



Original research article

Energy self-defence against official policy: prosumer motives and tactics in the Czech Republic, Hungary, Poland, and Slovakia

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ABSTRACT

This article analyses the obstacles and opportunities that prosumers from the V4 countries (the Czech Republic, Poland, Slovakia and Hungary) perceive in relation to the further development of prosumer energy. Given the growing number of prosumers in these countries, we are particularly interested in the motivations behind their actions. Our hypothesis assumes that the rapid increase in the number of prosumers in recent years represents a form of grassroots energy self-defence, driven by rising energy prices and the unpredictable state energy policies—factors that were further exacerbated by the outbreak of the war in Ukraine in 2022. In this article, the term ‘energy self-defence’ refers to prosumer activity, but we use it more broadly to encompass all local grassroots initiatives organized by various social actors independently of state administrations and large private companies, aimed at ensuring energy security and energy access, and at achieving independence from political and economic pressures. Drawing on focus group interviews conducted in the four countries of the region, we analyse the challenging relationships between prosumers and distribution system operators, prosumers’ attitudes towards state energy policies, and their capacity for collective action. One of the main conclusions of this research is that a lack of trust in official energy policy and the shock of rising energy prices may drive individuals to become prosumers. However, this is only the first step towards building an energy civic society capable of collective action—through energy cooperatives, energy communities, and political initiatives emerging from the prosumer movement.

1. Introduction

Owing to the uncertainty in energy markets caused by the war in Ukraine and the earlier pandemic crisis many individuals and household residents in the Visegrád Group (V4: Czech Republic, Poland, Slovakia and Hungary) began to fear they would have no access to cheap energy and will be unable to bear the rapidly rising costs of heating their homes. This led to a significant increase in the number of photovoltaic (PV) micro-installations and new heat pumps installed since 2022. This was not a part of a planned government policy, but rather a grassroots reaction to the lack of a clear, transparent and predictable vision of energy policy on the part of the authorities of the V4. For example, in 2022, as many as 57 % of all micro-installations were built in Poland without any support programme and most of them were mounted in response to high

energy prices [1]. The case of Eastern European countries shows that the sense of threat from the geopolitical situation, sluggish national energy transition and the lack of trust in official institutions responsible for energy policy can bring unintended consequences in the form of a spontaneous transition to energy and heating sources independent of the state. In this article, this process is called energy self-defence. In addition to prosumer activity, it includes all grassroots activities that various social actors organize locally and independently of the state administration and large private companies to ensure their energy security, access to energy and energy independence from political factors and economic conjunctures. The concept of self-defence has appeared in the literature in the context of the right to defend democracy against political authoritarianism [2], the moral right to tyrannicide when defending human rights [3] and the right to defend against the state and

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infrastructural colonization as a form of social and ecological conquest [4]. In this article, prosumerism is analysed as a manifestation of social self-defence against the unpredictable energy policy imposed by the state and energy corporations. Jacek Kuroń [5], one of the leaders of the democratic opposition in Poland from 1970 to 1980, claimed that ‘every matter that people of good will consider their own can become an opportunity for the creation of a social movement’ (p. 95). The threat of energy poverty and the constant pressure of rising energy costs affect broad social masses. Can this be the basis for grassroots mobilization in the V4 countries? To check whether this can happen, it is worth explaining the attitude of people taking action within the framework of energy self-defence towards the state, energy distribution companies and their readiness to switch to off-grid solutions.

This article analyses what obstacles and opportunities the inhabitants of the V4 countries see in the further development of prosumer energy and attempts to identify the opportunities for subsequent stages of decarbonisation in everyday life (such as investments in energy storage or electric cars) and the conversion of individual PV installations into broader initiatives (prosumer movements, energy communities and so on). We are also interested in how already installed PV panels can

change their users’ social behaviour and attitudes towards the challenges of energy transition. In the context of grassroots activities in the energy sector and building social energy self-defence, the question arises today about the relationship between the civic energy society and the state: should these activities be undertaken in times of crisis and transition in a coalition with the state or outside the state and the political sphere? Is the state an ally or have its unpredictable energy policy and the practices of state-owned energy distribution companies become an unintended cause of citizens investing in PV or heat pumps? Can these individual actions be transformed into broader energy initiatives such as energy cooperatives or communities? Given the growing number of prosumers in the V4 countries, we were interested in the motives behind their actions. We hypothesised that this is a form of social energy self-defence caused by rising energy prices and unpredictable official energy policy, reinforced by the outbreak of the war in Ukraine in 2022. Answers to these questions were sought during focus group interviews.

However, after this first wave of particular interest in PV in 2022, the situation developed differently in the following months. In the Czech Republic, in 2022, there were approximately 35,000 PV power plants connected to the grid. By the end of 2023, the number of newly

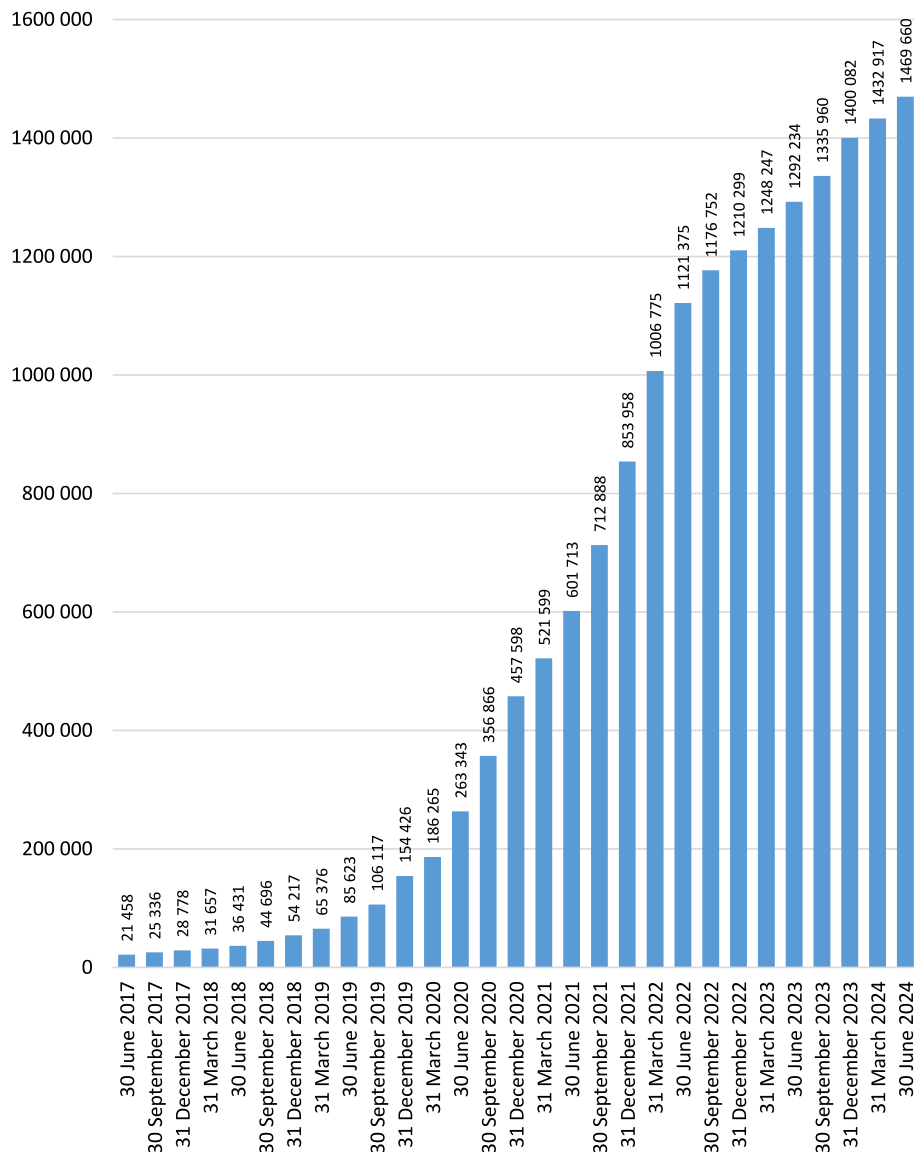


Fig. 1. Total number of micro-installations in Poland connected by distribution system operator: quarterly cycle

Source: Polish Power Transmission and Distribution Association (PTPIREE) <http://www.ptpiree.pl/energetyka-w-polsce/energetyka-w-liczbach/mikroinstalacje-w-polsce>.

connected PV power plants more than doubled to 82,000 [6]. In turn in Poland, the increase in the number of new PV installations installed by individual prosumers slowed slightly in 2023 (Fig. 1), yet in Hungary—where the war factor did not play a major role—the process initiated before 2022 continued in the following years (Fig. 2). While in 2022, when the war in Ukraine broke out, the number of installed PV capacity in Slovakia did not change significantly, the prolonged uncertainty on the energy market caused a boom in PV panels a year later in 2023—the installed solar PV capacity increased from 573 MW to 840 MW within a year. (Fig. 3) This was an increase of 47 % compared to 2022. Small-scale residential sources (of up to 10.8 kW) accounted for slightly more than half (52 %) of the recent annual capacity increase in Slovakia, with an average size of around 7 kW [7]. On the other hand, the heat pump market in Poland completely collapsed in 2023 (Fig. 4). After a record-breaking 2022 when over 188,000 water-to-air pumps were installed, in 2023, the number of this type of new heat pumps dropped to less than 111,000. This is important in the context of the development of PV micro-installations. As the data from Poland show, there is a strong tendency to combine these technologies. When we compare applications for PV submitted under the Clean Air programme with applications for heat pumps, the proportion is 10 to 5. In other words, for every 10 installed PV installations that received funding, there were 5 heat pumps. Applying for funding for a heat pump is therefore often the next step after investing in PV, which significantly contributes to the increased popularity of these devices [8]. In our study, the majority of heat pump owners had PV micro-installations. For this reason, in this article, we decided to use the results of focus group interviews conducted with four groups of prosumers and four groups of heat pump owners. (Details are described in Section 5 devoted to the research methods).

The changes in the dynamics of both the number of new heat pumps and PV micro-installations observed in recent years show that, in the face of the possible impact of various external factors, a permanent framework of public policy supporting the development of civic energy is needed to implement the bottom-up and systematic decarbonization of energy and heating systems. This is a particularly important challenge in case subsidies allowing consumers to become prosumers are limited [9].

However, the increased number of individual prosumers in the V4 countries was not supported by legal regulations and settlements between prosumers and energy distributors. In Poland, the earlier solution (net-metering) of the settlements for prosumers (applicable for

installations made until April 2022) acts as electricity storage which has a capacity of 0.8 kW and does not need to be purchased (of 1 kW of energy fed into the grid, a prosumer can recover 0.8 kW of energy for their own use during the year in periods when the sun does not shine). The prosumer only pays the distribution fee charged by the energy companies. This model, however, only applies to those prosumers who connected their installations by the end of April 2022. Prosumers who connected to the grid after April 2022 are covered by a completely different billing system known as net billing. From April 2022 to 1 July 2024, prosumers sold their surplus energy to the grid at the market price, set at the end of each month (market monthly electricity price). However, in July 2024, they had to switch to hourly billing (market electricity price): energy is sold to the grid at the price applicable at a given hour. The basic difference between net-billing and net-metering lies in the selling price of PV energy—the importance of energy storage has increased due to frequent price fluctuations in the new billing system.

In Hungary, household solar systems installed before 2024 operate under a net metering scheme, where electricity production and consumption are offset annually, with both valued at the same retail rate. This highly beneficial system allows excess energy generated during the sunnier months to be used throughout the year, with any positive balance compensated by energy service providers. It remains available for eligible users until 2035, though it was originally planned to be phased out for everyone from 2024. However, due to public outcry, the option was kept open for existing power plant owners. From January 2024, new installations fall under gross metering, where electricity fed into the grid and drawn from it are measured and billed separately. Exported electricity earns a low fixed feed-in tariff (5 HUF/kWh— ~ €0.0125/kWh), while imported electricity is purchased at the full retail price (~36–37 HUF/kWh— ~ €0.09/kWh), making self-consumption more economically advantageous than grid export under the new system [10].

Electricity sharing in the Czech Republic has only been possible since 2024 (apartment building residents since 2023) due to the amended Energy Act (as part of the transposition/implementation of the 2019 Winter Package), which introduces energy communities, renewable energy communities and prosumers as new types of market participants. It is possible to share surplus electricity not only with the community members (with and without using the distribution grid), but also with customers outside the community (always using the distribution grid). As far as billing is concerned, in the case of sharing without the use of the distribution system, the regulated component of the electricity price

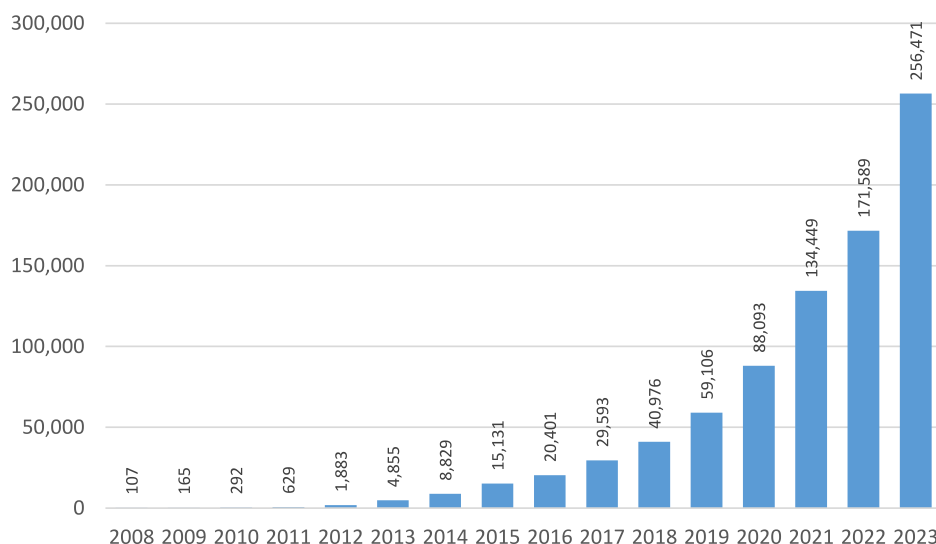


Fig. 2. Number of micro installations in Hungary between 2008 and 2023

Source: Hungarian Independent Transmission Operator (2024). Data for 2023 of small household-sized power plants [Háztartási méretű kiserőművek 2023. évi adatai]. Available at: <https://www.mekh.hu/nem-engedelykoteles-kiseromuvek-es-haztartasi-meretu-kiseromuvek-adatai>, retrieved on the 18th of October 2024.

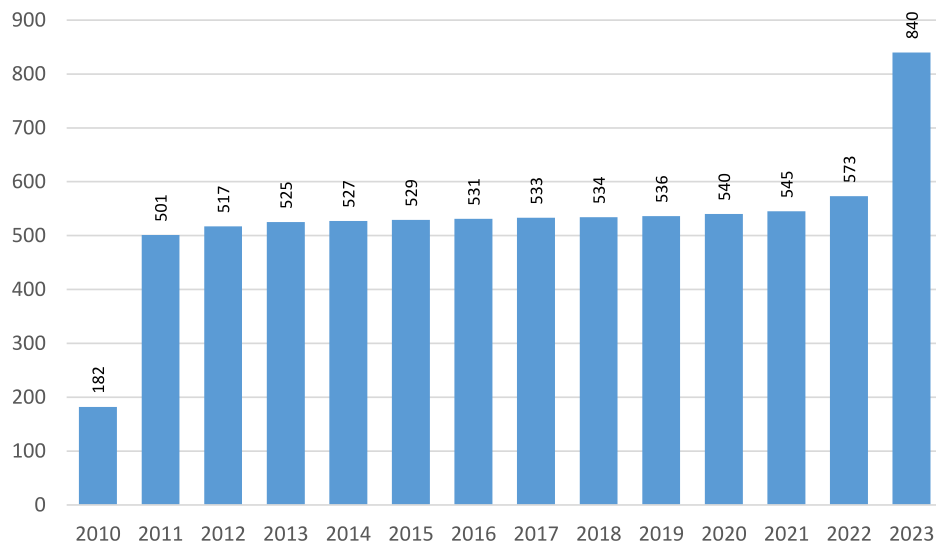


Fig. 3. Installed capacity of solar PV in Slovakia—2010–23 (MW)

Source: OKTE; SIEA; ÚRSO; regional DSOs (2024).

related to the payment per MWh is not paid. In the case involving the sharing of electricity with the use of the distribution system, the data for the billing of the electricity supply are used to account for the shared electricity and the data for the billing of the distribution system service. The regulated component of the electricity price related to the payment per MWh is therefore paid [11]. If you own a PV power plant with an installed capacity of up to 50 kW, you are legally entitled to apply for the selling of surplus electricity, even without the need for an energy business licence. The rate at which surplus energy is received depends on the distribution company. For example, Moravian Oil Mines (*Moravské Naftové Doly*, MND), as of April 2025 offers 1000 Kč/MWh (approx. EUR 40) for the first 2 MWh of electricity and for each additional MWh 500 Kč/MWh (EUR 20) with the fixed monthly fee of 60 Kč (EUR 2,4) [12]. ČEZ ESCO buys surplus electricity from PV plants based on the hourly (spot) price with a deduction of CZK 750/MWh [13]. The cost of electricity from the grid is much higher than what you can get for selling your surplus. This means that if you sell surplus, you earn less than you would save by using it immediately.

In the early 1990s, after the regime change, V 4 countries remained dependent on energy supplies from Russia for a long time [14]. On the other hand, they became dependent both technologically and economically on Western European core countries [15]. What role can prosumers play in these circumstances in the V4 countries and do they have a chance to socialize energy policy? The significant increase in the number of prosumers in the V4 countries, as well as the above-average growth dynamics of PV energy capacity (in the 27 EU countries, the installed capacity amounted to 257,057 GW at the end of 2023, which means that it increased by 51 GW compared to 2022 and that the dynamics have been maintained at the level of 25 % compared to 2021 and 2022; at the same time in Poland the growth rate of the PV market amounted to 38 % [1] and, like in the other V4 countries, was mainly driven by prosumers' activity) is a sufficient reason to look at social behaviour and prosumer trends in the V4 countries. Section 2 emphasizes the importance of the war in Ukraine as a factor strengthening financial and energy uncertainty. Section 3 outlines the centralized nature of energy systems in the V4 countries and the general distrust of official institutions as a factor reinforcing energy self-defence attitudes. In Section 4, we consider to what extent the phenomenon of the growing prosumer activity in the V4 countries may be a continuation, under different socio-historical conditions, of the tradition of Gramsci-style civil society movements that were observed in these countries in the 1970s and 1980s. Section 5 presents the methods of collecting empirical

data. Section 6 describes and discusses the research results. In Section 7, we demonstrate research conclusions and possible implications for energy policy.

2. The specificity of energy policy in the V4 countries and the impact of the war in Ukraine on changes in the energy sector

The V4 countries share a common history and geographic location and also face similar challenges, such as centralized energy systems [16] and problems with democracy in the last decade [17]. In most of the V4 countries, there is a strong influence of right-wing populists [18], a low level of social trust and a weak civic sphere. For example, in 2024, nearly 60 % of Polish society declared that they 'are not involved in their community or social work in civic organizations' [19]. A similar model of social withdrawal has been observed in recent years in the other V4 countries. From the beginning of the debate on energy transition, political elites from the former Eastern bloc were the most sceptical about the assumptions of the European Union's (EU) energy and climate policy [20–22]. Against this background, issues related to the EU energy and climate policy are a much greater and more complex challenge in the countries of Eastern Europe than in Western Europe. Indeed, it has been shown that public acceptance and readiness to pay for climate policy measures is significantly lower in Hungary than in Western European countries, mainly due to lower disposable income of households, low social capital and trust, a high level of corruption and limited environmental thinking [23]. The war in Ukraine and reliance on Russian energy resources have further complicated the region's energy transition [24]. The strong dependence on supplies of oil, gas and coal from Russia in this part of Europe is a legacy of the Eastern bloc, which existed until 1989 [25]. Although opinions about supplies from Russia divided the region into countries that continued to get supplies from that country (Hungary and Slovakia) and those that tried to diversify fuel supplies more decisively (Poland and the Czech Republic), uncertainty in energy policy became a common fact for the entire region [14]. The war in Ukraine was an additional challenge for the governments of the V4 countries. The outbreak of the war limited access to cheap Russian gas, which became a concern for state elites and forced many European governments to change their energy policies [26]. Consequently, the costs of the war affected broad social circles, particularly the labour class [27]. Working people in the entire region had growing concerns about the costs of the green transition [28]. These concerns affected not only the residents and employees of the still-active coal basins and the coal-

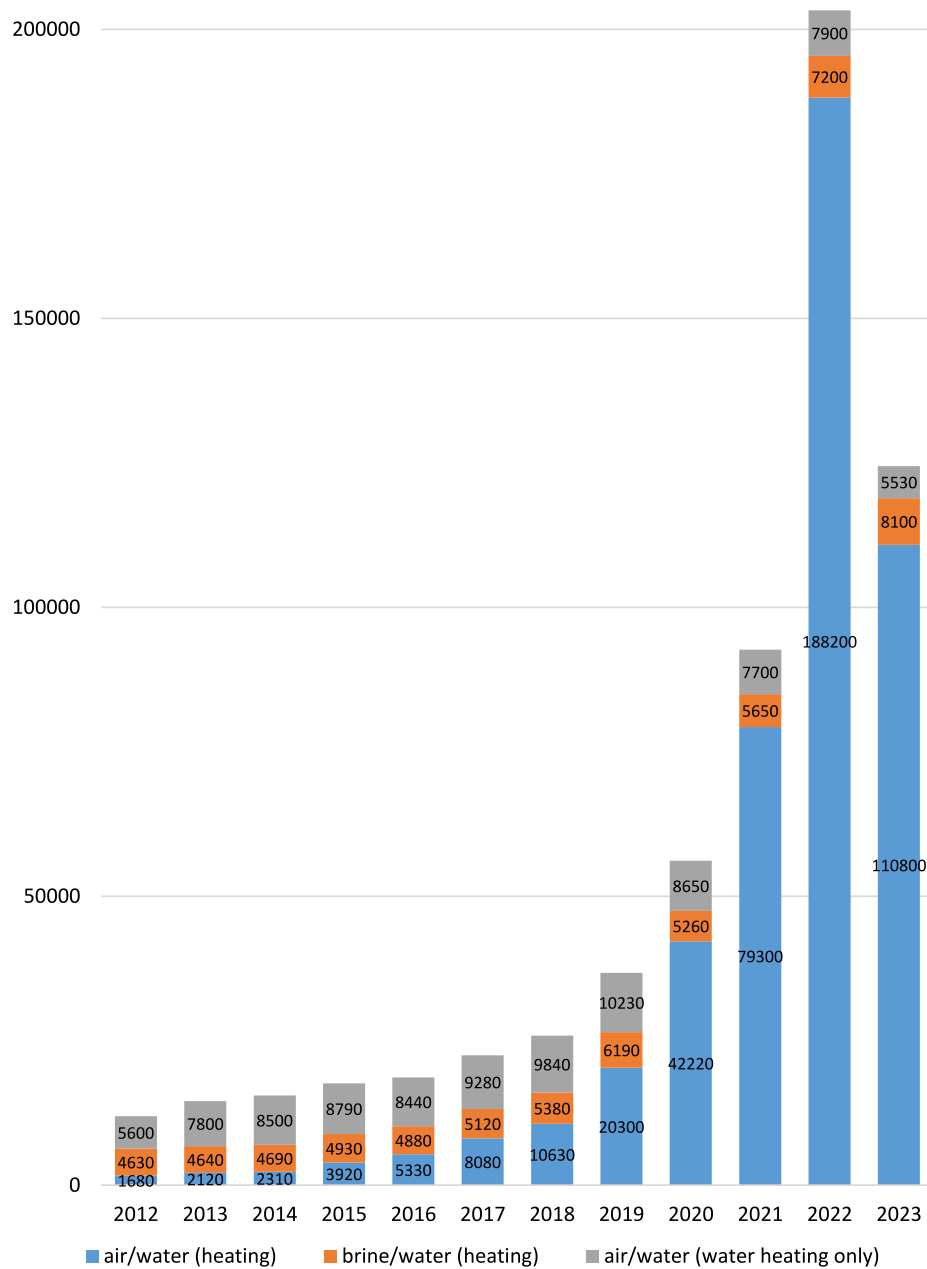


Fig. 4. Summary of heat pump sales in Poland from 2012 to 2023
Source: Polish Organization of Heat Pump Technolog Development PORT PC.

based energy sector [29] but also other sectors of society fearing that their financial situation would deteriorate during the energy transition process [30].

3. Centralization of energy and distrust in the state and official energy policy as an impulse for self-defence energy and development of prosumer energy in the V4 countries

While many authors see an opportunity for the growing importance and perhaps even dominance of decentralized organizations and structures of energy systems [31,32], the practices and governmental policies in the V4 countries do not confirm the trends of decentralized energy policy.

The centralization of the energy and political systems is the main obstacle encountered by grassroots energy initiatives in Eastern European countries [16]. This is manifested by state control of energy

infrastructure and main energy sources, implying the attitude of energy nationalism [33]. In practice, this evokes distrust towards the unreliable external environment and stresses the necessity to rely on domestic energy sources. The main features of a centralized energy system are as follows: energy infrastructure is located far from end users; energy distribution is based on unidirectional transmission and high-voltage networks: from large power plants to end users; energy is owned primarily by private companies and the state; for this reason, the state and large energy corporations are the main actors dealing with energy policy; and the management model is based on hierarchical and impersonal structures created from above, based on economic, territorial and administrative coercion.

In the Czech Republic and Slovakia, mainstream media emphasize the need to rely on nuclear energy as seemingly the most reliable 'domestic energy' [34]. In Poland, a slow phase-out of coal is also to take place while maintaining full state control over the energy sector:

centralized coal companies are to be replaced by state-controlled nuclear power plants and the importance of grass-roots renewable energy is to be reduced [35]. To defend local economic interests in V4 countries, coal consumption is often separated from climate policy challenges [36]. It is also emphasized that the specificity of the energy policies of Eastern European countries results from state capacities, relations with Russia, technological lock-in and electricity import dependency [15]. The adjective ‘dependent’ is key to explaining the delay in the transition to renewable energy sources in the V4 countries—‘dependent market economies’ in Eastern European countries [37] create more difficult conditions for the development of community energy. Under these conditions, the expansion of renewable energy deployment characterized by top-down policy-making, lack of transparency and the dominant role played by large power utilities has provided little incentive for decentralized community-owned projects [15]. In the V4 countries, activities related to energy transition are far from decentralisation of decisions and active participation of civil society. To put it differently, the semi-peripheral nature of the V4 countries is neither conducive to the development of energy democracy nor is it an impetus for innovation in the energy sector. Although it is difficult to achieve the goals of decarbonization policy and build sustainable energy solutions without civic engagement, an active society is more of a problem than a solution for the political elites in the V4 countries [38].

Semi-peripheral and dependent development in the V4 countries also reduces the level of trust in the state and constantly changing legal regulations. This atmosphere blocks the development of social innovations [39]. Problems with the ‘culture of trust’ in the countries of Eastern Europe are among the factors that deter people from building civic democracy in this region of Europe [40]. Sztompka describes the ‘culture of trust’ collective behaviour in a given society based on two simple rules: (a) trust others, assume they are credible until the opposite turns out to be true; (b) treat the trust shown to you by others seriously and meet their expectations until it turns out it was fake. The opposite of the ‘culture of trust’ is the ‘culture of distrust,’ dominated by indifference to the matters of others, insensitivity, suspicion, cynicism, and corruption [41]. In the 1990s, the ‘culture of distrust’ in Eastern European countries—which manifested itself with the new ‘risk environments’, widespread anomie (situation when society focuses on achieving the culturally preferred goals—whatever they are—but does not equally stress the approved norms regulating the means to achieve those goals [42] (p. 235)) and inefficiency of political elites—was explained by the cultural heritage of the communist era [43]. The current distrust in power elites and state policy is the result of the social and political practices that have been implemented for 35 years, since the collapse of the Eastern bloc in 1989. Trust and distrust cannot be underestimated when planning any social activities [44]. This also applies to energy policy and energy transition. There is a strong link between trust and a higher level of climate action [45,46]. Since climate change is a collective action problem, individuals need to trust others to act in the same faith, thus trust plays an indispensable role in turning climate change concerns into action. Furthermore, if there is a high level of corruption, people will be reluctant to financially sacrifice for climate action or energy transition fearing the government would mismanage/misappropriate the revenue [23].

In Eastern European countries, where a low level of general trust is constantly observed, faith in official energy price forecasts and energy policy after the outbreak of the war in Ukraine has completely collapsed. Although trust can refer to many dimensions (cultural characteristics of society, individual characteristics of people and the aspect of risk) [47], the assessment of how official institutions and official policies function has a significant impact on the overall level of trust and social attitudes. Hence, paradoxically, the high level of distrust towards the official order and the real and potential negative consequences of the actions taken by official institutions can stimulate grassroots social activities. Distrust towards the government’s actions encourages individual social actors, individual groups and organizations developing civic energy to

implement innovative solutions as a form of energy self-defence against the uncertain situation in the energy market and the lack of clear and long-term visions of energy policy on the part of the government. In this way, entities creating the civic energy sphere try to survive, develop and achieve independence from the government administration and the official energy system [48].

4. Traditions of Gramscian civil society in the V4 countries and energy self-defence as their continuation? Questions concerning prosumer energy

The tradition of creating grassroots civic movements as a form of self-defence against the state—which, on the one hand, wants to monopolize the entire public sphere and on the other hand, is an actor that arouses distrust and is more of a hindrance than a help in everyday social practice—is quite deeply rooted in the V4 countries. It is associated with dissident movements that were active from 1970 to 1980. The revival of the concept of civil society as understood by Gramsci—as a counterweight to the hostile state [49]—became a useful tactic of political struggle in the 1970s and 1980s, in both communist regimes in Eastern Europe and right-wing dictatorships in South America [50]. In the late 1970s and early 1980s, the concept of civil society became a catchphrase in Eastern Europe that made it possible to describe all forms of activity independent of the state and the ruling political regime. Before this term was popularised and hit the banners and journals of nascent opposition movements the activists and initiators of anti-government actions themselves had spoken about ‘alternative culture,’ ‘independent culture,’ ‘parallel structures’ or simply ‘independent society.’ What was important in this Eastern European phenomenon of civic revival was that the core of this movement was—as Vaclav Havel [51] wrote in his *Power of the Powerless*—‘ordinary people with ordinary cares, differing from the rest only in that they say aloud what the rest cannot say or are afraid to say’ (p. 49). Can the grassroots social activities that are emerging today in response to the energy crisis and energy transition give rise to a civic energy society [52] in the form of energy community, prosumer movements, ‘independent energy,’ ‘parallel energy structures,’ ‘independent energy culture’ and ‘independent energy society’? Can it finally become an effective energy self-defence against state authorities and private energy corporations? Gramsci’s concept of politics as a struggle for class and cultural hegemony offers a new perspective on energy transitions as a deeply political and contested issue [53]. Some argue that the neoGramscian concept of hegemony is somewhat related to the idea of regime in energy transition studies [54]—in this case, the privileged position of the state and private corporations can be undermined by various initiatives and actors of the civil energy society. Among these social actors are certainly prosumers [55], whose activities may refer to the civic and dissident movements of the 1970s and 1980s. It cannot be forgotten that civic movements and the renaissance of civil society from 1970 to 1980 in Poland, Czechoslovakia and Hungary were based on their opposition to the state. Cohen and Arato aptly describe this simple and consistent opposition to the official order:

... society against the state, nation against the state, social order against the political system, pays réel against pays légal or officiel, public life against the state, private life against public power, etc. The idea was always the protection and/or self-organization of social life in the face of the totalitarian or authoritarian state [56].

Answers to questions about the possible relationships between civil energy society, prosumer movements and the state and centralized energy companies today were sought during focus group interviews. The answers obtained allowed us to outline the possible shapes of energy self-defence in the V4 countries and to show the possible social space for the development of prosumer energy.

5. Research methods and empirical material

The research was carried out in January–April 2024 in Poland, the Czech Republic, Slovakia and Hungary. In each country, focus group interviews were conducted in three groups: prosumers, heat pump users and people experiencing energy poverty (12 groups in total). Respondents from each of these groups tried to cope with the energy crisis in different ways and prevent the rising costs of energy and home heating. However, this article uses only the material collected during focus group interviews with prosumers and heat pump owners, who were also largely prosumers. The empirical material collected during interviews with people struggling with energy poverty was used to analyse other, separate issues beyond the topic of this article. There were eight such groups and each had five to seven respondents. While in Slovakia, the interviews were held in Bratislava and in Poland in Wrocław, in the Czech Republic and Hungary they were conducted online (Table 1). As with a traditional focus group discussion, virtual focus groups generate data from the interaction of the participants—the advantages of virtual groups are the lower cost of conducting research and the fact that virtual focus groups do not have to be limited either in space or time (their duration can be more flexible) [57].

The only selection criterion for focus group interviews was the years 2022–2023 when respondents installed PV panels and/or a heat pump. Other criteria at the recruitment stage were not significant to us—the most important was the context of the time in which the decision to establish PV panels was made and the symbolic universes present in the prosumer environment [58] (p. 113), which justified and legitimized their actions and created a certain cultural (micro)climate in this group of people (we were tempted to use the term ‘prosumer subculture,’ but we will leave the justification of these intuitions for further research).

We decided that the process of installing PV panels by individuals should be discussed together with heat pump users because these two environments are strongly related. Most of the heat pump owners had previously or simultaneously installed PV panels [8]. Respondents were recruited for the study based on this single criterion by research companies in individual countries. They were commissioned to provide technical support for the study (recruitment, recording interviews, transcription and also room rental in the case of stationary interviews). All participants in the study were guaranteed full freedom of speech and full anonymity and their participation in the study was voluntary.

Table 1. presents the exact number of respondents in each country and the place where the interviews were conducted.

In each country, the interviews were conducted based on the same semi-structured interview scenario translated into four languages (Polish, Czech, Slovak and Hungarian). All interviews were recorded and then transcribed. The material from the focus group interviews obtained in this way was the starting point for the analysis of respondents’ statements and arguments. Qualitative analysis was performed according to the topics selected from the empirical material: motives for installing PVs by prosumers, their attitudes towards energy distributors and state policy in the context of civic energy, changes that have occurred in prosumers’ social behaviour and everyday lives, as well as opportunities for the development of energy cooperatives and communities in the V4 countries. All these elements create a comprehensive picture of grassroots reactions in the energy sphere to systemic

uncertainty in the V4 countries, which we call energy self-defence here.

Without a database of all prosumers in the four selected countries, it was not possible to create a representative sample that could be used in quantitative research. It must be noted that a lot of data and information concerning energy policy is hidden by states and governments under the pretext of protecting the security of the ‘national interest,’ which makes it difficult to conduct quantitative analyses. In such situations, qualitative methods come to the rescue. They are not representative by definition, but allow for drawing general conclusions about specific social groups [59]. It is worth remembering to distinguish between these two terms: representativeness (characterizes samples only) and generalizability (concerns findings). For this reason, a few cases, mirroring a pervasive phenomenon in society or groups, may be enough if its population is fairly homogeneous [60]. In research on energy transition, it is worth not only using statistical data but also skilfully reaching for various qualitative methods and obtaining information from sources such as: beliefs, attitudes, stereotypes, opinions, emotions, motivations; meetings, interactions, ceremonies, rituals, cultural products, rules and social conventions; documents and texts (historical, literary, journalistic) [60].

We aimed to collect in-depth answers through discussions and group interaction to better understand prosumers’ attitudes, beliefs and opinions about PV and heat pump usage as well as energy policy. It was particularly important to explain the motives for installing PV panels, the possibility of transforming individual prosumer behaviour into broader actions at the general social level and the relations of prosumers and the emerging civil energy society in the V4 countries dealing with the state and official energy systems. Although in the case of focus group interviews (similarly to other qualitative methods), data collection is inescapably a selective process and the researcher cannot and does not ‘get it all’ [61], still the obtained material allows for a better understanding of how the studied environment perceives social practice and the ongoing processes in public life. The research process often becomes a phenomenon with political consequences, where the researcher and respondents jointly create and discover a new type of self-knowledge and political awareness of the existing obstacles and opportunities to change the direction of development of the social situation, as well as of their place in this process [62]. Despite all these challenges, focus group interviews remain an important research tool for exploring phenomena occurring during energy transition [63].

6. Results and discussion

6.1. Motives for prosumerism in the V4 countries

The literature lists various motives and social functions of prosumer activities at the systemic level: strengthening decarbonisation policies, activating various social actors, creating social networks [64], as well as initiating and strengthening changes in energy systems [65]. Our analysis focused on the perspective of prosumers and how they perceived the world.

In Poland, people invest in PV primarily to become independent from energy prices and unpredictable state policy in the energy sector. It can even be said that in Polish conditions, the lack of trust in the state and its policy is among the main reasons for the emergence of energy self-defence. The will to be independent of the market situation, changing regulations and government decisions is a key factor in the creation of ‘community energy.’

A second factor affecting the development of micro-installations has been the possibility of obtaining various forms of funding from EU projects (for example, the Regional Operational Programme), municipal subsidies and programmes such as ‘Mój Prąd’ [My Electricity] for the installation of PV systems.

The third motive is the planned renovation of houses and the replacement of heating systems. Some gave up on coal or eco-pea coal furnaces, others had no choice (e.g. they had no access to the gas

Table 1
Number of respondents in focus group interviews in each country.

Place:	Poland (Wrocław)	Czech Republic (Online)	Slovakia (Bratislava)	Hungary (Online)	Total
Prosumers	7	6	7	6	26
Heat pump users	7	5	7	6	25
Total	14	11	14	12	51

network) and so they decided to install heat pumps. However, before they invested in a heat pump, they had to install PV first.

In the Czech Republic, the predominant rationale for the decision to invest in PV panels is economic, particularly the escalation in electricity prices and the aspiration to curtail energy consumption. The apprehension of escalating energy prices, notably electricity, was a recurrent theme. Residents of two prosumer households surveyed made the decision to invest in PV panels when their fixed-term contract with an energy supplier expired, and they initiated a period of research and deliberation before entering into a new contract. For example, one respondent stated that:

Our fix-term contract ended, so we started to think about getting something extra, but we have large wood resources so we heat with wood, so [the decision to invest in PV] was mainly for conventional consumption (CZ.1).

However, the availability of government subsidies was also identified as a significant motivator for one household. Notably, no one cited environmental or climate factors as a rationale for their decision to invest in PV panels.

In Hungary, respondents' motivation for installing solar panels was primarily driven by economic considerations, such as the competitive prices of renewables and long-term savings from low-carbon alternatives, such as electric vehicles. However, one respondent stated: 'I was building [a new house] in an area where there was already a new transformer and my goal was to make myself completely independent of any energy supplier.' (H.1.3).

6.2. Attitudes towards the utility service provider and state

Relations between prosumers and distribution system operators (DSOs) in the V 4 countries are generally not good. The experience with DSOs only led to an even greater distrust of the official energy system and deepened the division into 'them' and 'us' in the minds of prosumers (ordinary citizens, prosumers who are exploited, have to defend themselves against the actions of 'those' who manage the energy system). For example, the main DSO in Poland, Tauron Dystybuja, became a symbol of evil and the state's impure behaviour towards prosumers. This opinion was already expressed in earlier studies with prosumers in Poland [66]. The changes to the billing system—described in Section 2—worsened the already tense relations between DSOs and prosumers.

Thus, instead of savings, prosumers expect additional fees for a given billing period. As one of them said:

I am waiting for the bill, but I am already putting money aside so that I don't go bananas when the bill comes. It is no longer as rosy as in those older contracts which were very profitable. It is no longer like that now. (R.1.2)

Another respondent added:

I have recently found out how they calculate it. The prosumer pays 75 groszy (EUR 0.2) per kilowatt when he draws energy from the grid, and when he gives it back, he is paid 40 groszy (EUR 0.9). (R.1.4)

Generally, regardless of whether it concerns traditional energy consumers or prosumers, energy companies transfer the costs of energy transmission to them. The system operating in Poland does not allow, for the time being, the exchange of energy between autonomous micro-grid prosumers as part of the peer-to-peer (P2P) energy transaction.

In Hungary, participants revealed a spectrum of experiences, from satisfaction and smooth operations to significant frustration and legal concerns. Hungarian respondents agreed that what affected them as solar panel users were national regulations and EU rules, not the utility companies since their operations were heavily influenced by government policies. In general, Hungarian participants distrusted the government as they found energy policy inconsistent. For example, one

respondent stated that:

My problem is that the legal environment changes unilaterally and the state does not fulfil its contractual obligations but simply takes the initiative and changes the terms of the contract, and if that happens, I will certainly go all the way to the EU courts. (H.1.5.)

Others talked about the total centralization of decision-making without consulting market participants and citizens. One of them responded by asserting:

I think that one of the main problems with Hungary's energy policy is that they very much exclude the market and figure out in an office how much it will cost. Life would be much easier for owners, solar panellists, gas suppliers and everyone if they could plan in a predictable market environment, which is not the case at the moment. Because they shape and increase prices to put out the fire. For example, they block network development. (H.1.6)

Notably, the change in the solar takeover price and the announcement of the withdrawal of the balance-based billing system triggered a huge backlash among prosumers, which eventually made the government withdraw this regulation. Despite this 'success' of backtracking, respondents were sceptical about how much prosumers as interest groups could achieve in shaping public policy because the state owned the grid system and for other cultural factors such as individualism.

During focus group discussions in Slovakia, the notion of independence was predominant when it came to energy companies. When the respondents talked about their solar power plant being a source of independence, they did not mean independence from third countries (for example, Russia) from where energy was being supplied; they rather talked about independence from domestic energy companies. Own production enabled Slovak interviewees to utilise energy they produced themselves, although nobody from the focus group was disconnected from a DSO. Distribution companies were criticized by the interviewees but in most cases, Slovak prosumers were able to find a balance between utilising their own energy and still taking some electricity from the grid (see also the following section). DSOs were considered to be companies existing within a market economy, striving for profit and therefore, according to the interviewees, did not have incentives to deal with issues such as energy security or environment as long as these were not necessary for reaching profit. If they were interested in these issues, as one of the interviewees argued, DSOs would create conditions that would be much more favourable for prosumers. However, prosumers are in a disadvantageous position and there is not much they can do when it comes to existing regulations or prices. The only thing they can do to face the price of electricity, which they believe will rise in the future, is to install their own solar panels on their roofs.

In the Czech Republic, respondents generally adopted a conservative stance towards energy suppliers, preferring to engage with established, large-scale entities such as ČEZ or Innogy. These suppliers are perceived as offering greater stability and resilience. In addition, the respondents do not consider that they should be concerned about the energy security of citizens. As one woman stated:

As a regular customer of ČEZ, I am averse to experimenting. I am satisfied with the service provided and do not follow this issue [whether energy suppliers care about the energy security of citizens]. (CZ.3)

It is important to note that energy security has become a salient issue in the Czech Republic, precipitated by the collapse of multiple energy suppliers between October 2021 and March 2022 [67]. However, a notable exception to this trend emerged, characterized by a preference for more short-term contracts, which facilitated greater flexibility in switching suppliers.

6.3. Relationship between solar power and changed consumer behaviour

Does installing PV change anything in the everyday behaviour of prosumers? Two phases can be distinguished: first, they are delighted by free energy and the possibility of controlling self-generation of energy; second, they feel self-satisfaction and peace of mind as they do not have to pay big electricity bills. As one of the prosumers said:

My husband has an app and sometimes, at the beginning, when we installed it, he would check every day, every five minutes, how much we were producing. And now we're over it. We no longer look at our smartphones all the time. We are really happy only because we simply do not receive high bills. And we did not even use all the energy we produced. (R.1.4)

The topic of regaining peace, reducing worries about energy prices and increasing a sense of control over thermal comfort was often mentioned in respondents' statements. In this approach, PV not only supplies cheap energy but is also a certain self-defence tool against the threat of energy poverty. As one of the respondents stated:

The advantage is that I don't worry when it's very cold, when we didn't have PVs, well, we have that old pump with a heating curve set, so when we didn't have PVs, the electricity bills were very high. So we had to raise the heating curve a lot. Now I don't worry about it. It's just warm. (R.1.7)

Installing PV and the possibility of using free or cheap electricity does not mean that prosumers buy new devices that require a lot of energy. The desire to save energy rather dominates the behaviour of prosumers and does not entail the consumption of cheap energy just to 'show off':

My husband and I are very pragmatic. I didn't think about it and didn't want a sauna, although my friends talked about it. I decided that I wouldn't have time to clean it, so why do I need it? I'll use it once a year, so buying a sauna would be a waste of time and money. We didn't buy any other special gadgets in connection with cheap electricity from panels either. (R.1.3)

Installing PV can sometimes be a 'pioneering' action that causes an imitative effect and encourages others to do the same. In the case of PV, an individual's activity can affect a larger group of people and be a form of civic education. A resident of a small town admitted:

When I installed it, I will tell you from my own experience, my neighbour also installed it right away. Then the second did the same, and then the third one. And that's how it went in my town. (R.1.2)

From this perspective, prosumer activity goes beyond the energy sphere understood in a narrow sense and becomes an educational, civic and social activity. Therefore, it can be said that prosumers are becoming change agents towards a more decentralized and social energy model [68]. This triggers activity in many areas of collective life: the pursuit of securing cheap and independent energy generates social energy on many levels.

Hungarian participants shared the views of Polish prosumers about their satisfaction with low energy bills and a greater sense of control. A sense of greater autonomy seems to be an additional value in energy self-defence activities. In terms of changed behaviour, two dominant views were generally shared by participants. The first subgroup utilized excessive energy to finance additional consumption (Jevons paradox). Remarkably, two participants built pools and heated them with solar energy, which might be considered luxury consumption. Installation of air conditioning and purchase of electric vehicles were also mentioned by this group. The other subgroup expressed views that their new system made them more conscious of their consumption habits. Some participants highlighted the need for strategic energy use to maximize efficiency. For example, one respondent stated:

What we've already started to do is try to do the washing up and use a dishwasher, so anything that uses a significant amount of electricity when the sun is shining, or at least during the day, we charge the car during the day. So we're making a little bit of a mental switch as we don't charge the car at night or wash the dishes or do the laundry or something like that, but we do all this while generating the electricity so that as little as possible goes into the grid now. (H.1.6)

There was no clear trend among Slovak prosumers when it came to change of behaviour caused by the installation of solar panels. While some became more aware of energy consumption linked to their daily activities (like doing the laundry or using other energy-intensive appliances), others did not change their behaviour almost at all. Everybody, however, started to notice weather in general and solar activity in particular much more than before and some of the respondents even downloaded applications on their mobile phones to plan energy consumption. This was connected to their effort to consume their own electricity and not send it to the grid which most of them considered to be a much less beneficial option. One respondent claimed that:

One cannot be a slave to the system, so when there is bad weather [low solar radiation] I will not stop doing the laundry and move it for tomorrow. (SK.3).

The installation of PV panels exerted a direct or indirect influence on the behaviour of respondents from the Czech Republic. The indirect impact is defined as the influence on the behaviour of other household members rather than on the respondents' behaviour. The prevailing observation is that all respondents adopted a more diligent approach to monitoring weather forecasts. Furthermore, some respondents expressed an increased interest in issues affecting final consumers, including market functioning and billing. Additionally, a higher percentage of respondents acknowledged the issue of climate change and recognized the positive externalities of renewable energy, including the reduction of CO₂ emissions in particular. Finally, a significant proportion of respondents noticed that after installing PV panels, they became self-sufficient.

PVs saved us, a tree fell on our roof but we could work, and we are self-sufficient if anything happens. (CZ.3)

It is also clear from the responses that people became more active in sharing their experiences with others (for example, via dedicated groups on a Facebook platform).

6.4. Opportunities for energy community, energy solidarity and off-grid solutions

People engage in local collective energy activities (establish communities, energy cooperatives or peer-to-peer energy trading) for various, not only economic reasons (they want to strengthen their social identity [69], increase energy security [70] or make a social contribution to alleviating energy poverty [71]). However, moving from individual prosumerism to collective action is not always easy.

Creating energy communities or cooperatives is a challenge for prosumers in Poland. While they express interest in supra-individual prosumer activity, they point to many obstacles and problems related to such activity. As one of the respondents said:

If we had a direct recipient of our energy, but for now we cannot do this, neither technically nor legally. But if we could sell the surplus energy, we would be happy to do so. (R.1.7)

The idea of energy cooperatives or energy communities is generally accepted. However, in Poland, where social activity is low and many public problems are solved individually, the obstacles include a lack of time and a habit of joint action. This confirms previous analyses indicating that how the organization of community energy initiatives is managed can have a significant impact on attracting prosumers to

participate in this type of activity [72]. One of the prosumers said directly:

I produce more and you lack energy and I give it to you, right? And I am happy and you are happy because I sell it to you at lower prices, well, that's great. That's a balance. This kind of cooperation is good. I was just about to say that I would go for it but, unfortunately, I don't have time. If someone took care of it and organized it, I could be a shareholder. (R.1.6)

The idea of energy cooperatives can also be a way to unite forces and take joint actions to solve existing technical problems, such as switching off inverters in households. As one of the respondents said:

When establishing a cooperative, if, for example, we collect 200 people and each of us gives, I don't know, PLN 500 (EUR 120), we can install a transformer so that the current does not jump in the network and the inverter does not switch off. (R.1.4)

However, the main problem that prosumers face in creating independent energy cooperatives is the monopoly of large corporations on power grids and energy distribution. This exchange of opinions reflects these doubts well:

But there is the issue of distribution. And the networks that they will modernize. They have to send this energy somehow, right? (R.1.3)

And it will turn out that these are the biggest costs. Distribution. Those who have done nothing, contributed nothing, incurred no expenses, they collect the biggest fees. (R.1.4)

Managing energy infrastructure and the energy distribution grid seems to be crucial for the future development of energy communities, especially since democratization, moving away from fossil fuels and reducing energy consumption are linked to infrastructure [73].

In Hungary, the concept of an energy community garnered mixed reactions among participants. Some were enthusiastic about the idea and expressed a strong interest in joining such initiatives if they became viable in the future. They saw potential benefits for individuals and the community at large, although they pointed to regulatory and logistical challenges. One participant saw the energy community as a way to share excess energy instead of installing expensive battery solutions, sympathizing with the idea of sharing energy with kindergartens or other public institutions (see below). Another participant pointed out that energy cooperatives might be a distant reality for Hungary, given the lack of widespread solar panel adoption in some areas and the technical and regulatory challenges. Others doubted the feasibility of energy communities in Hungary due to the local mentality and the technical limitations of the existing infrastructure. They cited the need for substantial improvements in a local grid to manage electricity distribution effectively. Several participants in Hungary were open to this idea but under some conditions. They emphasized the importance of knowing where the electricity would go and ensuring it reaches the intended recipients. For example, one respondent said:

Yes, obviously it would be important for this to be truly charitable or to go to a place where I would be happy to give it. And let me give you an example of that, for example, I know that my little boy goes to this high school and then I donate the surplus to the high school. (H.1.5.)

In Slovakia, the idea of joining an energy community was almost unanimously rejected. The main reason for this negative response was mistrust towards neighbours. As one respondent said:

Never, with neighbours [form an energy community] never. (SK.7)

This stemmed from personal experience with neighbours that was very difficult in most cases. The respondents thought it would be extremely hard to find agreement on basically any issue within an energy community. This included common projects such as building a new

(and bigger, compared to rooftop installations) community-owned solar power plant or providing support for existing rooftop installations, for example, by sharing production, building a new transformer to support production (see technological limitations in the following section) or developing a common storage facility. According to the participants of the focus group in Slovakia, besides mistrust among prosumers, another issue was the heterogeneity of prosumers that would not allow them to join forces and create bigger projects, both physical (discussed above) and societal (like a political movement focused on prosumers in general).

Solidarity was basically non-existent within the Slovak group. Respondents were not willing to share overproduction with vulnerable groups. However, one respondent noted that everybody who had a virtual battery and did not consume in line with the rules was 'donating' electricity to their DSO, thus adding to already widespread criticism of distribution companies.

In the Czech Republic, the energy community was not yet a well-established phenomenon. The respondents expressed a degree of scepticism, whilst concurrently acknowledging the expanding demographic of PV panel users and their capacity for collaborative endeavours in this context. However, they did not perceive themselves as being part of what could be termed an energy community. The respondents expressed a lower level of trust in a decentralized system and perceived the customer-distributor relationship as being safer and more resilient. Concerns regarding technical failures, particularly during the winter season, were also expressed, with apprehensions about the consequences of a lack of electricity in the absence of a backup power source, such as the grid. One interviewee disclosed a personal experience of a breakdown in their own installation, which necessitated grid-sourced electricity.

My fans jammed, the inverter got disconnected and I was almost without electricity and I hurriedly reconnected to at least have [electricity] from the grid. (CZ.6)

Only one respondent expressed the willingness to terminate his contract with his distributor if he possessed the technology to physically store sufficient electricity.

In general, the model of prosumerism in the V4 countries based on private ownership and own panels on the roofs of buildings serves primarily the energy and economic efficiency of their owners. In this context, it is difficult to talk about strong energy citizenship, which sets goals such as energy justice and democracy at the macro-social level [74]. Focusing on energy justice would require a set of policies, such as maximum energy use, power load control and personal carbon allowances [75]. This means that investments in technologically advanced infrastructure are necessary. However, the daily practice of prosumers in the V4 countries encounters technological barriers at a completely different level: the power grid has been built for a one-way transmission of energy (from large centralized power plants to end users) over the last decades. The development of distributed energy sources, such as PV installations, has changed this dynamic, revealing technological obstacles to the development of decentralized energy systems. In some areas (especially rural ones), the grid is not prepared for such a large inflow of energy through the reverse path, which results in overloads and network outages. This requires a change in energy policy and investments in new networks by the state.

6.5. Technological, legal and systemic barriers to the development of PV

The main barriers to further development for the PV and heat pump market in Poland are constant changes in regulations for billing energy produced by micro-installations. Heat pumps require additional high investment costs and service costs. One of the respondents pointed this out:

I paid PLN 800 (approximately EUR 190)—I thought I would be blown up. The manufacturer determines the price of the service. It is not like there is competition between installers. So I paid PLN 800 for a pump inspection. These are high costs. However, without it, the warranty is lost. And the pump is a complicated device. (R.2.3)

Problems with changing regulations cause even greater distrust of the state administration among prosumers and heat pump users in general. This may constitute an obstacle to the implementation of subsequent stages of the green transition (for example, switching to electric cars):

The state operates in such a way that it first encourages and then changes the rules of the game. It will be the same with electric cars. Buy them, and then it will suddenly turn out that they will impose a tax and that's it. (R.2.2)

Some respondents also noted that the government actions aimed to defend the interests of coal companies in Poland, which, because of the increase in the number of prosumers, have become even less profitable, as has the energy they produce:

The fact that the state continues to finance coal companies certainly influences decisions towards prosumers. There is such a large lobby, all these Tauron distributors. (R.2.7)

However, the government's policy towards prosumers also contributes to the political radicalization of this environment in Poland. This is another aspect and perhaps another step in the transition from individual energy self-defence to coordinated collective actions. A group called 'Prosumer protest—PV owners' strike—PV protest' was formed on the Polish FB. On their profile, they write:

If you do not agree to too low energy buy-back rates, this group is for you! Join us! The more of us there are, the more power we have! During peak hours, energy rates are negative, which means we give it away for free. In a word, we are being robbed. In the first step, the group aims to unite as many prosumers as possible. In the second step, we will create a strike map, and in the third and most important step, we will protest and disconnect our installations from the grid [76].

This radicalization of moods, which may soon be a factor in the creation of a radical prosumer movement in Poland, was also visible during a focus group interview. As one of the prosumers put it:

We are still dependent on the government. Because if there is any war, and the first thing is to blow up the power plant, our heating will go to sleep. So the only option is to cut ourselves off from this entire system.

The following story of one of the prosumers may illustrate this kind of disconnection from the state energy system:

I have a friend who cut himself off from Tauron altogether and installed an energy storage facility and PVs on the roof. He also installed a generator and a gas tank: he put such a cylinder in the garden and he doesn't give a damn about the state. The whole thing cost him PLN 120,000 but he cut himself off completely. He doesn't have electricity from Tauron and he doesn't give a damn about them. Somehow I don't blame him, after the government's actions with billing electricity from PVs. After all, they robbed the owners of PVs in velvet gloves. (R.2.1)

From this perspective, in the context of energy transition, more radically oriented prosumers fit into the tradition of civil disobedience and the rejection of official state institutions and their rules of the game, referring to the tactics of social self-organization movements [77].

The main reasons why inverters are switched off are poor quality medium voltage lines and a lack of network investments or delays in their implementation. Moreover, there are insufficient new transformers

in rural areas that can regulate the voltage in the network. The main energy distributor in Poland, Tauron, is negatively perceived by prosumers and was held responsible for switching off the installations. As prosumer explained:

To put it simply, on sunny days, our beloved Tauron blocks and does not receive energy from us. If I had such a power bank so that I could charge it myself, then yes. But as long as I don't have it, I will definitely not go for it because, in June, I had a week when Tauron received practically no energy from me—in July, the same thing, in August the same thing happened again. (R.1.2)

Without state investment in the modernization of low- and medium-voltage networks, prosumers will continue to face problems. Outdated infrastructure, especially in rural areas, too thin cables and limited transformer power are among the key problems that cause (particularly on sunny days with higher energy production from panels) an increase in the voltage in the network and automatic shutdown of inverters. According to the official standard in Poland, the voltage in the low-voltage network should be $230\text{ V} \pm 10\%$. This means that the voltage fluctuates between 207 V and 253 V. To avoid shutting down the inverters and losses in energy production, some panel owners switched the device illegally to higher voltages (above 253 V). In this way, the PV installation did not shut down but additionally caused voltage surges in the immediate vicinity. In response to these practices, Tauron conducted an inspection and imposed penalties. This had little to do with promoting energy as a 'common good' and increasing mutual trust between prosumers, energy distribution companies and other citizens, and also deviated from the inclusion of citizens in a democratic energy system [78].

The only solution in the current conditions is to increase the self-consumption of energy by prosumers, invest in energy storage and good cooperation with other devices such as heat pumps. Adoption of a feed-in tariff along with the popularization of energy storage could be a strong incentive for the development of prosumer energy [79].

Similar problems exist with the network in Hungary. Respondents believed that nuclear energy was a primary focus of Hungary's energy policy, evidenced by the ongoing construction of the Paks 2 nuclear power plant. They saw nuclear energy as central to Hungary's long-term energy security strategy, especially since it is an emission-free energy source. They also believed that there was a strong commitment to (Russian) natural gas for economic and political reasons. This is the context in which respondents assessed solar power development in their country. The research participants unanimously recognized the government's efforts to promote solar energy through subsidies. However, most of them expressed frustration about subsidies' late payment, ad-hoc implementation of such schemes, as well as the lack of grid infrastructural development and exclusion of market mechanisms which would make the energy market more predictable and easier to plan in terms of investments. Solar panel users repeatedly emphasized the need for a more open and competitive market environment, believing that this could give better outcomes for consumers and the energy sector as a whole.

Research participants in Hungary expressed the view that public awareness about the benefits of solar panels was very limited in their country. They believed that the main reason for this was that a significant portion of the population only thinks in the short term and struggles to see the long-term benefits of such investments. To change this approach, effective communication and education were deemed essential. Other significant barriers to a greater uptake of solar power included the high upfront cost of installation, the lack of environmental thinking and insufficient information available to consumers. Therefore, the Hungarian focus group participants concluded that investment in infrastructure, additional financial incentives, education and promotion of grassroots community initiatives were crucial to overcoming these barriers.

The existing rules and regulations were the subject of criticism by

Slovak prosumers. These included more serious obstacles than high investment costs or limited access to subsidies. The lack of information, difficult access to existing information and their often even contradictory nature were mentioned as the most significant hurdles for prosumers. Many respondents also noted that they looked for information online but what they found was not helpful at all. As the institutions that, in their view, were responsible for disseminating information did not do their job properly, they were substituted by individuals on social media who were often spreading misinformation further contributing to informational ambiguity linked to prosumerism. According to our interviewee:

Many people succumb to misleading information because the biggest experts on social networks are people who never had [solar power plants] and they say it is nonsense. (SK.6)

In the Czech Republic, respondents identified regulatory and legal gaps and financing as the primary barriers to the purchase and utilisation of PV panels. As regards legislative/regulatory gaps, none of them were able to provide a detailed study or discussion of the issue. In terms of financing, they perceived the state to be a hindrance rather than a facilitator as the government support for PV declined. Another issue was the inadequate capacity of the distribution network, which hindered the integration of new solar installations into the grid. Additionally, a lack of public awareness and limited space for installations was identified as a challenge. The interviewees further posited that the Czech government was prioritising alternative, more extensive energy resources, such as nuclear power plants or utility-scale solar installations designed to feed electricity directly into the grid.

7. Conclusion and policy implications

The results obtained during focus group interviews with prosumers in the V4 countries (formed by the former communist bloc countries from Central and Eastern Europe) confirm the thesis that there is no universal model of energy transition, nor are there any universal, political traditions and economic conditions, independent of cultural context, determining social attitudes towards official energy policy and reactions to it. All transformations in the energy sector and the related multidimensional consequences in public life, especially at the civic rather than governmental level, are situated not only in a technological but also in a spatial and social context. In this sense, there is no such thing as a universal process of energy transition. Similarly, there is no universal knowledge about the development of decentralized energy. The analyses described in the literature concern mainly Western European countries and the United States. However, knowledge about possible forms of energy transition, like any other type of knowledge [80], is socially and spatially conditioned. For this reason, the knowledge gained about the opportunities and barriers to the development of civic energy in the V4 countries does not have to coincide with the findings obtained in other parts of Europe and the world. Interviews with prosumers have confirmed our general hypothesis that the energy price shock caused by the war in Ukraine triggered grassroots defensive reactions and radically increased investments in PV panels. However, various systemic constraints hinder the development of institutionalized structures of civic energy. The detailed research conclusions and the resulting reflections which are presented below may be useful for future practical social actions in the V4 countries and further research on prosumer initiatives:

1. Governments and power elites in the V4 countries tend to maintain centralized energy systems and fear the loss of state monopoly on the management and control of energy policy. Even if they agree to withdraw from coal as the main source of energy (for example, in Poland and the Czech Republic), they assign a special role to nuclear energy in energy transition. This allows them to maintain control over energy, which they treat as one of the resources, tools of control

and means of exercising power over society [81]. This directly entails reducing the importance of decentralized energy from renewable sources in the transition plans. This is a constant rule—the greater the role of nuclear energy in the country's energy system, the less chance there is for the development of mass and decentralized energy [82]. In practice, this means that prosumers in the V4 countries cannot count on friendly legal and political solutions that would facilitate their activities in the long term because the development of nuclear energy is more important for the ruling elites.

2. What prosumers in the V4 countries expect are clear and permanent regulations defining the possible framework for their activities, as well as a stable billing system that would allow determining the annual financial benefits from using PV. Without it, it is difficult to calculate the payback period of the funds invested in PV installations. The lack of clear and permanent rules for settling energy produced by PV micro-installations also blocks the development of the heat pump user sector.
3. In all V4 countries, economic factors were crucial for prosumers deciding to install a PV. Environmental and climate protection issues were not of major importance. These issues only appeared in the next stage (after they had installed PV and become more interested in energy policy and its conditions). This means that the mere possession of a PV installation can be the beginning of civic environmental education for both its owners and their immediate surroundings. Namely, solar panel owners often inspire their neighbours to make their own PV investments.
4. Increasing the number of PV installations in the V4 countries has not yet translated into the creation of energy communities or co-operatives. An attempt to become independent from state prices or private energy distributors does not automatically evolve into the socialization of the energy sector. Rather, we are dealing with the individualization of the strategy of action in the energy sector and the lack of space for creating social energy initiatives. If any joint actions were taken (such as the establishment of protest groups among prosumers in Poland), they were rather directed against the legal policy of the state than for joint, grassroots initiatives. In other words, the example of the V4 countries shows that the departure of citizens from state energy systems does not always mean the socialization of energy and the creation of grassroots energy communities. Relating the attitudes of prosumers to Merton's [42] classic theory of anomic behaviour—understood as 'a particular type of disjunction of means and goals: when society stresses the achievement of cultural goals but does not equally emphasize the prescribed means to those goals' [83]—it can be stated that their adaptive attitude is Merton's 'retreatism'—they do not accept the rules of the official energy system but switch to the production of their own electricity to 'drop out' of the system rather than to change it or create their own social and energy alternative. Some prosumers' actions correspond to Merton's 'innovation'—the acceptance of market logic in energy management while trying to circumvent the standards of the official system (for example, they switch inverters to higher voltages to achieve greater profits from energy production while exposing people from the neighbourhood to switching off inverters in their installations). A more activist attitude (rebellion), negating the rules of the official energy system, but at the same time combined with an attempt to initiate their actions based on the principles of social, neighbourly and energy solidarity, remain in the definite minority.
5. The inadequacy of medium and low voltage distribution lines is a major technological challenge. The antidote to this situation should be, on the one hand, investment by the state and energy companies in transmission infrastructure, which will allow for increased multidirectional energy transmission in the network. On the other hand, it is important to increase the importance of self-consumption of energy produced by prosumers through more widespread use of energy

storage and harmonious interaction with other devices such as heat pumps.

6. Comparative data from other countries regarding the number of citizen energy communities show that the V4 countries remain peripheries or semi-peripheries in this respect compared to the core countries of Europe, such as Germany, the Netherlands, Austria or Greece, where the number of citizen energy communities is the largest in Europe [84]. Changing the situation requires both the above-mentioned investments in the transmission network, but also social and political changes to increase the level of active citizenship, readiness to cooperate at the level of energy communities and concern for the common good in the countries of the former Eastern bloc. A lack of trust in the state must turn into greater trust in fellow citizens. Without this shift, there is no space for the development of grassroots initiatives grounded in the principles of cooperation and mutual aid, unity in diversity, and solidarity-based action beyond the official structures of the state and its energy regimes [85] – this capacity is particularly vital in times of ecological, energy, and social crises.

The next step in the analysis of prosumer energy and energy citizenship in the countries of Central and Eastern Europe should be the implementation of quantitative studies on representative samples of the entire populations of these societies. This article focuses only on prosumer environments and lacks data showing the dominant attitudes of entire societies. Combining qualitative and quantitative methods always creates a more comprehensive picture of the ongoing social changes. Such supplementation with data from quantitative methods will also allow for a more precise analysis of the transition from individual prosumer initiatives to mass and public civic activities in the sphere of energy policy at the macro-social level. All the more so because it can be predicted that the issue of prosumer energy and generally the issue of citizens' dependence on the state and market prices in the energy sphere will increasingly become an important part of the political agenda and disputes. In this sense, grassroots and spontaneous energy self-defence may be the first step towards expressing the political voice of citizens in social and energy disputes in the face of measures taken by governments and businesses.

CRedit authorship contribution statement

Piotr Żuk: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Jan Mazač:** Writing – review & editing, Writing – original draft, Investigation, Formal analysis, Data curation. **Dániel Muth:** Writing – review & editing, Writing – original draft, Investigation, Formal analysis, Data curation. **Lukáš Tichý:** Writing – review & editing, Writing – original draft, Investigation, Formal analysis, Data curation.

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

Data will be made available on request.

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