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# Energy poverty, power and capital: Moving beyond descriptive theories through the Swedish institutional case

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# ABSTRACT

Swedish multifamily housing is dominated by warm-rent apartments, where heating is included in the rent. This, together with low inequality and an extensive social security system, has been argued to protect a large part of the Swedish population from energy poverty. However, during the energy crisis of 2021–2023, energy poverty quickly rose on the public agenda. In this paper, we challenge the dominating "high-cost"-"low-income" understanding of energy poverty, and trace underlying causes rather than descriptions of what characterizes energy poor households in an attempt to learn from, and not just about, energy poverty. Based on a deductive analysis of oral histories of heating, we show that the absence of heating costs does not necessarily protect from energy poverty and that energy poverty can exist even when heating is provided through non-market institutions. Moreover, we use the Swedish case to argue for a new conceptualization of energy poverty, where rather than seeing energy poverty as being caused by high energy costs or needs, low incomes, or poor housing standards, it is a consequence of capital inequality. Thus, energy poverty should be seen as caused by the power households have over their indoor environment, and the mechanisms that distribute this power.

# 1. Introduction

In the classical Swedish play "The Pelican" by August Strindberg, set at the turn of the 19th century, a mother argues with her son over heating. He wishes to throw more wood onto the fire, he is freezing. She does whatever she can to stop him, repeating several times "And set fire to our money?" [own translation]. Eventually, the son snaps, throwing wood into the fireplace shouting: "No! But wood needs to burn to give heat! Be quick!"

Energy and money has a close relationship, both in terms of money giving heat as in the play above, and as symbols of power [1]. This is nowhere as obvious as in the concept of energy poverty. The energy poor, as a vulnerable group, has increased in political significance and in received academic attention over the past 30 years. Energy poverty is now mentioned in EU regulation, and member states are required to include considerations in national legislation and regulations [2–4]. Although no complete consensus around a common definition of energy deprivation or energy poverty exists, the EU has in their Revised Energy Efficiency Directive defined energy poverty as:

"[Energy] poverty' means a household's lack of access to essential energy services, where such services provide basic levels and decent standards of living and health, including adequate heating, hot water, cooling, lighting, and energy to power appliances, in the relevant national context, existing national social policy and other relevant national policies, caused by a combination of factors, including at least non-affordability, insufficient disposable income, high energy expenditure and poor energy efficiency of homes;"

While the political significance of energy poverty has increased across the EU, the same cannot quite be said about Sweden. In public and academic debate, this has been attributed to specific conditions of the Swedish context and housing stock. In the Swedish multifamily housing stock, the vast majority of apartments have heating included in the rent, and only a small share of said stock is fitted with individual metring and charging of heating [5]. These warm rents, historically low energy prices, and an extensive social security system, have all been used to argue that energy poverty is a practically non-existent issue in the Swedish context [6–8]. Energy poverty has however risen on the Swedish political agenda since the energy crisis of 2021–2023, when many households experienced severe electricity price shocks. Again, these debates centred around costs.

In her seminal work on fuel poverty in the UK, Boardman [9] argued that the main drivers behind energy deprivation are low incomes, high fuel costs, and energy-inefficient housing, factors that have recurred in

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the literature since as the "energy poverty triad". Of these three factors, her main concern was the quality of the housing stock [9,10]. In her reasoning, the housing stock needed to be improved to lift vulnerable households out of energy poverty, as they lacked the means to make these investments on their own.

This can be contrasted with the perspective of researchers such as Galvin [11], who convincingly argues that energy poverty, if defined by the traditional 10% energy burden, can be solved simply by redistributing income from high to low-income households. This also has the added benefit, he argues, of decreasing carbon emissions, as high-income households cause larger emissions than low and middleincome households. This puts income and income inequality, rather than housing and housing inequality, at the centre of the analysis.

These viewpoints are nuanced by researchers taking a vulnerability or assemblage approach, where energy poverty is seen as an intersection of multiple vulnerabilities [3,12,13]. A narrow conception of energy poverty, these researchers argue, misses the intersectional nature and causes of vulnerability. By adding differing energy needs, such as that of the chronically ill, gender differences, and the young and elderly, this perspective argues that more targeted policies can be designed. Assemblage perspectives take a similar intersectional approach, adding the non-human factors related to producing energy poverty, as Harrison and Popke state:

"As an assemblage, it is rather the outcome of the ways in which physical health, financial exigencies, social networks, the materiality of the home, and the infrastructure of energy provision interact to produce an uneven geographical landscape of energy cost and availability." [14, p. 954]

Moreover, these researchers tend to highlight structural causes such as privatization and municipalization of energy systems as important causes of energy deprivation [3,15]. In this conception, energy poverty is an infrastructural inequality [13]. These types of theories of causation, focusing on needs, suggest targeted interventions to help the most deprived households at the intersection of multiple deprivations.

There is however an issue with these three broad perspectives on energy poverty (energy inefficient housing, income inequality, and vulnerabilities), which we in this article wish to address. While these viewpoints use languages such as causes and drivers of energy poverty, they are much closer to descriptions of energy vulnerability. That the energy poor are in general low income, live in energy-inefficient housing, have larger energy needs, and that their difficult situation is aggravated by high energy costs, is undoubtedly the case. But why do low-income and vulnerable people live in poor housing? How come the housing was built poorly, or why has the necessary investment into upkeep and renovation been lacking? And the adjacent question, what causes energy price increases and shocks? This lack of an overarching causal theory of energy poverty is the gap we wish to fill in this article. Not only is a causal theory necessary for designing adequate policy measures that do more than "treat the symptoms" of energy poverty, it is also necessary if we wish to learn not only about energy poverty but also from energy poverty. A deeper understanding of root causes lets us in this way both alleviate household suffering, as well as gain an understanding of other household outcomes.

More than just adding to the literature on energy poverty, our perspective will also tie into the broad research on renovations in general. While power over renovations is well researched [16–18], as well as the role financial incentives and products play in these processes [19–21], there is a lack of research connecting energy poverty, power and capital distribution. To fill these gaps, the basis for this theory will be capital inequality and the conception of capital as power by Nitzan and Bichler [22]. We will ground our theory by basing our discussion on vulnerable households living in warm-rent apartments in Sweden, itself an unstudied case. Our empirical material is 23 oral histories gathered in Malmö in the context of the *Just Heat* project, chronicling heating history in Sweden, Romania, the United Kingdom and Finland.

The fact that heating, for a large portion of Swedish households, is not bought and sold on a traditional market, has been used by both academics and public administrators as a reason to believe that energy poverty is rare in Sweden [6,7]. If we believe in the traditional energy poverty triad, this would be true. But there is no a priori reason to believe that while heat (or more generally, energy) is provided through other mechanisms than a market, that this provision *necessarily* is adequate. As we will see below, this is in actuality not the case households do freeze under warm rent.

The fact that these households can be energy-poor or energyvulnerable, should come as no surprise based on now common definitions of energy poverty (see below). However, our explanatory models fall short of explaining why this could be the case. We will in this article explore energy poverty through the lens of differing access to capital, and the power that capital gives over conditions of the indoor environment. We ask: is energy poverty a type of capital poverty?

The article will be structured as follows: We begin in Section 2 to outline and present our theoretical framework of energy poverty as capital poverty. As part of this, we explain the Swedish institutional setting of warm and cold rent and their relationship to our framework. In Section 3, we present our data and our general empirical strategy. In Section 4, we present our results; in Section 5, we discuss these results; and draw our conclusions in Section 6.

# 2. Theoretical framework and institutional case

To re-conceptualize the cause of energy poverty, we can begin by considering what energy poverty is. Bouzarovski and Petrova define energy deprivation as: "the inability to attain a socially and materially necessitated level of domestic energy services." [12, p. 31]. This type of definition has the advantage of being institutionally and technologically agnostic, as well as relative in considering what is a necessary level of domestic energy services. It is also very clear what could constitute examples of this type of energy poverty, where households with excessively hot apartments in the summertime, cold homes during the colder months, or an inability to access energy for cooking could all be considered energy-poor. We will discuss heating as our main domestic energy service but will return to other forms of energy deprivation as well.

While the definition of energy poverty quoted above is agnostic of institutional settings, the commonly cited causes are not. In the energy poverty triad (as well as the addition of higher energy needs) lies the implicit assumption that energy is traded on a market. That high energy prices, low income, and energy inefficient homes (i.e. homes that require more purchased heat) together might either drain a household of its resources or leave it energy deprived, is only true under very specific institutional circumstances. If energy is provided by other means, such as collectively and locally owned infrastructure and power generation, or by the state free at end-use, then these drivers lose their causal link to household outcomes. On the contrary, these models would predict that a non-price-based system of allocation would eliminate the issue of energy deprivation.

This makes Swedish warm rent a particularly interesting institutional case. The vast majority of apartments (around 95%) are fitted with warm rent, meaning that around 50% of the households (and slightly less of the population) live in warm rent apartments. These numbers include both rental apartments and cooperative condominiums, so-called *bostadsrätter*. Pure owner-occupied apartments and cooperatively owned rentals do exist, but they constitute a very small portion of the housing stock. The rest of the stock is instead mainly constituted of owner-occupied single-family housing. Table 1 shows the share of warm rent per single-family housing and multi-family housing respectively, as well as the fuel and tenure types. Notable here is how dominating district heating is in the multifamily housing stock.

Warm rent is thus a large institution in the Swedish housing stock, historically advocated for on account of techno-economic as well as social grounds to promote energy-efficient and equal heating (for a historical review of the institution, see von Platten [24]). In the EU, J. Vahnberg and J. von Platten

#### Table 1

Descriptive statistics over the Swedish housing stock.

|                                    | Single-family housing | Multifamily housing |
|------------------------------------|-----------------------|---------------------|
| Inhabitants                        | 5.4 million           | 4,6 million         |
| Owner occupied/rental              | 97%/3%                | 46%/ 54%            |
| Low-income households              | 22%                   | 30%                 |
| Rural/urban                        | 27%/73%               | 18%/82%             |
| Share of warm rent                 | less than 3%          | 95%                 |
| Main heating source:               |                       |                     |
| District heating                   | 19%                   | 89%                 |
| Heat pump                          | 37%                   | 7%                  |
| Oil or gas                         | 4%                    | 1%                  |
| Electric heater                    | 31%                   | 2%                  |
| Biofuels (wood, pellets or biogas) | 9%                    | 1%                  |

Source: [23].

Sweden and Finland are alone in having such a large part of the housing stock with heating included in the rent [24]. Other countries do however, have cases where heating is included in the rent, such as the German "Warmmiete" (literally "warm rent") or the U.S., where around 11% of households had some parts of their energy bills included in their rent in 2009 [25]. This makes the case relevant both from a comparative perspective in contrast to the more common case of *cold rent*, as well as an example of the warm rent that does exist internationally.

For warm rent apartments, heating is not added to the individual household's bill based on their energy consumption (what is called "cold rent"). Instead, heating costs are a fixed part of the rent and are included in the yearly negotiations. These are most often conducted between the national rentals association, but sometimes between individual tenants and the landlord. In the case of cooperative condominiums, the board elected by the tenants sets the yearly fee, which together with capital costs for the households, comprises the total rent. Regardless of the procedure, the cost of heating does not vary month to month for the individual household, nor does the amount of heating they are provided with directly affect their housing costs. This shields households from the direct effects of energy price shocks (although these might affect them later through higher rent increases) and removes the financial incentive of decreasing heating when prices are high.

This institutional setting shifts burdens and incentives among tenants and landlords. Given that landlords pay the actual heating costs and tenants only indirectly pay the cost through rent, owners of rental apartments and cooperative organizations take on the liquidity risk in case of price shocks. Landlords and cooperatives also take on the incentive to increase the energy efficiency of the buildings, something repeatedly used as an argument in favour of the system [24,26]. In the case of rentals, energy retrofitting and renovations might however burden vulnerable households, causing rent increases and in the end higher housing costs [27].

Renovations and retrofitting are interesting aspects of the Swedish rental market. Due to the uniquely strong position of the tenants' union in Sweden [28], the union is consulted and involved in most rent increase negotiations. This includes renovations, as they might cause rents to increase. In an article on the subject, Bengtsson and Bohman [29] argue that while tenants formally are included in the process when discussing renovations, they have less influence over scope, but some over direction and outcome.

Another formal right relevant to our institutional case is the right to a minimum indoor temperature. In the Swedish National Board of Housing, Building and Planning's (Boverket) building regulation, spaces meant for dwelling are mandated to stay at the lowest 18 °C operative temperature [30]. This requirement is made stricter in the Swedish Public Health Agency's general advice of an indoor operative temperature for sensitive groups at 20 °C [31]. Indoor operative temperature differs from indoor ambient air temperature by being a weighted average between the mean radiant temperature and indoor ambient air temperature. With a colder outdoor environment, indoor operative temperature is by rule lower than indoor ambient air temperature. Yet, despite these regulations, the power imbalance between tenants and landlords can still offset tenants' rights, leading to landlords' objectives of energy savings compromising tenants' struggle for thermal comfort; a struggle in which they have very limited control and agency [32,33].

The interplay between these shifting incentives and formal rights constitutes the institutional setting we wish to explore through the conception of energy poverty as capital inequality. To sketch this conception, we begin with an overview of theories of capital, and how they pertain to energy poverty.

# 2.1. Housing, energy and capital

When considering capital in general, and energy poverty in particular, two broad conceptions are close at hand. One is that of physical capital. Buildings, energy systems, nuclear power plants, and electricity grids, are all part of the physical capital that produces adequate housing. In this conception of capital, capital is the physical means required to produce a given commodity. Neoclassical economists will simply call this capital (such as Solow [34]), Marx called this fixed capital, and it is in both economic theories seen to be used together with labour for production — they are *factors* of production.

A contrasting view of capital is that of *wealth*. In this view, exemplified by Piketty's work on income and wealth inequality, capital is a collection of financial assets [35,36]. Specifically, capital is the monetary value of stocks, bonds, property, deposit accounts and other more or less liquid assets. If income is the stream of money, capital is the stock. This view is also compatible with the view of capital as an ownership right generating an income stream, either through dividends or by capital realization.

The latter conception has the great advantage of being measurable, as well as comparable over time. While physical capital is indeed very real and necessary for production (i.e. we need buildings to produce housing), it has the disadvantage of not being comparable. This arises both from physical capital being inherently heterogeneous, but also as its value in the production process varies over time [37]. Financial assets are homogeneous at any given instant (in monetary values), and when seen as a share of the total wealth, comparable over time.

Had we wanted to measure physical capital, in our context the infrastructure delivering energy services to households such as district heating, housing, and electricity grids, we would have an identification problem. How do we measure the quality of energy infrastructure and the accessibility of energy thereof? In the specific, this might be possible by a range of technical estimates — in the aggregate, this is less feasible (or even possible). This is one way to describe the multiplicity of experiences of energy poverty. Inadequate provision through energy-inefficient housing is different from decaying energy infrastructure such as district heating in post-Soviet countries [15], as well as the recurring blackouts in northern Sweden [6]. Comparing these differing infrastructural deprivations is both a theoretical and empirical challenge.

What we can instead measure is the value accounted for in households' and firms' balance sheets. As pointed out by Richard and Rambaud [38], accounting standards are internationally standardized and rigidly enforced not only by governments but also by a range of private bodies. This means that the capital value of housing and energy infrastructure is accounted for in similar ways across economies. The accounted value is thus comparable (and has been made comparable by design). Concretely, the capital that we are comparing are ownership rights. In our case, it is a monetary value to property, district heating grids, electricity grids, and energy plants. As argued by Nitzan and Bichler [37], these ownership rights give owners power over the asset they own, as well as the people who are affected by it. Following this logic, we might not only want to look at households' income statements, but also their balance sheets.

This power bestowed by ownership rights, and recorded in balance sheets, determines market outcomes. In Nitzan and Bichler's [37] terminology, market outcomes are a question of a power struggle between competing firms as well as between firms and consumers. In times of inflation, they both argue and provide empirical evidence for the profit share of national income increases, as well as the profit of larger firms compared to smaller [22,37]. Price increases are redistributive. From this perspective, each price increase from a firm is an attempt to gain at the expense of consumers or other firms. This price increase could come in different forms, such as nominal increases, like recent price increases in Swedish district heating, or quality decreases, like volumetric decreases or planned obsolescence similar to what is being observed in post-Soviet district heating systems. The important takeaway is that prices (and provision) only partly depend on production costs and competition, and mainly depend on the ability to increase relative prices.

The second important takeaway from the perspective of capital as power is that the same relationship between production and prices exists between physical capital and financial value. Here, the value of an asset is "equal to the present value of the expected future earnings" [37, p. 356]. Not a controversial statement in and of itself, except the fact that this means that the actual physical properties of the asset are partially incidental to the valuation. More important are the nominal cash flows. Investment, renovation and upkeep in infrastructures such as housing and electric and district heating grids might not always be a good business strategy if they decrease this valuation.

Drawing from these theoretical conclusions, we can make predictions about the processes producing energy poverty. First, the costs households incur depend less on the production costs of energy or the amount of energy provided, but rather on the power struggle between households and energy providers. This power struggle need not relate to nominal prices on a market, but can just as well relate to the amount and quality of a product. As housing and energy infrastructure is *sticky* [23], in the sense that the built environment conditions market behaviour over time, and requires significant investment (in the financial or general sense) to change, both tenants and landlords (even in the case when they are the same household) are faced with options constrained by path dependence. We thus expect a similar power struggle over renovations and upkeep, both to the degree they are performed, as well as possible rent increases thereafter.

We will in the following parts of this paper begin to use this theoretical perspective of energy poverty as capital inequality to interpret the case of Swedish warm rent. When capital is considered as power, we can sketch the processes that produce energy vulnerability, and how they depend on the distribution of assets.

## 3. Data and method

The empirical material we use is 23 in-depth interviews conducted in the context of the research project *JustHeat: Looking back to move forward: a social and cultural history of home heating.* JustHeat is an interdisciplinary research project that explores the lived experiences of past home heating transitions with the aim to make upcoming transitions more just and inclusive [39]. The project spans across Sweden, Finland, Romania, and the UK and uses oral history methodology where participants "tell us in detail about their memories of keeping warm at home throughout their lives and the ways their lives have been affected by changes to home heating systems and routines" [40]. The oral history interview progresses through the homes the participant has lived in during their lives, letting them discuss their memories of domestic heating, with minimal participation of the interviewer. In total, JustHeat has collected 284 oral histories across the four countries, out of which 44 were collected in Sweden [39].

This paper draws on a sub-sample of 23 oral histories collected in and around the Swedish municipality of Malmö, the third-largest city in the country. Compared to other municipalities in Sweden, Malmö has high levels of inequality, making it an interesting geographical location to explore energy poverty as capital poverty and inequality. Participants were recruited through local community organizations and on an individual basis via various outreaching activities; as the inquiry was of qualitative nature, there was no aim to attain a quantitatively representative sample, but rather to speak to citizens in Malmö of various backgrounds, age, gender, and living (and housing) situations. The ages of the participants varied from around 20 to 90 years old, including students as well as pensioners.

Although the oral histories were carried out in accordance with the framing of JustHeat, the comprehensive scope of the interviews allows for secondary analyses of a myriad of inquiries related to home heating, such as energy poverty. As discussed by Ambrose et al. [41] in a pilot study that proceeded JustHeat, oral histories require a significant investment of time, often more than filling out a survey or being part of a semi-structured interview. This motivates conducting secondary analyses when possible to ensure that collected data are thoroughly utilized. In the context of this paper, the lifetime approach in the oral histories has the advantage of including a wider range of living conditions beyond the particular housing the participants are currently living in. Given that vulnerability to energy poverty can vary throughout one's lifetime, the approach of JustHeat filled the oral histories with contrasts and reflections on home heating in different stages of people's lives. For example, the majority of our sample had lived in warm-rent apartments at some point in their lives, and the interviews include examples of owner-occupied single-family housing, cooperative condominiums, and rental single-family housing, as well as apartments with cold-rent. Moreover, while there was not a particular focus on energy poverty in the oral histories, this has the advantage of sampling based on willingness to talk about heating, rather than necessarily willingness to discuss inadequate heating in warm rent apartments. This enables us to use the oral histories to explore how power and a lack thereof can affect access to adequate heating, which is an advantage for analyses of capital inequality. It also gives us a population with a wide range of experience, as described by the different housing and tenure types above.

For our analysis, we have two concurrent aims and research questions. First: Does the institution of warm rent protect against energy poverty, in the sense of households receiving adequate energy provision? Here, we mean adequate in the sense of being "socially and materially necessitated level of domestic energy services" [12, p. 31], which operatively is the level of heating recommended by the Swedish Public Health Agency [31]. And second: Is energy poverty a consequence of capital inequality? These two questions will be treated differently in the analysis, which is broadly a thematic one.

The oral histories were conducted, transcribed, and summarized through chronological reconstruction by one of the authors as a means to keep participants' narratives intact. They were after this thematically analysed by the other author, and then analysed together. The analysis of the oral history narratives was deductive in its approach, identifying themes of inadequate energy provision (energy poverty) and capital inequality in line with the two research questions.

Our theoretical framework does legwork both in our choice of data, our choice of themes, and our final analysis, in line with St. Pierre and Jackson [42], rather than deriving codes from our data. As described above, oral histories on the experience of heating in the home in the Swedish case relate to both energy poverty as capital inequality, and our institutional case. Deriving our themes from theory in turn lets us compare these oral histories with predicted outcome, weakening or strengthening our trust in theory. In turn, the institutional details emerging from the analysis inform and change theory about these institutions and power relations.

In particular, three themes were explored in the analysis: Inadequate heating under non-market provision, Power and power struggles, and Lost battles. With support from the theoretical grounding of this paper, these themes all explore the provision of energy, especially where conflict around energy emerges. In these conflicts (and where no such conflicts exist), we draw lines of differentiated power and power struggles over energy, which are further detailed by our case description of Swedish institutions and heating systems. By keeping oral history narratives intact, the context, reflections, and real and perceived power dynamics of participants' experiences are preserved in the analysis, enabling overarching narratives of capital and power to emerge within the themes being explored.

As the oral histories did not include questions on or registration of sensitive information, no ethical approval was needed in line with the Swedish laws and regulations detailed in the Swedish Ethical Review Authority's (Etikprövningsmyndigheten) Guide to the Ethical Review of Research on Humans [43].

# 4. Results

To present our results, we divide participant experiences into three broad themes: "4.1 Inadequate heating under non-market provision", "4.2 Power and power struggles", and "4.3 Lost battles". In Section 4.1, we describe the interviewee's experiences of heating, and whether the warm rent system necessarily provides adequate heating. In Section 4.2, we explore themes of power in the oral histories, detailing short-term power of heating and long-term power over renovation. One notable sub-theme is how both price and heating are opaque for tenants. In Section 4.3, we sketch the adaptive measures that our interviewees have turned to when experiencing inadequate heating as an example of how costs and risks can be moved onto tenants.

### 4.1. Inadequate heating under non-market provision

In an ideal conception of warm-rent apartments, heat is delivered in an adequate amount, and the tenant simply pays the rent each month. One interviewee (number 19) comments on her own apartment with centrally regulated heating (which is most common) delivered with district heating, that it is set around 20 degrees and that is the heat she gets. She gets adequate heating and does not have to (nor is she able to) adjust the radiators herself. These themes of temperature (adequate or not) and power will be our main topics.

But warm rent is not always warm, as people can freeze in an apartment even if they do not pay for their heating. Several of our participants report living in thermally inadequate warm-rent apartments, and some of them discuss neighbours and relatives experiencing similar distress. The experiences were different, but several of them were induced by contrasting changes. One of our interviewees (number 17) describes how at one point in her life she lived in a large rental housing company where she never had any issue with heating, but having moved to a different private company she experienced much thermal discomfort. This experience is shared by another participant (number 12), who had never thought much about heating until moving into an attic remade into student accommodation. The apartment could be as cold as 15 degrees during the winter and up to 34 degrees during the summer.

The same participant (number 12) reflects on the impact of poorly constructed and renovated buildings on tenants, as in one friend's student accommodation *"You could feel the wind blowing through"*. She thinks that student housing in general is worse than other housing, given the short tenure time (put a pin on the thought about time — it will be relevant later). Another interviewee (number 13) describes how something went wrong when their landlord renovated the building, leaving his radiators not functioning over the winter. While he was in contact with the landlord, they could not figure out what was wrong.

These experiences point to households living in energy poverty regardless of costs, thus challenging dominating theories of energy poverty. The households' respective incomes, current energy prices, or the dwellings' energy performance are not directly connected to the distress of inadequate heating. Because heating is provided by nonmarket means (and only indirectly paid for by households through rent), we cannot use (energy) market mechanisms to explain household outcomes. Instead, we must turn to other explanatory mechanisms. Moreover, in response to our first research question, we can state that warm rent does not necessarily protect against energy poverty.

## 4.2. Power and power struggles

Landlords' involvement in the heating, and their direct power over both short-term temperature and long-term energy renovation, is central in several of the participants' discussions. Because radiators in rental apartments tend to be regulated with thermostats set by the landlord (one thermostat measuring outdoor temperature and one measuring inside the apartment), households can only downwards regulate the temperature in their apartment. One participant (interview 22) attributes this to regulation, saying: "And then they had to comply with these environmental regulations which made everyone in the residential complex feel cold". He connects this to the fixed temperature that the tenants cannot adjust, and how complaints about freezing indoors were simply ignored by the landlords. Similarly, the interviewee describing a student (number 12) apartment that would get down to 15 degrees complained to their landlord who was quite unengaged in the question, but eventually disabled the thermostat (within the apartment) so that the radiators delivered maximum heat. This still did not raise the temperature above 17 degrees. Another participant describes a private landlord who would come and measure the temperature, but then fail do to anything to improve the indoor environment. In relation to their landlord, these answers indicate that tenants have limited influence over indoor temperature.

Two of our participants (interview number 17) reason about their relationship to the radiators, saying: *"The hardest part is the radiators, who dominates them?"*. When they are freezing and experience that the radiators are not working, they are unsure if it is because the landlord has turned them off or if it is because of how they use the radiators. *"We have no idea"*, one of them says. Heating and the technology used for heating are opaque to the tenants. Several interviewees describe this opaqueness, but not always in negative terms. One participant (number 4) describes how the fact that they have had adequate heating, they are not worried by the lack of agency this entails. Regardless of the feelings towards the fact, several concluded that the short-term power over the heating is in the hands of the landlord. Because heating and heating systems are opaque for the tenants, they lack the necessary knowledge to affect heating outcomes, putting them in a weaker position vis-à-vi the landlord.

As heating is opaque for households living in apartments, it is not surprising that pricing mechanisms for heating might be as well. One participant discusses the poverty in Malmö, and how people turn off their radiators in an attempt to reduce heating costs. The line between warm and cold rent is not always clear, as the interviewee unsure about who controls radiators (interview number 17) poignantly states: "*I don't know if heating is included in the rent*". Similar findings were reported from SOM-survey data, a country wide yearly survey conducted by the SOM-institute at Gothenburg university. Von Platten and Vahnberg found that low-income households reduce their heating to the point of freezing to a larger degree than middle- and high-income households, even in the multi-family housing stock [44].

Here, knowledge of pricing mechanisms, as well as a worry over high heating costs, leads households to decrease their energy consumption. While both heating and heating technology, as well as the pricing mechanism of warm rent, are designed to keep households warm as well as shield them from price shocks and the heat-or-eat dilemma, lack of knowledge about these systems leaves households with inadequate heat. The landlord's ownership, and through that ownership a professional knowledge over heating, puts households with less resources (here: income) in a disadvantaged position. Inadequate heating is thus produced along the lines of capital inequality.

Power that the landlord has over energy provision to the building goes hand in hand with the power to initiate upkeep, renovations and energy retrofitting that comes with ownership of the rental building. One participant (number 21) reflects on some of her neighbours freezing because of badly installed windows, and how she froze in an apartment she lived in before: "It's all about the landlord. What windows has he installed? How is the building's insulation? How does the landlord deal with your complaints?" Because the landlord has the final say in initiating renovation (because of their ownership), the tenants' relationship to them becomes crucial for their indoor environment.

Several of our interviewees describe complaining about the temperature in their apartment, without much of a response from the landlord. But this potential lack of response has deeper implications for the long-term quality of their housing. Here, the question of time and resources comes back in. One participant (number 15) considers that she should have fought harder for the landlord to improve the property (and describes almost an uproar among tenants), but feels that it would be almost a full-time job to pursue the matter. One can replace the lack of formal power or capital with time and other resources, again showing how power and capital directly and indirectly affect households' heating provision and thermal comfort.

Another participant (number 18) describes a very positive process where the landlord takes all tenants' complaints very seriously and responds quickly, but she is still aware of her own powerlessness. If the landlord is willing and able to improve their tenants' situation, or if the tenants are well organized and able to negotiate for their interests, then this lack of formal power might not be a direct issue (if still an inconvenience for tenants). But if landlords are unwilling or unable, and tenants are in an insecure situation, housing quality can falter. Participant 8 talks about neighbours and friends who do not speak Swedish, migrants who might have their first secure home in Sweden and are afraid to complain lest they risk their tenure. They say: "Those who are born here and know the system, sure. But the others, they don't [complain]. And in the private housing we have here, people are afraid. Perhaps they'll lose their apartment. And perhaps he [the landlord] will be mean to them if they need help [...] "Very difficult to move somewhere else".

These types of insecurities, together with a lack of knowledge of specific institutional structures and legal rights, might leave vulnerable households without feasible courses of action. After describing how she froze in the winter and felt too hot in the summer, participant 7 explains that she is unwilling to complain to her landlord. During a difficult period in her life, she was allowed to stay in the apartment without paying rent: "So I don't really dare to make demands. I still feel that way. That I'm kind of... or I want to pick my battles wisely". Together, these examples show how fear and knowledge asymmetries can affect the perceived power balance between tenants and landlords, a power balance that ultimately stems from the landlord's ownership.

Broadly, we see that our informants perceive indoor temperature and renovation as ultimately decided by the owner of the properties. This is repeated both by tenants that have adequate and inadequate heating. The power imbalance is aggravated by differing knowledge over heating and pricing mechanisms, as well as household resources. In summary, we see that energy poverty follows lines of capital inequality, answering our second research question.

# 4.3. Lost battles

Households that do experience inadequate thermal comfort in warm rent apartments, and that are unable or unwilling to negotiate a change from their landlord (who in their turn might be unable or unwilling), reasonably turn to other means of acquiring adequate heating. Several of our participants reported buying and using extra clothes indoors, sometimes to the detriment of other activities: "I wore so much clothing that it was a bit difficult to do the things I wanted to" (number 8). But maybe more interesting for our purposes, several households decided to buy and use electric space heaters to compensate for the lack of adequate heating.

When a household installs a space heater, they move heating costs from the heat included in the rent to electricity use, which in general is not included in the rent. This moves heating costs and liquidity risks from the landlord to the household. Several of our interviewees discuss this very problem, weighing the payoff of heating their apartment to an acceptable level versus the higher electricity bills this entails. In effect, property owners are able to rent their apartments to warm rent prices, while only partly delivering the product in question. Because warmrent apartments are more expensive than cold-rent (all else equal), this can be a way for landlords to extract larger rents from households. In our terminology, the power that the landlord holds as an owner of the property gives them leverage in the negotiation of prices, or in this case instead decreasing adequate energy provision.

An auxiliary effect of this shift is that energy used for heating is hidden. The vast majority of Swedish apartments are heated with district heating, an energy source that is comparatively energy-efficient and with low levels of carbon emissions. Direct electric heating is on the contrary not as energy efficient, and vastly more costly, especially during price shocks. It thus worsens the energy efficiency of the building in heating terms (and hides this energy usage in the households' electricity bills). Moreover, not only does this move costs and liquidity risks from landlords to tenants, it also increases these costs and risks. In effect, when households use an electric space heater, the apartment partially becomes a cold rent apartment using direct electric heating.

This observed shift (and increase) in costs and risk not only strengthens the hypothesis that energy poverty flows from capital inequality, it also highlights one of the mechanisms of this effect. As households lack power over the building's heating system and renovation, they here turn to electric heating, which they do control. While investing in equipment that lets them control their heating, they then also take on the costs and risk that formally should be born by the landlord. Again, while households formally have the right to a certain indoor temperature, and formally have the cost of heating included in the rent, the power relationship between owner and renter shifts this institutional setting. Capital inequality can make warm rent into cold rent.

# 5. Discussion

The institutional and actual difference between warm and cold rent apartments is central to our discussion. In von Platten's work on energy poverty in Sweden, she argues that living in a cold-rent apartment is one of the defining risk factors for households living in apartments [45]. If the household in turn has a low income, then it reasonably would respond to high energy prices by decreasing indoor temperatures, one of its few possible courses of action.

Households in our sample experienced energy poverty without having any (formal) heating costs. As a counterexample, this means that the extended energy poverty triad of low income, energy-inefficient housing, high energy prices and high energy needs are insufficient explanatory causes. Crucially, this points to an inadequate theoretical framework for the processes producing energy poverty. As a consequence, policies aimed at alleviating any one of these drivers, such as direct cash transfers proposed by Galvin [11] or energy retrofit subsidies advocated by Boardman [10], might not have the intended consequences. While the aims of these two policies are clearly good, redistribution of income and improved housing not being adverse goals, it might not achieve improved energy access for households. Our empirical material clearly shows the former, while von Platten [27] shows unintended negative consequences of improved energy efficiency.

More than just experiencing energy poverty, the households experienced a lack of adequate heating while their rental contracts gave them the formal right to certain indoor temperatures (specifically, 18 °C). This inadequate provision centred around negotiations about temperature with their landlord. Because landlords control both temperature and necessary renovations (through their ownership rights), the result of this negotiation process determines household outcomes. Households with large resources to mobilize against an unwilling landlord have a better chance than those with fewer, whether this is social capital, time or knowledge (but might still not be able to, as explored by Bengtsson and Bohman [29]). This is in line with von Platten [46], who argues that differing amounts of flexibility capital together with financial resources determine household abilities to shield themselves from higher prices.

Decreasing energy provision below legal bounds decreases costs for landlords, whether this is intended or not. In our material, we see both a withholding of temperature in the short run by thermostat control and in the long run by not investing in renovations. We can interpret this as type of price increase by quality decreases of the product, a way that landlords use their relative power (through owning the building in question) to indirectly increase rent. This transmits to households either through inadequate energy provision as discussed, or through tenants using alternative heating sources. In this way, they incur costs and risks formally born by the landlord. Capital, in the sense of ownership, is in this case more important than income, in line with predictions based on our theoretical framework.

This result connects to other jurisdictions in two main ways. In the institutional cases where heating or other energy costs are included in rent, such as the German Warmmiete, some social housing in the UK, or part of the US multifamily housing stock, we might still find exposed households. This highlights that groups that might be invisible under traditional conceptions of energy poverty, because they lack heating costs, still can experience energy deprivation. More so, in the cases where a larger share of the vulnerable population is housed in this type of institutional setting, it becomes especially important to consider their situation. When heating costs are covered in social housing for example, one might suspect that heating provision is adequate. Our results show that this is not always the case.

The second way this result connects to other jurisdictions is how it informs our conception of energy poverty more broadly. If energy poverty mainly relates to power over renovation (and over thermostats), we can discuss what gives households access to change and improve their housing conditions. We would thus expect balance sheets and the assets recorded in them to be more important than income statements, especially when we broaden the perspective beyond the individual household. For the household itself, assets are important because they translate to resources available for renovations, either through assets that can be made liquid, or as collateral for credit (see [23] for reasoning about access to credit and path dependence). For owner-occupants this is straightforward, and for collective condominium owners this process is mediated by the cooperative. This connects the specific case of Swedish warm rent not only to other cases where heating is included in rental costs, but all cases where households have more or less control over their indoor environment.

This situates our results within the general literature about renovations of rental apartments, where tenants are shown to have little power over renovations, renovation outcomes and the rent thereafter [16– 18]. In this literature, renovations risk lead to displacement [17,47], damaged trust in institutions [48], as well as cultural trauma [49,50]. What our results show in contrast to this literature is that the power households lack over renovation and energy provision also risk leading to energy poverty, and such a type of energy poverty that is not visible in the conventional definitions and measures. Moreover, setting balance sheets and the assets recorded on them at the centre of our analysis connects household energy outcomes to broader themes of financialization of housing [19,20].

A similar reasoning could be made about landlords and energy providers — seeing buildings, district heating networks or electricity grids as financial assets prioritizes their market valuation, which might not fall in line with decreasing costs for households. On the contrary, Nitzan and Bichler [37] would predict that firm behaviour would rather aim at increasing relative costs for households, at the expense of worsening energy infrastructure. Again, at the centre of this analysis is the power struggle between households and firms, as well as between firms. These predictions open up clear avenues for further research.

In this sense, energy poverty as capital poverty connects to theories of uneven development and path dependence [15,51–53]. As housing and energy infrastructure is sticky, mobilizing significant resources is necessary to change energy outcomes over time. We would thus expect energy inequality to follow lines of wealth inequality, as wealth is significantly more unevenly distributed than income [35,36], which in turn can explain how spatial infrastructural inequality is reproduced at several geographical scales [54–56]. It is therefore not surprising that energy inequality is seen on regional [3,57], country [23,58] and city level [59].

If we consider energy to be a necessary good or right [60], the perspective of energy inequity adds to the point that formal rights do not necessarily translate into desired outcomes, something discussed already by Marx [61]. Rights without enforcement leave power struggles to play out by themselves, and not necessarily to the betterment of the households we wish to aid. Policymakers that take inspiration from the Swedish warm rent system, which undeniably is closer to a "right to energy" system than market allocation, must consider what capital inequality does to energy provision.

# 5.1. Methodological limitations

This study draws on oral histories collected for the JustHeat project that was not particularly focused on energy poverty, but that aimed to explore the lived experiences of previous home heating transitions. While the oral histories provide comprehensive data on various heating experiences throughout peoples' lives that indeed are relevant to the subject of our study of energy poverty as capital inequality, it is important to note that more insights into the lived experiences of energy poverty would have been achieved had the data collection been designed for this particular study. While the results and conclusions of this paper are well-grounded in the available data, there are more facets to be explored regarding the institutional aspects of energy poverty within the Swedish context and beyond.

# 6. Conclusion

When considering energy poverty, we have argued that it is not enough to only consider income, energy efficiency of housing, energy prices and energy needs. On the contrary, these descriptions fail to account for why certain households are energy poor, and instead describe what it means to be energy-poor. An important scholarly feat, but lacks a causal theory. Instead, we argue that there has been an excessive focus on income statements to the detriment of balance sheets. When considering households' collected debts and assets, together with what they do not own, we argue that this gives a more informative picture of energy poverty as a phenomenon, and what processes produce it.

We exemplify this through the case of warm-rent apartments in Sweden. Due to this institutional setting, heating is (nominally) free at use; the energy costs have a marginal cost of zero for tenants. By the usual "drivers" of energy poverty, we could expect households not to be energy-poor. But because neither the specific indoor temperature nor renovations are within the power of tenants, they may still experience inadequate domestic energy provision. What becomes deciding instead is the ownership rights of landlords over properties and the heating systems within. This power of the landlords, and the negotiation between households and landlords, also determine renovations important for energy performance over time.

While energy has a close connection to money, it cannot be considered as such without regard to institutional settings and ownership structures. When energy poverty is considered a consequence of capital inequality, and capital as power, the details around ownership and rights that follow ownership become important. This enables us to talk about energy poverty when energy is not provided by a market, as well as long-term and structural causes as to why certain households live in poor-quality housing. We argue that to sufficiently explain energy inequality, we must take into account these institutional details and ownership aspects of housing and energy infrastructure.

## CRediT authorship contribution statement

Jack Vahnberg: Writing – original draft, Methodology, Formal analysis, Conceptualization. Jenny von Platten: Writing – review & editing, Supervision, Data curation.

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## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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# Data availability

The authors do not have permission to share data.

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