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Energy as social relation: Refugees' energy commons for infrastructuring beyond the grid

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ABSTRACT

This paper reconceptualizes energy as a social relation of (re)production, focusing on the overlooked intersection of refugees, housing precarity, and energy practices. Drawing upon ethnographies with refugees living in squatted houses in Thessaloniki, Greece, we introduce the concept of *refugees' energy commons*, to explain how refugees' communities self-organize to meet their energy needs -repairing, maintaining, and improvising energy infrastructures to provide heating, cooling, insulation, cooking, and communication. These collective energy infrastructuring practices which act as means to reclaim disrupted life trajectories, question the dominant discourses around energy poverty revealing that access to energy is not simply a matter of technical adaptation or ability to pay bills; rather, it is a matter of being embedded into a set of social relations of (re)production, within which communities, institutions, and technologies, enable or disable access to the housing-energy nexus.

1. Introduction

Mahmoud, from Syria, arrived in Greece in 2019. For over a year, he lived in state-run camps outside Thessaloniki alongside thousands of other asylum seekers. But as soon as he obtained asylum protection status, he lost his right to stay in state-supported accommodation. With no stable job and income, he could not afford to pay for rent; so he, like several other refugees, resumed to living as a squatter in a dilapidated house, close to city centre. The house he squatted had been abandoned for several years and needed extensive repair work to become inhabitable again. Mahmoud repaired himself the roof, the kitchen and the toilet, and replastered and painted the walls. However, the vacant house had also been long ago disconnected from the electricity grid, and it proved impossible for Mahmoud to reconnect, without proof of rental or ownership status. Like many other refugees squatting nearby buildings, he too had to go at great lengths to find alternative ways to get access to electricity. He explains:

> I now get electricity with this big cable, which connects me to the network of the squatted house next door, where some Iraqis live. They, in turn, have secretly connected their own house directly to the nearby electricity pole. The cables run hidden behind our houses, end up in my house. There are quite a few refugees living here in the neighborhood, and we share the electricity from house to house. In my own house, the cable branches into the kitchen, the bathroom and the bedroom. I made the electricity connections myself, with the help of other squatters. At first, I didn't know how to do it, but other people helped me learn. (Personal interview, November 26, 2024).

In recent years, a significant body of academic work documents the living conditions of refugees in Europe. Much of it focuses specifically on Greece, one of the main countries from which most refugees have entered Europe in the decade 2015–2025 [1]. These studies have focused on state-run camps, apartments rented via the UNHCR (United Nations High Commissioner for Refugees) programs, or self-managed housing squats [2–10]. However, the energy precarity of European refugee populations remain under-researched. Despite the importance placed by both policy and academia on energy poverty and energy transitions [11–14], both academic research and policy practice have systematically overlooked issues related to energy provision and consumption in refugees' housing in the European context.

Indeed, the few studies published on refugees' energy needs and infrastructures focus on non-European contexts [15–17] pointing to a significant research gap or 'darkness', as aptly noted by Rosenberg-

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Jansen [18], regarding the energy conditions, needs and activities of refugees in European countries. Within the European context, refugees' energy needs have not yet been examined, and there is absolutely no knowledge on if and how they cope and if and how they access basic energy infrastructures.

Our research addresses this significant gap in research and analysis. Drawing on longitudinal ethnographic analysis this paper addresses the previously undocumented challenges that refugee populations in Europe face in securing access to energy. These populations often reside in substandard housing, frequently disconnected from basic infrastructure. Drawing on extensive ethnographic research conducted with refugees squatting in abandoned buildings in Thessaloniki, Greece, we provide new empirical and theoretical insights into the nexus of housing and energy access among refugees. By examining the improvised energy landscapes that refugees are compelled to construct, we advance a critical understanding of energy as a social relation, namely, the ability to access social relations of production and reproduction which eventually can give access to energy. Our findings challenge conventional definitions of energy poverty, highlight the socio-political dimensions of infrastructural exclusion and contribute two broader theoretical insights.

First, we introduce the concept of *'refugees' energy commons'* to capture the social relations and infrastructuring practices that refugees develop to navigate living outside the formal energy grid, grounded on mutual support, trust, care, and solidarity. These self-organised and self-managed infrastructures not only enable access to energy but also reconfigure social relations in contexts of infrastructural exclusion. To theorize these processes, we draw on scholarship on energy commons [19–21], refugees and migrants' commons [22–24] and refugees and migrants' infrastructures [25–27].

Second, our ethnographic material allows us to examine access to energy as not only an economic or technical issue; but also as an everyday social relation of production and reproduction [28]– one that is materially embedded in people's bodies and labour, infrastructural entanglements, practices of commoning, and institutional negotiations. Documenting the emergent energy landscapes that refugees in Europe must assemble to secure access to energy, allowed us to expand relational approaches to energy studies [29] and to demonstrate that although the social relations though which energy is accessed can be exclusionary, the need to access energy can also become generative of new forms of proximity, solidarity and community building and belonging. Conceptualizing energy as a social relation of production/reproduction thus enables a deeper analysis of the transformative potential that shifts in social relations can have in enabling or disabling access to both housing and energy, as refugees' life stories and trajectories reveal.

In the sections that follow, we outline our methodology, and then present the theoretical framework and gaps in literature, within which we embed our research and suggestion to reconceptualize energy as a social relation of (re)production. We then follow with documenting the creation of commoning energy infrastructures by refugees, and explain how this material leads us to suggest the concept of *refugees' energy commons* to depict self-managed infrastructuring practices. The paper concludes with reflections over how researching the new energy infrastructure landscapes that refugees create pushes us to move beyond examining energy issues through the lens of energy poverty.

2. Note on methodology

The paper presents the results of ethnographic research conducted in Greece between June 2024 and April 2025 with refugees squatting abandoned houses in various neighbourhoods in and around Thessaloniki. This article does not name the neighbourhoods under examination in order to protect the newly arrived residents - refugees. The data includes first-hand observation, fieldnotes and diaries, energy biographies and semi-structured interviews with 20 residents -recent refugees as well as older residents of the same area. Additionally, we conducted several informal discussions and open-ended interactions, during visits inside the squatted houses that included drinking coffee and tea, cooking food together with the inhabitants, and participating in the connection, repair and maintenance of energy infrastructures and household appliances. It should be noted that the relations of trust that enabled participant observation practices had been built over a much longer period of four years (2020–2024) that preceded the recent ethnographic fieldwork period. Over these 4-year period, we developed contacts with the residents of the squatted houses and supported them in renovating their homes. Therefore, the research we present here can be considered longitudinal as it is empirically based on interviews, life stories, and participatory research over a longer period of time.

The participants in the research were from Palestine, Algeria, Morocco, Iraq and Syria, and their names have been changed to protect their identity. The residents of these houses, due to their similar linguistic, cultural, religious, and national backgrounds, are particularly apt to develop relations of proximity, communication and practices of community and commoning. Perhaps greater effort would have been required to foster such relationships among people with less closely aligned cultural identities. However, as we will show in our findings, the driving force behind the emergence of relationships of solidarity is the common survival struggle under Greek and EU migration policies. We would also like to emphasize that we use the term "refugees" not with the intention of reproducing the categorical divisions between immigrants and refugees [30] but in recognition of the newcomers' desire to be identified as refugees –so that they may gain more social and political rights and feel safer in the countries of arrival.

Our ethnographic approach responds to growing calls to "emphasize subaltern or alternative voices that are often overshadowed in energy debates by hegemonic discourses of authority" [31 ,p.1]. It also engages with foundational questions posed by energy anthropologists regarding the lived experience of energy: "what is the place of energy in human life? … how [do] people themselves encounter energy and judge its place in their lives"? [32 ,p.1]. Furthermore, our analysis aligns with calls for relational understandings of energy provision that situate energy within broader social, political, and infrastructural dynamics [29].

3. The limitations of European energy poverty research and policy: refugees' energy commoning as infrastructuring practice

A growing body of literature on energy poverty, vulnerability and deprivation focusing on Europe [11,12,33,34] highlights energy as a critical issue for households. This literature examines energy services, prices and technologies and the challenges associated with energy transition and offers recommendations and measures for fulfilling households' energy needs. However, these studies focus on households occupied by officially registered European citizens. Thus far, the energy needs and practices of refugee populations are neglected. According to Rosenberg-Jansen, who has worked on energy and refugees outside European contexts, "refugee households are not involved in the design of energy programmes, which leaves refugees in the dark (or having to find their own solutions)" [18 ,p.2]. As noted by Burbidge et al. "academic and policy literature, and wider societal awareness on the specific energy challenges faced by refugees is remarkably rare" [35 ,p.2]. Indeed European [36] and Greek [37] legislation on climate change and renewable energy sources do not provide any guidelines for addressing the energy needs of refugees. Similarly, European [38] and Greek [39] housing policies for refugees do not take into account the energy needs of newly arrived people. Therefore, a significant institutional gap is identified here, which we argue is linked to the broader structural and racialized inequalities that relate to the housing-energy nexus [40,41].

Over the last decade, an important discussion developed regarding arrival infrastructures for newcomers [27,42]. According to Meeus et al. arrival infrastructures are "those parts of the urban fabric within which newcomers become entangled on arrival" [25 ,p.1]. Whereas the

infrastructures set up by various actors such as authorities, civil society, and solidarity groups and related to housing, access to employment, political support, social services and medical support have been examined, refugees' energy infrastructures have been absent from the relevant research.

This creates a significant research gap which our research aims to address. Therefore, we seek to enrich the discussion on refugees' infrastructures by adding the energy aspect. We draw inspiration from the recent bibliographic shift toward the practices and processes of 'infrastructuring' [43–45], which may challenge and transcend state migration policies. Meeus et al. put emphasis on the "continuous and manifold 'infrastructuring practices' by a range of actors in urban settings, … within, against, and beyond the infrastructures of the state" [25 ,p.2]. Importantly, according to Wajsberg and Schapendonk, an approach to refugees' infrastructuring practices should approach refugees as the "main actors in the making, holding and repairing of infrastructures" [26, p.2355); in their study they explore how refugees "build, invert, repair and re-create infrastructures" [26, p.2355). Refugees' infrastructuring practices may include "sites of solidarity" [26, p.2352) "non-institutionalized practices of sheltering" [26, p.2354) and infrastructures of hospitality like refugees' squats [2,3,46]. In particular, deprivation-based squatting by newcomers has been a typical housing practice for several decades in European cities [47,48]. There is also an increasing focus on non-institutional activities and practices in the scholarly discussion of infrastructures. For example, Simone [43,49] suggests the concept of "people as infrastructure", to emphasize the non-institutional activities of the urban poor and the transformative potentialities of their infrastructuring practices.

However, one aspect is less examined: the potential of these practices to lead to commoning processes and of people's infrastructural agency. These crucial aspects have led several scholars [50–54] to examine infrastructures as commons. Amin depicts infrastructures as a "socio-technical assemblage" [55 ,p.138] and proposes the notion of 'infra-commoning' to explore "the infrastructural aesthetic, social praxis and collective organization shaping the culture of the commons" [55 ,p. 146].

In this paper, we conceptualise the commons as the self-managing and sharing of resources, in this case energy resources, devices and infrastructures, as well as social forms of cooperation, self-organization, sharing of knowledge and collective infrastructuring practices beyond the systems of the market and the state. In recent decades, scholars have argued that the social practices of "commoning" [56 ,p. 279] and "being-in-common" [57 ,p.610] are as important as materialities and resources. Linebaugh states that "the commons is an activity" [56 ,p.279], while Federici contends that "commons are not things but social relations" [58 ,p.94] and De Angelis aptly underscores that "the life-blood of the commons, its dynamic energy and first source of its power and form, is the process of commoning, doing in common" [59 ,p.628]. What is also crucial is how practices of commoning may "produce new relations between people" [60 ,p.2] and new values [61] of mutual support, solidarity, co-responsibility and care.

In this regard, in recent years, numerous scholars [4,23,24,62] have insisted on the importance of recognising refugees' commoning practices, which include "shared knowledge, affective cooperation, mutual support and care between migrants when they are on the road or when they arrive somewhere" [22 ,p.171]. The studies cited above mainly explored and highlighted the social relations and commoning practices of refugees when crossing physical, political and social borders, which is why they usually refer to "mobile commons" [22]. Meanwhile, few studies, mainly on housing commons [59,61,63,64], recognize and include in refugees' commoning the self-managed infrastructuring practices in their places of residence. Energy infrastructures as refugees' commons remain an unexplored topic.

As defined by several scholars [21,65], energy commons are the non-state and non-market production, distribution and use of energy; they may include energy communities and cooperatives that contribute to a decentralised "energy transition, decarbonisation, and to combatting the climate emergency" [66 ,p.1], social movements and struggles "against privatisation and for common/public ownership of energy resources and technologies" [19 ,p.1] and "calls for energy justice, citizenship and democracy" [20 ,p.11].

Focusing on the everyday energy commoning practices that take place in the squatted houses of Thessaloniki, we examine the collective ways in which refugees repair, build, sustain and use energy as a means of covering their heating, cooling, insulation, cooking and communication needs. In doing so, we show that the commoning practices of infrastructuring energy are also a way to build a community.

In what follows, we shall show that these are precisely the social values that emerge among refugees in the process of energy infrastructuring and sharing of energy in the squatted houses under study. Thus, in this paper, we explore the concrete materialities of energy infrastructures and how refugees are making these infrastructures in common. More specifically, we examine how refugees' energy infrastructuring practices rely on commoning relations and produce new ones or, in other words, how energy infrastructuring activities "take shape and shape those who shape them" (60, p.7).

4. The refugees' housing-energy nexus: the greek context

Greece is a key entry point for refugees in southeastern Europe, a country that received approximately 1.5 million newcomers from Africa and Asia over the past decade [1]. As in much of Europe, refugees in Greece represent a structurally vulnerable population, often living in conditions of severe poverty. Asylum seekers, in particular, receive minimal state support—ranging from €150 per month for individuals to €420 for families [67]—amounting to just 18 % of the national minimum wage (€830/month as of 2024) [68]. According to all refugees participants in our study, this allowance is insufficient to meet even basic housing and energy needs. Despite these significant numbers and seriousness of the issue, there is a striking absence of academic studies addressing the intersection of housing and energy in studies about refugees in Europe or Greece.

Refugees arriving in Greece are initially accommodated in state-run camps situated in remote locations. So, according to our interlocutors, while they do have work rights, it is almost impossible for them to find employment in these isolated locations – other than low-paid seasonal agricultural sector jobs. However, once their asylum request has been examined, regardless of whether the decision is positive or negative, they lose their right to reside in state structures and must seek housing on their own. Between 2017 and 2022, UNHCR in collaboration with the Greek State and non-governmental organisations ran the ESTIA housing programme (Emergency Support to Integration and Accommodation), which used EU funding to rent 27,000 urban apartments to accommodate asylum seekers across Greek cities [69]. The number of beneficiaries exceeded 90,000 [70]. However, the programme's funding came to an end in December 2022. In addition, the 2019 elected right-wing Greek government tightened migration policy, and evicted many refugees' squats [3]. In 2019 the IOM (International Organization for Migration), introduced a new housing programme, HELIOS (Hellenic Integration Support for Beneficiaries of International Protection). Instead of providing refugees with apartments rented by the programme, HELIOS offers short-term (3 to 6 months) rent subsidies to refugees to rent apartments for which they sign rental contracts in their name. The result is that refugees struggle to secure a rental contract, and those who do, struggle to keep up with rent payments, after the HELIOS subsidies end [71]. According to official data [72], only 580 apartments across the country were registered in the programme, whilst 24,509 people received financial assistance for renting (by October 2024). In this context, persons who are recognized as refugees seek to obtain travel documents and travel on to their desired destination-countries in Central and Northern Europe, where they often have relatives and friends and where they consider to have better prospects for finding

employment.

However, those who lack the financial means to continue their journey, or those who are rejected from the asylum process remain 'trapped' in Greece, and often become homeless. Some turn to squatting abandoned and dilapidated buildings in search of a housing solution.

5. From darkness to light: squatting and infrastructuring energy at Thessaloniki's squatted houses

The squatted houses of Thessaloniki, where our field research focuses, are small (40–80 square meters) and had been abandoned for many decades, often due to unclear or disputed ownership status. At the moment when refugees occupied them, they were dilapidated, crumbling and unihabitable. Over the past five years, these empty shells found new life and purpose when the refugees found shelter there and started occupying them.

Since these houses had been abandoned for many decades, they are in poor condition, with no electricity or water connection, damp walls, shuttered windows, and damaged window frames. Those who squat them have to find ways to repair them and make them inhabitable again. However, as these houses had lost their connection to water and electricity grids, the newcomers who inhabited them had no way to reconnect to energy or water services without official rental or ownership contracts. For several months, or even years, they had to live, literally in darkness. As Hassan from Morocco recalled:

The first months were very difficult. While I did have a house, I had no energy. I had zero energy. I couldn't cook, take a bath, wash my clothes, charge my phone, sleeping was a problem, and of course I didn't have a TV or a fridge. I did not have energy, so I could not cover these needs. (Personal interview, September 13, 2024).

During one of our first visits to the squatted houses, on a cold winter afternoon in 2021, Mohammed from Palestine welcomed us in his small living room, whose floor was covered with carpets, and gave us a blanket to cover our legs and protect from the cold and dampness. Then, he offered us hot rose-scented tea that he had boiled on a gas stove. When it began to get dark, he lit a few candles and told us:

I took these candles from the church next door, I also took some sand from a construction site. I filled these plastic cups with the sand and sticked the candles in the sand to have some romantic light in the evening. They are aesthetically beautiful, I like to smell and drink my tea and at the same time to observe the flickering of the flames, I like the shadows they create, they calm me and help me think about my life. Of course, it is difficult to live without electricity, and I will look into getting some solar panels, but I would keep these candles, I like the atmosphere they create. (Personal interview, November 13, 2021).

In Mohammed's narrative, the experience of improvised non-electric lighting from the flickering candles, in combination with the taste and smell of the tea, created a feeling of calmness, which may be lost in the conditions of "steady, harsh and cold light" [73 ,p.76] that an electric lamp creates. Ingold argues that "light is the *experience* of inhabiting the world" [74 ,p.333], whilst Petrova's [75] analysis depicts light as a significant material and social agency in the production of domestic space. In the case of Thessaloniki's squatted-houses lighting their homes, (despite the lack of connection to the electricity grid) was indeed the very first infrastructuring endeavour in which refugees engaged when they started turning the abandoned houses into homes.

As Merleau-Ponty emphasizes, "we do not so much see light as we see *in* it" [74,76], and in the case of the squatted houses, the dim light created by the new inhabitants also serves to dim their presence, so as not to be seen and noticed by passers-by and neighbours. Said from Algeria, who has been living in a squatted house for three years recalls:

For about a year, I used to enter this house from the back, not from the door on the street. I would jump over the back wall and open the door at the back of the house so that the neighbours wouldn't notice me. Also, I used candles, so that the house was very dimly lit. Thus, I could say that the lack of electricity made the house safer for me. Because if a neighbour sees me entering the house or if they see that there is light, then they may call the police. (Personal interview, July 19, 2024).

As Davey puts it "without light, form and space have little meaning to most of us" [77 ,p.47]. Pondering the question "what does light *do*?" Bille and Sørensen note that "light reveal[s] or conceal[s] aspects of material and social life" [78 ,p.265]. As Petrova [75] argues, the ability and ways in which one illuminates one's home acts as a cultural and social signifier. In the case of the squatted houses, illuminating dwellings took on an entirely new social significance, since practices of invisibility [79,80] are a key survival strategy of refugees and migrants who "attempt to elude … [the] gaze [of dominant regimes of visibility] and seek to remain imperceptible" [81 ,p.7].

Despite the difficulties, with time, the new residents of the squatted houses started forming social relations with local or refugee neighbours. In fact, in conversations we had with older residents, they told us that they were wary of the new refugees at first, but later appreciated seeing the abandoned houses cleaned and maintained. At the same time, friendships began to develop. This process enabled the newcomers to eventually access electricity, often relying solely on solidarity networks, friendships and contacts with community centres supporting refugees. These practices include often connecting to another house's gird, and sharing electricity bills. Collective practices of energy sharing between houses have emerged, through which refugees try to improve the houses' energy conditions while also strengthening their social relationships. This is described by Jamil from Syria, who had been living in a squatted house for four years:

In the beginning, it was very difficult, I slept with two sleeping bags in the winter so as not to get cold, and in the summer, I was suffering a bit because the house had no electricity, so I couldn't have fans or a fridge for cool water. In the winter, because the house had no hot water, I went to take a bath at the university student dormitories. I had some friends who lived there. To wash my clothes, I would wash them at a social centre and for food I would also go to some community centres for refugees. It was a difficult period but through these difficulties I found and met people who stood by me and helped me a lot. Without these alternatives, it would be impossible to survive. (Personal interview, July 10, 2024).

These practices show clearly how the survival of refugees in the squatted houses relies on social relationships, friendships and supportive infrastructures set up by other people. These practices help them, not only to strengthen their social relations, but also to become accepted in the neighborhing community, and gradually start infrastructuring energy in the squatted houses. However, they face several difficulties; for example, some thought about installing solar panels on the roofs and terraces of the houses, but they were could not afford the purchase price. Omar from Morocco explained:

The residents of four neighbouring squatted houses wanted to buy solar panels and become energy independent, so that they would not need to connect the houses to the main electricity grid. But it is very expensive to buy them. We need at least 3000 euros for each house to buy good-quality solar panels, batteries, motors, inverters and cables, and of course in the winter with clouds, they do not produce enough electricity. (Personal interview, November 20, 2024).

As an alternative to solar panels, they improvised infrastructural techniques for energy coverage. For example, they use secondhand car batteries. Hakim from Algeria described the process:

At first, we used candles for lighting at night. … Then, for about a year we used secondhand recharged car batteries. Cheap 10-year-old used Chinese batteries. We bought them from a battery shop and with an inventor we can plug in a socket and turn on two to three lamps and charge our mobile phones. Once a month we take the battery to the store to have it recharged. This method was suggested to us by two other friends from Algeria who worked in a car repair shop. We have explained this method to other squatters, and many now also use such batteries, and we share them with each other. (Personal interview, October 1, 2024).

Gradually, different forms of energy commoning emerged among the refugees squatters; practices of mutual energy support necessary for their survival. As Federici emphasizes, "the construction of commons is becoming a necessary means of survival" [58 ,p.88]. However, the impromptu energy infrastructures at the squatted houses are precarious and incomplete, making energy infrastructuring a relentless and demanding process that continuously demands retaining exiting and building new practices of commoning.

6. Energy as social relation of (re)production: creating transgressive housing-energy infrastructures

The previous section documented how access to energy but also the very survival of refugees in the squatted houses of Thessaloniki relies on building supportive relations with other people. The practices we documented are, to a certain extent, aligned with Simone's notion of "people as infrastructure" [43,49], that is, "entangled attunements, [and] maneuvers, … among shape-shifting constellations of materials and bodies" [49 ,p. 1341].

However, in order for people to perform this role as 'infrastructure', a prior embeddedness in social relations of production and reproduction with each other is necessary. For refugees, embedding in such social relations is not straightforward. In fact, the very lack of embeddedness in local social relations of (re)production in arrival countries, is the very definition of being a refugee. All refugees who live in the squatted houses emphasize that to meet their energy needs, they first had to create such social relations, that later enabled them to rely on mutual support with other neighbours and squatters in the area.

The activation of social relations of production and reproduction with other people is the precondition upon which people can perform a role as infrastructure; in the case of the squatted houses, social relations of reproduction were the precondition for building commoning infrastructural practices that enabled them to finally anchor themselves in the neighborhood.

Salim from Algeria described:

I live in a squat with three other friends. To make the electrical connections, we had the help of some Syrian neighbours who used to work as electricians in their hometown and of the Moroccans who live in the squatted house next door. The latter secretly get electricity from a power pole in the street and share it with us. They transfer it to us with a 50-m cable, which passes between behind the houses, so no one else sees it. Then the Syrians showed us how to connect the fuses, how to collect the yellow cables and tie them with a scotch tape and where to put the blue and black cables in the fuse. So, with their help, we did the electrical connections, and we have electricity for the bulbs, the water heater, the TV and the electric stove. (Personal interview, August 28, 2024).

In another part of the area, the squatters of a ruined house build a different set of social relations. They looked for and found the original owner of the house, a man now in his seventies, and struck a deal with him. He would reconnect them to the grid and instead of paying rent, they would pay the electricity bill and restore and maintain the house. But at the same time, they also distributed their own electricity supply with hidden cables to the neighbouring squatted houses, so that all residents share one electricity bill, thus paying less monthly fixed changes. Through this practice of sharing, energy and energy cables, are transformed into a commons at the local microscale. It is important to note here that, the fixed changes included in energy bills in Greece are often as high as the energy consumption charges, as they include the municipal taxes, and the state TV license, both calculated on the basis of the square footage of the residence. In the case described above, where only one small house is officially connected to the grid, but energy is branched out to four other houses, which share the bill, refugees save a significant amount of money by paying only one set of fixed charges per month. It is a case in the point that Wajsberg and Schapendonk make, that refugees' infrastructures can be a "transgression that emerges from people's relational practices" [26 ,p.2353]. These transgressive infrastructures generated by the refugees' relational practices circumvent –out of necessity– the lack of state and market policies for energy provision in impoverished and refugees' households. Interestingly, these practices, are reminiscent of practices among Greek nationals, which became widespread after the 2008 crisis. During the austerity that followed, activist groups assisted households who could not pay their electricity bill, to reconnect to the grid in invisible ways by creating energy commoming and communities long before the term was hyped and promoted by green policy agendas [75,82]. As nearly two decades have passed no direct connection can be established between the practices Greek citizens developed to tap into energy during the financial crisis and the practices that newly arrived refugees develop. However, what does link these practices in common, is that they both testify to the great lengths that people living under energy deprivation can go to, in order to meet their energy needs. The hidden connections to the electricity grid, the 'tricks' with electricity bills and the sharing of electricity among the squatted houses via hidden cables constitute a clear case of infrastructural "manoeuverability" [83 ,p. 289] which is made possible because of the refugees' pre-existing knowledge. Several scholars [82,84,85] point out that people in many countries with inadequate state energy infrastructure develop their own techniques and knowledge to meet their energy needs. In the words of Rami from Palestine:

Some refugees have knowledge and skills on how to build our homes from scratch, how to cook our food over a wood fire, how to connect our house to the electricity poles, how to survive in difficult conditions. We know how to live without a central system of heating, electricity, or water because there is a lack of state provision of energy in our countries of origin. (Personal interview, September 26, 2024).

7. This house belongs to everyone who helped make it inhabitable again

The tangible collective repair of abandoned houses and the rebuilding of the energy infrastructures, connections and thermal insulation by the refugees themselves produce a sense of belonging, which most of the time is not individual but collective. As formulated by Stavrides "commoning practices, thus, do not simply produce or distribute goods but essentially create new forms of social life, forms of life-in-common" [60 ,p.2]. Samir from Algeria, captures this beautifully:

'the wires that carry electricity from house to house are like connecting our lives, charging our lives, giving us the energy to rebuild our lives, not alone but all together.' (Personal interview, 14 December 2024).

Consequently, as self-organised practices of energy infrastructuring transform the abandoned houses again into inhabitable spaces, they also "charge" the lives of the refugees-occupiers. The process of charging energy commons means that the squatted houses energetically being-in-common both as sharing energy connections that provide light, heating, and power for electrical appliances but also as social relationships that are strengthened by values of solidarity, care, and mutual support. As Rashed from Syria emphasized:

When something breaks in a house, for example, the power goes out or a fuse blows, I help fix it, and then if something breaks in mine, other neighbours come and help me fix it'. (Personal interview, December 7, 2024).

It is also worth noting that some squatters collect wood from the neighbouring *Seih Sou* forest and distribute it to other squatters so they can use wood stoves for heating in the winter. As Youcef from Algeria points out:

In the squat where I live with four other friends, from Algeria and Morocco, we have built a wood stove, we fill it with wood that we collect from the nearby forest. In addition to the heat, we cook on it, boil water in a pot and make nice soups. Sometimes other friends from the other squatted houses join us, we like to gather around the stove, cook and talk. These are some nice moments. (Personal interview, August 21,

2024).

Several authors [58,86,87] have addressed forest wood as a natural common and have examined the practices of gathering wood and the struggles around free access to forests. In the case of the refugees living in the examined houses, the collected wood takes the form of an energy common, mainly a means of collective cooking, enhancing the communication and community building of the inhabitants of squatted houses. As Laacher argues, "the home is the centre of the world, not [only] in the topographical sense, but [also] in the existential sense: a place where … [people] come together, … a warm place and a place where we make fire, a place where we find a shelter, a place where refuge is possible" [88 ,p.133]. Through the process of lighting the fire in the wood stove and cooking, refugees come together, share stories, and create a sense of home in their new place while also remembering and connecting with their homes in their places of origin. In the words of Ahmed from Syria 'when we light the stove, the smell of wood is so nice, it brings back memories of my village in Syria, it's like a little celebration.' (Personal interview, November 22, 2024). Youcef added:

If we were in a container in a refugee camp or an apartment, we would be forbidden from having a wood stove. Here I feel this freedom that I create the heat with my own hands. It doesn't come ready-made from the radiator. It's not sent to me by a company or the state. It is mine, it is ours. (Personal interview, November 23, 2024).

What is important in the case of the examined squatted houses is that, in addition to bypassing the state and the market, refugees also exercise energy commoning practices that consist of social relations of mutual support and care about each other's energy needs. As Federici points out, "the heart of the commons is a profound sense of responsibility toward other people" [58, p.ix].

In this regard Yasin from Iraq explained:

The last 2 years I have everything I need in the house. But it took a lot of work, and a lot of people helped me, people who live in other squats, neighbours, and solidarity groups. We cleaned the house, fixed the windows, insulated the roof, fixed the floor, painted it and connected the electricity. Without the solidarity of other people, I would not be able to live in this house. In fact, this house belongs to everyone who helped make it habitable again. (Personal interview, September 15, 2024).

Therefore, collective and self-managed forms of energy empower, bring together, and give the residents of squatted houses a sense of self-sufficiency and autonomy. Energy commons as material infrastructure, social relationships and a mode of communication become a vehicle for the formation of a sense of home and community. Ibrahim from Syria noted:

No HELIOS, no ESTIA, no camp, no rented apartments. A squat is a much better housing solution, here we have built everything ourselves, with the help of many friends we give energy to the house, we give energy to our life. I have hosted many people; it may not be a luxury house, but it is always open to anyone in need, there have been many people on the move, homeless refugees and European volunteers, and most of them have helped significantly in rebuilding the house. I want to continue living this way. I don't think I could host so many people if I lived in a rented house with an owner. (Personal interview, December 5, 2024).

Thus, in addition to providing energy to the squatted houses, the refugees' energy commoning practices empower them to literally rebuild these houses, while rebuilding their lives according to their needs and desires. In her study of no border infrastructural practices, Ticktin finds that "people are building the worlds they want to live in, and they imagine as they build" [62 ,p.15]. In the case of the squatted houses, despite all the difficulties, refugees build energy infrastructures and, in parallel, recharge and reimagine their new lives.

8. Concluding reflections

In this paper, we documented and discussed the commoning practices for building infrastructures for energy provision by refugees living in the squatted houses in Thessaloniki, Greece. The analysis of our ethnographic work in this area allowed us to address key research questions posed by energy scholars on how "people live with – and without – energy" [32 ,p.5]; and to respond to calls by subaltern urbanism scholars to "recognize the lived materialities of squatters as emergent forms of dwelling, sociality and cooperation" [89 ,p.339] and as "a terrain of habitation, livelihood, self-organization" [90 ,p.223].

Prompted by the narratives of refugees we introduced the concept of refugees' energy commons, to explain the self-organised practices of infrastructuring energy in refugees' squats as well as the different meanings that energy provision can have, how refugees perceive energy, what practices and activities they engage in and how energy constitutes not only a means for meeting basic needs, but also a means of building practices of solidarity and mutual support. Our research contributes to raising awareness of the energy conditions of refugee housing and opens new pathways for further research.

First, through documenting new practices of energy commoning which arise through the need to access energy in non-commodified ways, we note that refugees' energy commons do not map onto existing commoning practices or pre-existing political, ecological or ideological affinities. As refugees struggle to overcome housing and energy enclosures, they invent novel practices of sharing, commoning, cooperation and mutual support. As Federici argues "the new enclosures ironically demonstrated not only that commons have not vanished, but new forms of social cooperation are constantly being produced" [58 , p.102]. People who have been forced to go through multiple borders, controls and bureaucratic delays, try to recreate their lives and invent housing and energy commons that are fully or partially independent of the state and the market. Bringing into focus these practices enrich the discussion on energy commons.

Second, our research points at the importance to expand the research focus and enrich the discussions on the housing-energy nexus for refugees. The material we present here underscores that refugees are particularly vulnerable not only when it comes to accessing housing but also when it comes to accessing energy. Finding substandard rentals or occupying abandoned buildings, such as the examined squatted houses in Thessaloniki with energy and other infrastructures damaged, means that refugees have to activate their knowledge and invent techniques to repair the buildings and find improvised ways to heat, cool and light them and provide electricity.

Third, our ethnographic material points to the need to reconceptualize energy as a social relation and go beyond energy poverty debates, as explained below. We hope our research can open a broader discussion around the social life of energy. Accessing energy is imperative for one's survival, and as such, it becomes generative of new social relations between people who come together in order to cope with the lack of official housing and energy provision for refugees in the European context. Thus, we argue that EU (green) energy policy should make clear provisions for refugees, taking into account that refugees' energy commoning practices–on the ground. Strategies to address decarbonization can—and should—begin with the everyday people's practiced uses of energy. The lived experiences around infrastructuring energy in refugees' squats which we document in this paper, opens a research agenda around the importance of the social life of energy which revolves around everyday life practices of cooking, lighting, heating, cooling, and communicating, but is also marked by darkness, dimness, and hiding. Alluding to the term proposed by Bille and Sørensen, who talked about the "social life of light" as a way of "revealing or concealing particular aspects of social life" [78 ,p.266], and to Petrova's very important work on the socio-cultural aspects of illuminating homes [75], we show here that the presence of energy is linked to refugees' practices of visibility and invisibility. The energy activities of refugees depend on their legal status, financial means, acceptance by neighbours and mutually supportive relationships with other residents. Thus, refugees' energy commons may be visible or invisible. In fact, there is a small paradox here; although a presence and visibility among refugees is essential for

creating the solidarity practices that secure energy provision, at the same time, an 'absence' or 'invisibility' and 'illegibility' of the squatters' communities to the state and the market is equally important for the survival of the infrastructures and practices that secure their energy provision.

In relation to our previous point, we note that energy becomes a social binder. Sharing electricity from house to house via cables, sharing reused car batteries, collective gathering and sharing of firewood, collaboration in restoring the abandoned houses, sharing energy infrastructuring and engineering knowledge all constitute forms of what we call refugees' energy commons. These infrastructuring practices, which cover the basic energy needs of refugees, are produced by commoning relations. But in turn, they also generate new commoning relations. As we show in this paper, by remaking energy infrastructures, refugees also collectively re-build their lives and empower their interconnections. This way, energy becomes a social binder, and energy commoning becomes a means to enable refugees to reconfigure their houses, their lives and their trajectories.

In the presentation of our research material, we are careful not to romanticize the agentic and community-building practices of refugee energy commoning. As we have shown, people living in abandoned houses face extreme difficulties and precarity, mainly due to EU and Greek migration policies. However, we want to highlight that squatting may begin as a survival practice and "sheltering strategy by marginalized individuals" [91], but the mutual aid relationships that can develop subsequently, oftentimes lead to innovative constructions in common, including energy infrastructures and collective energy practices.

Finally, we hope that our suggestion to reconceptualize energy as a social relation of production and reproduction—grounded on ethnographic research—will open a critical dialogue around the dominant concept of *energy poverty*, whose typically technocratic definitions hide more than they reveal, as they obfuscate the complex socio-political and cultural dynamics that shape the aim for universal access to energy [92]. Rather than focusing on energy prices and inability to pay bills, we argue, energy access (or lack of) must be understood as symptomatic of deeper structural inequalities embedded within racialized capitalist relations of housing and energy infrastructures production [40,41]. We therefore call for a critical revision—or even the abandonment—of the concept of energy poverty in its current form. Instead, we advocate for a more expansive analytical framework that situates energy access within the broader housing/energy nexus, and examines it as a function of differential access to the social relations of production and reproduction that underpin everyday life.

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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.

Data availability

The data that has been used is confidential.

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