences from region to region. A representative example is the so-called '10% rule' which was taken as a standard measure of fuel poverty in Europe and the U.S. in the 2000s. Households in energy poverty are defined as those that need to spend more than 10% of their income on energy services to survive and stay healthy (Jessel, Sawyer, and Hernández 2019). Policy strategies driven by percentage-based definitions are often committed to reducing affected households' energy expenditures to under 10% using financial aid.

Against this traditional conceptualisation of energy poverty, a growing number of studies stress the need for a multidimensional and contextualised characterisation of energy poverty (Walker and Day 2012; Primc and Slabe-Erker 2020). The capability framework provides a useful theoretical and analytical basis for treating energy poverty issues beyond the domain of distributive justice. Specifically, we find two major benefits of applying the capability approach in energy poverty analysis and in energy justice research more broadly.

First, the capability approach offers a theoretical foundation for why energy poverty is a concern of social justice. For example, Nussbaum's works (2001, 2003) on the link between central capabilities and human rights provide a normative explanation of why energy poverty should be treated as a threat to human dignity. This was backed by Day, Walker, and Simcock (2016), who proposed a capabilitiarian definition of energy poverty. In capability terms, they defined energy poverty as 'an inability to realise essential capabilities as a direct or indirect result of insufficient access to affordable, reliable and safe energy services, and taking into account available reasonable alternative means of realising these capabilities' (260). This conception of energy

poverty reframes the issue as a state of 'capability deprivation' that can seriously prevent individuals from pursuing their life goals and values. Access to affordable and safe energy services can, therefore, be a matter of human rights (Walker 2015; Löfquist 2020).

Second, capability thinking invites us to shift the focus of energy poverty relief policies from 'who gets how much of what' to 'what needs to be done in order to help everybody live a fully human live [*sic*]' (Berges 2007, 22). This second aspect of capability-based energy justice calls for a context-specific understanding of energy poverty problems and diversified solutions. Just as Sen (2004) underlined public discussion and reasoning in the operationalisation of the capability approach, capability-based solutions to energy injustice require policy measures tailored to specific cultural and climatic contexts. Indeed, energy poverty comes in various forms and intensities and, therefore, affects households differently. It is linked not only to a household's energy expenditures but also to external conditions like climate variations, energy prices, the energy performance of residential buildings. This complex nature of energy poverty requires diversified problem-solving processes that can foster creative solutions.

Based on the assessment framework and its core concepts described in Tables 1 and 2, the rest of this section analyses U.S. energy poverty relief programs from a capability perspective. As discussed in Kyprianou et al. (2019), there are, in general, four standard types of policy measures used to address energy poverty challenges: (a) consumer protection policies (e.g., discounted tariffs and shut-off protection), (b) financial aids (e.g., short-term bill payments and energy vouchers), (c) energy savings measures and renewable energy deployment (e.g., promotion of energy audits, efficiency improvement, weatherisation, and small-scale renewable energy projects), and (d) information provision (e.g., awareness campaigns, workshops, and community activities). The first two policy measures fall under the category of compensation-based interventions and the last two exemplify empowerment-focused policy measures. Using the U.S. case, we delve into the differential effects of these policy approaches on people's energy capabilities.

An Overview of U.S. Energy Poverty Relief Programs

U.S. energy poverty relief measures began in the late 1970s (LIHEAP Clearinghouse 2016). National programs were needed because of rising fuel costs in the wake of the oil shock. The Weatherization Assistance Program (WAP) was launched in 1976, and the Low-Income Energy Assistance Program, a predecessor of the Low Income Home Energy Assistance Program (LIHEAP), was created in 1980 (LIHEAP Clearinghouse 2017). Both federal programs pursue energy poverty mitigation but use distinct strategies to reduce peoples' energy burdens. While WAP focuses on long-term solutions that

Table 3. Comparison of U.S. federal programs for energy poverty alleviation.

	WAP	LIHEAP
Main purpose	Energy efficiency enhancement of vulnerable people's dwellings	Energy cost assistance in the forms of direct bill payments and low-cost energy efficiency enhancement support
Timeframe	Long term	Short term (mostly)
Administering organisation	Department of Energy (DOE)	Department of Health and Human Services (DHHS)
Statute	Governed by various federal regulations	Low-Income Home Energy Assistance Act of 1981
Guarantees	50 states, the District of Columbia, five territories, and 153 federally recognised tribes or tribal organisations	50 states, the District of Columbia, five territories, and 153 federally recognised tribes or tribal organisations
Funding sources	DOE, LIHEAP, and other non-federal sources (state, local, and private), 902 million USD in FY 2017	LIHEAP, 3.74 billion USD in FY 2020
Structure	Weatherisation assistance and training and technical assistance (up to 20% of the total appropriation)	Heating or cooling assistance, crisis assistance, and weatherisation assistance (up to 15% or 25%)

Source: Summarised by the authors based on (LIHEAP Clearinghouse 2016; LIHEAP Clearinghouse 2017; Bednar and Reames 2020, 435).

reduce energy bills through weatherisation, LIHEAP mainly implements immediate relief measures that help vulnerable groups meet their energy demand. LIHEAP provides a certain amount of financial aid to households every year if they are eligible for the policy benefits. In contrast, WAP invests in a long-lasting energy efficiency enhancement of the recipient's residence (Bednar and Reames 2020). The two programs are summarised and compared in Table 3.

Figure 1 shows the total amount of LIHEAP funding and a breakdown of its funding uses between 2001 and 2018. The funding amount saw a drastic increase in 2009 because of the American Recovery and Reinvestment Act, a stimulus package introduced in response to the 2008 economic crisis (Bednar
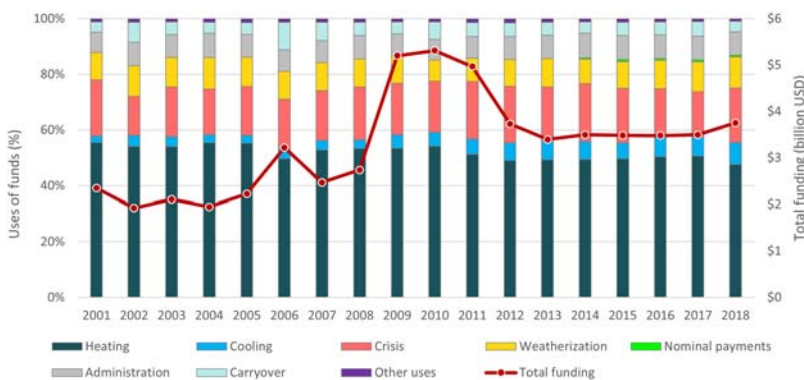

Figure 1. Breakdown of LIHEAP funding uses from 2001 to 2018. Note: Years are fiscal years of LIHEAP spanning from October 1 to September 30. Source: Summarised by the authors using the total amount of LIHEAP funding and its uses found in (Administration for Children & Families n.d.-a).

and Reames 2020). Since then, funding has been maintained at 3.5 billion USD per year.

LIHEAP provides a block grant to guarantees (including states, the District of Columbia, territories, and federally recognised tribes). It allows them to use allocated funds to address locale-specific challenges associated with energy poverty. For this reason, the design and goals of LIHEAP vary by state (Administration for Children & Families n.d.-c). In general, most LIHEAP funds are used to help low-income households pay for energy needs related to heating or cooling (Administration for Children & Families n.d.-a). States also use funding from LIHEAP to run crisis assistance programs. The crisis programs are designed to provide grants to people in an emergency situation, such as a shortage of heating fuel during winter (Administration for Children & Families n.d.-b).

Over its 45 years of operation, WAP evolved into a leading energy poverty relief program in the U.S. by addressing whole-house energy efficiency and making the criteria for screening eligible households more sophisticated (U.S. Department of Energy 2019). WAP promotes a 'whole-community approach' to weatherisation as households in proximity tend to share similar socio-economic conditions (Mrówczyńska et al. 2020). Because of the flexibility of LIHEAP, up to 15% of its funding allocation (or up to 25% with a waiver) can be transferred to WAP. As shown in Figure 1, approximately 10% of LIHEAP's total budget was used to fund weatherisation projects in the past two decades. Nevertheless, the scale of LIHEAP's contribution to weatherisation measures has been much larger than WAP's. In FY 2017, LIHEAP, WAP, and non-federal funds from state-level, local, and private sources (mostly utility funds) accounted for 47%, 25%, and 28% of the total investment in weatherisation projects (902 million USD), respectively (Administration for Children & Families n.d.-a). Figure 2 compares the scale of LIHEAP spending on weatherisation projects by state. In 2018, the most aggressive
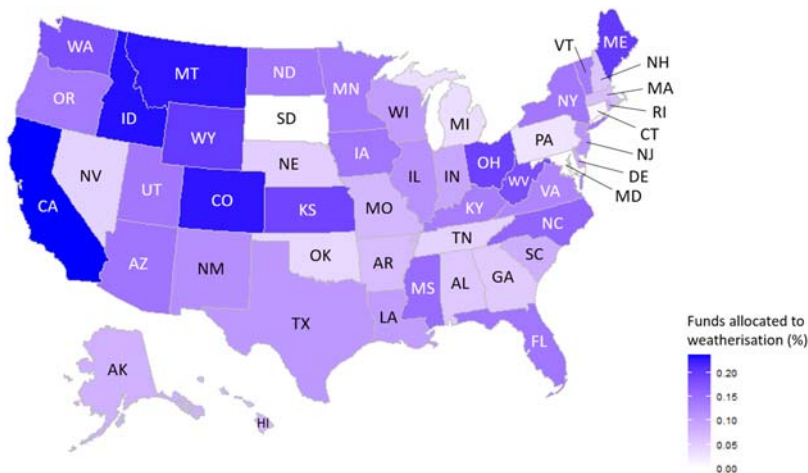
Figure 2. Percentage of LIHEAP funds allocated to weatherisation assistance in 2018. Source: Mapped by authors based on (Administration for Children & Families n.d.-a).

financial assistance for weatherisation was reported in California (CA) (23% of its total LIHEAP funding allocation), followed by Idaho (ID), Montana (MT), and Colorado (CO); states like Maryland (MD) and South Dakota (SD) did not use their LIHEAP funds for weatherisation projects at all (Administration for Children & Families n.d.-a).

Critique of U.S. Compensation-based Policy Strategies Through the Lens of Capabilitarian Energy Justice

Based on a brief review of U.S. LIHEAP and WAP policy research, we find that the energy bill assistance measures for low-income families have been the predominant form of U.S. government efforts to alleviate energy poverty. Including privately sourced funding, we further find that bill payment programs account for more than 80% of total energy poverty assistance funding (Drehobl and Ross 2016). This tendency results in that '[f]unding for temporary assistance (e.g. for bill payments) dwarfs funding for more enduring assistance (e.g. weatherization)' as discussed in Brown et al. (2020, 28). While financial assistance for energy bill payments can relieve the hardship of energy deprivation experienced by vulnerable families in the short term, we question whether compensation-based policies can meaningfully contribute to the enhancement of energy capabilities in the long term.

Despite the long history of federal programs that fight energy poverty in the U.S., a large number of low-income households are still situated in a condition of energy poverty, and, even worse, only a small percentage of them receive assistance (Xu and Chen 2019). According to the U.S. Department of Health and Human Services (2016), only 16% of income-eligible households received federal heating assistance in FY 2014. Each eligible family received $386 of heating and winter crisis benefits on average, which was a significantly lower level of aid compared to the financial support provided in the early 1980s. Furthermore, low-income minority groups that have weaker socio-political influence (e.g., African-American and Latino communities and people living in rental housing) tend to experience more difficulty receiving policy benefits (Drehobl and Ross 2016).

The primary issue with bill assistance measures is that they are designed to restore people's energy capabilities only temporarily, by paying immediate home energy bills on their behalf. This type of financial aid is highly effective when the need is urgent, as energy access can be a time-sensitive problem for affected families. However, there are a number of unpredictable political and socio-ecological factors (e.g., funding abundance, growth of the older population, weather variations, and climate change) that can affect the availability and level of future bill assistance. Bednar and Reames (2020) criticised the general misperception of energy poverty as 'a temporary misfortune to be remedied primarily by some form of debt recovery' (2). Policymakers need to understand that temporary end-of-pipe solutions cannot end the challenge of energy poverty.

Table 4. Illustrative assessment of energy poverty relief policies.

Categories of energy capabilities	Secondary energy capabilities	Policy effects	
		Compensation-based policy (e.g., energy bill assistance)	Empowerment-focused policy (e.g., weatherisation and community-based energy projects)
A. Ability to access affordable and safe energy services that enable one to secure biological and physical well-being	Space heating and cooling, lighting, cooking, access to water and food, personal hygiene maintenance, medical care, etc.	Provides fast, immediate, but short-term effects on maintaining access to essential energy services; uncertainty about future assistance remains.	Realises long-term energy savings; provides higher certainty about the future energy situation.
B. Ability to take advantage of basic energy services to develop intellectual and emotional capacities and exercise individual autonomy	Information access, education, transportation, social interaction with others, etc.	Provides direct assistance on continuing to use conventional energy services for non-health-related personal and social activities; uncertainty remains.	Allows at-risk households to have access to affordable and clean energy services; relieves a psychological concern over future high energy burdens.
C. Ability to have control over energy-related decisions that affect one's ability to pursue valuable ends and live with human dignity	Participating in decision-making process, resisting unjust energy decisions, taking individual and collective action that can transform the energy-society relationship, etc.	Not expected.	Helps at-risk households better understand their home's energy use; turn them from passive policy beneficiaries into active energy decision-makers.

We now apply the three-category assessment framework to the two U.S. programs and discuss the implications for capabilitarian energy justice. As Table 4 presents, each energy capability category can be interpreted in real-life language using the concept of 'secondary capabilities' as discussed in Day, Walker, and Simcock (2016). For example, the ability to maintain biological and physical health (category A) is dependent on one's use of energy for heating, air conditioning, lighting, cooking, and other essential daily activities. In the case of category B, we interpret that being able to receive appropriate education and build stable relationships with others requires access to affordable and reliable energy services. Unlike the first two, the last category is not directly related to the use of energy. Secondary capabilities for this dimension include one's ability to take part in energy-related decisions, whether small or large, and take individual and collective action on energy-sourced problems. From choosing heating fuels to resisting a socially and environmentally harmful energy project, the core question of category C is whether people have the ability to control energy matters that affect the quality of their lives. Therefore, capabilities of

this category are expanded when individuals and communities have opportunities to play a meaningful role in the process of energy decision-making.

In the last two columns of Table 4, we summarise the effects of U.S. policy strategies on households' energy capabilities. As discussed in an earlier section, we characterise energy bill assistance and weatherisation as compensation-based and empowerment-focused assistance measures, respectively. The major difference between the two is the expected length and depth of policy effects. While the former provides immediate short-term relief from energy burdens, the latter enhances one's long-term ability to have control over energy use and planning. Although compensation policies are effective in helping people continue accessing energy services for a period of time, they are not designed to eradicate the root causes of energy poverty. Rather, such policies can make energy-poor households more reliant on assistance, leaving them to live with uncertainty. In comparison, empowering measures provide fundamental changes in the energy condition of at-risk households by upgrading home energy efficiency and promoting community-scale energy projects. As a result, vulnerable households can be converted from passive policy beneficiaries into active energy decision-makers.

Admittedly, compensation policies should be included in the policy agenda: they are fast, and they effectively address urgent household energy crises. The problem is that the U.S. policy approach has excessively favoured financial assistance with a focus on 'the distribution of government resources and the number of vulnerable households assisted rather than improving household well-being and reducing overall energy poverty' (Bednar and Reames 2020, 1). The results of our policy review suggest augmenting the scale and variety of policy measures that help enhance all three categories of people's energy capabilities. In the U.S. case, a meaningful expansion of WAP can improve people's energy capabilities because whole-house weatherisation generates not only economic benefits (e.g., energy savings) but also social benefits (e.g., health, safety, and security) (Schweitzer and Tonn 2003; Freed and Felder 2017; Tonn, Rose, and Hawkins 2018). However, it is crucial to note that the actual benefits of WAP projects are dependent on how effectively energy efficiency measures are implemented and maintained (Clinch and Healy 2001; Raissi and Reames 2020). Successful energy poverty mitigation, therefore, requires not only a greater scale of funding for energy efficiency measures but high-quality program implementation and evaluation. Increased assistance for small-scale renewable energy projects is also needed in the future policy agenda for energy poverty alleviation.

Discussion: Moving Towards Empowering Strategies for Energy Poverty Mitigation

By delving into the interdisciplinary literature on the capability approach and energy justice, we have reasoned that achieving capabilitarian energy justice

requires not only financially compensating low-income households for their high energy-income ratio but, more importantly, also empowering them to break the cycle of energy vulnerability and restore energy capabilities. In this section, we briefly discuss how to realise a higher level of capabilitarian energy justice with empowerment solutions to energy poverty challenges.

At the political level, government funding needs to be directed more towards energy efficiency improvement, weatherisation, and community-scale renewable projects (Drehobl and Ross 2016). Low-income families often have difficulty implementing energy efficiency and renewable solutions by themselves because of the high upfront costs. Therefore, new policy strategies are needed to help at-risk households tackle the underlying condition of energy poverty with energy-saving measures and decrease their reliance on bill assistance. California's Single-Family Affordable Solar Homes (SASH) Program is a good example of state-level efforts. The SASH program helps low-income homeowners install solar photovoltaic systems and efficiency measures by providing up-front financial incentives (California Public Utilities Commission n.d.). The program is operated as part of the state's solar initiative but administered by a non-profit solar contractor, GRID Alternatives. Benefits of the program include not only household-level energy bill savings and energy efficiency improvement but also carbon footprint reduction, increased awareness of sustainable energy options, green job creation, and trust-building at the community level.

In addition to seeking technological improvement in the energy performance of individual homes, promoting local action on the issue of energy poverty can help vulnerable communities gather their voices and shape a healthy energy culture. By building a self-governable and resilient energy community, households can have opportunities to take part in decision-making and influence each other's energy behaviours in a positive way (Stephenson et al. 2010; Sweeney et al. 2013; Stephenson et al. 2015). The case of Marin Clean Energy (MCE) in California exemplifies how collective energy capabilities can be achieved through community-based engagement and initiatives (Taminiau et al. 2019; Byrne et al. 2020; Marin Clean Energy 2020). MCE's program provides renewable electricity to 34 communities across four counties (nearly 417,000 customers as of 2018) at rates that are competitive with those of Pacific Gas & Electric (the largest investor-owned utility in California). Participating households can choose how much renewable-sourced power to include in their electricity use (from 60% to 100%). Also, MCE is committed to creating an inclusive energy culture by providing technical and financial assistance to low- and moderate-income families, residents of multi-family housing, and renters—all of whom are often excluded from the benefits of renewable energy and energy efficiency measures. MCE's work illustrates a form of 'energy commoning,' which engages not only wealthy communities but also low-income and minority communities in the process of rethinking energy.

Conclusion

We began this study by raising two research questions: Do current U.S. policy approaches to energy poverty fulfil the criteria of capabilitarian energy justice? If not, how can capability thinking help to improve policy measures for long-term energy poverty mitigation?

To explore the first question, we proposed a capability-based assessment framework for energy poverty relief policies, defining three dimensions of energy capabilities. Also, we conceptually compared compensation-based and empowerment-focused policies that make distinct contributions to the alleviation of household energy burdens. From the U.S. case analysis, we found that the energy bill payment program (a standard compensation-type measure) has been the most dominant form of assistance for energy-poor households. Because financial assistance has limited ability to eradicate the root causes of energy affordability challenges, we have evaluated that the current compensation-focused policy strategies are not structured to fully meet the standards of capabilitarian energy justice.

Concerning the second research question, our work suggests that upscaling home energy efficiency assistance could realise a more profound enhancement in people's energy capabilities. We also found local-level collective efforts could address energy justice challenges and create a community-centred, democratic energy culture. Community engagement and empowerment measures can be effectively implemented in partnership with civil society groups. WAP and LIHEAP send substantial funds to state programs that support low-income households in energy poverty. In turn, state governments allocate funds to civil society partners, who are in the best position to develop strong connections with at-risk communities and understand their energy needs (Hernández and Bird 2010; Creutzfeldt et al. 2020). As seen in the California cases, cooperation among state and local governments, civil society, and local energy communities can create synergistic effects.

The role of the federal government will continue to be critical to making new policy strategies possible. Systemic change in the current policy approach requires the federal government to prioritise citizens' well-being over the interest of incumbent stakeholders and recognise the development of creative energy-poverty solutions as an important policy agenda. We expect that expanded application of capability thinking in energy research and policymaking will help researchers and decision-makers perceive the multi-layered issue of energy poverty from a different angle and conceive of capability-enhancing policy interventions.

Notes

1. We regard 'normal life' as partly context-dependent, defined by social, economic, and political conditions and moral and ethical principles in the context of a particular

society. As proponents of capability research have argued, there are general capability principles and context-dependent ones. In this study, we attempt to consider both general and context-specific aspects of normal life in relation to energy use.

2. The concept of 'energy vulnerability' underscores the need to move from a supply-focused understanding of energy insecurity (as shown in the term 'fuel poverty') to a multi-level understanding of the issue that recognises the diverse factors (e.g., socio-economic, political, and infrastructural) driving the phenomenon.

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References

Administration for Children & Families. n.d.-a. *LIHEAP Data Warehouse: Custom Reports*. https://liheappm.acf.hhs.gov/data_warehouse/index.php?report=adHocQueries.

Administration for Children & Families. n.d.-b. *LIHEAP Program Duration: Heating, Cooling, and Crisis*. https://liheapch.acf.hhs.gov/tables/program_dates.htm.

Administration for Children & Families. n.d.-c. *State Programs*. https://liheapch.acf.hhs.gov/state.

Ahmad, S., M. V. Mathai, and G. Parayil. 2014. "Household Electricity Access, Availability and Human Well-Being: Evidence from India." *Energy Policy* 69: 308–315. doi:10.1016/j.enpol.2014.02.004.

Alkire, S. 2005. "Why the Capability Approach?" *Journal of Human Development* 6 (1): 115–135. doi:10.1080/146498805200034275.

Bartiaux, F., C. Vandeschrick, M. Moezzi, and N. Frogneux. 2018. "Energy Justice, Unequal Access to Affordable Warmth, and Capability Deprivation: A Quantitative Analysis for Belgium." *Applied Energy* 225: 1219–1233. doi: 10.1016/j.apenergy.2018.04.113.

Bednar, D. J., and T. G. Reames. 2020. "Recognition of and Response to Energy Poverty in the United States." *Nature Energy*. doi:10.1038/s41560-020-0582-0.

Berges, S. 2007. "Why the Capability Approach is Justified." *Journal of Applied Philosophy* 24 (1): 16–25. doi:10.1111/j.1468-5930.2007.00368.x.

Boemi, S.-N., and A. M. Papadopoulos. 2019. "Energy Poverty and Energy Efficiency Improvements: A Longitudinal Approach of the Hellenic Households." *Energy and Buildings* 197: 242–250. doi:10.1016/j.enbuild.2019.05.027.

Bouzarovski, S., and S. Petrova. 2015. "A Global Perspective on Domestic Energy Deprivation: Overcoming the Energy Poverty–Fuel Poverty Binary." *Energy Research & Social Science* 10: 31–40. doi:10.1016/j.erss.2015.06.007.

Brown, M. A., A. Soni, M. V. Lapsa, K. Southworth, and M. Cox. 2020. "High Energy Burden and Low-income Energy Affordability: Conclusions from a Literature Review." *Progress in Energy* 2: 042003. doi:10.1088/2516-1083/abb954.

Bullard, R. D. 1994. *Dumping in Dixie: Race, Class, and Environmental Quality*. 2nd ed. Boulder, CO: Westview Press.

Byrne, J., L. Glover, and C. Martinez. 2002. "The Production of Unequal Nature." In *Environmental Justice: Discourses in International Political Economy*, edited by John Byrne, Leigh Glover, and Cecilia Martinez, 261–291. New York: Routledge.

Byrne, J., C. Martinez, and C. Ruggero. 2009. "Relocating Energy in the Social Commons: Ideas for a Sustainable Energy Utility." *Bulletin of Science, Technology & Society* 29 (2): 81–94. doi:10.1177/0270467609332315.

Byrne, J., J. Nyangon, S. Hegedus, J. Taminiau, P. Li, O. de Paz, and K. Redhead. 2020. *Navigating the Changing Landscape of Community Solar in Delaware: Policy Designs and Governance Frameworks to Support Community-Owned Sustainable Energy*. Newark, DE: Center for Energy & Environmental Policy, University of Delaware. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3653334.

California Public Utilities Commission. n.d. "CSI Single-Family Affordable Solar Homes (SASH) Program." Accessed April 25, 2020. https://www.cpuc.ca.gov/General.aspx?id=3043.

Chard, R., and G. Walker. 2016. "Living with Fuel Poverty in Older age: Coping Strategies and Their Problematic Implications." *Energy Research & Social Science* 18: 62–70. doi:10.1016/j.erss.2016.03.004.

Charlier, D., B. Legendre, and A. Risch. 2019. "Fuel Poverty in Residential Housing: Providing Financial Support Versus Combatting Substandard Housing." *Applied Economics* 51 (49): 5369–5387. doi:10.1080/00036846.2019.1613501.

Clinch, J. P., and J. D. Healy. 2001. "Cost-benefit Analysis of Domestic Energy Efficiency." *Energy Policy* 29 (2): 113–124. doi:10.1016/S0301-4215(00)00110-5.

Creutzfeldt, N., C. Gill, R. McPherson, and M. Cornelis. 2020. "The Social and Local Dimensions of Governance of Energy Poverty: Adaptive Responses to State Remoteness." *Journal of Consumer Policy* 43 (3): 635–658. doi:10.1007/s10603-019-09442-z.

Damgaard, C., D. McCauley, and J. Long. 2017. "Assessing the Energy Justice Implications of Bioenergy Development in Nepal." *Energy, Sustainability and Society* 7 (1): 8. doi:10.1186/s13705-017-0111-6.

Day, R., G. Walker, and N. Simcock. 2016. "Conceptualising Energy use and Energy Poverty Using a Capabilities Framework." *Energy Policy* 93: 255–264. doi:10.1016/j.enpol.2016.03.019.

de Wildt, T. E., E. J. L. Chappin, G. van de Kaa, P. M. Herder, and I. R. van de Poel. 2020. "Conflicted by Decarbonisation: Five Types of Conflict at the Nexus of Capabilities and Decentralised Energy Systems Identified with an Agent-Based Model." *Energy Research & Social Science* 64: 101451. doi:10.1016/j.erss.2020.101451.

Drehobl, A., and L. Ross. 2016. *Lifting the High Energy Burden in America's Largest Cities: How Energy Efficiency Can Improve Low Income and Underserved Communities*. Washington, DC: American Council for an Energy-Efficiency Economy. https://www.aceee.org/research-report/u1602.

Drèze, J., and A. Sen. 1989. *Hunger and Public Action*. Oxford: Clarendon Press.

Freed, M., and F. A. Felder. 2017. "Non-energy Benefits: Workhorse or Unicorn of Energy Efficiency Programs?" *The Electricity Journal* 30 (1): 43–46. doi:10.1016/j.tej.2016.12.004.

Gasper, D. 2007. "What is the Capability Approach?: Its Core, Rationale, Partners and Dangers." *The Journal of Socio-Economics* 36 (3): 335–359. doi:10.1016/j.socec.2006.12.001.

Hart, C. S., and N. Brando. 2018. "A Capability Approach to Children's Well-Being, Agency and Participatory Rights in Education." *European Journal of Education* 53 (3): 293–309. doi:10.1111/ejed.12284.

Heffron, R. J., and D. McCauley. 2014. "Achieving Sustainable Supply Chains Through Energy Justice." *Applied Energy* 123: 435–437. doi:10.1016/j.apenergy.2013.12.034.

Heffron, R. J., and D. McCauley. 2017. "The Concept of Energy Justice Across the Disciplines." *Energy Policy* 105: 658–667. doi:10.1016/j.enpol.2017.03.018.

Hernández, D., and S. Bird. 2010. "Energy Burden and the Need for Integrated low-Income Housing and Energy Policy." *Poverty & Public Policy* 2 (4): 5–25. doi:10.2202/1944-2858.1095.

Hillerbrand, R. 2018. "Why Affordable Clean Energy Is Not Enough. A Capability Perspective on the Sustainable Development Goals." *Sustainability* 10 (7): 2485. doi:10.3390/su10072485.

Hillerbrand, R., and K. Goldammer. 2018. "Energy Technologies and Human Well-Being. Using Sustainable Design for the Energy Transition." In *The Future of Engineering: Philosophical Foundations, Ethical Problems and Application Cases*, edited by A. Fritzsche and S. J. Oks, 151–175. Cham: Springer.

Hillerbrand, R., C. Milchram, and J. Schippl. 2019. "The Capability Approach as a Normative Framework for Technology Assessment." *TATuP - Zeitschrift für Technikfolgenabschätzung in Theorie und Praxis* 28 (1): 52–57. doi:10.14512/tatup.28.1.52.

Holland, B. 2008. "Ecology and the Limits of Justice: Establishing Capability Ceilings in Nussbaum's Capabilities Approach." *Journal of Human Development* 9 (3): 401–425. doi:10.1080/14649880802236631.

Ibrahim, S. S. 2006. "From Individual to Collective Capabilities: The Capability Approach as a Conceptual Framework for Self-Help." *Journal of Human Development* 7 (3): 397–416. doi:10.1080/14649880600815982.

Ibrahim, S., and S. Alkire. 2007. "Agency and Empowerment: A Proposal for Internationally Comparable Indicators." *Oxford Development Studies* 35 (4): 379–403. doi:10.1080/13600810701701897.

Jenkins, K., D. McCauley, R. Heffron, H. Stephan, and R. Rehner. 2016. "Energy Justice: A Conceptual Review." *Energy Research & Social Science* 11: 174–182. doi:10.1016/j.erss.2015.10.004.

Jenkins, K. E. H., S. Spruit, C. Milchram, J. Höffken, and B. Taebi. 2020. "Synthesizing Value Sensitive Design, Responsible Research and Innovation, and Energy Justice: A Conceptual Review." *Energy Research & Social Science* 69: 101727. doi:10.1016/j.erss.2020.101727.

Jessel, S., S. Sawyer, and D. Hernández. 2019. "Energy, Poverty, and Health in Climate Change: A Comprehensive Review of an Emerging Literature." *Frontiers in Public Health* 7: 357. doi:10.3389/fpubh.2019.00357.

Kyprianou, I., D. K. Serghides, A. Varo, J. P. Gouveia, D. Kopeva, and L. Murauskaite. 2019. "Energy Poverty Policies and Measures in 5 EU Countries: A Comparative Study." *Energy and Buildings* 196: 46–60. doi:10.1016/j.enbuild.2019.05.003.

Lee, J., and J. Byrne. 2019. "Expanding the Conceptual and Analytical Basis of Energy Justice: Beyond the Three-Tenet Framework." *Frontiers in Energy Research* 7: 99. doi:10.3389/fenrg.2019.00099.

LIHEAP Clearinghouse. 2016. *Weatherization: Coordinating LIHEAP and WAP.* Butte, MT: LIHEAP Clearinghouse. https://liheapch.acf.hhs.gov/sites/default/files//webfiles/docs/LIHEAP_Weatherization_Report.pdf.

LIHEAP Clearinghouse. 2017. *LIHEAP Primer: What You Need to Know.* Butte, MT: LIHEAP Clearinghouse. https://liheapch.acf.hhs.gov/sites/default/files/webfiles/docs/LIHEAPprimer.pdf.

Löfquist, L. 2020. "Is There a Universal Human Right to Electricity?" *The International Journal of Human Rights* 24 (6): 711–723. doi:10.1080/13642987.2019.1671355.

Marin Clean Energy. 2020. "A Decade of Community Choice Energy in California." Accessed September 2, 2020. https://www.mcecleanenergy.org/news/10-years-service/.

Martínez, D. M., and B. W. Ebenhack. 2008. "Understanding the Role of Energy Consumption in Human Development Through the use of Saturation Phenomena." *Energy Policy* 36 (4): 1430–1435. doi:10.1016/j.enpol.2007.12.016.

Mathai, M. V. 2009. "Elements of an Alternative to Nuclear Power as a Response to the Energy-Environment Crisis in India." *Bulletin of Science, Technology & Society* 29 (2): 139–150. doi:10.1177/0270467608331185.

McCauley, D., R. Heffron, H. Stephan, and K. Jenkins. 2013. "Advancing Energy Justice: The Triumvirate of Tenets." *International Energy Law Review* 32 (3): 107–110.

Melin, A., and D. Kronlid. 2019. "Energy Scenarios and Justice for Future Humans: an Application of the Capabilities Approach to the Case of Swedish Energy Politics." *Etikk I Praksis: Nordic Journal of Applied Ethics* 13 (1): 39–54. doi:10.5324/eip.v13i1.2749.

Middlemiss, L., P. Ambrosio-Albalá, N. Emmel, R. Gillard, J. Gilbertson, T. Hargreaves, C. Mullen, T. Ryan, C. Snell, and A. Tod. 2019. "Energy Poverty and Social Relations: A Capabilities Approach." *Energy Research & Social Science* 55: 227–235. doi:10.1016/j.erss.2019.05.002.

Mrówczyńska, M., M. Skiba, A. Bazan-Krzywoszańska, and M. Sztubecka. 2020. "Household Standards and Socio-Economic Aspects as a Factor Determining Energy Consumption in the City." *Applied Energy* 264: 114680. doi:10.1016/j.apenergy.2020.114680.

Nielsen, L., and D. V. Axelsen. 2017. "Capabilitarian Sufficiency: Capabilities and Social Justice." *Journal of Human Development and Capabilities* 18 (1): 46–59. doi:10.1080/19452829.2016.1145632.

Nussbaum, M. C. 2001. *Women and Human Development: The Capabilities Approach.* Cambridge: Cambridge University Press.

Nussbaum, M. 2003. "Capabilities as Fundamental Entitlements: Sen and Social Justice." *Feminist Economics* 9 (2-3): 33–59. doi:10.1080/1354570022000077926.

Ouedraogo, N. S. 2013. "Energy Consumption and Human Development: Evidence from a Panel Cointegration and Error Correction Model." *Energy* 63: 28–41. doi:10.1016/j.energy.2013.09.067.

Pasten, C., and J. C. Santamarina. 2012. "Energy and Quality of Life." *Energy Policy* 49: 468–476. doi:10.1016/j.enpol.2012.06.051.

Pellegrini-Masini, G., A. Pirni, and S. Maran. 2020. "Energy Justice Revisited: A Critical Review on the Philosophical and Political Origins of Equality." *Energy Research & Social Science* 59: 101310. doi:10.1016/j.erss.2019.101310.

Pogge, T. C. 2002. "Can the Capability Approach Be Justified?" *Philosophical Topics* 30 (2): 167–228.

Ponce, R. S., J. A. P. Cancio, and J. E. Sánchez. 2018. "The Capabilities Approach and Values of Sustainability: Towards an Inclusive Pedagogy." *Journal of Innovation & Knowledge* 3 (2): 76–81. doi:10.1016/j.jik.2017.12.008.

Primc, K., and R. Slabe-Erker. 2020. "Social Policy or Energy Policy? Time to Reconsider Energy Poverty Policies." *Energy for Sustainable Development* 55: 32–36. doi:10.1016/j.esd.2020.01.001.

Raissi, S., and T. G. Reames. 2020. ""If We Had a Little More Flexibility." Perceptions of Programmatic Challenges and Opportunities Implementing Government-Funded low-Income Energy Efficiency Programs." *Energy Policy* 147: 111880. doi:10.1016/j.enpol.2020.111880.

Rawls, J. 1999. *The law of Peoples: with, the Idea of Public Reason Revisited*. Cambridge, MA: Harvard University Press.

Robeyns, I. 2005. "The Capability Approach: a Theoretical Survey." *Journal of Human Development* 6 (1): 93–117. doi:10.1080/146498805200034266.

Robeyns, I. 2006. "The Capability Approach in Practice." *Journal of Political Philosophy* 14 (3): 351–376. doi:10.1111/j.1467-9760.2006.00263.x.

Samarakoon, S. 2019. "A Justice and Wellbeing Centered Framework for Analysing Energy Poverty in the Global South." *Ecological Economics* 165: 106385. doi:10.1016/j.ecolecon.2019.106385.

Sareen, S, H. Thomson, S. T. Herrero, J. P. Gouveia, I. Lippert, and A. Lis. 2020. "European Energy Poverty Metrics: Scales, Prospects and Limits." *Global Transitions* 2: 26–36. doi:10.1016/j.glt.2020.01.003.

Schlosberg, D. 2007. *Defining Environmental Justice: Theories, Movements, and Nature*. Oxford: Oxford University Press.

Schweitzer, M., and B. Tonn. 2003. "Non-energy Benefits of the US Weatherization Assistance Program: a Summary of Their Scope and Magnitude." *Applied Energy* 76 (4): 321–335. doi:10.1016/S0306-2619(03)00003-5.

Sen, A. 1985a. *Commodities and Capabilities*. Amsterdam: North-Holland.

Sen, A. 1985b. "Well-Being, Agency and Freedom: The Dewey Lectures 1984." *The Journal of Philosophy* 82 (4): 169–221. doi:10.2307/2026184.

Sen, A. 1992. *Inequality Reexamined*. Cambridge, MA: Harvard University Press.

Sen, A. 2004. "Capabilities, Lists, and Public Reason: Continuing the Conversation." *Feminist Economics* 10 (3): 77–80. doi:10.1080/1354570042000315163.

Sen, A. 2005. "Human Rights and Capabilities." *Journal of Human Development* 6 (2): 151–166. doi:10.1080/14649880500120491.

Sen, A. 2009. *The Idea of Justice*. Cambridge, MA: Harvard University Press.

Snell, C., M. Bevan, and H. Thomson. 2015. "Justice, Fuel Poverty and Disabled People in England." *Energy Research & Social Science* 10: 123–132. doi:10.1016/j.erss.2015.07.012.

Sovacool, B. K. 2014. "What Are We Doing Here? Analyzing Fifteen Years of Energy Scholarship and Proposing a Social Science Research Agenda." *Energy Research & Social Science* 1: 1–29. doi:10.1016/j.erss.2014.02.003.

Sovacool, B. K., M. Burke, L. Baker, C. K. Kotikalapudi, and H. Wlokas. 2017. "New Frontiers and Conceptual Frameworks for Energy Justice." *Energy Policy* 105: 677–691. doi:10.1016/j.enpol.2017.03.005.

Sovacool, B. K., R. V. Sidortsov, and B. R. Jones. 2014. *Deciphering Energy Justice and Injustice. In Energy Security, Equality and Justice.* New York, NY: Routledge.

Stephenson, J., B. Barton, G. Carrington, A. Doering, R. Ford, D. Hopkins, and R. Lawson 2015. "The Energy Cultures Framework: Exploring the Role of Norms, Practices and Material Culture in Shaping Energy Behaviour in New Zealand." *Energy Research & Social Science* 7: 117–123. doi:10.1016/j.erss.2015.03.005.

Stephenson, J., B. Barton, G. Carrington, D. Gnoth, R. Lawson, and P. Thorsnes. 2010. "Energy Cultures: A Framework for Understanding Energy Behaviours." *Energy Policy* 38 (10): 6120–6129. doi:10.1016/j.enpol.2010.05.069.

Sugden, R. 1993. "Welfare, Resources, and Capabilities: A Review of Inequality Reexamined by Amartya Sen." *Journal of Economic Literature* 31 (4): 1947–1962.

Sweeney, J. C., J. Kresling, D. Webb, G. N. Soutar, and T. Mazzarol. 2013. "Energy Saving Behaviours: Development of a Practice-Based Model." *Energy Policy* 61: 371–381. doi:10.1016/j.enpol.2013.06.121.

Taminiau, J., J. P. Banks, D. Bleviss, and J. Byrne. 2019. "Advancing Transformative Sustainability: A Comparative Analysis of Electricity Service and Supply Innovators in the United States." *WIREs Energy and Environment* 8 (4): e337. doi:10.1002/wene.337.

Tonn, B., E. Rose, and B. Hawkins. 2018. "Evaluation of the U.S. Department of Energy's Weatherization Assistance Program: Impact Results." *Energy Policy* 118: 279–290. doi:10.1016/j.enpol.2018.03.051.

Tornaghi, C. 2017. "Urban Agriculture in the Food-Disabling City: (Re)Defining Urban Food Justice, Reimagining a Politics of Empowerment." *Antipode* 49 (3):781-801. doi:10.1111/anti.12291.

United Nations. 2018. *Policy Brief 8: Interlinkages Among Energy, Poverty and Inequalities.* New York, NY: United Nations. https://sustainabledevelopment.un.org/content/documents/17480PB8.pdf.

U.S. Department of Energy. 2019. *Weatherization Assistance Program Briefing Book.* Washington, DC: U.S. Department of Energy. https://www.energy.gov/sites/prod/files/2020/01/f70/wap_briefing_book_v2.4_01.2020.pdf.

U.S. Department of Health and Human Services. 2016. *LIHEAP Home Energy Notebook - For Fiscal Year 2014.* Washington, DC: U.S. Department of Health and Human Services. https://www.acf.hhs.gov/sites/default/files/documents/ocs/hen_final_508_compliant_fy14.pdf.

Walker, G. 2015. "The Right to Energy: Meaning, Specification and the Politics of Definition." *L'Europe en Formation* 378 (4): 26–38. doi:10.3917/eufor.378.0026.

Walker, G., and R. Day. 2012. "Fuel Poverty as Injustice: Integrating Distribution, Recognition and Procedure in the Struggle for Affordable Warmth." *Energy Policy* 49: 69–75. doi:10.1016/j.enpol.2012.01.044.

Wood, N., and K. Roelich. 2020. "Substantiating Energy Justice: Creating a Space to Understand Energy Dilemmas." *Sustainability* 12 (5): 1917. doi:10.3390/su12051917.

Xu, X., and C. Chen. 2019. "Energy Efficiency and Energy Justice for U.S. low-Income Households: An Analysis of Multifaceted Challenges and Potential." *Energy Policy* 128: 763–774. doi:10.1016/j.enpol.2019.01.020.