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The links and entanglements of energy vulnerability: Unpacking the consequences of the energy crisis in Denmark

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ABSTRACT

In 2022, energy prices rose markedly across Europe, impacting household budgets and everyday energy practices and providing an interesting backdrop for research on energy vulnerability. While such research is an established field throughout many European countries, there is limited research within the Nordic countries. In Denmark, the energy crisis during the winter of 2022/2023 led to increased political attention on new topics relating to vulnerable households and energy security.

In this paper, we use the recent energy crisis to elucidate the complex links of energy vulnerability in Denmark through rich qualitative and quantitative material. Using data from a survey questionnaire and household interviews conducted during Winter 2022/2023, we identified that feelings of high financial stress and not being able to afford to maintain comfort standards any longer are indications of energy vulnerability and that this is more prevalent in low-income households and for younger Danes (<40y), families with one or more children, and tenants. Moreover, through four case stories, the paper illustrates how Danish households experience energy vulnerability in everyday life and how they cope with constraints in their energy use and respond to the challenges of rising energy prices.

The paper contributes to the existing literature by presenting experiences of energy vulnerability in a Nordic welfare context and by identifying variation in experiences across household groups, which highlights the complexity of energy vulnerability. Despite high levels of energy efficiency, (relatively) affordable energy costs, and social welfare, energy vulnerability is present in Denmark, not least when energy prices increase rapidly.

1. Introduction

Energy vulnerability or energy poverty, especially in relation to heating demand, has been widely investigated in Europe [1–4] and the USA [5,6]. Although Nordic countries are included in several studies based on Eurostat data [7,8], energy vulnerability has received little attention in this context, and few studies have addressed the occurrence of energy vulnerability in Nordic countries or analysed personal experiences of energy vulnerability. Recent exceptions are Bonderup and Middlemiss [9], who focused on the connections between energy poverty and unhealthy housing, Gram-Hanssen et al. [10], who focused on energy justice in heat metering in residential apartment buildings in Denmark, and Bredvold and Inderberg [11], who identified coping strategies among energy-vulnerable households in Norway. In addition, Danish studies have found that the relationship between energy prices and energy consumption differs for low-income groups [12,13]. However, to our knowledge, no study has investigated energy poverty or vulnerability as such in Denmark. A European Commission document points out that *"energy poverty among Danish households remains to date a largely unexplored topic"* [14]. The novelty of this paper is to provide in-depth knowledge about energy vulnerability in Denmark and to add to the wider literature by unpacking the links and entanglements of energy vulnerability with other types of vulnerability, leading to a conceptual development of energy vulnerability.

During times with increasing costs of energy consumption, like the winter of 2022/2023, more households can be expected to experience some form of energy deprivation. This paper delves into the situation of Danish households during the recent energy crisis and describes how the changing energy landscapes of Europe can signify a growing deprivation in energy use and household heating. The paper explores how Danish households experienced vulnerability connected to energy deprivation during the winter of 2022/23. We focus on households' energy use for

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heating, which involves different types of heating supply, as well as other everyday energy-related practices in the households affected by the crisis. Furthermore, we focus on perceived vulnerability rather than objective economic factors. We thus define households as energy vulnerable if they experienced themselves as financially affected by the energy crisis and had to impose restrictions in their everyday consumption of energy and other expenditures such as food. This definition does not include a specific economic threshold for being energy vulnerable, thereby highlighting the complexity of defining energy vulnerability, as it relates to a complex entanglement of vulnerabilities.

Denmark is known as a frontrunner nation on energy efficiency [15] and is ranked second on the overall energy trilemma rankings of 2022, indicating a solid performance on energy security, energy equity, and environmental sustainability [16]. In line with this, the percentage of households reporting that they are 'Unable to keep adequately warm' is generally lower than the EU averages [1, see also the Energy Poverty Advisory Hub]. Furthermore, Denmark has a widespread rollout of fourth-generation district heating, i.e. systems that integrate smart thermal grids [17], and smart electricity meters that enable hourly electricity pricing [18]. Like other European countries (e.g. the UK [19]), Danish households experienced rising costs during 2022 and 2023. According to the Danish Consumer Price Index (StatBank Denmark, PRIS111), energy and food prices increased substantially from early 2022 to 2023. This price increase rendered energy visible rather than invisible as it often would be [20], which brought energy vulnerability to public attention in Denmark (Anonymised for peer review).

Our study is focused on energy practices within the home during the energy crisis. The paper uses survey data and qualitative interviews to understand energy vulnerability in Denmark, through the research question: How do Danish households experience energy vulnerability, and how do they cope with constraints in their energy use, responding to the challenges of rising energy prices? Below we present a literature review followed by a method section. The analysis is divided into a quantitative part based on survey data and a qualitative part based on interview data. The paper ends with a discussion and conclusion.

2. Conceptual literature review: energy poverty and energy vulnerability

Recognition of social groups and their specific needs, as discussed in the energy justice literature [21], is closely connected to issues of fuel poverty, which has historically been thought of as a lack of information and energy efficiency in buildings and appliances of the energy poor, rather than recognising the different needs of different socio-economic groups in terms of energy use and heating. For example, elderly people and people with chronic illnesses might need higher room temperatures to support their comfort and health [10,21,22]. In addition, different social groups might have different competencies and resources to act on available information on poor housing or energy conditions. Recognising the specific needs and challenges of different social groups is fundamental to ensuring energy justice and reducing fuel poverty [21].

Fuel poverty has been widely used as a concept to describe the financial inability of households to heat their home to an adequate, healthy, and comfortable level [23]. Fuel or energy poverty is often linked with energy-inefficient buildings, high energy costs, poverty, poor health outcomes due to cold and damp homes, and excess mortality over winter [8,9,23]. The concept of fuel poverty has been broadened to energy poverty to encompass all energy types and services, e.g. addressing households' inability to sufficiently cool down homes in warmer climates, which may result in similarly severe health outcomes [23]. However, the two terms have also been used interchangeably [8]. Bouzarovski and Petrova argue that both fuel and energy poverty can be considered "*as a set of domestic energy circumstances that do not allow for participating in the lifestyles, customs, and activities that define membership of society*" [4]. As such, fuel and energy poverty implies a situation where the household cannot maintain their everyday life on the same level as others.

Thomson et al. [8] found a higher incidence of poor physical and mental health among energy-poor households compared to non-energy-poor households in most European countries. Robinson [2] investigated how energy poverty is shaped by socio-spatial gender relations in England and how aspects of being vulnerable to energy poverty are unevenly distributed. The perspective goes beyond the household to recognise energy vulnerability on an individual level and points to five dimensions of gendered and socio-spatial vulnerability: exclusion from the "productive" economy (e.g. part-time work, full-time education), unpaid reproductive and care work (incl. Greater exposure to energy vulnerability due to more time spent at home), exposure to physiological and mental health impacts (e.g. increased sensitivity to ambient temperatures or pressure to cope with negative changes), lack of social protection or financial support during a life course, and coping and helping others to cope [2]. Incorporating the concept of vulnerability to describe households' energy deprivation broadens our understanding of the factors involved in their disadvantaged situations beyond housing characteristics, household income, and energy prices to socio-material and socio-technical configurations of e.g. infrastructures, tenure arrangements, and social norms [2,4,24]. Thus, research shows that energy vulnerability might have negative consequences on comfort, well-being, health, and social life, particularly for already financially distressed households [25].

Middlemiss and Gillard [1] explored a definition of energy vulnerability bottom-up; i.e. the lived experiences of fuel-poor households' in terms of vulnerabilities and challenges related to energy use at home. This is similar to what we intend to do in this paper. Firstly, Middlemiss and Gillard [1] define fuel poverty as a state of being that *"captures the inability of certain households to acquire the energy services to live a decent and healthy life"*. Consequently, fuel poverty is a condition or a state, while energy vulnerability is a sensitivity towards changes and capacities to act and adapt according to specific life and housing circumstances or situations [1,4]. They identified six vulnerability challenges in fuel-poor households, all of which are challenges to energy use: 1) quality of dwelling fabric, 2) energy costs and supply issues, 3) stability of household income, 4) tenancy relations, 5) social relations within and outside the household, and 6) ill health. These challenges describe daily life and struggles related to energy use in fuel-poor households and are useful, both in assessing energy vulnerability at a household level, but also in indicating structural causes of vulnerability [1]. The paper highlights that experiences of energy vulnerability are multidimensional and dynamic due to the many factors involved, such as the energy efficiency of the home and its technologies, as well as social relations in and around the household.

Following this, we will use energy vulnerability as a term that describes a vulnerable position experienced by households due to a dramatic rise in prices during an energy crisis. The focus is thus on the multidimensional experiences of energy vulnerability, as described by the respondents themselves, as these households were affected by a range of different parameters during the crisis. Energy-vulnerable households are vulnerable when changes occur and their situation is altered e.g. in relation to income, building standards, energy supply and prices, or the social dynamics of the household. As Middha and Willand [26] argue, it is not as simple as 'eat or heat', as *"the literature lacks an understanding of the nuances and lived experiences of intersecting hardships"*. Our study adds to this understanding.

3. Methods and data

The paper builds on a mixed-methods design combining survey questionnaire data and in-depth interviews to explore how households' everyday practices were affected by the energy crisis and describes energy vulnerability experienced during the energy crisis. By relying on self-reporting, the study's methodology can be referred to as a subjective

approach to identifying energy vulnerability [27].

The survey was part of an international study using the same procedure and questionnaire in different European countries. However, this paper is based solely on the responses from Denmark. The questionnaire was constructed based on previous literature and conducted through computer-assisted web interviews, which an experienced consultancy was contracted to carry out. The respondents were adults (18 years or older) residing in Denmark at the time of the interview (March 2023). They were sampled according to household income to ensure an equal number of respondents per household income quintile. Responses stopped being collected once 1000 respondents were reached. The survey questionnaire covers themes of reactions and attitudes concerning the energy crisis, including perceptions of the household and societal situation. Some questions required standardisation to accommodate variation in the sample, e.g. the questionnaire addressed water heating and space heating separately although these are often billed jointly in Denmark. We took such adjustments into account when interpreting the results. The responses from the survey were used for factor analysis and multiple regression analysis. The factor analysis used a non-iterated principal axis method [28], also known as the principal factor method, where the covariance of items is computed based on squared multiple correlations. One underlying factor was retained from the covariance of seven questions (items) on reactions to rising energy prices. The retained factor was used to construct a variable to indicate variation in energy vulnerability using the regression method, where the contribution of each item (question) was weighted based on its correlation with the underlying factor, which constructed a variable with a mean close to 0 and a standard deviation close to 1 [29]. As the standard deviation is rarely exactly 0 because the estimation method does not find an exact solution to the factor model [30], the variable measuring energy vulnerability was rescaled to have a standard deviation of 10, while retaining the mean at 0, resulting in a minimum value of −15.8 and maximum value of 24.4 (see Appendix IV). The multiple regression analysis was used to estimate the correlation between the constructed variable of energy vulnerability from the factor analysis, and a list of characteristics, such as household income, age, and gender. In addition, marginal means were estimated to compare energy vulnerability, i.e., scores on the factor variable across groups indicated by the characteristics.

The interview study consists of 30 semi-structured interviews with households experiencing increases in heating and energy prices. We mainly recruited interviewees residing in areas without district heating because people in areas with district heating generally did not experience the same high increases in price as those with other types of heating, especially gas heating. The interviews were conducted in the participants' homes and included home tours where the participants showed the interviewer around their home and explained how they used the different rooms and how they heated the home, etc. The 30 households were selected to represent variation in terms of socioeconomic resources, demographics, and housing type. About a third of the households said that they had become more financially vulnerable during the energy crisis. The recruitment process included different strategies, but recruitment was primarily done through social media. Recruitment aimed to, on the one hand, reach households who were hit particularly hard economically (e.g., recruitment through a Facebook group about food waste) and on the other hand reach households who were explicitly interested in environmental issues (e.g., recruitment through a Facebook group about green energy). The group of vulnerable households proved more difficult to reach and therefore personal networks, field trips, and contacts in social housing organisations were also used in the recruitment process. When recruiting vulnerable households, we asked them whether they had experienced rising energy bills, whether it had affected their everyday life, whether they were worried about their financial situation, and how worried they were, on a scale of 1 to 5, about being able to pay their energy bills in the near future. If they said yes to the first three questions and answered 4 or 5 to the latter, they were recruited as energy-vulnerable households. We acknowledge that we might not have reached the most marginalised households in Denmark through this process, e.g. we did not reach the homeless or low-income households living in low standard, private rental homes in the countryside. This paper centres on the interviewed households in the study who were most affected by the crisis, e.g. those who felt anxious about future energy bills, freezing in their homes due to lowered heat, or restricting their shopping and cooking activities.

While building on the whole dataset of vulnerable households, the analysis presents four case stories in-depth. Focusing on four cases allows us to present in detail how energy poverty is experienced in deprived households in Denmark. The cases were not selected to represent the broadness of our complete interview study, rather they are the households who expressed severe challenges in making ends meet because of the energy crisis. To identify these, the three authors involved in the qualitative study placed all 30 interviewees on a continuum regarding expressed vulnerability and deprivation. The four cases are thus interviewees who expressed the highest degree of economic deprivation, who had to make the most changes to their everyday lives, and who had to consider and limit their expenditures the most, thus affecting every aspect of their everyday lives. While interviewees could not be placed in a specific order on this continuum, groupings emerged along it. The four interviewees in this paper make up the group at the most deprived end of the continuum, and these turned out to be four women. The selected case stories are presented in Table 1. The recruitment process and the empirical basis are described in detail in (*Anonymised for peer review)*.

The mixed methods approach in this paper is based on a parallel or convergent mixed methods design [31]. The two methods have been conducted independently of each other but address the same research questions and were analysed within the same framework of energy and fuel poverty research. The findings have been analysed independently as a parallel mixed data analysis [32] before the results were combined in the discussion section. The purpose of integrating the two methods is triangulation [33], namely to shed light on the same phenomenon (energy vulnerability) using two methods to elucidate the phenomenon better. The survey provides insight into the broadness of the phenomenon of energy vulnerability in Denmark, while the interviews offer nuanced and in-depth insight into the experiences of the most deprived households. The mixed methods design thus adds to the robustness of the study by drawing on the complementary strengths of two methods.

4. Quantitative analysis of energy vulnerability

The survey asked respondents whether they had experienced rising energy costs in the last 10 months (since March 2022) across four types of energy use: water heating, space heating, electricity, and water. Out of the 1000 respondents, 914 stated that they had experienced increased prices for at least one type of energy use. Electricity was the most frequently mentioned energy type to have been subject to a price rise (86 %; see Appendix I). This indicates that the rising costs of energy resulted in Danish consumers experiencing higher expenses. Subsequent questions addressed how the respondents ($N = 914$) who had experienced increased energy prices reacted to the increased costs. From the eight statements presented in Fig. 1, the most frequent reaction was to try to save as much energy as possible, followed by trying to save on other expenses to cover the rising energy costs.

To investigate differences in energy vulnerability across various types of households, we constructed an underlying measure based on the eight statements from Fig. 1. An initial factor analysis showed that the statement ‘I am trying to save energy as much as possible’ correlated weakly with the underlying factor and had the weakest correlation with the other statements in a Cronbach's Alpha analysis (see Appendix II). This might be due to the construction of the statement, as it is unspecific, and because it is the one with which most respondents agreed. Therefore, we chose to exclude it from the factor analysis, and the underlying

Table 1
Overview of interviewees.

No.	Pseudonym	Housing type	Energy type	Occupation	Household	Recruitment
3	Camilla	Terraced SH	Gas	Homecare, children with a diagnosis	1 Adult, 2 Children	Through another participant
7	Amy	Apartment SH	Gas	1 on social benefit 1 in work	2 Adults, 3 Children	Café in social housing
13	Tara	Terraced PR	Electricity	Social benefit	1 Adult	Facebook: Stop Wasting Food
15	Lily	Detached OO	Gas and wood stove	Social benefit	1 Adult, 2 Children	Facebook: Stop Wasting Food

Abbreviations: HP = heat pump; SH = social housing; PR = private rent; OO = owner occupied. Pseudonyms represent the adult(s) taking part in the interview.

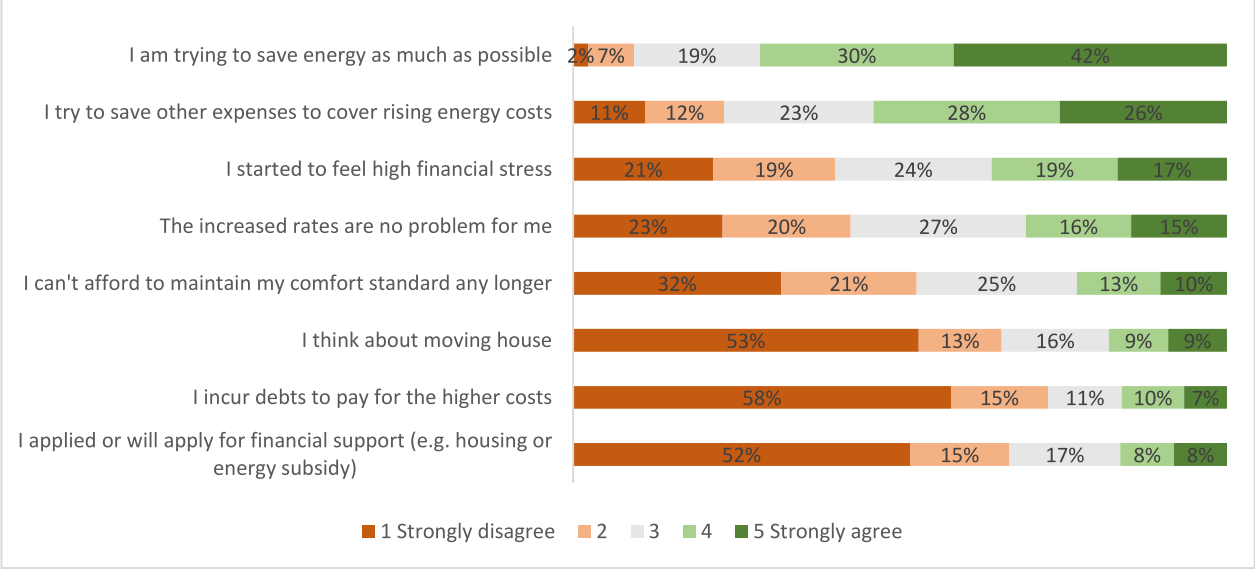

Fig. 1. Responses to statements following the introductory text: "What was your reaction to increased energy costs? Please indicate how much you agree with the following statements". $N = 914$.

factor was constructed based on the remaining seven statements. Indications of shared variance or covariance identified by Kaiser–Meyer–Olkin (KMO) and Cronbach's Alpha tests supported the construction of a factor (see Table 2).

In constructing an underlying factor indicating energy vulnerability, the scoring coefficients were used to weigh the contribution of the statements, as described in the methods and data section. The statements that contributed most to the factor were therefore those with the highest scoring coefficients. Two statements corresponded more strongly with the retained underlying factor, namely 'I have started to feel high financial stress' and 'I can't afford to maintain my comfort standards any longer'. This indicates that these variables are of the most importance in terms of the retained factor, or variable, measuring energy vulnerability. Three other statements correlated moderately strongly with the factor of energy vulnerability. These were 'I incur debts to pay for the higher costs', 'I applied or will apply for financial support (e.g., housing or energy subsidy)', and 'I try to save on other expenses to cover rising energy costs'. The statements that contributed least were 'I think about moving house' and 'the increased rates are no problem for me'.

Table 2
Results of the factor analysis, where items are sorted by scoring coefficient. The items consist of responses on a Likert scale (from 1 'Strongly disagree' to 5 'Strongly agree') to statements following the question: What was your reaction to increased energy costs? Please indicate how much you agree with the following statements. * Squared multiple correlations of variables with all other variables.

	Scoring coef.	Factor loadings
I have started to feel high financial stress	**0.307**	0.806
I can't afford to maintain my comfort standards any longer	**0.274**	0.795
I incur debts to pay for the higher costs	**0.199**	0.680
I applied or will apply for financial support (e.g., housing or energy subsidy)	**0.146**	0.606
I try to save on other expenses to cover rising energy costs	**0.131**	0.584
I think about moving house	**0.090**	0.499
The increased rates are no problem for me	**−0.089**	−0.473
Cronbach's alpha	0.823	
Kaiser-Meyer-Olkin measure of sampling adequacy (KMO)	0.841	
Eigenvalue	2.925	
No. of observations	914	

Fig. 2 compares scores for the energy vulnerability factor for the selected social groups of respondents in the form of marginal effects and predicted estimates, from Model 1 in Appendix III. Significant differences are marked with asterisks. A score above 0 means that this specific category tended to be more energy vulnerable on average, based on their own experience. Lower energy vulnerability is indicated by scores below 0.

The results show that low-income households, younger respondents, families with child(ren), and renters tended to be more energy vulnerable than their counterparts. On average, these groups agreed more strongly with the statements reflecting the impact of the rising energy prices, e.g., related to feeling high financial stress and not being able to afford to maintain comfort standards. Not surprisingly, the largest variations were found for household income, where the lowest income groups in quintile one (Q1) scored higher than all the other groups in this analysis, and the highest income groups in quintile four (Q4) and five (Q5) had significantly lower average marginal effects than the other income groups.

Studies on energy vulnerability and gender have shown that more women than men struggle to afford energy services that meet their

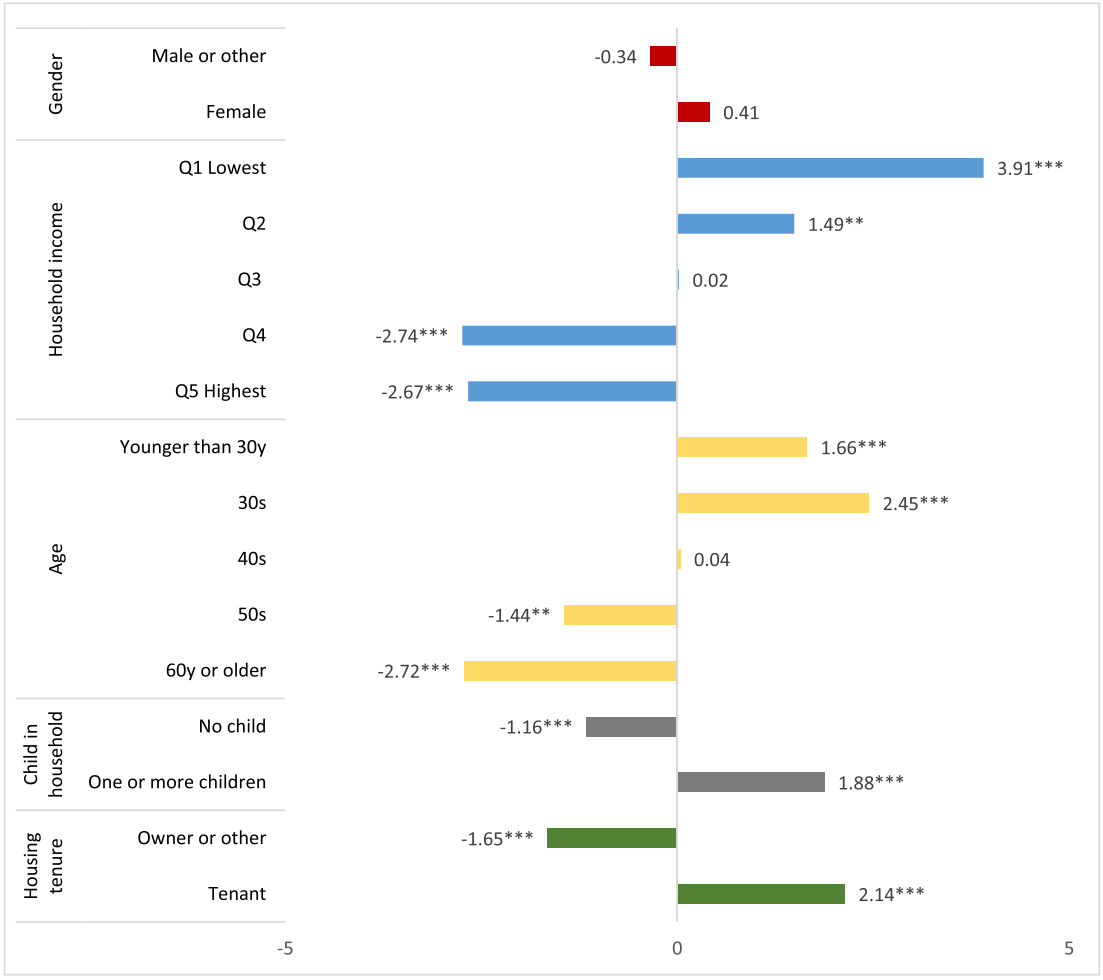

Fig. 2. Comparison of scores for the factor on energy vulnerability in the form of predictive margins from Model 1 in Appendix III. The factor was constructed to have a mean of 0 and a standard deviation of 10 (see Appendix IV).

needs, and more women than men head low-income families. Therefore, gender differences have been in focus [2,34]. In our qualitative study, four households were selected as the most deprived due to their expression of being severely affected by the energy crisis and rising prices. Three of these four are single women and two of them have children, illustrating how women, especially mothers, appear to be more vulnerable. It is therefore noteworthy that there is no significant difference between men and women in the energy vulnerability factor in this study (Fig. 2). However, as Appendix IV shows, women do seem to be more energy vulnerable on average compared to men. This is further supported in Model 2 in Appendix III, as this difference is significant at a 95 % confidence level. Fig. 3 illustrates an apparent gender difference before other circumstances, such as income and age, are taken into account, but when including other characteristics in the model, the gender difference decreases and becomes non-significant. This indicates that it is not gender that influences the experience of energy vulnerability, but rather the circumstances related to gender, e.g., that more women than men are sole parents (StatBank Denmark, FAM100N). That said, the estimates of e.g., low-income households are still stronger than for gender, suggesting that income is a more important parameter of experienced energy vulnerability.

The quantitative analysis of energy vulnerability pointed to three main indicators linked to the experience of energy vulnerability among Danish households: 1) I started to feel high financial stress (after energy prices increased), 2) I cannot afford to maintain my comfort standards any longer, and 3) I incur debts to pay for the higher energy costs. Furthermore, the analysis indicated that four groups in particular tended

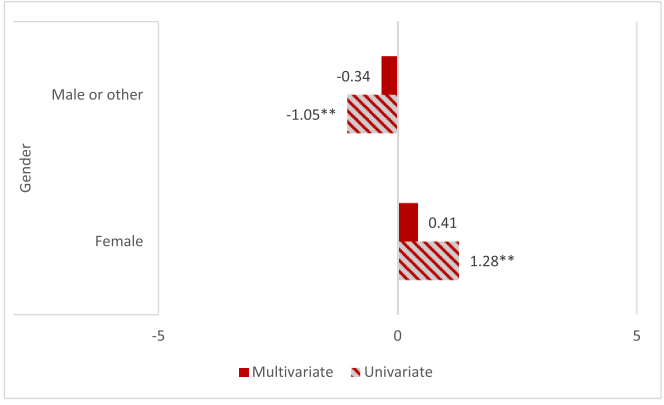

Fig. 3. Comparison of scores for the factor on energy vulnerability in the form of predictive margins for males and females from Models 1 (multivariate) and 2 (univariate) in Appendix III.

to experience energy vulnerability more than their counterparts. These were: 1) lower-income households, 2) younger respondents, 3) tenants, and 4) households with child(ren). It is especially interesting that older respondents (60 years or older) tended to be less energy vulnerable, as this contradicts the prevalent focus on the special needs of older people [22]. Instead, this might indicate that older people have social security, with options to make use of a heating subsidy.

5. Qualitative analysis of energy vulnerability

The quantitative analysis found that indicators of energy vulnerability were present in Denmark during the winter of 2022/23. The qualitative analysis will be used to describe the lived experiences of energy vulnerability. The cases present different ways that Danish households experienced being energy vulnerable, adding in-depth knowledge of specific experiences and practices to the quantitative patterns presented above for a better understanding of: how the interviewed households feel about experiencing energy vulnerability; what changes and compromises they make in their everyday lives, including energy-related practices; and what resources they have to cope with the new situation? These descriptions are used to nuance the picture of energy vulnerability and deepen the characteristics of the households that were most affected by the energy crisis.

The case stories are presented as vignettes to give thick descriptions of everyday life and situations within the households during the winter of 2022/23. The households were single women, some of them single mothers, and one family of two parents with three children living at home. Three of the households were renters (either private rental or social housing) living in an apartment or a semi-detached house. One household lived in an owner-occupied detached house.

Case 1. Single mother, terraced house with gas heating.

Camilla (I3) is a woman in her 40s living with her dog and two teenage children (14 and 16 years old). The children are both diagnosed with autism and cannot attend school full-time. Camilla is therefore paid by the municipality for taking care of her children at home. She explains that she is not allowed to have additional income and can therefore not supplement their finances. She received a heating subsidy offered by the Danish government only during the winter of 2022/23 for low-income households with heating sources that were affected by high price increases, such as gas. The family lives in a small town in a social rental terraced house from the 1980s. Like all the other units in the housing area, Camilla believes it needs repairs and modernisation. Camilla thinks that it lacks insulation in the floors and walls as they get very cold, and that the windows and outer doors need to be replaced as they are draughty. Ice forms on the inside of some windows. She has turned the heating down, but not so much that she and her children are freezing in the living room. She has bought slippers and blankets to help keep them warm and cosy. She is frustrated that the houses have not been renovated properly and that, as a renter, she cannot decide for herself how to improve the house and its heating. She is also frustrated that she does not have access to smart or real-time gas metering to monitor her consumption and therefore does not know the price of her annual gas bill until it arrives.

The rising energy prices have caused substantial worry, and the family has made significant changes to their everyday practices in order to use less energy. All electrical devices not in use are turned off, and on days when electricity prices are high, her son is not allowed to use his gaming PC. However, it is important for Camilla that her son can play computer games with his friends as it is his main social contact due to his diagnosis. Camilla follows electricity prices through an app, planning her washing, cooking, and baking according to these prices. She often cooks during the day if the prices are low, or prepares meals for several days at a time, and then heats food for dinner in the microwave. She likes to cook and bake but feels that she must make many compromises in terms of how she does this. However, she does not compromise on baking rye bread as her son does not like supermarket rye bread and therefore eats less healthily if they do not have home-baked rye bread. The family mostly watch television on smartphones that can be charged when prices are low. They charge power banks at night and use them to charge mobile devices when prices are high. Despite the compromises, Camilla says that in some ways she finds it interesting to see how much they can cut down on their consumption to make it more sustainable and help solve the energy crisis, although forced by their financial situation. Camilla has savings to draw upon for the next gas bill if need be. However, she prefers to keep her savings to allow her to repair the car if necessary or go on holiday with her children in the future. Therefore, she would rather make practical changes to her everyday life to reduce energy consumption, as it is difficult to put additional money aside in her current financial position.

"I think that if I hadn't had savings, then I would have had a crisis about how all of this should go. Also (…) you maybe don't go to – I don't know – Tivoli gardens or wherever else you want to go, because that has to be a luxury that happens when it's your birthday. So, you think that you need to spend your money in other places, so you can make ends meet. And there are many things you can think of that would be clever to do, but where you'd also like to live a little. If you can."

Case 2. Single woman, rented house with electric heating.

Tara (I13) is a woman in her 30s living alone with her dog and a canary in a privately rented, semi-detached house in a small town. She receives a disability pension and is therefore not allowed to earn additional money. She suffers from stress, anxiety, and a chronic health condition. She is very frustrated, angry, and emotionally affected by the crisis and very concerned about the rising energy prices and paying her bills. She did not receive a heating subsidy from the state as it was not aimed at households with electric heating.

Tara had received much higher electricity bills than anticipated as she moved into the house just prior to the crisis. She explains that she feels lucky to rent the home through family, as she has been able to postpone her monthly rent. To cover her bills, she has sold items that she could live without and cut down on everything. She has struggled to familiarise herself with the heating system and has changed her subscription with the electricity provider to save money. She maintains a low temperature but does not close off rooms in the house. Her chronic health condition means that she suffers from muscle pain and is sensitive to cold. Therefore, she sleeps with some heating on in the bedroom and uses two duvets.

Tara follows the electricity price on an app and tries to adjust her everyday practices (e.g., showering or brewing coffee) in line with the price dynamic. She expresses a deep concern about her electricity consumption for appliances, heating, and hot water, so besides turning down the heat, she has practically stopped using the oven and television, and tries to only use or charge one appliance at a time, deciding whether to charge her electric toothbrush, turn on the coffee machine, or wash the dishes. This is a rationalisation that allows Tara to feel that she takes control of her energy bill. She only uses a little light and tries to keep herself cosy with a head lamp and tealight candles. She is also very concerned about her grocery shopping, i.e. where to shop and what to buy in terms of cost-of-living prices. She has started to use "Stop Wasting Food", a volunteer-run organisation that distributes leftover food for free, although it is challenging her anxiety as well as her pride. Overall, she is very stressed by her financial situation due to both the energy crisis and the cost-of-living crisis and constantly weighs up whether an activity in the house or the use of an appliance is necessary at that precise moment. She says that she does not see herself as poor, but rather as temporarily in deep trouble.

"I prioritise all the time and it's actually about: do I want to fill a washing-up bowl with water to do the dishes, do I want to use the washing machine, or do I want to take a shower? Really, I try to do one thing each day. If I shower today, then I for instance can't do the dishes or cook. Simply so that I can fend for myself, to know that I've done what I can for these bills not to get out of hand, and it actually is like that. I really, deeply, hope that this is just for a period of time."

Case 3. Family with three children, rented flat with gas heating.

Amy (I7) is a woman in her 40s who lives with her husband and three children (5, 6, and 17 years) in a mid-sized town in a social housing rental apartment. She receives welfare payments and is undergoing a job capacity assessment, and her husband is in employment. Amy says that

she was very scared at first when the energy crisis hit the media, but that they were very lucky to have a one-year fixed electricity price that was renewed around the time when the crisis started. Therefore, they did not feel the rising energy prices much at first and they also did not start to reduce their consumption of energy. However, the price in their electricity scheme rose the following year, and as both their electricity and gas bills had increased at the time of the interview, the family was in a deprived financial position. They sometimes borrow money from Amy's parents and have had to skip paying for municipal childcare. In summer, Amy applied for summer holiday help from an NGO, which meant that they could take the children to an amusement park, as they did not have money to go on a summer holiday or take part in any activities with the children during the holiday.

The family's financial situation is very much related to the general cost-of-living crisis. Amy explains how they started buying mostly reduced-price food close to its use-by date, storing it in the freezer, and using fewer cold cuts for packed lunches. They have started to turn off televisions that are not in use, as well as turning off lights in rooms that are not being used, filling up the washing machine, cutting down on the use of the tumble dryer, and using their oven less. However, this family has a lot of electric appliances in their apartment (including four TVs). Due to anxiety and depression, Amy used to have the TV turned on when she was falling asleep to provide background noise and light but has since switched to having her phone on instead to save energy. The family generally keep temperatures low and use candles to help heat the living room. They use duvets on the sofa if they feel cold, and to increase the feeling of cosiness. They started closing the window blinds to keep the cold out and blocked the vents to avoid draughts. Amy acknowledges that some of their energy consumption was wasteful, but she also does not like to be forced to think so much about her energy use, while also feeling nervous about the prices rising even more, as she feels it puts extra pressure on her mental health. She mostly wishes that everything would go back to 'normal'.

"We just pay the bills, and then what's left is what we have to live off. So, we've always been good at shopping (…) for discounts and use-by-date items and meat close to its expiration date and then just freezing it, right. But I'd say… Now that we spend more money on the [energy] bill, but just generally everything is more expensive, then we have become better at buying use-by-date goods, more discount offers and only taking what you need. And then sometimes just thinking a little bit about when to cook and the thing about putting everything in one place [appliance] instead of starting four appliances to cook."

Case 4. Single mother, detached house with gas heating and wood stove.

Lily (I15) is a woman in her 50s who lives with her two teenage sons in an owner-occupied detached house in a village. She is on welfare payments and in a vocational rehabilitation programme. As soon as Russia invaded Ukraine and the media started reporting about rising gas prices (February 2022), Lily stopped using the gas stove for heating. At the time of the interview, it had not been turned on for about a year, even though she is still paying off the gas stove credit. Instead, the family heats the house with the wood stove in the living room, using only surplus and waste wood acquired for free through contacts in the local community. They heat water on the wood stove, as they turned off the hot water from the gas stove in the summer. They mainly shower at school, football practice, or the public swimming pool, or occasionally boil water in a kettle to mix with cold water for showering. Lily stopped using the cooker hood and started opening the window instead but is very concerned about indoor temperatures dropping too low, which could generate moisture, e.g., when cooking. She has made tealight heaters by placing a tealight candle on a saucer with an overturned flowerpot on top of it. These are used in the teenagers' rooms and in the bathroom as the only heating source. Lily spent a 135 EUR gift voucher she had received on tealight candles for these heaters. She feels in control by heating this way as she has already paid the expenses. She has calculated that this method can see the family through the winter. This method resembles prepayment energy, where it is not possible to use more energy than has already been purchased. She also often uses candlelight and lights with batteries as a source of light in the living room.

The family no longer have a freezer as Lily threw out their old chest freezer to save energy. She says that it fits well with their ambition to limit their meat consumption. She disassembled the desktop computer (her sons have laptops for use in their rooms), and the TV is only turned on when prices are low, and mainly to watch a film on special occasions (e.g., at Christmas). Otherwise, the family watches television together on a smartphone. Phones are all charged at night. Lily washes clothes during the night when the electricity prices are lowest. Sometimes, if prices are very low, she sets an alarm to wake her up in the middle of the night when the wash cycle is complete, then empties the washing machine and puts on a new wash. Clothes are hung to dry, and cooking is planned according to electricity prices. The family use "Stop Wasting Food" and are part of a local system to share leftover fruit and vegetables from a nearby grocery store through their social network. Lily received a winter grant from an NGO, amounting to 135 EUR for groceries and 135 EUR for clothes. This meant that her son could get a new pair of trousers. Lily has always been price conscious, but now it has become a necessity.

"There's a change in it because you have to look twice at things and even though I've always been price conscious. I haven't just picked things up, because I think also… It also becomes a kind of sport, but now it's just that the sport has become an absolutely mandatory part of everyday life and then it's not so fun anymore. But now it's necessary."

6. Discussion

As called for by Bredvold and Inderberg [11], this mixed methods study shed light on an understudied issue of energy deprivation in a Nordic context of wealthy countries, and the complex links between vulnerabilities that lead households to experience energy deprivation or vulnerability.

The quantitative data showed that almost three out of every four respondents tried to save as much energy as possible. The reasons for this could include financial necessity, sustainability considerations, or a combination of both. However, every two out of five respondents started to feel high financial stress, which indicates that many saved on energy as a necessity to keep their costs down. The case stories from the qualitative data provide an in-depth understanding of the lived experiences of being energy vulnerable. The four case-story households have similar characteristics. Three are single female providers, and two are also single parents. The characteristics of the case stories generally correspond with the characteristics of energy-vulnerable households identified in the quantitative material: relatively young (40s or below), tenants with a low income, with children living at home, and female. Similarly, Bredvold and Inderberg [11] found the most energy-deprived households in Norway to be low income, mainly dependent on social benefits or one sole provider, below pension age, and tenants living in energy-inefficient housing, defining these households as 'energy precarious'.

The qualitative analysis points to three main findings in relation to the households' experience of being energy vulnerable. Firstly, health issues influenced the households' everyday practices and their challenges in coping with the high energy prices. Illness is a parameter in everyday life in all households; either the women themselves had a chronic disease or mental health issue or their children had mental health issues. These health issues negatively affect their financial circumstances and ability to undertake a paid job (three of the women are on social benefits), and it influences their physical and mental resources for coping with the changing situation presented by the crisis. This is in line with previous research [10,21]. Furthermore, in some cases, health considerations trump financial considerations as the top priority, especially when these relate to children's health, as in Camillia's household.

Secondly, it was crucial to feel some control over the difficult situation by tracking consumption and potentially adapting accordingly or at least being prepared for the size of the bill. The qualitative data from the study showed that for many households, tracking the prices during the day and planning electricity use accordingly became a way to limit electricity expenditure during the crisis. The households with gas heating, such as Camilla's, could not track their consumption, which caused them to worry about the price of the annual bill. Consequently, they did not know how much their efforts to save on gas consumption mattered. Lily had simply turned off the gas stove altogether. For Tara, having electric heating meant that she could continuously assess the cost increases and that all her energy consumption was covered by one bill. As a consequence, her everyday practices were all affected by the high electricity prices, and she was constantly prioritising which appliances to use.

Thirdly, house ownership and housing standards play a central role. The survey showed that tenants experienced energy vulnerability more often than homeowners. Living in social housing means that you have less power to carry out renovations to make the house more energy efficient. Camilla, for example, is frustrated with her home's poor insulation. She wishes the housing organisation would replace the central gas stoves with heat pumps to provide a more affordable and green heating supply. Tara, renting a terraced house through family, feels lucky that she has been able to postpone the rent because of this relationship, but also feels ashamed to ask for a postponement. Lily feels empowered by owning her own home, but she also feels the heavy responsibility of making ends meet to pay the bills and keep the house, as well as keeping it well maintained.

As Middlemiss and Gillard [1] point out, energy vulnerability is dynamic and relates to more than energy prices. Our case study underscores this, as health issues, types of energy supply and pricing schemes, home ownership, and dwelling standards all play a central role, alongside household income, job situation, and social relations in and outside of the households, which are all entangled in a complex picture of feeling energy vulnerable. Furthermore, when energy prices rose, so did the price of food and everyday groceries. As a result, financial constraints might lead to prioritising between nutritious food and adequate energy service [26]. This was also revealed in the case stories, where financial constraints led to compromises in relation to food shopping and cooking habits, as they needed to save money on food because it had become more expensive, but also to cover rising energy costs. For some, the solution was to find as much free food as possible, making do with food from food-waste organisations, leftover food from local shops, or buying food nearing its use-by date. Cooking practices changed as well, with households planning their cooking strictly according to electricity prices, using less meat, cooking with only one appliance, or not cooking at all. Health also played a role here. For example, Camilla prioritised baking rye bread to support her sons' diet but prioritising nutritious food and health concerns affected their energy vulnerability.

The coping mechanisms for dealing with the high energy prices clearly affected the interviewees' ability to participate ‘in the lifestyles, customs, and activities that define membership of society’ [23]. In the quantitative analysis, more than half of the respondents indicated that they tried to save on other expenses to cover the rising energy costs. The interviewees had to make hard choices and live life differently than before and differently than most people they knew. In general, financial resources to help cope with the new situation were limited. While Tara, Lily and Amy had no more resources to draw upon, Camilla was trying to keep her savings to allow for future unexpected expenses or to be able to go on holiday with her children. In terms of mental resources for coping, Tara seemed to be on the verge of despair, seeing no more ways to save, while the others came across as less despairing despite their challenging situation.

To understand the variation in experiences of energy vulnerability, the quantitative study took a subjective approach, relying on self-reported agreement with seven statements that broadened the concept, compared to using Eurostat data, which often focus on an inability to keep adequately warm or arrears on energy bills [27]. This analysis showed that four groups are more likely to experience energy vulnerability during an energy crisis. Firstly, and as expected, we found that low-income households experienced energy vulnerability to a larger degree. However, somewhat surprisingly, younger respondents also appeared to be more vulnerable than older groups. This contradicts some previous studies [8] and might point to characteristics of this study within a Nordic welfare society, where the safety net to a greater extent covers the elderly, as also shown by Bredvold and Inderberg [11]. Thirdly, families with child(ren) seemed to be more energy vulnerable, as illustrated by the four case stories. Fourthly, renters seemed to be more affected than homeowners. The housing norm in Denmark is home-ownership if one can afford it, and for many, renting is therefore a consequence of limited financial resources. The qualitative analysis corroborated the quantitative findings on this, adding insights into the experience of renting during an energy crisis, where experiencing a lack of control was central.

Recent research has underscored the need for a gender-sensitive approach to energy vulnerability considering gender-related differences within the household. The quantitative data showed a convergence between being female and being energy vulnerable, and in the qualitative material, choosing the households that expressed the highest financial stress as case stories led us to four female interviewees. This should not, however, lead to a straightforward conclusion of gender being a cause of energy vulnerability. Rather, this study indicates that females are more energy vulnerable, not because they are female, but because they have a lower income and have sole responsibility for their children more often than men. The survey does not include enough single mothers/parents to quantitatively analyse this. Overall, however, our findings in many ways support Robinson's [2] identification of the dimensions of gendered and socio-spatial vulnerability, where the analysis showed that exclusion from the productive economy, caring work, mental health impacts, a lack of coping resources, and a lack of financial support were particular dimensions found in the study. These are positions often held by female householders, also in a Scandinavian egalitarian society.

7. Conclusion and policy implications

The rising energy prices during the winter of 2022/23 put additional pressure on households who were previously managing financially but with no or limited room in the budget for additional expenses. Energy poverty is a well-known phenomenon in many European countries, but in Denmark, deprivation related to energy use has received less attention. The novelty of our paper lies in exploring energy poverty among Danish households and using this to unpack the links and entanglements of energy vulnerability with other types of vulnerability, thereby developing the concept of energy vulnerability. Like in other countries where experiences of being unable to adequately heat one's home are relatively rare, the energy crisis beginning in 2022 meant that many households that were not previously energy poor became vulnerable to energy when prices increased. As mentioned in the methods section, we did not reach the most marginalised households through this study and therefore cannot generalise across all types of households in Denmark. However, the study shows that sudden changes like an energy crisis put households that would normally function financially into a position of experienced energy vulnerability, despite living in a rich Nordic country with high housing standards and a high level of energy security. These households indicated feeling high financial stress, challenges with maintaining their comfort standards, saving on other expenses, or even incurring debts to cover energy costs. Our analyses show that the households struggling the most are characterised more often than not by being lone parents living in rental housing, on benefits or in low-paid jobs, struggling with health issues (adults and/or children), and being

female. While most Danes felt the impact of the energy crisis, many could still manage, with some compromising to make ends meet. However, for a select group of people affected simultaneously by different challenges, the rising energy costs necessitated substantial sacrifices. As both data sets show, affected households tried to save as much as possible on energy costs and other expenses—especially food—to cover rising energy and living costs. It is also crucial to keep in mind the context. If the paper had been based on a comparison with a context outside of the Nordic welfare states, the Danish case would most likely be less dire. Energy poverty, like other kinds of poverty, is relative to one's situation and surroundings. However, in the case of a crisis, feelings of deprivation are also relative to the pre-crisis situation. More than one-third of survey respondents indicated that they had begun to feel financial stress. This was mirrored by the interviewees, who felt pressure and stress about their financial situation and worried about how they would be able to manage if prices did not decrease again. The sustainability gain from lowering their energy consumption was a bonus for some, but the direness of the situation seemingly made it difficult to appreciate this.

It is clear from the analyses that energy vulnerability cannot be seen as relating to energy prices alone. Being vulnerable arises from a combination of the financial situation and other factors such as health, housing standards, and assistance from social networks. When the price of energy increased, so did the price of everything else, leading to an overall feeling of financial stress among the participants. This also means that the strategies to deal with energy vulnerability do not relate to energy practices alone, but also include airing rooms (to avoid mould due to low temperatures), watching television, cooking, shopping, washing clothes, washing dishes, showering, and transport. Food shopping and food preparation practices were particularly affected.

The findings indicate that the experience of energy vulnerability resembles what has been found in other European countries [7]. This suggests that a more egalitarian Scandinavian welfare society still produces similar situations of energy deprivation, just on a smaller scale. The dwelling fabric, energy costs and supply issues, stability and amount of income, tenancy relations, social relations, and health issues are thus all challenges in vulnerable households, also in Denmark. However, the difference is that the deprivation may be less severe.

The recent energy crisis and general uncertainty over energy supply highlights the importance of energy in ensuring stable and well-working energy practices. Energy infrastructure supplying households with affordable, clean, and reliable energy is a critical infrastructure and must be treated as such. The findings of this study therefore have several policy implications.

Firstly, the study indicates a risk of energy crises tearing a hole in the welfare state net. Therefore, it is paramount to provide a rapid policy response if energy prices rise to aid households who are otherwise 'just getting by'. Households affected by a combination of challenges particularly require rapid assistance. Extraordinary heating subsidies are one solution, but attention is needed in terms of how quickly these are supplied, whether the amount is sufficient, and whether all eligible households receive it. Post crisis, energy-vulnerable households will have drawn upon all their back-up financial resources, including savings, selling items, and borrowing from friends and family, and are thus less prepared for future general or personal crises.

Secondly, while the increase in prices during the winter of 2022/23 was not a consequence of an environmental political attempt to lower consumption through taxation, our study can provide insight into the potential consequences of doing so. The study indicates that such attempts would likely lower consumption, but that households would be affected disproportionately, and it would create dire living conditions for some households, and more so for those who are already consuming less than the average, as we know income is a strong predictor of higher energy consumption. Such initiatives are thus likely to have a social bias that must be addressed politically.

Thirdly, avoiding households becoming energy vulnerable requires paying attention to the households' overall situation, as well as how this changes over time. Neither societal conditions nor household situations are static, and the need for assistance is therefore also not static. A household might not be permanently energy poor, but might be energy vulnerable, becoming energy poor at specific times. This can have substantial consequences both during and after, and therefore requires policy attention.

CRediT authorship contribution statement

Line Valdorff Madsen: Writing – review & editing, Writing – original draft, Validation, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Anders Rhiger Hansen:** Writing – review & editing, Writing – original draft, Visualization, Validation, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Rikke Skovgaard Nielsen:** Writing – review & editing, Writing – original draft, Validation, Software, Methodology, Formal analysis, Data curation, Conceptualization. **Kirsten Gram-Hanssen:** Writing – review & editing, Validation, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

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Data availability

Anonymised data will be made available in a research archive: https://zenodo.org/records/13847672.

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Appendix A. Appendix I

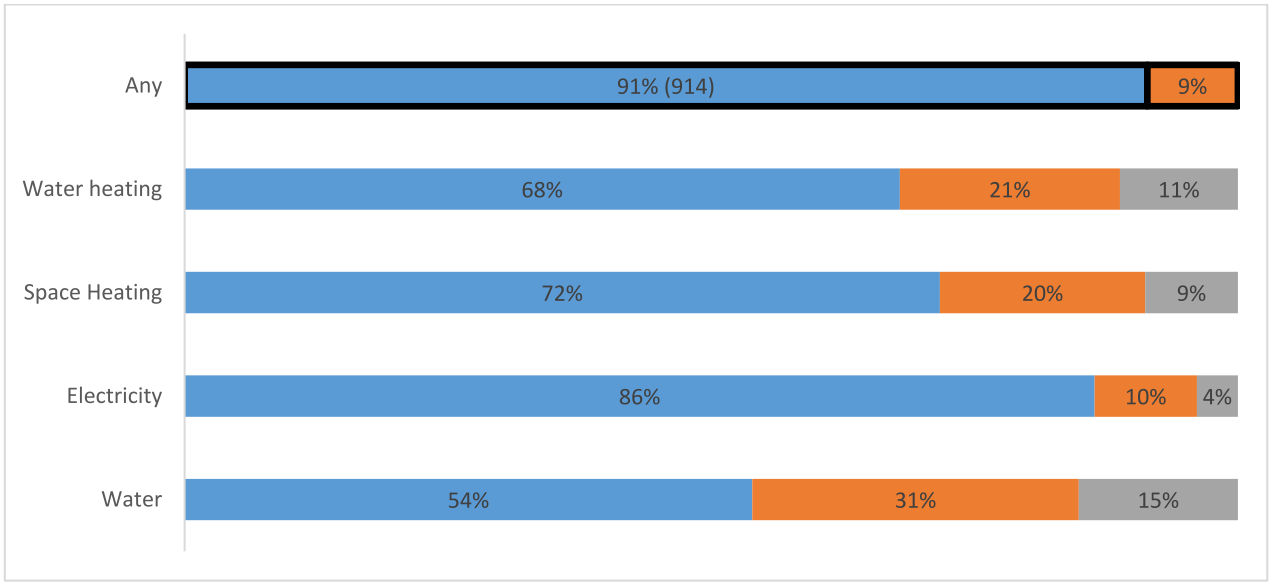

Fig. 4. Experience of rising energy costs during the crisis across types of resources. Responses to the question: "Did you experience a rise in your energy costs in the last 10 months (since March 2022)? [for…]", $N = 1000$.

Appendix B. Appendix II

Table 3
What was your reaction to increased energy costs? Please indicate how much you agree with the following statements.* reversed.

	Item-test correlation	Item-rest correlation	Average inter-item covariance	Alpha
I am trying to save energy as much as possible	0.378	0.235	0.706	0.823
The increased rates are no problem for me*	0.585	0.431	0.612	0.803
I incur debts to pay for the higher costs	0.684	0.562	0.575	0.783
I applied or will apply for financial support (e.g. housing or energy subsidy)	0.636	0.497	0.593	0.793
I have thought about moving house	0.572	0.413	0.618	0.805
I try to save on other expenses to cover rising energy costs	0.696	0.576	0.570	0.781
I can't afford to maintain my comfort standards any longer	0.813	0.728	0.516	0.757
I have started to feel high financial stress	0.832	0.750	0.500	0.752
Test scale			**0.586**	**0.810**

Appendix C. Appendix III

Table 4
Ordinary least-squares linear multivariate regression model estimates with robust standard errors and predictive responses derived from the linear regression using the delta method.

	Linear regression				Predictive margins			
	Coefficient	std. err.	t	P > |t|	Margin	std. err.	t	P > t
Gender								
Male or other (Ref.)					−0.340	0.404	−0.84	0.400
Female	0.754	0.618	1.22	0.222	0.414	0.452	0.92	0.360
Household income								
Q1	3.889	1.007	3.86	0.000	3.910	0.731	5.35	0.000
Q2	1.473	0.952	1.55	0.122	1.494	0.660	2.26	0.024
Q3 (Ref.)					0.021	0.676	0.03	0.975
Q4	−2.763	0.928	−2.98	0.003	−2.742	0.638	−4.30	0.000
Q5	−2.690	0.941	−2.86	0.004	−2.669	0.668	−4.00	0.000
Age (years)								
Younger than 30 (Ref.)					1.658	0.641	2.59	0.010
30s	0.789	0.933	0.85	0.398	2.448	0.694	3.53	0.000
40s	−1.618	0.978	−1.65	0.098	0.040	0.737	0.05	0.956

(continued on next page)

Table 4 (*continued*)

	Linear regression				Predictive margins			
	Coefficient	std. err.	t	P > |t|	Margin	std. err.	t	P > t
50s	−3.094	0.913	−3.39	0.001	−1.436	0.647	−2.22	0.027
60 or older	−4.373	0.974	−4.49	0.000	−2.715	0.709	−3.83	0.000
Child (<16 yrs) in the household								
No children (Ref.)					−1.156	0.394	−2.93	0.003
One or more children	3.034	0.712	4.26	0.000	1.879	0.539	3.48	0.001
Adults in the household								
One adult (Ref.)					−1.169	0.645	−1.81	0.070
Two or more adults	1.598	0.758	2.11	0.035	0.428	0.348	1.23	0.218
Housing tenure								
Owner or other (Ref.)					−1.651	0.427	−3.86	0.000
Tenant	3.790	0.740	5.12	0.000	2.140	0.523	4.09	0.000
Housing type								
Detached house (Ref.)					−0.599	0.491	−1.22	0.223
Terraced house	1.794	0.845	2.12	0.034	1.195	0.675	1.77	0.077
Apartment	0.765	0.836	0.92	0.360	0.166	0.579	0.29	0.774
Area								
Urban (Ref.)					−0.250	0.393	−0.64	0.524
Rural	1.198	0.819	1.46	0.144	0.948	0.699	1.36	0.175
Suburban/peri-urban	0.266	0.741	0.36	0.720	0.016	0.621	0.03	0.979
Constant	−3.485	1.230	−2.83	0.005				
R-squared	0.2167							
Number of observations	914				914			

Table 5
Ordinary least-squares linear univariate regression model estimates with robust standard errors and predictive responses derived from the linear regression using the delta method.

	Linear regression (OLS)				Predictive margins (delta-method)			
	Coefficient	std. err.	t	P > |t|	Margin	std. err.	t	P > t
Gender								
Male or other (Ref.)					−1.051	0.436	−2.41	0.016
Female	2.331	0.663	3.52	0.000	1.280	0.499	2.57	0.010
Constant	−1.051	0.436	−2.41	0.016				
R-squared	0.0135							
Number of observations	914				914			

Appendix D. Appendix IV

Table 7
Descriptive statistics for variables in Models 1 and 2.

Variable	Mean	Std. dev.	Min.	Max.
Energy vulnerability (factor)	0	10	−15.81	24.39

Table 6
Descriptive statistics for the factor measuring energy vulnerability.

Variable	Frequency mean	Frequency	Energy vulnerability mean
Household income			
Q1	0.197	180	4.125
Q2	0.197	180	1.935
Q3	0.211	193	−0.232
Q4	0.199	182	−2.678
Q5	0.196	179	−3.130
Gender			
Male or other	0.549	502	−1.051
Female	0.451	412	1.280
Age (years)			
Younger than 30	0.207	189	2.273
30s	0.210	192	3.201
40s	0.177	162	0.813
50s	0.186	170	−2.157

(*continued on next page*)

Table 6 (*continued*)

Variable	Frequency mean	Frequency	Energy vulnerability mean
60 or older	0.220	201	−4.027
Adults in the household			
One adult	0.268	245	0.445
Two or more adults	0.732	669	−0.163
Child (<16 yrs) in the household			
No children	0.619	566	−1.412
One or more children	0.381	348	2.297
Housing tenure			
Owner or other	0.565	516	−2.563
Tenant	0.435	398	3.322
Housing type			
Detached house	0.466	426	−1.861
Terraced house	0.185	169	1.703
Apartment	0.349	319	1.584
Area			
Urban	0.593	542	−0.110
Rural	0.152	139	0.043
Suburban/peri-urban	0.255	233	0.230

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