Energy Research & Social Science 97 (2023) 102987

Contents lists available at ScienceDirect

Energy Research & Social Science

journal homepage: www.elsevier.com/locate/erss

Original research article

As essential as bread: Fuelwood use as a cultural practice to cope with energy poverty in Europe

Ana Stojilovska [a,*], Dušana Dokupilová [b], João Pedro Gouveia [c], Anna Zsófia Bajomi [d,f], Sergio Tirado-Herrero [e], Nóra Feldmár [f], Ioanna Kyprianou [g], Mariëlle Feenstra [h]

[a] Department of Government and Public Policy, Institute for Political Science, Centre for Social Sciences, Tóth Kálmán utca 4, 1097 Budapest, Hungary
[b] Institute for Forecasting, Centre for Social and Psychological Studies, Slovak Academy of Sciences, Šancová 56, Bratislava, Slovakia
[c] CENSE – Center for Environmental and Sustainability Research, CHANGE - Global Change and Sustainability Institute, NOVA School of Science and Technology, NOVA University Lisbon, Campus de Caparica, 2829-516 Caparica, Portugal
[d] Department of Architecture and Urban Planning, Polytechnic University of Milan, 20133 Milano, Italy
[e] Department of Geography, Universidad Autónoma de Madrid, Spain
[f] Habitat for Humanity Hungary, 1027 Budapest, Hungary
[g] Energy, Environment, Water Research Centre, The Cyprus Institute, 20 Konstantinou Kavafi, Nicosia 2121, Cyprus
[h] Delft University of Technology, Department Technology, Policy and Management, Jaffalaan 5, 2628 BX Delft, The Netherlands

ARTICLE INFO

Keywords:
Energy vulnerability
Coping strategies
Lived experience
Biomass
Firewood
Europe

ABSTRACT

Fuelwood has been overlooked by European energy transition policies, despite its importance as a domestic energy source for many European households. We study fuelwood use for coping with energy poverty based on the lived experience of energy-vulnerable households in five diverse European countries (Portugal, Slovakia, Hungary, Austria, and North Macedonia). From their perspective, fuelwood is a central and multifunctional tool for coping with energy poverty because of its many favorable features, including enabling energy security and access, that overweigh its adverse environmental and health impacts. We argue that the use of fuelwood for coping with energy poverty is embedded in cultural practices building upon the interconnection of three stages of coping behavior. The first stage is fuelwood *becoming a socio-cultural norm*, which means it is considered a cultural practice for coping with energy poverty due to its many benefits that protect the energy vulnerable from increasing energy prices, disconnections, and further energy deprivation. This enhances the subsequent phase, featuring *the normalization of subsistence* which is the acceptance of life with minimal energy needs. This leads to the final stage with *increasing system detachment* which is continued reliance on individual and informal arrangements of satisfying energy needs and avoiding seeking or demanding institutional support.

1. Introduction

As a solid fuel, fuelwood has been overlooked by the European energy transition policies, despite its evident links to several sustainable development goals (SDGs), and their corresponding human development and environmental outcomes. For instance, while the European Green Deal mentions the phasing out of coal, biomass is not mentioned in any form [1]. The subsequent policy REPowerEU Plan includes biogas as one of the energy sources to replace Russian gas and makes an implicit link between energy poverty and biogas use when discussing energy communities for biogas [2], the latter which are still a new and underexplored entity in Europe. Fuelwood and other primary solid biofuels take up 17 % of the average household's final energy consumption in the EU [3], thus fuelwood is an important resource for many European households. In particular, fuelwood is a fuel (and technology) recognized as a tool for coping with households' inability to attain a necessary level of domestic energy services, defined as energy poverty or energy vulnerability [4].[1] We know that households affected by energy vulnerability employ various strategies to reduce, adjust or replace their energy needs to cope with their situation [5,6]. Primarily due to its low

* Corresponding author.
E-mail addresses: Ana.Stojilovska@tk.hu (A. Stojilovska), dusana.dokupilova@savba.sk (D. Dokupilová), jplg@fct.unl.pt (J.P. Gouveia), anna.bajomi@habitat.hu (A.Z. Bajomi), sergio.tirado@uam.es (S. Tirado-Herrero), nora.feldmar@habitat.hu (N. Feldmár), i.kyprianou@cyi.ac.cy (I. Kyprianou), m.h.feenstra@tudelft.nl (M. Feenstra).

[1] We use energy poverty and energy vulnerability interchangeably referring to the same phenomenon of (risk at) the inability to satisfy domestic energy needs.

https://doi.org/10.1016/j.erss.2023.102987
Received 13 September 2022; Received in revised form 29 January 2023; Accepted 1 February 2023
Available online 13 February 2023

price, fuelwood fits the profile of a resource well suited for coping with energy poverty. However, the literature on general energy poverty coping strategies does not capture fuelwood's multifaceted usefulness to energy-vulnerable households, and the broader impacts of its use, including high concentrations of particulate matter creating outdoor pollution [7]. Although there is some research on the use of fuelwood as a coping strategy [8,9], there is little knowledge, especially in a wider European context about the irreplaceable role of fuelwood in coping with energy poverty, due to its many additional features protecting households from increasing energy prices and further material deprivation. Culture becomes another key ingredient for explaining the use of energy and technologies [10] and the experience of energy poverty [11]. These patterns around fuelwood use for coping with energy poverty echo the subsistence level of energy services and the cultural importance of fuelwood in the Global South, also highlighting the role of gender [12–15]. This adds to the potential global socio-cultural relevance of fuelwood for energy-vulnerable households. The issue of fuelwood use for coping with energy poverty is especially relevant in the context of the ongoing energy crisis which magnifies the layers of vulnerability that underpin this phenomenon [16,17]. These insights imply a link between fuelwood and energy poverty relevant to SGD 1 (no poverty), SDG 5 (gender equality), SDG 7 (affordable and clear energy), and SDG 13 (climate action). Access to clean, sustainable, and affordable energy services is a global commitment embedded in SDGs to be transposed into energy policies [18]. Finally, the European Green Deal has launched a socially just energy transition which requires greater alignment of social, environmental, and development goals. In this context, fuelwood serving as a crossroad between material deprivation and environmental degradation should not be overlooked.

This work is inspired by insights gained from our data acquired through interviews with energy-vulnerable households relying on fuelwood to cope with energy poverty in five European countries (Portugal, Slovakia, Hungary, Austria, and North Macedonia). The countries have different levels of energy poverty determined by diverse path-dependencies. We aim to provide comprehensive anatomy of fuelwood use based on the lived experience of energy-vulnerable households [19] regarding their observations about the features and use of the fuel and the technology, the institutional and personal lock-ins encouraging fuelwood use, and its wider societal implications. We argue that the use of fuelwood for coping with energy poverty is embedded in cultural practices building upon the interconnection of three stages of coping behavior. The first stage is *fuelwood becoming a socio-cultural norm,* which means it is considered a cultural practice for coping with energy poverty due to its many benefits that protect the energy vulnerable from increasing energy prices, disconnections, and further energy deprivation. This enhances the subsequent phase, featuring the *normalization of subsistence* which is the acceptance of life with minimal energy needs. This leads to the final stage with *increasing system detachment* which is continued reliance on individual and informal arrangements of satisfying energy needs and avoiding seeking or demanding institutional support.

The structure of the article is: the Introduction and the Literature review (Fuelwood use in energy poverty context: more than just a cheap fuel) are followed by Methodology, Results (Layers of energy vulnerability around fuelwood use as a cultural practice for coping), Discussion and Conclusions.

2. Fuelwood use in energy poverty context: More than just a cheap fuel

To understand fuelwood use as a cultural practice to cope with energy poverty, we apply an energy justice lens to explain the conditions which facilitate the coping of the energy vulnerable with fuelwood, and its impacts on the energy vulnerable, and the environment. Theoretically different but interconnected constructs, such as social practices, socio-cultural norms, coping, and agency are also applied, in order to elaborate on the practice of coping with fuelwood and its cultural relevance in the context of deprivation. This conceptual framework is shown in Fig. 1. This stream of literature then supports the explanation of the empirical findings to build up the conceptual contribution illustrated in Fig. 6.

As a state in which everyone is entitled to use affordable, safe, and clean energy, the concept of energy justice [20], assesses energy poverty as an energy injustice through three layers. There are spatial (distributive justice), household (recognition justice), and policy (procedural justice) [21,22] levels of energy vulnerability that lock households in using fuelwood to cope with energy poverty. First, as a distributive injustice, energy poverty is shaped by the lock-ins of infrastructure, markets, and locations [21–24] which explains the spatial and financial limitations to accessing certain energy sources such as piped natural gas. This means that some households in rural, but also urban areas, have limited access to other heating options than fuelwood [25,26]. Furthermore, due to its low price, energy-vulnerable households switch to fuelwood to keep their energy costs low [8,9]. Second, energy poverty is an issue of recognition injustice by exposing the energy-vulnerable households' features and personal lock-ins [6,21–23]. Thus, fuelwood use to cope with energy poverty has been related to certain vulnerable groups such as minorities [26,27] or in a more global context, women [28]. Third, energy poverty is viewed as a procedural injustice determined by how policies affecting the energy vulnerable are fair [21–23] and whether institutions ignore the needs of the energy poor [26]. Lack of adequate support pushes households into developing individual and often damaging coping strategies to deal with their material deprivation [6,29]. For example, it is known that the extensive use of fuelwood contributes to indoor and outdoor air pollution [9,30,31]. In sum, fuelwood unifies multiple energy vulnerabilities, such as vulnerable people who live in vulnerable spaces dependent on old technologies and polluting fuels without adequate policy support which amplifies the problem [26]. These developments around energy poverty have been co-shaped by various path-dependencies which are past decisions on infrastructure, housing, and energy supply [9] locking households into consumption pathways out of their control [32]. In Fig. 1 we illustrate the three levels of energy vulnerability which set the spatial, household, and policy conditions for using fuelwood as a cultural practice to cope with energy poverty. In the center is the practice of coping with fuelwood which is elevated to a cultural practice expressed through socio-cultural normalization, subsistence, and system detachment (elaborated below).

Using fuelwood to deal with household energy deprivation is an essential coping strategy. The literature on coping with energy poverty has been inspired by medical and psychological studies to report on the impact on individuals who have been exposed to dangers, such as natural disasters [6]. People's response to such stressful situations has been usually simplistically explained as either having an emotional or a problem-solving reaction [33,34]. In the context of domestic energy deprivation, coping gained a more nuanced understanding, by describing the various practical activities households in energy poverty undertake to deal with their situation. These are numerous and refer to multiple ways of reducing their energy needs or bargaining between the satisfaction of their energy and other basic needs. This means reducing the quality or quantity of food intake, using blankets or outdoor clothing at home, going to bed earlier, or heating one room with a fuelwood stove [5,6,26,35,36]. Many of these practices point out that living on a subsistence level can be defined as the minimal standard of productive life [37]. The most common form of coping for energy-vulnerable households is self-reliance or reliance on their family circle [6,38]. In some instances, affected individuals show reluctance to seek out help from relevant institutions because of previous bad experiences or mistrust [29]. This can lead to their engagement in informality [39] and detachment from potential systematic solutions. However, what is missing in the literature is expanding this understanding of coping with energy poverty by focusing on fuelwood as an energy source with

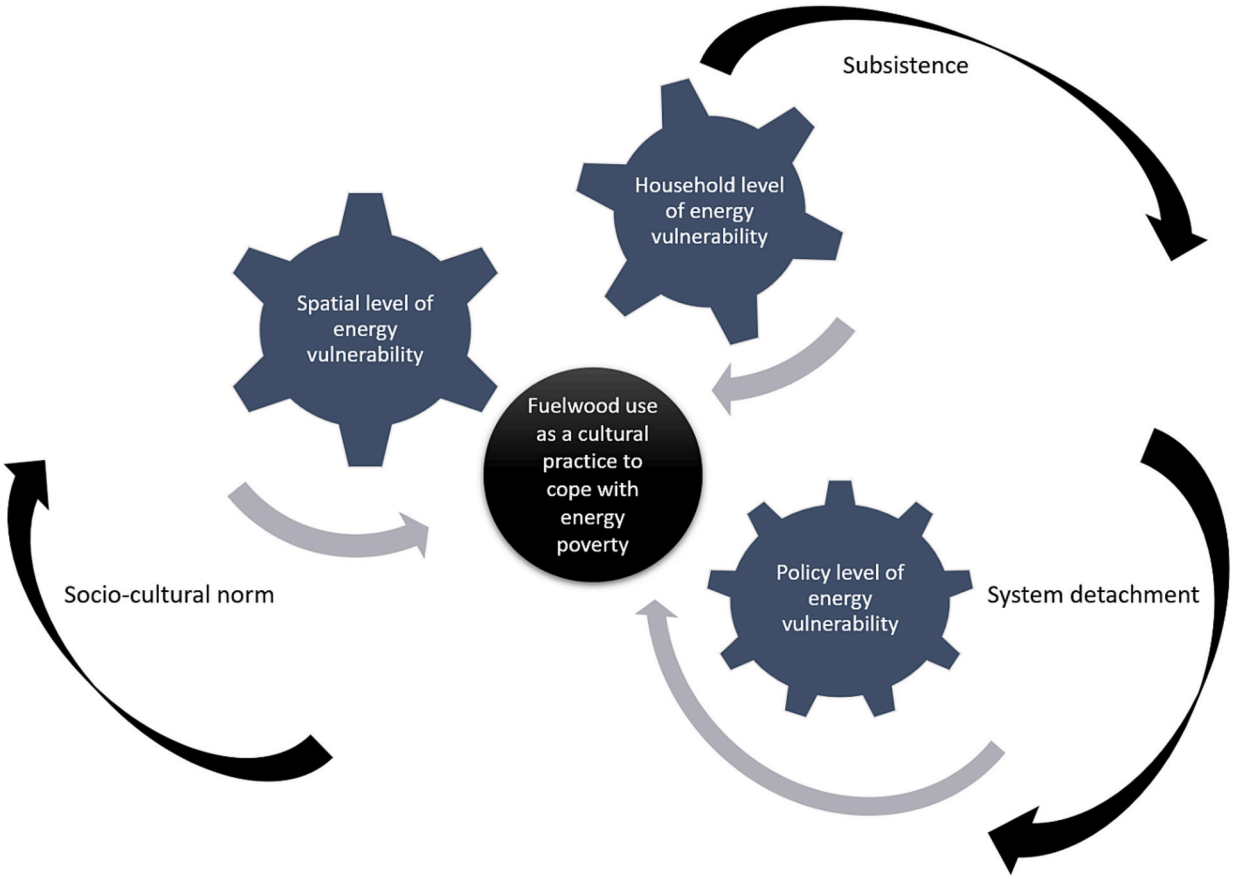

Fig. 1. Conceptual framework to understand fuelwood use as a cultural practice to cope with energy poverty.

various benefits to energy-vulnerable households, but adverse environmental and health impacts.

In the Global South, fuelwood plays a much bigger role as a domestic energy source, especially for cooking, and its use is deeply embedded in domestic cultural practices and beliefs. For instance, fuelwood use is a highly gendered topic following a traditional division of labor leaving women to attend to cooking and collecting fuelwood for cooking with an adverse effect on their health [40–43]. These adverse health effects of fuelwood use, such as injuries resulting from its collection or carrying or the air pollution it causes, are often accepted as a cultural phenomenon or a lived reality [44,45]. Yet in that context, fuelwood is used due to the combination of affordability, availability, and convenience [40], and there are instances in which the exposure to energy poverty has been mitigated by using locally sourced fuelwood [46]. Fuelwood use is also embedded in domestic routines and practices. From a socio-cultural perspective, fuelwood use can be explained by, for example, the taste of food cooked with wood fire or the socialization that takes place during fuelwood collection and transport; an explanation that goes beyond the socio-economic interpretation of this practice [12–14]. Fuelwood is also seen as a safety tool protecting from (further) material deprivation. For instance, households that adopt fuelwood stacking (using a combination of fuels [40] to reduce their exposure to the price variation of a single fuel) do so in response to the cutting of social policies [13].

More broadly, it has been argued that culture is embedded in energy use [47,48] through the cultural practices surrounding or involving energy use at home. For example, Wilhite et al. [47] argue that energy services tend to be energy-intensive when they are culturally significant, such as lighting and heating in Norway and bathing in Japan. Social practice is a routinized type of behavior involving bodily, mental, and emotional activities, use of 'things' as well as know-how [49]. We understand how social practices develop, change and intersect by understanding trends and patterns in energy demand [50]. Socio-cultural norms, defined as expectations about people's behavior [51], have a key role in understanding energy and technology use. The socio-cultural norms co-shape the everyday practice in energy use and operating technology as well as the opinions on acceptable levels of indoor thermal comfort [52,53]. Domestic heating through fire-making is a behavior that is deeply connected to social and emotional human needs, but also survival in remote areas with cold climates [54]. An 'energy cultures' approach can expose the struggles of individuals and society producing a socially just energy system [55]. Culture has also been associated with energy through studying households' or individuals' energy-related behavior to optimize their behavioral change [56–58]. This behavioral change framework does not fully take into consideration that the energy vulnerable cannot be expected to get out of energy poverty through altered attitudes. While the Energy Cultures framework suggests behavior understood through the interactions between norms, material culture, and practices [57], in an energy poverty context of fuelwood use, the fuelwood has to be considered a constant material culture conditioning the other two elements - norms and practices.

Energy-vulnerable households have a distinct behavior that might appear as a limited agency, however, coping with fuelwood can be reinterpreted by the energy vulnerable in a positive way. An agency can be defined as an intentional causal intervention that is often related to resistance, performativity, motivation, and desire, and framed as an 'ability or capacity of an individual' in the context of resilience [59–61]. Households in energy poverty have different priorities regarding energy use driven by necessity while experiencing a reduced quality of life. Their coping strategies show that life on a subsistence level has become their common way of life [6,62,63] in which context fuelwood often plays a relevant role. On one hand, the behavior of energy-vulnerable households is considered suboptimal because their cognitive resources

have been depleted due to the conditions of material deprivation they are living in [64]. The social and material environment co-shape behavior [65]. On the other hand, the agency of energy-vulnerable individuals can explain their positive reinterpretation of events [33]. There are examples of positive experiences of empowerment due to collective coping strategies [6]. Thus, one must understand what is culturally important to affected households to provide more effective support. For instance, Pakistani and Bangladeshi communities in the UK use two living rooms rather than one and spend more on cooking and appliance usage [66] and Japanese culture dictates a preference for person-heating rather than space heating [47]. Social norms also impact the way one can obtain help to avoid hardship associated with energy poverty [53] and can be bound up with stigma [67]. This conditions how energy poverty needs to be confronted in those communities. Research suggests that the energy poor need not only to gain the capacity to act but to align their position within dominant discourses and institutions to be empowered [68]. Overall, as coping practices with fuelwood can be interpreted as co-shaped by socio-cultural constructs (such as social norms, social practices, contextually shaped behavior, and agency), this work adds to the stream of literature looking at the link between culture and energy poverty by focusing on fuelwood use.

3. Methodology

In this section, we present the research design, justification for the country selection, and describe the diverse national contexts. Then, we provide information about data collection, methods, data analysis, and data description.

3.1. Research design

The research design is a cross-country multiple-case study inspecting fuelwood use by energy-vulnerable households based on their lived experience in five diverse European countries (Portugal, Slovakia, Hungary, Austria, and North Macedonia). Case studies are used to inspect underexplored contemporary issues in an in-depth manner [69,70].

There are several reasons for selecting these five countries. First, we are interested in European countries where domestic fuelwood consumption is high and that have diverse levels of energy poverty (Fig. 2 and Fig. 3). Second, we are interested in countries in which fuelwood use is relevant for domestic energy needs and/or for coping with energy poverty, and we are aware of post-socialist, Mediterranean countries, and Central European countries having diverse path-dependencies which affect the heating choice and the incidence of energy poverty [71,72]. Third, out of these geographical regions (post-socialist, Mediterranean, and Central Europe), the countries were selected through researchers studying energy poverty in these countries, who are members of a COST Action, the ENGAGER network of energy poverty scholars and practitioners contributing to transformational change in the investigation and amelioration of household-level energy poverty in Europe between 2017 and 2021 [73]. The researchers and the countries they studied were selected according to the following criteria. Firstly, they had to have a dataset of interviews available in transcripts or media channels (TV and newspapers) with responses collected from individuals in energy-vulnerable households. Moreover, the interviews should represent households using fuelwood for heating purposes and be recorded in the form of direct citations of the interviewees showing their lived experiences. Finally, the data had to be collected in recent years.

A case study is based on analytical generalization, and a multiple-case sampling such as the one presented in this article increases the generalizability and confidence of the findings [70,74]. Thus, across the five case study countries, the data refer to the same issues (energy vulnerable, fuelwood users, lived experience, European context) while representing a diverse set of conditions (different levels of energy poverty, geographical locations, and socio-political realities). By detecting similar patterns, we can claim an analytical generalization of the findings across the studied countries. However, due to the qualitative nature of the research, we do not claim that the results are representative at the national level, but a display of the specific contexts of households in energy poverty using fuelwood.

3.2. Country contexts

The five selected European countries for analysis are Portugal, Slovakia, Hungary, Austria, and North Macedonia. They have a medium to a high share of fuelwood use in households ranging from 21 % in Slovakia and Hungary, 25 % in Portugal and Austria, and up to 38 % in

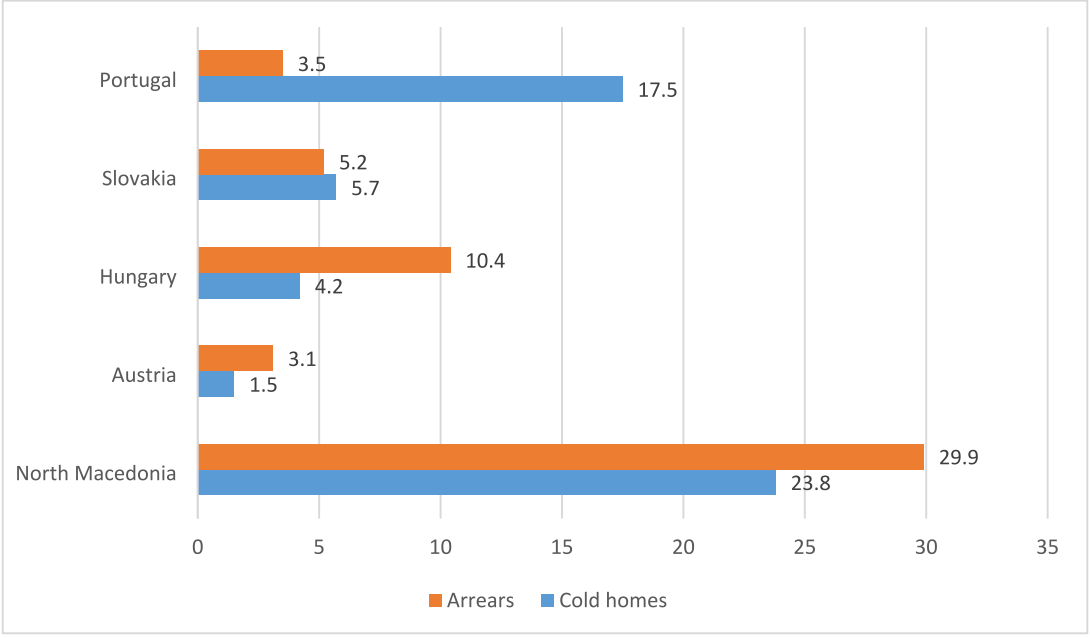

Fig. 2. Energy poverty as a share of households measured through arrears on utility bills (code: ilc_mdes07) and the inability to keep homes adequately warm (code: ilc_mdes01) in Portugal, Slovakia, Hungary, Austria, and North Macedonia in 2020. Source: [78,79].

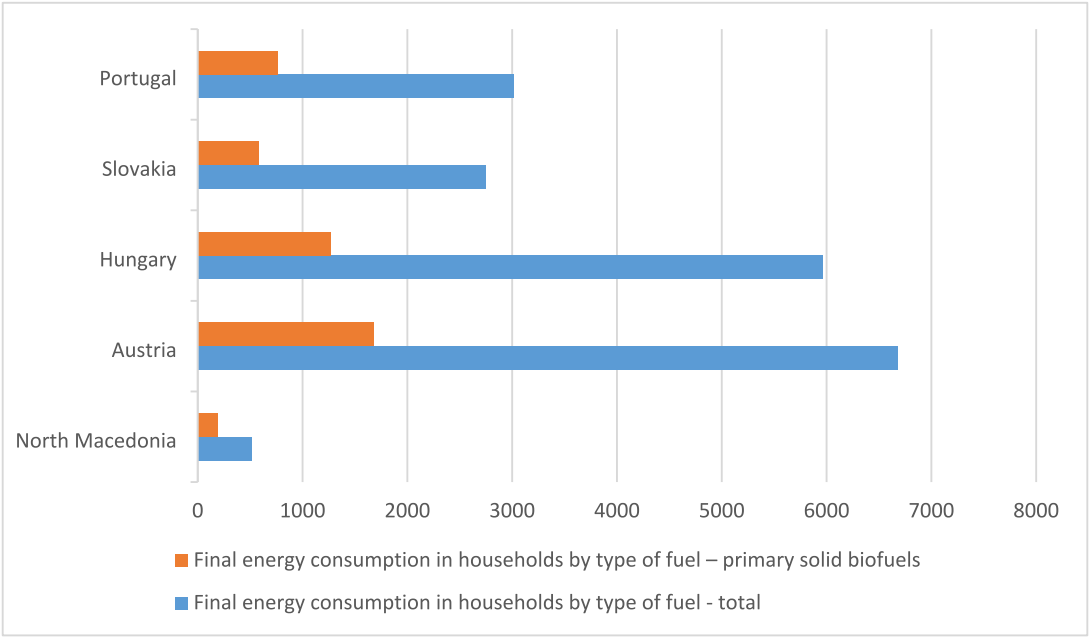

Fig. 3. Fuelwood and other primary solid biofuels as a share in the final energy consumption of households in Portugal, Slovakia, Hungary, Austria, and North Macedonia in 2020 in thousand tons of oil equivalent (code: ten00125). Source: [3].

North Macedonia (as a share in the final energy consumption in households, Fig. 3). These countries have a higher share of primary solid biofuels than the EU average of 17 %. They manifest different levels of energy poverty with Austria showing the lowest, and North Macedonia having the highest incidence (Fig. 2), as indicated by two of the most commonly used indicators for energy poverty – the inability to keep the households adequately warm, and arrears on utility bills. Some countries, such as Hungary and Portugal differ regarding the two indicators because of the nature of the indicators; cold home is the subjective self-assessment, while arrears are affected by the regulations about arrears and disconnections. In Portugal, there is a significantly lower number of households with arrears than those with cold homes because of coping strategies and underconsumption, high reliance on fuelwood for heating, and a social tariff supporting around 800,000 families to pay their energy bills.

The five countries belong to different regions of 'energy poverty geography' with Austria belonging to the 'core' of regions less affected by energy poverty; and Slovakia, Hungary, Portugal, and North Macedonia belonging to the geographical 'European energy poverty periphery' of Central and Eastern Europe and Mediterranean nations, where incidence rates of energy poverty are higher than in Northern and Western Europe [75,76]. At the same time, the conditions impacting energy poverty and fuelwood use in the countries have been determined by different path-dependencies. To name a few, Hungary, Slovakia, and North Macedonia are post-socialist countries where energy poverty has been shaped by the liberalization of energy prices and the quality of the housing stock [9]. Structural drivers in Portugal include the poor energy performance of residential buildings, the lack of central heating, and the additional energy needs for cooling in summer [77]. Lastly, in Austria energy poverty affects a small part of the population concentrated in highly materially deprived households [17].

Following our conceptual approach (Fig. 1) we show the relevant country contexts and describe the lock-ins stimulating the use of fuelwood for coping with energy poverty.

In Portugal, biomass is the second most used source of energy after electricity representing 27.2 % of the total [80]. The significant use of biomass is resulting from historically low incomes, high energy prices, and lack of access to natural gas in most rural areas, with alternatives being more expensive to use such as LPG bottles or portable electric heaters. There are no widespread central heating systems or district heating networks either. Forest biomass is often used in rural areas, where access to forest wood is easier and cheaper, and many people collect it locally. Fireplaces can be found in over 35 % of Portuguese households [80]. It is also important to note that the Statistical Office in Portugal estimates only the consumption of purchased fuelwood. However, the consumed fuelwood collected nearby or from another source is not accounted for [81], thus the real use of biomass in fireplaces for space heating might be significantly higher than what is unfolded by statistics. In addition, there is a higher proportion of the elderly population in rural locations [82], which can be considered a particularly vulnerable group using fuelwood. The measures against energy poverty in Portugal are mostly aligned with the efforts to improve energy efficiency, such as improving the building quality in line with the country's Long Term Renovation Strategy and Portugal's State Housing Plan [72]. There are also available social tariffs for natural gas and electricity awarded to low-income households [72].

In Slovakia, biomass is the second most used source for heating – 66 % of households use gas, and 21 % use biomass [83]. Households pay the highest proportion of their income for energy within Europe [84] due to a combination of high levels of energy prices, low incomes, and low energy efficiency of Slovak buildings [85]. The latter is caused by the old and unreconstructed building stock with 49 % of the buildings built in the period between 1946 and 1980 when energy prices were very low (especially gas and coal) [83]. The dwellings are often over-dimensioned and inhabited by the original owners, who are now retired. Due to the high share of energy expenditures on income, people choose to use fuelwood because it is the most convenient way to heat their home to a comfortable temperature. The wood is cheap and available because Slovakia has a lot of forest land (40,6 % is wooded area) and 30 % of the forests are privately owned [86]. In Slovakia, energy-poor households using fuelwood for heating are mostly located in rural areas. The most vulnerable households are single-person households and pensioners [87]. There is little support for energy-vulnerable households in Slovakia. Only those eligible for the allowance in material need with a monthly income lower than 218 EUR for singles and 317 EUR for multi-member families can receive 60 to 95 EUR per month for housing expenditures.

In Hungary, as of 2018, 42 % of all households and 75 % of rural

households relied partially or entirely on solid-fuel heating [88]. This trend started in the late 2000s when rapidly increasing natural gas prices led to the expansion of energy poverty among the general population, which was accompanied by the substitution of natural gas with coal or firewood [9]. Solid fuel users are over-represented in low-income deciles [89] and among households living in the low energy efficiency single-family houses built before the 1990s [90]. Solid fuel heating is also prevalent among Hungarian Roma communities [91]. Many households heating with solid fuels in Hungary use individual heaters such as inefficient metal stoves resulting in low and uneven levels of thermal comfort [90]. The Hungarian utility cost reduction program - a country-wide instrument for controlling the price of utility services and other regulated activities in place since 2013 (which has been scraped for high energy users in the meanwhile) - favors primarily upper-income households relying on natural gas, electricity, and district heating but does not cover solid fuels [89]. Instead, the "Social Fuel Wood Program" introduced in 2011, provides direct in-kind support - often in the form of free firewood or coal - to households living in municipalities with a population of up to 5000. This scheme has been criticized because of the low quality of the fuels provided (e.g., wet firewood and poor-quality coal) in some locations and also because of the arbitrariness and clientelism in its distribution across municipalities [91]. Finally, 50–60 % of the total fuelwood consumed in Hungary is of unknown origin and potentially sourced from illegal logging because the sum of domestic fuelwood, energy crops production, and fuelwood imports does not match the total quantity of fuelwood used [89,92–94].

In Austria, forests are primarily in private ownership, and many fuelwood users either have their own wood or can acquire it within their social circle [26]. Fuelwood is of high national importance and is valued as a renewable source of energy used widely by the residential sector in general [95]. That means fuelwood is used for additional warmth in the household but also strategically to reduce the energy costs in regions dependent on oil supply [26]. In particular, rural areas without access to gas and using oil, aim to diversify their energy sources by using fuelwood [26] to reduce their energy costs. Thus, fuelwood is used both by energy vulnerable and not energy vulnerable [26]. For the energy vulnerable, fuelwood enables access to an affordable source of domestic energy. There is a high correlation between income poverty and energy poverty in Austria and both are low [6,17]. Energy-vulnerable households often consist of single pensioners living on a minimal pension, or households in rural areas without access to natural gas [6]. The common practice of energy-poor households is the self-restriction of heating [96] in which context coping with fuelwood helps. The low share of energy poor in Austria is due to a well-equipped social welfare system with various programs to address the different needs of vulnerable groups [6,26]. However, renovation can be seen as problematic as it does not reduce costs as energy-poor households use renovation benefits for increased comfort rather than reduced consumption [97].

In North Macedonia, around 90 % of the population does not have access to a central form of heating and can only use fuelwood or electricity for heating – both fuels being used with inefficient heating technologies [26]. Fuelwood is the most used source of domestic heat also because it is the cheapest fuel and can be used even in urban areas as most of the households live in individual dwellings and are homeowners [26]. Fuelwood is used in an individual central heating system but is more commonly used in single stoves [26]. In the capital city, 71 % of fuelwood users use fuelwood stoves [98]. A particularly vulnerable group consists of minorities such as Roma who are highly dependent on fuelwood use [26]. Unemployment and income poverty are high in the country, while the electricity supply provider is a monopoly in private ownership [6,26]. As a result, the country has many energy-vulnerable households that consider having cheap heating to be a priority. The available support is limited. Social welfare recipients in North Macedonia used to be eligible for a small monthly energy poverty subsidy, but this measure, with a bit of expansion, was rebranded for vulnerable consumers [72]. This measure addresses all energy carriers, including fuelwood, and is given in a form of small financial reimbursement [15]. The high reliance on fuelwood in urban areas contributes to high and dangerous levels of air pollution in winter [31]. There have been measures to reduce air pollution, such as the replacement of fuelwood stoves with pellet ones in the capital city, but this measure was not linked to efforts to reduce energy poverty [15].

3.3. Data collection and methods

Our multiple-case study of fuelwood use by energy-vulnerable households combines six independent research projects on energy poverty in the selected countries which make up the original datasets (Table 1). The original studies were designed and developed with diverse approaches, but they all explored energy poverty and fuelwood use from the energy-vulnerable households' point of view.

Our main data collection method is the interview, structured or semi-structured, which allows for an in-depth study of people and communities [102] and for discovering knowledge from the point of view of the interviewee [103]. Interviews provide evidence in the form of subjective truths and personal stories [104] which enables us to uncover the fuelwood-related energy deprivation based on the lived experience of interviewed households. By lived experience [19] we mean the opinion, experiences, and stories of the households in energy poverty using fuelwood told from their perspective and in their own words. We thus use direct quotes from the interviewed households to support our findings.

3.4. Data analysis

We rely on thematic synthesis as a methodological framework that allows for bringing together different qualitative datasets. Thematic synthesis enables us to stay true to the results of the primary studies, but also facilitates the production of new concepts which begins with a free line-by-line coding of the findings of primary studies and leads to the development of analytical themes [105]. On that basis, we carried out a secondary analysis of primary empirical data to find answers to a new research question that differs from the question in the original studies and generate new knowledge [106].

To prepare the data for analysis and create one dataset per country of only fuelwood users in energy poverty, we have sub-sampled the household data from Austria and North Macedonia datasets to exclude households not using fuelwood for heating and not being energy vulnerable. From the Hungary I dataset, we excluded those who did not use fuelwood. Then, we merged the two Slovakian datasets into one, and we did the same with the Hungarian ones, while the Austrian and Macedonian were separated.

In our study, we have defined households as being in energy poverty if they manifest at least one of the following features: they cannot pay for the energy services or heating, cannot keep their dwelling sufficiently warm, are low-income, or have no income, have dwelling quality issues, such as leaking roof or low-quality heaters, and have no access to electricity or have experienced disconnections, are social welfare recipients, have significantly reduced the heated space or indoor temperature, and had to make a trade-off between meeting their energy needs and other basic needs.

The datasets were analyzed qualitatively around the following questions: a) how do these energy-vulnerable households use fuelwood, b) why do they use fuelwood, c) how do they cope with fuelwood, and d) why it is important to them. We found the following thematic codes: flexibility, access, control, security of supply, self-reliance, affordability, stability, labor- and time-intensiveness, dependence, physical health impacts, financial priorities, air pollution, and semi-comfort. Then, we organized these codes according to households' views on favorable and unfavorable features of fuelwood for coping with energy poverty, along with relevant technological or institutional lock-ins which play a role in energy-vulnerable households preferring fuelwood. After this coding,

Table 1
Information about the original studies.

Original datasets	Portugal	Slovakia I	Slovakia II	Hungary I	Hungary II	Austria and North Macedonia
Research aims	To support media news on energy poverty to get a better understanding of the lived experiences of the most vulnerable consumers	To study energy poverty in the country	To assess the situation in Roma communities based on complex information and their willingness to make changes in their habits	To identify, conceptualize and empirically substantiate how the EU's "transition to a low-carbon, secure and competitive economy" may be reproducing and reinforcing current energy vulnerability trends in the Member States, titled TRANSFAIR [99] supported by Marie Skłodowska-Curie Action	To explore energy poverty among solid fuel users, part of a doctoral thesis and part of the research titled "Societal challenges of energy use" of the Centre for Social Sciences and funded by the Incubator – Collaborative Research Fund	To explore the relationship between heating, energy poverty, and related injustices, part of a doctoral thesis [26]
Location	Verdelhos, inland mountainous rural area	Rural areas	Villages in the district of Martin and Žilina Roma communities in the eastern part of Slovakia - district Spišská Nová Ves	Budapest, Salgótarján (Nógrad county, Northern Hungary), the village of Tiszabura (Jász-Nagykun-Szolnok county, Central Hungary), Roma segregated settlement in the town of Bag (Pest County)	Village of Ág, in Baranya county	Vienna specifically and multiple locations across Austria; Skopje specifically and multiple locations across North Macedonia
Type of households targeted and their selection	The most vulnerable consumers in rural areas unfolded by the energy poverty vulnerability index for Portugal (EPVI) [100], selection based on availability and referral	Energy-vulnerable households using fuelwood in rural areas were selected based on recommendations and visual assessment of the dwellings	Roma citizens using fuelwood, selected in Roma communities	Low-income, energy-vulnerable households using prepayment meters (and in some cases fuelwood), selected through purposive sampling	Energy-vulnerable households using fuelwood were selected based on the location where Habitat for Humanity Hungary is carrying out interventions to ameliorate housing conditions [101] and has previously conducted an on-site questionnaire survey and was the source of the photo used (Fig. 4)	All households (energy vulnerable and not) using different types of heating, were selected randomly for the survey, and purposively for interviews, documents through stakeholders
Methods	Interview	Interview	Interview	Interview	Interview	Interview through an online questionnaire, phone survey (which includes open-ended questions), documents
Number of interviewed households	10	20	20	24	13	150 surveys in Vienna, 100 interviews in Austria; 150 surveys in Skopje, 119 interviews in North Macedonia
Year of data collection	2019	2021–2022	2021	2019–2020	2019	2017

the qualitative data was analyzed following data condensation, data display, and conclusion drawing [74]. We describe the features of fuelwood around the three elements of the novel concept of using fuelwood as a cultural practice to cope with energy poverty (Fig. 6).

3.5. Data description

We only describe the sub-sampled datasets of energy-vulnerable households using fuelwood. Our interviewees were often retired persons, disabled, single women, living in low-income households, or large families. Some were also low work intensity households or did not have access to full-time legal employment. In North Macedonia, Hungary, and Slovakia we found a significant representation of Roma minorities. The interviewees often live in inefficient dwellings or even in substandard housing the latter found in the Hungarian case study. Some lived in social housing and had prepaid meters. Their limited budget forces them to choose between energy and other basic needs. In Table 2 we provide some basic socio-demographic data about the energy-vulnerable households whose interview citations were used in the manuscript.

In general, our interviewees have old-fashioned fuelwood stoves which enable single-room heating. There were several cases of an individual central form of heating run on fuelwood in their dwelling. Some have more than one stove. The fuelwood stoves were often suitable to be used for cooking. In some cases, households were using fireplaces or combining fuelwood with other fuels for heating. In Portugal, some households even used open fire inside the house. Overall, fuelwood heating equipment was outdated and inefficient. The majority of interviewed households reduce their heated space at home and indoor temperatures to save money. Many heat only one room either for economizing purposes or due to the technological limitations of their fuelwood heating. Some collect the fuelwood on their own, either legally or illegally.

Table 2
Basic socio-demographic data about the used interviews.

No	ID	Country	Year	Gender of respondent	Age (or age group)	Location
1	HH no.LS	PT	2019	Female	74	Rural
2	HH no.NC	PT	2019	Male	38	Rural
3	HH no.OC	PT	2019	Female	53	Rural
4	HH no.2/1	SK	2022	Male	80	Rural
5	HH no.2/2	SK	2022	Male	50–60	Rural
6	HH no.1/1	SK	2022	Female	80+	Rural
7	HH no.3/1	SK	2021	Female	25–30	Rural
8	HH no.4	SK	2022	Female	80	Rural
9	HH no.1/AB	HU	2019	Female	16	Rural
10	HH no. TRANSFAIR_HUHH19	HU	2020	Female	NA	Rural
11	HH no.11/AB	HU	2019	Female	40–50	Rural
12	HH.no. TRANSFAIR_HUHH05	HU	2020	Male + female (2 respondents)	NA	Urban
13	HH no.115/V	AT	2017	Female	NA	Urban
14	HH no.95/AT	AT	2017	NA	NA	Rural
15	HH no. WEO	AT	NA	Female	NA	NA
16	HH no.98/V	AT	2017	Female	NA	Urban
17	HH no.38/V	AT	2017	Female	NA	Urban
18	HH no.103/SK	MK	2017	Female	NA	Urban
19	HH no.23/MK	MK	2017	Male	NA	Urban
20	HH no.10/SK	MK	2017	Male	NA	Urban
21	HH no.55/SK	MK	2017	Female	NA	Rural
22	HH no.142/SK	MK	2017	Female	NA	Urban
23	HH no.28/MK	MK	2017	NA	NA	Rural

4. Layers of energy vulnerability around fuelwood use as a cultural practice for coping

Overall, we have found strong evidence from our datasets supporting the novel contribution (illustrated in Fig. 6) however to a different degree among the countries. Since we are interested in similar findings from the different case studies, we present only the main common findings and we do not comment on the differences, but we reflect on some key differentiating points in the discussion.

This section is structured by following the main results about the benefits and weaknesses of using fuelwood through the experiences of the energy vulnerable across five different European countries. These insights build the three elements of the novel concept of fuelwood use as a cultural practice for coping with their situation. The use of fuelwood has multiple benefits which are appreciated by energy-vulnerable households. They outweigh even some of the fuelwood's adverse effects. Both the strengths and weaknesses of fuelwood use are convincing for using fuelwood to cope with energy vulnerability across the studied countries. These positive features are associated with using fuelwood: flexibility, access, control, security of supply, self-reliance, affordability, and stability. The following features are not favorable but still acceptable for energy-vulnerable households: labor- and time-intensiveness, dependence, physical health impacts, financial priorities, and air pollution, and there are mixed reviews about semi-comfort.

We summarized the findings around fuelwood features (Table 3) following the three elements of the novel understanding of fuelwood use as a cultural practice to cope with energy poverty (Fig. 6) in the next three sub-sections. First, we discuss fuelwood's favorable features and how the appreciation for these makes fuelwood a socio-cultural norm (Section 4.1). Next, we discuss some of the fuelwood's strengths and weaknesses and how the strengths outweigh the weaknesses, making the reduced energy quality provision an accepted reality (Section 4.2). Finally, we show how the preoccupation of households with coping with their material deprivation also with the help of fuelwood distances them from considering or looking for solutions from institutions, leading to increasing their system detachment (Section 4.3).

Table 3
Favorable and unfavorable features of fuelwood for coping with energy poverty based on the experience of the interviewed energy-vulnerable households in the studied countries.

Elements of the concept of fuelwood use as a cultural practice to cope with energy poverty	Socio-cultural norm	Subsistence	System detachment
Features of fuelwood for coping with energy poverty and whether they are considered favorable or not, and their alignment with the elements of the novel concept	Flexibility (+) Security of supply (+) Affordability (+) Stability (+) Control (+) Access (+)	Semi-comfort (+ −) Labor and time intensiveness (−) Physical health impacts (−) Air pollution (−)	Financial priorities (−) Self-reliance (+) Dependence (−)

4.1. Fuelwood as a socio-cultural norm

In this section, we argue that fuelwood due to its many features is often described favorably by the interviewed households because it enables them to deal with their material deprivation. Because it is so important to them, fuelwood is becoming a socio-cultural norm.

In particular, fuelwood is primarily used for heating, but the heating stove can be used for cooking at the same time. That means fuelwood can provide various energy services simultaneously, such as cooking and preparing hot water. A family economizing on electricity costs by multitasking because of the flexibility that fuelwood allows, stated: *"If we don't want to use electricity (to heat water) we just light the stove. So in winter, it's very good. If we light it, it gives us a good warmth."* (Hungary, HH no.1/AB).

Fuelwood's ability to replace other expensive energy carriers, such as electricity or gas, guarantees the households the security of supply and prevents disconnections because unlike those networked supplies, fuelwood is a prepaid or a user-controlled fuel. Some of the most deprived collect the fuelwood on their own as explained by a Roma household: "*We collect tree branches and wood from streets… It's very difficult because we don't have any income. We live out of donations.*" (North Macedonia, HH no.103/SK). Fuelwood is strategically used as an interim fuel to reduce the costs of the main heating fuel, such as gas: "*I use a fireplace and fuelwood for the interim heating period (beginning and end of the heating season). I have to afford the energy bills, so I economize on other things… I use very little energy.*" (Austria, HH no.115/V).

At the same time, fuelwood is highlighted as the cheapest heating fuel that allows significant savings on heating costs compared to natural gas, electricity, or oil for heating. In some cases, it is even a free energy source if they own or have access to a piece of land with trees or a forest.

We can see the appreciation for fuelwood's affordability through the example of an 80-year-old retiree: *"It is the cheapest way to be warm. I pay only 200 EUR per year for fuelwood. I have my own forest, so I pay only for cutting and transport.*"(Slovakia, HH no.2/1).

Having cheap fuel at a stable price (or even for free) for several energy services means that energy-vulnerable households have spare money to meet other basic needs. A stable and low baseline for heating costs is especially relevant in times of rising energy prices as fuelwood prevents suffering from further deprivation. We can observe the stability that fuelwood provides through this example of a man living in a rural area aged 50–60 years: *„I use fuelwood because it is free. I have my forest, I cut down the trees and bring them home. I have a tractor. There is always somebody who can help me – a son or neighbors in a forest. So, I pay nothing for the heating. And I can afford to pay all my bills and even help my children to pay for their university studies. But I had to stop using gas for heating – it was impossible for me to manage my financial situation.*"(Slovakia, HH no.2/2).

Fuelwood, unlike electricity or natural gas, is bought as a product and not paid for as a monthly energy service. That means it is acquired usually once a year and becomes a reliable resource of which households have full control in terms of time, duration, and intensity of heating and can adapt it to their needs. The ability to have control of such a relevant resource is a form of energy independence that gives them mental relief: "*Because I use several fuels, I am independent of price (fluctuations). Fuelwood is the cheapest.*" (Austria, HH no.95/AT). Another household explains how important it is to have control of their heating: *"Today the thermometer reads 15 °C on the street, it's 9 °C inside the house. It's not bad, when winter gets tough, we get to be here with negative degrees". The only gratifying solution is to make a fire on the kitchen floor. The only thing that saves me is wood, I have the fire on all day."* (Portugal, HH no.LS). However, as a prepaid or pre-acquired source of domestic energy, it can also lead to situations in which households run out of fuelwood and are not able to refill their woodshed thus leading to very precarious conditions.

Some interviewees use fuelwood because they can access it or do not have access to other heating options. Fuelwood enables access to heating to even those disconnected from basic services such as electricity. The access story can be observed in this case: "*I am a single mother with two sons….Since 3 years ago I don't have access to energy. The meters have been taken down. We use candles and a gas cooker…We cannot bathe at home because we don't have hot water – we use a fuelwood stove for heating.*" (Austria, HH no. WEO).

4.2. Acceptance of subsistence

Energy-vulnerable households embrace their subsistence through the acceptance of the negative side-effects of using fuelwood and getting used to the reduced quality level of energy service provision fuelwood enables. Through the use of fuelwood, energy-vulnerable households are redefining and accepting a substandard level of satisfying energy needs.

A crucial feature of fuelwood heating is that it does not offer fully optimal heating in the entire dwelling, but one or two well-heated rooms at some point in the day. The use of fuelwood for heating often entails reduced comfort due to the design of the fuelwood stove and the nature of fuelwood itself which can be of different quality. Usually, fuelwood heats a limited part of the dwelling, and in many cases one room only: "*Yes, (we get stuck in one room) because it's cold. We cannot heat it all. Too much money for wood.*" (Hungary, HH no. TRANSFAIR_HUHH19). We show this semi-comfort which is acceptable for our interviewees but not particularly liked: "*Heating on fuelwood is cheap, but the whole flat is not heated. (Basic) bills are too high for our standard. There is a need for careful planning (of all costs) and depriving oneself of many things. The bigger expenses are luxury*." (North Macedonia, HH no.23/MK). To visually illustrate these partial comfort conditions, we refer to Fig. 4 taken within an ongoing project on Habitat for Humanity Hungary aimed at replacing

Fig. 4. Replacing an old fuelwood stove (on the left) with a new one in Hungary. Source: [101].

old fuelwood stoves (on the left) with modern ones [101]. Despite the improvement in equipment, stoves as a technology enable space-limited heating of the dwelling as they emit heat only in the room they are located.

As fuelwood heating provides just enough warmth, many households need to use additional, inexpensive means to compensate for the lack of full comfort. A single female pensioner heats only the kitchen with the fuelwood stove during the day keeping the door to the bedroom open: "*But becoming older I feel cold more often and more intensely. I start to heat my house (room) only when it is very cold inside – when two layers of thick cardigans are not enough to feel comfortable. All the time I wear multiple layers of clothes.*" (Slovakia, HH no.1/1). Another household heats with both fuelwood and electricity, maintaining an indoor temperature of up to 18 °C, which they find acceptable: "*It's ok for my needs. I economize the heating because I'm economical with the resources. I put on warmer clothes.*" (Austria, HH no.98/V). In some cases when family members leave their subsistence level of semi-comfort behind, they are reluctant to experience it again when visiting their parents' house: "*(She) can't get her daughters to come home for Christmas. Despite living in Switzerland, they say it is much colder here.*" (Portugal, HH no.LS).

Fuelwood heating is rarely used in automated heating devices thus at least one person needs to attend to the fire and it is common for fuelwood users to come back from work to a cold home: "*We only heat one room in which the fuelwood stove is located and we all sleep there in winter. We don't heat when we are at work.*" (North Macedonia, HH no.10/SK). Using fuelwood heating also requires physical labor, which can be challenging for some users, particularly the elderly or those with illnesses. These individuals must be able to chop the wood and maintain the fire in order to use fuelwood. Many also need to collect it which is an additional physical challenge and can be compensated by depriving themselves of other necessities: "*There are many old people who are saving on medications to buy firewood, they no longer have the strength to go and collect it in the mountains. Cold is certain death.*" (Portugal, HH no.NC). Another example shows the acceptance of the need to deal with the labor-intensiveness of fuelwood use for a family with a visually impaired daughter for which fuelwood brings some extra income: "*Of course, you have to carry (the firewood) in all the time and cut it. It's not bad, it's just a must. If I had a choice, I wouldn't go to live in a block of flats. So that I don't have to cut wood and carry wood to the fire?! I'm sure not.*" (laughs) (Hungary, HH no.11/AB).

The use of fuelwood can adversely affect individuals' physical health, both from the physical strain of handling it and from exposure to indoor air pollution. A household explains: "*The window was closed, no air vent, and the smoke was spreading through the rooms of the house. I only open the windows when I can no longer breathe. Usually, it's not even necessary, my walls are so full of cracks that the air circulates.*" (Portugal, HH no.LS). There are other health risks related to the operation of stoves in the presence of vulnerable household members as told by a family living in social housing: "*I am afraid of turning on the stove because of the children, I have grandkids and they are still small. If I turn it on, it is here, in the open, and if they play or fall on it accidentally… so I usually use it when they are not around.*" (Hungary, HH.no. TRANSFAIR_HUHH05).

Energy-vulnerable households are aware that using fuelwood causes outdoor air pollution and is harmful to the environment, but they cannot find any affordable alternative to replace fuelwood. An example from the village Verdelhos located on the highest mountain on the Portuguese mainland explains why they use fuelwood over other cleaner heating options: "*Verdelhos village is a land of aging people, there is no money for electricity bills or to buy gas bottles. Only wood saves these people, but it is less and less, robbed by forest fires and cellulose companies. And this is a good example of what is happening in the country.*" (Portugal, HH no.OC).

4.3. Increasing system detachment

Energy-vulnerable households found a sort of haven in using fuelwood which has become a central tool for coping with energy poverty. Their focus is on meeting their reduced energy needs and maximizing energy savings through fuelwood use which entraps them into the circle of meeting their needs on their own. Thus, they are not keen to ask for help or demand responsibility from institutions which increases the gap in support provision between institutions as providers and energy-vulnerable households as receivers.

Energy-vulnerable households are preoccupied daily with managing their resources to make ends meet. Since fuelwood is so relevant for managing their material deprivation, they prioritize buying fuelwood, and everything else is secondary. This means they might be cutting back on other essentials or reorganizing their financial and family priorities at home. A family is organizing its domestic obligations around heating in winter: *"It's just that I don't like going out much anyway, especially to relatives, and when my mum and dad go out, they say 'Are you coming?' 'Ah, I'm watching the fire'. … Yeah, well, somebody's got to watch the fire. You stay there, I'll call over the neighbors." (laughs)* (Hungary, HH no.1/AB). Another family deprives itself of many social activities to afford fuelwood: "*On the lower floor we have a fuelwood stove and we heat the whole level through open doors. Where the stove is, it's the warmest. I do everything on the fuelwood stove. We give priority to buying fuelwood. We don't go to the movies, on vacations.*" (North Macedonia, HH no.55/SK).

What is common to these households is that they rarely think about solutions for their situation outside of their home or friends' circle. A Roma household using fuelwood to cook and heat one room is asked whether it has received any assistance regarding heating and energy use: "*I don't know if the municipality gives subsidies. Who will give you a stove?*" (North Macedonia, HH no.142/SK). A similar response by a Roma household with small children: "*We have to help ourselves. Who else would help us? People do not believe in the help of the social system.*" (Slovakia, HH no.3/1).

Often, households rely on their social circle to help them with their fuelwood use. A single female pensioner on a minimal pension explains: "*Fuelwood is very affordable and I get it from friends. I would not replace fuelwood due to financial reasons. Because I'm old I would prefer to be a bit warmer (the indoor temperature). My daughter brings the fuelwood from the basement. I will use the fuelwood till I'm healthy (able) to do so.*" (Austria, HH no.38/V).

Furthermore, relying on fuelwood means being risk-free from disconnections, and it increases self-reliance for energy provision. In some cases, this factor is so important that households strategically choose fuelwood to escape dependency on a monopolistic utility provider: "*We manage to pay the energy bills with difficulties, by defeating small battles, but we manage to make ends meet. …The huge electricity bill is a problem. In most cases, this bill does not reflect the real consumption of a household. We've undertaken experiments in which for a month we drastically and consciously reduced the energy consumption to reduce the energy bill. When the next bill comes - the numbers are way higher than before and they do not reflect the real consumed electricity. Which means that this is a classic theft, extortion, and corporate slavery.*" (North Macedonia, HH no.28/MK). Although not represented with a citation in the manuscript and Table 2, we provide Fig. 5 of an interviewed household in North Macedonia using an old fuelwood stove for heating located in their kitchen from the doctoral study about North Macedonia and Austria [26].

Energy-vulnerable households are dependent on fuelwood use because they do not have the financial means to change their heating fuels and technologies. Fuelwood is their only option even if they prefer another type of heating or a modern stove. A household of five people in a small dead-end village explains: "*I am afraid of gas. I'd stick with wood-burning, just not like this, I could imagine a central heating system maybe, but not necessarily. I'm happy to have a little bit of fuel every year.*" (Hungary, HH no.11/AB). A similar worry is shared by a retiree with a university degree who heats one room only: "*If the gas infrastructure had been available when I was working, I would have preferred gas. It is cleaner and much easier to handle. Even if I had the possibility to connect to the gas infrastructure now, I would not do it. I do not have energy and financial resources. So, I have to use firewood because electricity is too expensive.*

Fig. 5. Old-fashioned fuelwood stove in North Macedonia.

Sometimes it is too tiring and I am worried about the future." (Slovakia, HH no.4).

5. Discussion

Based on the lived experience of energy-vulnerable households, we have demonstrated that fuelwood is a central and multifunctional tool for coping with energy poverty across Portugal, Slovakia, Hungary, Austria, and North Macedonia. We added to these discussions the lived experience and citizen knowledge of households in energy poverty [19,107] whose perspectives have often been excluded from relevant studies on the topic. Thus, expanding on the knowledge that spatial, household, and policy lock-ins reinforce the use of fuelwood for coping with energy poverty, we have shown that fuelwood provides multiple benefits appreciated by energy-vulnerable households. Even its disadvantages are overlooked making fuelwood a desired and reliable tool to cope with energy vulnerability across the studied countries.

Fuelwood use for coping with energy poverty is embedded in cultural practices based on the interconnection of three stages of coping behavior in a form of a vicious circle (Fig. 6). The first stage is *fuelwood becoming a socio-cultural norm*, which means it is considered a cultural practice for coping with energy poverty due to its many benefits that protect the energy vulnerable from increasing energy prices, disconnections, and further energy deprivation. This enhances the subsequent phase, featuring the *normalization of subsistence* which is the acceptance of life with minimal energy needs. This leads to the final stage with *increasing system detachment* which is continued reliance on individual and informal arrangements of satisfying energy needs and avoiding seeking or demanding institutional support. Overall, fuelwood use has multiple benefits which are appreciated by energy-vulnerable households. They outweigh some of the fuelwood's adverse effects. Both the strengths and weaknesses of fuelwood use are convincing for using fuelwood to cope with energy vulnerability across the studied countries.

First, because of its unique features described favorably, such as dealing with the material deprivation of the energy vulnerable, fuelwood is becoming a socio-cultural norm. Socio-cultural norm is building a cultural practice centered around fuelwood use necessary for meeting basic (rather minimal) energy needs. Fuelwood is very valuable to households not only because it's affordable. Fuelwood enables them a form of energy independence preventing disconnections (and avoiding dependence on utility providers' will). It also offers protection from energy shocks and further derivation as it can replace other energy carriers. It is a product, not a networked energy service, and once acquired, it is at the household's discretion to determine the time and extent of heating. In contrast, for instance, the rigid district heating configurations force households to keep their homes fully and continuously heated while they are unable to control their energy consumption [108]. Thus, fuelwood provides them with a safety net of control of their living conditions [109] and a sense of stability as it can replace more expensive energy carriers. As dealing with energy poverty can have mental health impacts on the energy vulnerable [110,111], the reliance on a cheap and available energy source can be considered as a mental relief. Because fuelwood is so important to these households, their

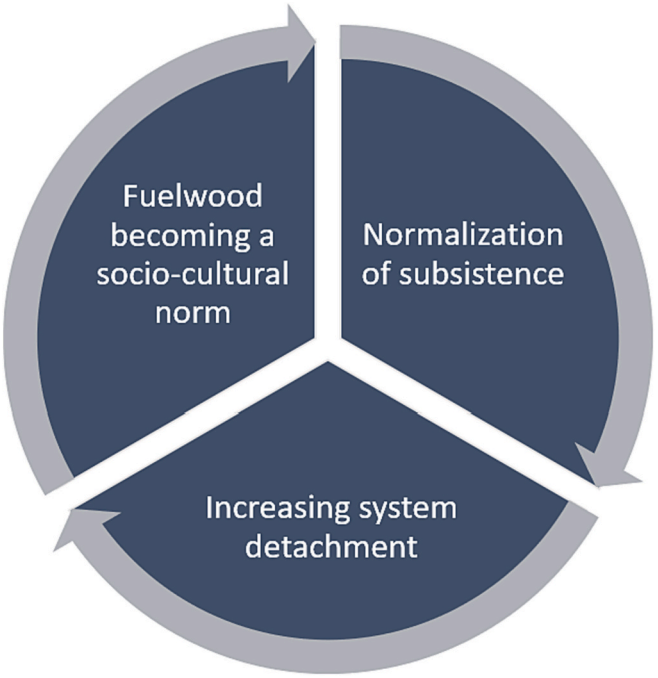

Fig. 6. Conceptualizing fuelwood use as a cultural practice to cope with energy poverty through three interdependent processes.

limited financial means are often prioritized towards its purchase. In this way households express their culture, or what is important to them, through energy use [47], giving preference to fuelwood purchase, using it widely, and depending on it. Thus, fuelwood becomes culturalized for coping with energy poverty.

Second, subsistence is normalized which is the acceptance of using suboptimal energy services. To manage material deprivation conditions, households engage in various strategies to deal with energy poverty [5,6,35,36,112], including restricting heating or other energy services (one room heating, one light on), trade-offs between basic needs (reduction in food expenditure), or make-up strategies for economizing (warm clothes and blankets, using the fuelwood stove for preparing hot water). Fuelwood is a central tool for enabling life with minimal energy needs and reduced levels of energy services (one warm room, not heating at night or when not at home, accepting a reduced temperature) that correspond with subsistence or a minimum standard of productive living in society [37]. These households become accustomed to this reduced level of comfort and energy spent, normalize it, and accept it [6,15,62]. This process also includes accepting the adverse effects of fuelwood, such as on their own health or the environmental impact [52]. However, we can see that energy-vulnerable fuelwood users have an agency that redefines the notions of sufficient energy services and comfort. In this way substandard (subsistence) becomes normalized. The deprivation also refers to limited access to culture and recreational activities [113]. The material culture although suboptimal is reinterpreted to appear for the energy vulnerable in a positive (and empowering) manner which protects them from further material deprivation.

Third, the increasing system detachment is a consequence of households' coping. The way households cope has wider societal and development implications. Some households develop coping strategies that make them engaged in informality and finding informal solutions [39]. Households arrange their heating and housing individually [15] prioritizing fuelwood supply. They often see the institutional system as something they can't trust or rely on [29]. Holding on to fuelwood makes households more detached from systemic institutional solutions, and increases coping on their own, as they mistrust the system, and do not even think that institutions deliver solutions for them. As energy-vulnerable households are dependent on fuelwood use, modern solutions cannot compete with cheap or free fuelwood [26], which means investing in energy efficiency or stove replacement does not pay off since households are used to low levels of energy expenditure and underconsumption [15]. Furthermore, conditions such as trust, and communication are needed to facilitate cooperation with the energy vulnerable [114].

Lastly, we report a set of limitations. First, our data comes from several individual studies on energy poverty and fuelwood use collected in different periods between 2017 and 2021. We think this sample is still representative of the communities impacted by energy poverty in the represented countries: although the exact number of national energy poverty might change in percentage per year, for the most vulnerable households, energy poverty is a state of static helplessness. We aimed to understand the personal stories and experiences of the energy vulnerable which all of the datasets were able to provide. Second, our comparative qualitative approach focuses on identifying commonalities between the experiences of the interviewed households, and therefore, we did not explore the differences across the case studies. However, we know that using fuelwood to cope with energy poverty is the least frequent in Austria and more present in the other studied countries, in correlation with the share of energy poverty in these countries. Energy poverty and coping are the least frequent in Austria because of the good heat infrastructure and stronger social welfare system in the country [6]. Third, we do not claim that fuelwood use equals being in energy poverty, and we are aware that fuelwood is often used outside of this context. Still, this study explicitly focused on energy-vulnerable households using fuelwood. In this regard, we do not claim that the situation is representative at the national level because of our qualitative approach using qualitative methods.

6. Conclusions

We explored fuelwood use for coping with energy poverty based on the lived experience of energy-vulnerable households in five diverse European countries. Due to its multiple favorable features, fuelwood is a crucial tool for coping with energy poverty and becomes a cultural practice based on the lived experience of energy-vulnerable households across Portugal, Slovakia, Hungary, Austria, and North Macedonia.

We have shown that fuelwood use to cope with energy poverty can be understood as a broader problem related to other vulnerable regions and groups in Europe. We argue that fuelwood use by energy-vulnerable households as a cultural practice can be linked to the domestic fuelwood practices in the Global South. Even if this study does not intend to compare the energy poverty-related fuelwood use in Europe to the Global South conditions, we cannot but emphasize the similarities in the extent to which fuelwood is a crucial ingredient in the livelihoods of materially deprived households for coping with their situation. Analyzed data indicates, for instance, similar acceptance of fuelwood's adverse health impacts [44,45]. Fuelwood affordability is not the only feature defining its usefulness for energy-vulnerable households [12–14]. Its widespread availability and reliability also protect energy-vulnerable households from price increases [13]. By hinting at similar cultural behavior patterns around fuelwood use in the context of energy poverty in both Europe and the Global South we want to emphasize the extent of the material, environmental, and health deprivation experienced by energy-vulnerable households and their entrapment around fuelwood use as a coping strategy. This adds to the potential global socio-cultural relevance of fuelwood for energy-vulnerable households which is identified as a future research avenue. Adjusted to the specific context of energy-vulnerable fuelwood users, we think that this conceptual framework has the potential of global applicability to explain fuelwood use as a cultural practice to cope with energy poverty.

Culturalizing fuelwood for coping with energy poverty means that fuelwood is culturally important to energy-vulnerable households to cope with their energy vulnerability. Fuelwood becomes embedded in the cultural practice of energy-vulnerable households and enables them to co-build a distinct behavior centering on fuelwood use. Even more, fuelwood becoming a cultural practice to cope with energy poverty shows that calls for behavior change should not be done without considering the position of users [38]. As culture is embedded in energy use [10,47,48], the behavior of energy-vulnerable households deserves special attention to prevent fostering a sub-culture built around the acceptance of severe material deprivation and environmental degradation through fuelwood collection and use. What cannot be ignored is energy-vulnerable households' acceptance of their precarious living conditions and the adverse health impacts derived from fuelwood use for coping with energy poverty. As energy poverty is a serious form of energy injustice harming human well-being in multiple ways [115], fuelwood use for coping with energy poverty should not get further embedded in cultural practices.

Finally, this topic is of great policy relevance. Fuelwood is not a priority in European policies on the energy transition. Similarly, concerning solid fuel stove use, indoor air pollution is a forgotten policy issue in the Global North such as in Central and Eastern Europe [116]. Neglecting this issue means that energy-vulnerable households will continue to cope with fuelwood to deal with energy poverty, which prevents their active participation in the low-carbon transition envisaged with the EU's Green Deal. On the other hand, some environmental regulations may have a significant impact on users of inefficient fuelwood stoves. The Ecodesign regulation which sets up the ecodesign requirements for energy-related products bans inefficient stoves in the EU [117] and will likely put many energy-vulnerable households at risk of losing access to their old stoves. It will be a serious blow to their livelihood if adequate policies to assist them are not adopted. This is

especially crucial in the current context of high inflation with rapidly increasing energy and food prices, which worsen the conditions for the energy vulnerable. We know that the previous economic crisis prompted households to use more fuelwood [118]. The current energy crisis reveals, even more, how valuable fuelwood can be for coping. By showing the experiences of energy-vulnerable households, we are illustrating the citizen knowledge which can upgrade the techno-economic approach of experts to alleviating energy poverty. Lastly, measures to alleviate energy poverty should co-address the adverse health and environmental impacts of coping with fuelwood, rather than allow the energy vulnerable to accept these adverse impacts. In some cases, such as Hungary and Portugal fuelwood use in households is inconsistently shown in statistics which undermines the extent of the issue. As misrecognition is central to the reproduction of energy poverty [119], there is a need to address the institutional, policy, and spatial lock-ins which entrap vulnerable households relying on fuelwood into energy poverty [5,6,120]. These lock-ins are the initial drivers for fuelwood being a cultural practice for coping with energy poverty. The agency in consumption as well as the responsibility for change are distributed among bodies, technologies, and social contexts [121]. Fuelwood use in the energy poverty context reveals a set of energy injustices: distributive injustice of vulnerable spaces of deprivation; recognition injustice of ignoring the cultural practices of vulnerable people; and unjust policies across the studied countries (procedural injustice) which fail to tackle the issue. Therefore, future EU policies should recognize the link between fuelwood and energy poverty in a way that offers a gradual and supporting phase-out of fuelwood that does not endanger the livelihood of the energy vulnerable, while ensuring the progress of the SDGs.

Funding

This work was supported by ENGAGER 2017-2021, COST (European Cooperation in Science and Technology – www.cost.eu), grant number CA16232. The Centre for Social Sciences supported the open-source funding.

Declaration of competing interest

The authors declare that there is no conflict of interest.

Data availability

The authors do not have permission to share data.

Acknowledgments

This article is based upon work from COST Action European Energy Poverty: Agenda Co-Creation and Knowledge Innovation (ENGAGER 2017-2021, CA16232) supported by COST (European Cooperation in Science and Technology – www.cost.eu). Ana Stojilovska is grateful for the support provided by the Centre for Social Sciences, Hungary, and the Central European University Doctoral Stipend. Dušana Dokupilová thanks to the support of VEGA grant no. 2/0186/21. Anna Zsófia Bajomi would like to thank Lea Kőszeghy, Centre for Social Sciences, Hungary, and lead of the "Societal challenges of energy use" project supported by the Incubator – Collaborative Research Fund. Sergio Tirado-Herrero acknowledges funding from the European Union's Horizon 2020 research and innovation program under the Marie Skłodowska-Curie (grant agreement TRANSFAIR No. 752870) and funding from the 'Ramón y Cajal' program supported by the Spanish Ministry of Science and Innovation (grant RYC2020-029750-I). João Pedro Gouveia acknowledges the support provided to CENSE by the Portuguese Foundation for Science and Technology (FCT) through the strategic project UIDB/04085/2020. The authors are grateful to Nina Kuklišová who proofread the manuscript. We would like to thank the four anonymous reviewers for their detailed and helpful comments. We would like to acknowledge our interviewees without whose insightful contribution this research would not have been made.

References

[1] European_Commission, Communication from the commission to the European parliament, the European council, the council, the European economic and social committee and the committee of the regions, in: The European Green Deal, 2019.
[2] European_Commission, COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE EUROPEAN COUNCIL, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS, REPowerEU Plan, 2022.
[3] Eurostat, Final energy consumption in households by type of fuel, 2022.
[4] S. Bouzarovski, S. Petrova, A global perspective on domestic energy deprivation: overcoming the energy poverty–fuel poverty binary, Energy Research & Social Science 10 (2015) 31–40.
[5] W. Anderson, V. White, A. Finney, Coping with low incomes and cold homes, Energy Policy 49 (2012) 40–52.
[6] A. Stojilovska, H. Yoon, C. Robert, Out of the margins, into the light: Exploring energy poverty and household coping strategies in Austria, North Macedonia, France, and Spain, Energy Research & Social Science 82 (2021), 102279.
[7] European_Environmental_Agency, Europe's Air quality Status 2022, 2022.
[8] S. Bouzarovski, S. Petrova, R. Sarlamanov, Energy poverty policies in the EU: A critical perspective, Energy Policy 49 (2012) 76–82.
[9] S. Bouzarovski, S. Tirado Herrero, S. Petrova, D. Ürge-Vorsatz, Unpacking the spaces and politics of energy poverty: path-dependencies, deprivation and fuel switching in post-communist Hungary, Local Environ. 21 (9) (2016) 1151–1170.
[10] I.K. Allen, Heated attachments to coal: everyday industrial breadwinning petro-masculinity and domestic heating in the Silesian lme, in: K. Iwińska, X. Bukowska (Eds.), Gender and Energy Transition: Case Studies From the Upper Silesia Coal-mining Region, Springer International Publishing, Cham, 2022, pp. 189–222.
[11] S.M. Chaudhry, M. Shafiullah, Does culture affect energy poverty?Evidence from a cross-country analysis, Energy Economics 102 (2021), 105536.
[12] T. Ariztia, F. Fonseca, O. Bernasconi, Heating ecologies: resituating stocking and maintenance in domestic heating, Energy Research & SocialScience 47 (2019) 128–136.
[13] S.T. Coelho, A. Sanches-Pereira, L.G. Tudeschini, J. Goldemberg, The energy transition history of fuelwood replacement for liquefied petroleum gas in Brazilian households from 1920 to 2016, Energy Policy 123 (2018) 41–52.
[14] A. Jagadish, P. Dwivedi, In the hearth, on the mind: Cultural consensus on fuelwood and cookstoves in the middle Himalayas of India, Energy Research & SocialScience 37 (2018) 44–51.
[15] A. Stojilovska, Energy Poverty in a subsistence-like economy: the case of North Macedonia, in: G. Jiglau, A. Sinea, U. Dubois, P. Biermann (Eds.), Perspectives on Energy Poverty in Post-communist Europe, Routledge, 2020, pp. 99–116.
[16] L. Middlemiss Who is vulnerable to energy poverty in the Global North, and what is their experience?, WIREs Energy Environ. n.d.n/a(n/a) e455.
[17] A. Stojilovska, Energy poverty and the role of institutions: exploring procedural energy justice – Ombudsman in focus, J. Environ. Policy Plan. (2021) 1–13.
[18] M. Feenstra, G. Özerol, Energy justice as a search light for gender-energy nexus: towards a conceptual framework, Renew. Sust. Energ. Rev. 138 (2021), 110668.
[19] L. Middlemiss, R. Gillard, Fuel poverty from the bottom-up: characterising household energy vulnerability through the lived experience of the fuel poor, Energy Research & SocialScience 6 (2015) 146–154.
[20] R.J. Heffron, D. McCauley, Achieving sustainable supply chains through energy justice, Appl. Energy 123 (2014) 435–437.
[21] K. Jenkins, D. McCauley, R. Heffron, H. Stephan, R. Rehner, Energy justice: A conceptual review, Energy Research & SocialScience 11 (2016) 174–182.
[22] G. Walker, R. Day, Fuel poverty as injustice: integrating distribution, recognition and procedure in the struggle for affordable warmth, Energy Policy 49 (2012) 69–75.
[23] S. Bouzarovski, N. Simcock, Spatializing energy justice, Energy Policy 107 (2017) 640–648.
[24] C. Robinson, D. Yan, S. Bouzarovski, Y. Zhang, Energy poverty and thermal comfort in northern urban China: a household-scale typology of infrastructural inequalities, Energy Build. 177 (2018) 363–374.
[25] S. Petrova, A. Prodromidou, Everyday politics of austerity: Infrastructure and vulnerability in times of crisis, Environ. Plan. C: Politics Space 37 (8) (2019) 1380–1399.
[26] A. Stojilovska, Synergies between heating and energy poverty - the injustice of heat, Central European University, Budapest, 2021.
[27] S.Tirado Herrero, Fuel poverty alleviations as a co-benefit of climate investments: evidence from Hungary, Department of Environmental Sciences and Policy, Central European University, Budapest, 2013.
[28] J. Clancy, V. Daskalova, M. Feenstra, N. Franceschelli, M. Sanz, Gender perspective onaccess to energy in the EU, 2017.
[29] K. Grossmann, G. Jiglau, U. Dubois, A. Sinea, F. Martín-Consuegra, M. Dereniowska, R. Franke, R. Guyet, A. Horta, F. Katman, L. Papamikrouli, R. Castaño-Rosa, L. Sandmann, A. Stojilovska, A. Varo, The critical role of trust in experiencing and coping with energy poverty: Evidence from across Europe, Energy Res. Soc. Sci. 76 (2021), 102064.
[30] OECD/IEA, Energy in the Western Balkans the Path to Reform and Reconstruction, IEA, 2008.
[31] World_Bank_Group, FYR Macedonia Green Growth Country Assessment, 2014.

[32] G.A. Wilson, Community resilience, globalization, and transitional pathways of decision-making, Geoforum 43 (6) (2012) 1218–1231.
[33] J.P. Baker, H. Berenbaum, Emotional approach and problem-focused coping: a comparison of potentially adaptive strategies, Cognit. Emot. 21 (1) (2007) 95–118.
[34] R.S. Lazarus, S. Folkman, Stress, Appraisal, and Coping, Springer, New York, 1984.
[35] T.K.M. Beatty, L. Blow, T.F. Crossley, Is there a 'heat-or-eat' trade-off in the UK? J. R. Stat. Soc., A: Stat. Soc. 177 (1) (2014) 281–294.
[36] L. Papada, D. Kaliampakos, Measuring energy poverty in Greece, Energy Policy 94 (2016) 157–165.
[37] M. Sharif, The Concept and measurement of subsistence: a survey of the literature, World Dev. 14 (5) (1986) 555–577.
[38] P. Ambrosio-Albala, L. Middlemiss, A. Owen, T. Hargreaves, N. Emmel, J. Gilbertson, A. Tod, C. Snell, C. Mullen, N. Longhurst, R. Gillard, From rational to relational: how energy poor households engage with the British retail energy market, Energy Res. Soc. Sci. 70 (2020), 101765.
[39] N. Teschner, A. Sinea, A. Vornicu, T. Abu-Hamed, M. Negev, Extreme energy poverty in the urban peripheries of Romania and Israel: policy, planning and infrastructure, Energy Res. Soc. Sci. 66 (2020), 101502.
[40] M. Njenga, J.K. Gitau, R. Mendum, Women's work is never done: lifting the gendered burden of firewood collection and household energy use in Kenya, Energy Res. Soc. Sci. 77 (2021), 102071.
[41] M. Moniruzzaman, R. Day, Gendered energy poverty and energy justice in rural Bangladesh, Energy Policy 144 (2020), 111554.
[42] K. Kaygusuz, Energy services and energy poverty for sustainable rural development, Renew. Sust. Energ. Rev. 15 (2) (2011) 936–947.
[43] M. González-Eguino, Energy poverty: an overview, Renew. Sust. Energ. Rev. 47 (2015) 377–385.
[44] M. Matinga, J. Clancy, Gender, Firewood and health: the potential of ethnography to inform policy and practice, in: J. Clancy, G. Özerol, N. Mohlakoana, M. Feenstra, L.S. Cueva (Eds.), Engendering the Energy Transition, Palgrave Macmillan Cham, 2020.
[45] I. Kyprianou, D. Serghides, S. Carlucci, Urban vulnerability in the EMME region and sustainable development goals: a new conceptual framework, Sustain. Cities Soc. 80 (2022), 103763.
[46] H. Thomson, R. Day, K. Ricalde, L.I. Brand-Correa, K. Cedano, M. Martinez, O. Santillán, Y. Delgado Triana, J.G. Luis Cordova, J.F. Milian Gómez, D. Garcia Torres, C. Mercado, M.E. Castelao Caruana, M.G. Pereira, Understanding, recognizing, and sharing energy poverty knowledge and gaps in Latin America and the Caribbean – because conocer es resolver, Energy Research & SocialScience 87 (2022), 102475.
[47] H. Wilhite, H. Nakagami, T. Masuda, Y. Yamaga, H. Haneda, A cross-cultural analysis of household energy use behaviour in Japan and Norway, Energy Policy 24 (9) (1996) 795–803.
[48] M. Westrom, Bathing in Japan: applying a practice theory vocabulary to energy use through ethnography, Energy Research & SocialScience 44 (2018) 232–241.
[49] A. Reckwitz, Toward a theory of social practices: a development in culturalist theorizing, Eur. J. Soc. Theory 5 (2) (2002) 243–263.
[50] E. Shove, G. Walker, What is energy for? Social practice and energy demand, Theory, Culture & Society 31 (5) (2014) 41–58.
[51] C. Bicchieri, The rules we live by, in: C. Bicchieri (Ed.), The Grammar of Society: The Nature and Dynamics of Social Norms, Cambridge University Press, Cambridge, 2005, pp. 1–54.
[52] I. Reeve, J. Scott, D.W. Hine, N. Bhullar, "This is not a burning issue for me": how citizens justify their use of wood heaters in a city with a severe air pollution problem, Energy Policy 57 (2013) 204–211.
[53] I.L.C. Connon, Transcending the triad Political distrust, local cultural norms and reconceptualising the drivers of domestic energy poverty in the UK, in: H.T. Neil Simcock, Saska Petrova, Stefan Bouzarovski (Eds.), Energy Poverty and Vulnerability a Global Perspective, Routledge, London, 2017, pp. 46–60.
[54] A. Sahlberg, B.S.A. Karlsson, J. Sjöblom, H. Ström, Don't extinguish my fire – understanding public resistance to a Swedish policy aimed at reducing particle emissions by phasing out old wood stoves, Energy Policy 167 (2022), 113017.
[55] M.C. LaBelle, Energy Cultures: Technology, Justice, and Geopolitics in Eastern Europe, Edward Elgar Publishing, 2020.
[56] J. Stephenson, B. Barton, G. Carrington, A. Doering, R. Ford, D. Hopkins, R. Lawson, A. McCarthy, D. Rees, M. Scott, P. Thorsnes, S. Walton, J. Williams, B. Wooliscroft, The energy cultures framework: exploring the role of norms, practices and material culture in shaping energy behaviour in New Zealand, Energy Research & SocialScience 7 (2015) 117–123.
[57] J. Stephenson, B. Barton, G. Carrington, D. Gnoth, R. Lawson, P. Thorsnes, Energy cultures: a framework for understanding energy behaviours, Energy Policy 38 (10) (2010) 6120–6129.
[58] H. Rau, P. Moran, R. Manton, J. Goggins, Changing energy cultures?Household energy use before and after a building energy efficiency retrofit, Sustainable Cities and Society 54 (2020), 101983.
[59] H. Dagdeviren, M. Donoghue, Resilience, agency and coping with hardship: evidence from Europe during the Great Recession, J. Soc. Policy 48 (3) (2018) 547–567.
[60] C. Ratner, Agency and culture, J. Theory Soc. Behav. 30 (4) (2000) 413–434.
[61] K. Frank, Agency, Anthropol. Theory 6 (3) (2006) 281–302.
[62] A. Horta, J.P. Gouveia, L. Schmidt, J.C. Sousa, P. Palma, S. Simões, Energy poverty in Portugal: combining vulnerability mapping with household interviews, Energy Build. 203 (2019), 109423.
[63] R. Chard, G. Walker, Living with fuel poverty in older age: coping strategies and their problematic implications, Energy Research & SocialScience 18 (2016) 62–70.
[64] N. DellaValle, People's decisions matter: understanding and addressing energy poverty with behavioral economics, Energy Build. 204 (2019), 109515.
[65] K. Hoff, J.E. Stiglitz, Striving for balance in economics: Towards a theory of the social determination of behavior, J. Econ. Behav. Organ. 126 (2016) 25–57.
[66] S. Todd, A. Steele, Modelling a culturally sensitive approach to fuel poverty, Struct. Surv. 24 (4) (2006) 300–310.
[67] S.K. Hards, Status, stigma and energy practices in the home, Local Environ. 18 (4) (2013) 438–454.
[68] N. DellaValle, V. Czako, Empowering energy citizenship among the energy poor, Energy Res. Soc. Sci. 89 (2022), 102654.
[69] K.F. Punch, Introduction to Social Research: Quantitative and Qualitative Approaches, 2nd ed., Sage Publications, London; Thousand Oaks, Calif., 2005.
[70] R.K. Yin, Case Study Research: Design and Methods, 3rd ed., Sage Publications, Thousand OaksCalif, 2003.
[71] I. Kyprianou, D.K. Serghides, A. Varo, J.P. Gouveia, D. Kopeva, L. Murauskaite, Energy poverty policies and measures in 5 EU countries: a comparative study, Energy Build. 196 (2019) 46–60.
[72] A. Stojilovska, R. Guyet, K. Mahoney, J.P. Gouveia, R. Castaño-Rosa, L. Živčič, R. Barbosa, T. Tkalec, Energy poverty and emerging debates: Beyond the traditional triangle of energy poverty drivers, Energy Policy 169 (2022), 113181.
[73] ENGAGER , Aims and Objectives, n.d.
[74] M.B. Miles, A.M. Huberman, J. Saldana, Qualitative Data Analysis: A Methods Sourcebook, 3rd ed., Sage Publications, Thousand OaksCalif, 2014.
[75] S. Bouzarovski, S. Tirado Herrero, The energy divide: Integrating energy transitions, regional inequalities and poverty trends in the European Union, Eur. Urban Reg. Stud. 24 (1) (2017) 69–86.
[76] S. Bouzarovski, Energy poverty in the European Union: landscapes of vulnerability, Wiley Interdiscip. Rev. Energy Environ 3 (3) (2014) 276–289.
[77] J.P. Gouveia, J. Seixas, G. Long, Mining households' energy data to disclose fuel poverty: lessons for Southern Europe, J. Clean. Prod. 178 (2018) 534–550.
[78] Eurostat, Arrears on Utility Bills - EU-SILC Survey, 2022.
[79] Eurostat, Inability to keep home adequately warm - EU-SILC survey, 2022.
[80] Statistics_Portugal, Survey on Energy Consumption in the Domestic Sector, 2021.
[81] Statistics_Portugal, Survey on Energy Consumption in the Domestic Sector, 2010.
[82] I. Antepara, L. Papada, J.P. Gouveia, N. Katsoulakos, D. Kaliampakos, Improving energy poverty measurement in southern European Regions through equivalization of modeled energy costs, Sustainability 12 (14) (2020) 5721.
[83] Slovak_Stastical_Office n.d. Houses - Basic Results.
[84] OpenEXP, European Energy Poverty Index, 2019.
[85] Slovak_Stastical_Office n.d. Dwellings by Type of Building, Occupancy and Construction Period - HC53.
[86] Slovak_Stastical_Office n.d. Forest Land Fund and Stand Soil.
[87] D. Dokupilová, D. Gerber, R. Filčák, Energetická chudoba na Slovensku 2020: Od analýz k odporúčaniam pre verejné politiky, 2020.
[88] Hungarian_Statistical_Officen.d. Data on Housing by Activity Status, Deciles.
[89] C. Weiner, T. Szép, The Hungarian utility cost reduction programme: an impact assessment, Energ. Strat. Rev. 40 (2022), 100817.
[90] A.Z. Bajomi, N. Feldmár, S. Tirado-Herrero, Will plans to ease energy poverty go up in smoke? Assessing the Hungarian NECP through the lens of solid fuel users' vulnerabilities, Sustainability 13 (23) (2021), 13047.
[91] A.Z. Bajomi, N. Feldmár, L. Kőszeghy, Trapped in politics energy poverty in Hungary, in: A.S. George Jiglau, Ute Dubois, Philipp Biermann (Eds.), Perspectives on Energy Poverty in Post-communist Europe, Routledge, London, 2020.
[92] A.Z. Bajomi N. Feldmár n.d. Housing quality and energy poverty, Habitat.
[93] B.S. CEE, Country Analysis – Hungary Final version BIO SCREEN CEE, 2021.
[94] Hungarian_Statistical_Office, The standard of living of households, 2016.
[95] Federal_Ministry_Republic_of_Austria, Integrated National Energy and Climate Plan for Austria, 2019.
[96] K. Eisfeld, S. Seebauer, The energy austerity pitfall: linking hidden energy poverty with self-restriction in household use in Austria, Energy Res. Soc. Sci. 84 (2022), 102427.
[97] T. Berger, A. Höltl, Thermal insulation of rental residential housing: Do energy poor households benefit?A case study in Krems, Austria, Energy Policy 127 (2019) 341–349.
[98] Skopje_se_zagreva, Skopje Heats Open Data, 2017. https://www.skopjesezagreva.mk/otvoreni-podatoci/.
[99] European_Commission, Unfair transitions? A critical examination low-carbon energy pathways in the EU from a domestic energy vulnerability perspective, 2020.
[100] J.P. Gouveia, P. Palma, S.G. Simoes, Energy poverty vulnerability index: a multidimensional tool to identify hotspots for local action, Energy Rep. 5 (2019) 187–201.
[101] Habitat_for_Humanity_Hungary , Heat Column - Modern, Cost-effective Wood-burning Stove (Hőoszlop – Korszerű, költséghatékony, fatüzelésű kályha), n.d.
[102] A.C.G.M. Robben, J.A. Sluka, Ethnographic Fieldwork : An Anthropological Reader, Blackwell Pub, Malden, MA, 2007.
[103] J.P. Spradley, The Ethnographic Interview Holt, Rinehart and Winston, New York, 1979.
[104] M. Moezzi, K.B. Janda, S. Rotmann, Using stories, narratives, and storytelling in energy and climate change research, Energy Research & SocialScience 31 (2017) 1–10.

[105] J. Thomas, A. Harden, Methods for the thematic synthesis of qualitative research in systematic reviews, BMC Med. Res. Methodol. 8 (1) (2008) 45.
[106] P.S. Hinds, R.J. Vogel, L. Clarke-Steffen, The possibilities and pitfalls of doing a secondary analysis of a qualitative data set, Qual. Health Res. 7 (3) (1997) 408–424.
[107] S. Moles-Grueso, A. Stojilovska, Towards spatializing consumer energy sustainability. Empirical findings about the policy and practice of energy conservation and poverty in Barcelona and North Macedonia, J. Environ. Policy Plan. (2021) 1–14.
[108] S. Tirado Herrero, D. Ürge-Vorsatz, Trapped in the heat: a post-communist type of fuel poverty, Energy Policy 49 (2012) 60–68.
[109] E. Roberts, Warming with wood: exploring the everyday heating practices of rural off-gas households in Wales, Energy Policy 142 (2020), 111451.
[110] J. Harris, H. J., M. H., J. R., O. T., M. S., Health, mental health and housing conditions in England, Research for the eaga Charitable Trust by theNational Centre for Social Research, 2010.
[111] C. Liddell, C. Morris, Fuel poverty and human health: a review of recent evidence, Energy Policy 38 (6) (2010) 2987–2997.
[112] M.T. De Haro, A. Koslowski, Fuel poverty and high-rise living: using community-based interviewers to investigate tenants' inability to keep warm in their homes, J. Poverty Soc. Justice 21 (2) (2013) 109–121.
[113] F. Bartiaux, C. Vandeschrick, M. Moezzi, N. Frogneux, Energy justice, unequal access to affordable warmth, and capability deprivation: a quantitative analysis for Belgium, Appl. Energy 225 (2018) 1219–1233.
[114] N. DellaValle, S. Sareen, Nudging and boosting for equity?Towards a behavioural economics of energy justice, Energy Research & Social Science 68 (2020), 101589.
[115] V. Pellicer-Sifres, N. Simcock, A. Boni, Understanding the multiple harms of energy poverty through the Nussbaum's theory of central capabilities, Local Environ. (2021) 1025–1041.
[116] J. Frankowski, S. Tirado Herrero, "What is in it for me?" A people-centered account of household energy transition co-benefits in Poland, Energy Research & SocialScience 71 (2021), 101787.
[117] Official_Journal_of_the_European_Union, DIRECTIVE 2009/125/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products, 2009.
[118] G. Arabatzis, K. Kitikidou, S. Tampakis, K. Soutsas, The fuelwood consumption in a rural area of Greece, Renew. Sust. Energ. Rev. 16 (9) (2012) 6489–6496.
[119] N. Simcock, J. Frankowski, S. Bouzarovski, Rendered invisible: institutional misrecognition and the reproduction of energy poverty, Geoforum 124 (2021) 1–9.
[120] S. Petrova, Encountering energy precarity: geographies of fuel poverty among young adults in the UK, Trans. Inst. Br. Geogr. 43 (1) (2018) 17–30.
[121] H. Wilhite, Energy consumption as cultural practice: implications for the theory and policy of sustainable energy use, in: S. Strauss, S. Rupp, T. Love (Eds.), Cultures of Energy Power Practices Technologies, Routledge, New York, 2013.