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Ageism, welfare, and the energy transition: a comparative analysis of the perceptions among the elderly in Poland and Norway

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Abstract

Background One of the potential dimensions on which exclusion and injustice may occur in energy transitions is age. Age-based patterns of exclusion—ageism—has recently been conceptualized in the context of decarbonization as energy ageism. This paper offers a comparative empirical analysis of the senior citizens' outlook towards an imminent energy transition as well as the impact of energy poverty in two European countries: Norway and Poland.

Results Drawing on interviews and focus groups with Polish and Norwegian seniors, we present the differences and similarities between the two countries, and the determinants of energy ageism, as well as the concept's overall applicability and empirical usefulness. We find that socioeconomic conditions outweigh ageism, that is, the resilience of senior citizens in dealing with energy poverty during a transition is conditioned by their material standing and welfare state robustness rather than age based. An important factor is household heating technology, combined with economic vulnerability can push some individuals into energy poverty, while others using alternative sources of heat can navigate through energy crises unscathed.

Conclusions We note the importance of mainstreaming social inclusion considerations in energy policy and of targeted digital competence building which can enhance senior citizen integration in the energy transition. Lower levels of digital competences among senior citizens certainly play a role and need to be addressed with education programs to increase participation. In both countries, household heating is a major issue and heating sources are strong predictors of energy poverty and regulatory measures and subsidies should be designed at national, regional, and municipal level to assist vulnerable groups in this area.

Keywords Energy transition, Decarbonization, Ageism, Justice, Energy poverty, Vulnerable groups

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Background

The decarbonization of the energy sector, including heating and transportation, is necessitated by the looming climate crisis. Since today's emissions will have an impact on the future generations' opportunities for maintaining a safe and livable environment, climate action is often cast in terms of reducing the debt we owe to future generations. Consequently, inaction is seen as a climate *injustice* towards the young and the yet-unborn generations [1]. However, the energy transition needed to achieve a carbon neutral energy system and society will also have important implications in terms of distributional (who pays?) and procedural (who decides?) justice.

Normative dimensions of energy transitions are tackled by the growing literature on *energy justice* [2–4], whereas the problems of participation in decision-making are taken up under the banner of *energy democracy* [5–8] and *energy citizenship* [9, 10]. It has by now become something of a universally accepted orthodoxy that decarbonization can only succeed if it is achieved through a "just transition", a notion which is variously defined but most often implies an emphasis on social inclusion and distributive justice [11, 12]. The inclusion of marginal and vulnerable groups is often mentioned, but less frequently specified. *Energy poverty*—the inability to either afford or access basic and necessary energy services—is seen as the main threat. While access to modern energy services is one of the leading problems in the developing world [13, 14], where some 940 million people remain without access to electricity [15], energy poverty is also a challenge in the highly developed countries of the global North [16–19]. Over 50 million households in the European Union are categorized as energy poor [20], and the number has increased first in the aftermath of the COVID-19 crisis, and has further risen sharply as a result of the Russian invasion of Ukraine [21].

One of the potential dimensions on which exclusion and injustice may occur in energy transitions is *age*. Although energy poverty can have a very negative impact on children [22], the elderly are particularly vulnerable. What is more, while climate inaction creates injustices burdening the young and the next generations, ongoing and planned energy transition measures may be particularly excluding for seniors, due to either economic factors or the need for digital competences they do not possess, a fact that has been noted already in the 1980s [23]. That age-based pattern of exclusion—ageism—has recently been conceptualized in the context of decarbonization as *energy ageism* [24]. The concept of energy ageism assumes that the exclusion of older people from energy transitions may manifest itself in several forms, such as technological exclusion, digital and informational exclusion, and economic exclusion. Spatial variables, diverse financial resources (economic capital) and cultural resources (cultural capital) may increase or decrease the risk of energy exclusion [24]. We assume that each of these resources can influence the situation of seniors in Poland, Norway and any other country in the context of energy policy.

This paper seeks to advance the study of energy ageism and offers a comparative empirical analysis of senior citizens' outlook towards an imminent energy transition as well as the impact of energy poverty in two European countries: Norway and Poland. Although both are OECD states, and in global terms—highly developed—their socioeconomic situations are quite different. Poland's 2021 per capita GDP was estimated at 17,946 USD, while Norway's at 89,042 USD. Drawing on interviews and focus groups with Polish and Norwegian seniors, we present the differences and similarities between the two countries, and the determinants of energy ageism, as well as the concept's overall applicability and empirical usefulness.

We conclude that while lower levels of digital competences certainly play a role, socioeconomic conditions outweigh energy ageism as an exclusion factor. In both countries, household heating is a major issue and heating sources are predictors of energy poverty. However, Norwegian elders have the means and welfare state support that reduce the risk of energy poverty, whereas in Poland seniors remain a highly vulnerable group.

In sum, a robust welfare state helps to facilitate a just and inclusive energy transition and minimize energy poverty, and there is a need for conscious integration of social policy in energy policy, and on the other hand—of monitoring of social inclusion in the energy transition. It should also be recognized that socioeconomic status has a lot to say in connection with energy and age. These differences do not diminish with age, which makes this increasingly relevant. Secondly, a greater degree of consideration, training and facilitation is required for everyone to benefit from the energy transition, not just those with sufficient digital skills.

We begin with a theoretical framework section which reviews the interdisciplinary literature looking at the relationship of age and exclusion in the context of transitions, drawing on sociology, social anthropology, economics, and transition studies. We then describe the materials and methods of our empirical analysis, as well as some background on the socioeconomic context, the characteristics of the energy system and the ongoing and future transition and energy related patterns of energy use in the studied cases. We then present the results, dividing the material in three key topics, and discuss our findings before presenting some broader conclusions.

Theoretical framework

Across industrialized societies, not only in the global North, a demographic shift is occurring, with extended life expectancy and lower childbirth rates, meaning that pensioners, or older adults in general, are growing in numbers. What do we know about the elderly and their energy use? Estiri and Zagheni [25] studied the relationship between age groups and energy consumption in the U.S. Their key finding is that energy consumption in general increases over the lifespan, with some exceptions. Much of the increased energy consumption can be explained by the increasing size of housing, though energy consumption increases for the 70 + group, regardless of their income and housing characteristics. Zhu & Lin [26] found that residential electricity consumption increases by 20.03–32.13%% on average after retirement. The increased time spent at home after retirement is one important explanatory variable for their finding. The study also notes that after retirement, electricity expenditure increases by 36.44% on average. Annual retirement increases China's national consumption by 1.71 billion kWh. This highlights the importance of addressing future energy demand shocks, as well as the importance of shaping electricity prices that avoids decreased welfare following an increase in the number of elders combined with a decreased energy supply. However, a study in Italy conducted by Garau, Lecca and Mandras [27] looking at the impact of population ageing on energy use noted that although elders use more energy, a larger share of elders slows down economic growth and in turn energy consumption as a whole, leading to a net effect of decreased energy consumption in countries with more elders. Furthermore, living through economic hardship and a traumatic period such as a famine or a war in childhood appears to gear individuals towards energy efficiency later in life and decreases the likelihood of living in energy poverty in old age [28].

However, considering the elderly a homogenous group with similar needs and skills is not sufficient. Social science disciplines approach the topic of aging and the category of the elderly differently but share a skepticism towards reifying this category and creating assumptions about senior citizens behavior, needs, and expectations, particularly in the context of technological shifts such as energy transitions.

As emphasized particularly by the Critical Gerontology perspective in social anthropology [29], "the old" is a social and cultural category through which social knowledge is formulated and acquired [30]. These perceptions have shaped the category of old age as a problem which needs solving. It is additionally a category many are uncomfortable with and seek to create distance from as it reminds people of the boundary between life and death [31].

Such perceptions become highlighted in stereotypes of old age and digitalization, which is intricately connected to matters of individual and collective interactions with energy. The stereotype is often reinforced by elderly who are resistant to learning or adopting new technology [30]. By resisting to adopt the new possibilities that digitalization brings, elderly people are at risk of becoming marginalized by digital exclusion [32]. Studies have shown that cultural understanding and routine are key when it comes to either choosing to adopt or resist new technology [33].

Therefore, it is important to include elderly people in the design process of various technologies to ensure that all groups of society can adopt modern technologies. Such 'co-design' is key for the green energy transition which ultimately affects all members of society. Researchers and policymakers need to identify how people understand and perceive energy to understand how energy might contribute to their definition of a good life. Energy ethics must therefore be taken into account in order to become more mindful of the moral aspects of social life as it pertains to matters of energy [34, 35].

The current sustainable energy transition is a movement of people into a new sociocultural context. Energy consumption is thus not something performed by individuals, but a consequence of interactions shared between people, their knowledge, social context and things. Cultural understanding and routine shape how we interact with matters of energy as all else. Social practice theory as well as social learning theory can offer a better understanding of elderly people's embedded knowledge and energy consumption [36].

Science and Technology Studies (STS) also explore this theme, which takes a special interest in the interplay between society and the logics, workings, and developments of technology and technological artifacts. Prominent themes within STS include policy, the creation of publics and experts, discourse, and the sociotechnical systems [37]. The notion of the *user* is a common theme within STS, which is also why the design of a technology or technological artifact is interesting in itself. Akrich [38] developed concepts such as *script* and *configuring the user*. The former concept is based on the idea of developers, or designers, inscribing their view of the world into the technological artifacts, which again constitute certain types of action. However, when faced with the real world, the end-user can often deviate from the script, i.e., de-scripting it [39]. The design of something is therefore telling of what the designers imagine the user to be like, and what inherent capabilities the users have—according to the designer.

In respect to old age and the ongoing sustainability transition, it is useful to ask what constitutes an older user? In recent decades, the concept of user-involvement has become popular. However, studies show that this is not always the reality. Oftentimes, assumptions about the user dominate over de facto user involvement [40, 41]. This can lead to a design that is not fully utilized by the end-user, or in the language of STS; *a de-scription* [38]. Bischof and Jarke [42] have looked into how older adults are perceived in the development of welfare technologies and found that there is a tendency towards perceiving older users as passive, and the technology as a fix for old age. This is, however, not limited to policies and solutions aimed at the elderly but rather a feature of technocratic planning. In a project that aimed at developing solutions for users that allowed for a better integration into the European smart grid, Skjølsvold and Lindkvist [40] uncovered that in practice, the user involvement was kept to a minimum compared to the initial plan. Other studies from the UK regarding heat pumps have shown that complicated instructions and/or unclear communication with providers of the technology can result in the technology not being used as intended, resulting in suboptimal results for the consumer [2, 43].

These findings should motivate researchers to unpack the concept of user involvement and look critically at the way distinct categories of citizens, e.g., the elderly, are in fact using energy services and technologies and how they interpret energy transitions. For this reason, we propose to empirically assess the apparent challenges that energy transitions pose for elderly citizens, and how they themselves rank the problems they face. Our study is designed as exploratory and asks about the existence and determinants of energy ageism in two fossil-fuel producing OECD states characterized by various levels of human development. We understand energy ageism as "all socially conditioned mechanisms related to energy policy that disable and discriminate against older people, reducing their quality of life through limited access (economically, technologically, spatially, informationally and culturally) to different energy sources, new energy technologies and the benefits of full access to energy circulation" [24]. Our study seeks to identify such mechanisms where they exist and uncover factors that mediate their impact.

Methods

A study conducted in Europe emphasized that social and public policies must take into account the growth in elderly, single households and their lack of information regarding renewable energy options, or the finance and technology required to access it [44]. But to what extent senior citizens' energy practices and their capability for contributing to and benefiting from energy transitions are indeed conditioned by their age, rather than other factors?

In this study we use the concept of energy ageism as a departure point to explore the way senior citizens—understood as those who have reached pension age[1]—are affected by and have the means of participating in the energy transition towards a low carbon system. By participation we mean active involvement and both contributing to and benefiting from transition, not as passive objects of change but involved subjects, a notion close to the ideal of energy citizenship and prosumerism [6, 10]. We have collected quantitative background data in the form of available statistics as well as new qualitative data, through 15 semi-structured interviews and 6 focus groups conducted in Norway and Poland, in sum—52 interviewees. The research was conducted in the summer of 2022 (interviews in Norway June–August 2022, interviews in Poland June 2022). Our interview guides investigated topics such as high energy prices, increasing digitalization of society, heating, use of renewable energy deployment, the energy transition energy and the possible lack of consideration for older users in this process.[2]

The interviews and focus groups lasted between 60 and 90 min, they were carried out by research team members and were all recorded, transcribed in Polish and Norwegian, then translated to English using automated translation tools (Google Translate and Deepl), allowing the entire research team to get acquainted with the material. The transcripts were analyzed with the assistance of NVivo qualitative research software, and coded following three themes, which guide our analysis: the possibility to be actively involved in energy transitions, the use of energy and risk of energy poverty, and finally, perceived age-based discrimination and barriers. For direct quotes used in the text, we referred to the verbatim transcripts in the original languages and translated them individually to make sure the meaning was not altered by automated translation tools.

The Norwegian respondents were directly recruited by the researchers, using their networks of contacts as well as directly approached (i.e., visited at home or a nursing home and asked to participate in the study). To avoid selection bias, we have continuously monitored the demographics of the sample to recruit as diverse

[1] For Norway, that means 67 years of age, while for Poland, since 2017, this is 60 years for women and 65 years for men. Our sample covered both people who only recently reached retirement age as well as individuals over 80 years of age.

[2] The Polish focus group interviews did not use questions referring to biographical information of the respondents, launching directly into the discussion of heating technologies and prices, as most engaging for the interviewees.

interviewees as possible. In Poland, the interviewed seniors were divided into three categories: district heating users, those who heated their flats with coal or coke, and those who abandoned coal for gas or electricity heating. This division overlapped partly with the spatial division, namely, coal-heated flats in Poland are usually located in old tenement houses from the pre-war period in large cities. In Norway, where forms of electric heating are dominant, we sought a to make the sample illustrative and include both urban and rural households, high and low income, as well as pensioners living independently, in assisted living arrangements and in senior care homes.

Results

Background information on the cases

The Norwegian population falls just short of 5.4 million. Roughly 870 thousand were over the age of 67, as of 2022. 90% of these, according to Statistics Norway, owned real-estate, and 45% reported living very spaciously. 55% lived in a detached house. Norwegian pensioners tend to be financially well off. In various living conditions surveys, few lack access to material goods such as cars, proper clothes, heating systems for their homes, and internet. To heat their households, 42% used waterborne heat/heat pump (this percentage has increased over the past years), 44% used electricity (this percentage has slightly decreased), and 13% used a fireplace or wood stove (this percentage has decreased). In research published by Statistics Norway, the chance of households owning a heat pump increases with age and is also more likely for detached houses and farmhouses—which are dominated by elderly households. There is also a small significant decrease in electric heating for households owning a heat pump. According to a 2017 SSB study, Norwegians scored highest in Europe in terms of digital competence, and the oldest segment (68–75) scored high on basic knowledge, such as using digital banking services and email [45].

Norway is a significant producer of oil and natural gas, however, the domestic energy system is dominated by hydroelectric power (91.5% in 2021), and electricity is a typical source for heating, with district heating in cities being rather uncommon [46]. The focus of climate policy is the further decarbonization of transport (road and maritime), as well as the reduction of emissions from domestic oil and gas production through electrification of the process (e.g., oil platforms). As this will require increasing electricity generation capacity, the expansion of new clean energy sources, particularly onshore and offshore wind, but also solar and hydropower, is a hot political topic. The main impact on senior citizens is then in transportation (incentives for EV, and disincentivizing individual car use in cities), expansion of wind farms in rural areas and a ban on fossil heating in some areas.

At the end of 2021, Poland's population was estimated at just under thirty-eight million people, over 180 thousand less than in 2020. In addition to demographic processes, the ongoing COVID-19 pandemic had a significant impact on the population decline, with the country experiencing the largest year to year drop in population since World War II. Despite this population decrease, the number of older people increased: at the end of 2021, there were 9,730.100 people over 60 years of age. The share of older people in the Polish population has been rising steadily since 2006. In 2005, it was 17.2%, reaching 25.7% in 2021. In the group of people over 60 years old, nearly 74% were 65 years old or older. In 2021, the number of economically inactive people aged 60–89 amounted to 7.8 million, representing 84.4% of the population in this age group [47]. Taking into account low pensions in Poland [48], it can be concluded that low professional activity is another reason for seniors' modest financial income, which mainly comes from social benefits. Due to these economic conditions, in 2021, the cost of using a flat or house and energy carriers accounted for up to 23.1% of the senior citizens' budget. These data suggest that energy poverty and heating costs are major challenges for Polish seniors. In addition, they still have low digital literacy. Only 54.0% of people aged 60 to 74 in Poland used the internet regularly (at least once a week) [47].

As a country heavily reliant on coal for both electricity generation and heating, Poland is considered a hard case for decarbonization. Currently, governmental policies towards energy transition that impact senior citizens in particular were motivated both by climate and air quality concerns, with certain municipalities introducing bans on certain most polluting forms of heating and providing incentives for switching to gas or heat pumps. Meanwhile, soaring prices for carbon emissions on the European market have also impacted individual electricity bills.

Contributing to and benefiting from the energy transition

The overall levels of involvement in the energy transition, understood as e.g., ownership of new renewable energy sources, heat pumps, and electric vehicles, were similarly low among our respondents in Poland and Norway. Not surprisingly, economic reasons are the main obstacle for Polish seniors to actively engage and benefit from the energy transition directly. Even those who would like to take advantage of innovative technologies are aware of financial barriers:

I would like to have this pump and photovoltaics

very much, but I simply cannot afford this. [State support] programmes do not solve the problem. This is a drop in the ocean. You must spend your money and have PLN 80,000 to get PLN 10,000 or PLN 12,000, but where to get the rest? We will not take any more loans. I would not pay back the loan for the rest of my life (PL-1-3).

On the other hand, Poland is a much larger market for different types of renewable technologies, and one of Europe's leaders in solar PV, solar heat, and heat pump installations, so the idea of participating in energy transitions through prosumerism (i.e., becoming a producer as well as consumer or energy) is more directly apparent to Polish pensioners we interviewed, whereas their Norwegian counterparts more often framed the energy transition in terms of expanding wind power (offshore, as many have been skeptical to onshore wind, controversial in the country [49]) or even new hydro and nuclear facilities:

Then there have been talks of thorium all these years, but it is because the waste problematic has not been that difficult on that side. (…) And then there is this about solar cells. If you are getting a new roof, then maybe one should say that solar cells are the alternative. Like with my housing association one should be able to install it (NO-D4).

Despite the popularity of electric vehicles in Norway, none of our interviewees owned an electric car, although almost all owned private cars. The reasons given were economic ("the cheapest option is to drive what you already have" NO-D7), environmental ("there are quite a lot of resources that go into making an electric car" NO-D9), as well as related to habits and practices:

I have thought about it, but the thing is, first, I do not want an electric car, I want to fill up with gas. I do not want to forget to charge the car, I want to see how much is in the tank (NO-D2).

While 'range anxiety' is an important phenomenon constraining the diffusion of electric vehicles [50], in Norway the levels of acceptance for EVs are much higher, and this particular view can be seen as illustrative of reluctance to adopt a new technology—and adjust own habits at an older age. Both in the case of recent technologies for electricity/heating and electric vehicles, high upfront investments are evaluated from the perspective of the respondents' age. Long-term mortgages, investments which will take thirty years to pay off or technological innovation which only offers environmental benefits in its full, decades-long lifecycle, are much less attractive for pensioners who at times perceived them as a burden for their heirs, not an opportunity for themselves.

Limited opportunities for benefiting from the green transition can also spawn resentment and fuel anti-ecological attitudes, especially if ready-made narratives are popular in the public debate. In Poland, this takes the form of right-populist inspired anti-climate attitude [51] and obstructionist rhetoric [52]:

This is a hoax that has been around for 40 years. They haven't convinced me about this ecology. The EU talks about this climate policy. On the other hand, the government in Warsaw, whether it is left-wing or right-wing, doesn't obey its own orders but those of other countries. Unfortunately, Poland is still not a free country, and you can see it with the naked eye (PL-1-2).

While our Norwegian respondents displayed more climate awareness and a more pro-environmental outlook, many shared popular anti-renewable sentiments, which are also disseminated by populist and Eurosceptic political forces—"I'm not very happy about these windmills because they destroy lots of nature, and the big ones are terrible and they howl and make noises" (NO-D2). Some of our interviewees were also blaming the high energy prices on Norway's integration with the European market, which according to some politicians should be limited—"many believe that politicians must take back control over our natural resources, including electricity" (NO-D1). However, there are also nuances: "in Sweden and Denmark when I'm there, I see how much wind power there is. So, it is not certain that it is as harmful as what they say here" (NO-D4).

Energy use and risk of energy poverty

Our research, conducted in 2022, coincided with a major energy crisis across Europe, which manifested itself in record-high prices for natural gas in continental Europe, including Poland, and record-high electricity prices in Norway. It was therefore an opportunity to explore the vulnerabilities senior citizens face in such a critical period.

In Poland, the energy crisis turned out to be especially difficult for those who had given up coal heating earlier:

I gave up coal stoves because they were burdensome and inconvenient. And practically after removing these stoves, replacing the windows, and refurbishing the entire flat, I was doing very well. I heat the flat with electric panels. And it has been working for seven years. But after these recent electricity increases, the cost has gone up dramatically (PL-3-3).

While this problem is not limited to old age pensioners, they are a majority among coal furnace users, because

they tend to live in houses that are still equipped with them, particularly old tenement houses in towns and cities of Western and Southern Poland. Those respondents who were affected by the price were visibly prone to long for the 'old order' and idealize the 'old times': "The problem with gas has become very drastic, so I think they are slowly returning to coal. I think that they will start to open mines and coal will be used as it was in the past" (PL-1-6); "I hope that this will change, and all this panic will end. And that it will be normal again. That I will continue to burn coke and that the price will not be so drastic" (PL-1-3); "Coke is the most comfortable for me. If only the price was the same as before, it's convenient for me" (PL-1-1).

The Polish government, which supported every household using coal stoves with a one-time allowance of PLN 3,000 during the energy crisis in the winter of 2022 and 2023 could have confirmed the beliefs shared by the authors of the above statements about the special and timeless importance of coal. Those using other sources of heating could count on much lower support or none at all. Consequently, the most satisfied respondents were those connected to the district heating system: "I would not give it up. Because even after these increases, it is still a convenience. You don't have to carry coal and all the overpayments and underpayments somehow balance out over the year" (PL-2-2). District heating users were also pointing out its environmental (air quality) co-benefits, which are an essential element in Poland where urban smog is one of the most prominent environmental concerns (PL-2-5). From our interviews a sense of energy security (but also social security) goes hand in hand with support for the visions of a green social order.

Norwegian energy consumers were also hit very hard by power prices, which at times rose one-hundred times above usual levels. Bredvold and Inderberg [53] have explored the impact of high power prices on vulnerable Norwegian households, noting that those which are heavily dependent on electricity, have unstable incomes, and live in energy-inefficient rental housing are most exposed. In practice, this means households typically headed by unemployed persons of working age. Our research confirms that in the Norwegian context, this does not apply to pensioner households. Although all our respondents were eager to discuss the energy crisis, none of them have felt this to be an acute problem. This was due to modest, but stable income, generally low consumption levels, as well as alternative heating sources (e.g., wood pellets, which did not see a price hike, or heat pumps in a retrofitted house, which proved efficient). In sum, despite experiencing the rising prices, none of the respondents showed particular interest in monitoring their own energy use and for instance adjusting to fluctuating power prices (which is possible in Norway where individual customers can follow the spot electricity price).

Ageism: perceived discrimination and barriers

Even though "energy ageism" was a difficult concept for participants in the study to relate to, we have nevertheless come up with some interesting findings about ageism related to energy, in addition to other topics. Most of Norwegian interviewees did not feel discriminated against. At the same time, several expressed that they were aware that they themselves could not know whether they were discriminated against based on age or whether other factors would play a role. Some of the experiences they reported indeed bear signs of discrimination. Several mentioned conflicts with electricity companies or telecommunications companies that they could not resolve until their children got involved and could negotiate a solution on their behalf.

Another respondent felt they were prevented from benefiting from the green shift after handicap parking spaces were removed in central Oslo and they could no longer travel there—"I feel we are excluded … Not everybody can cycle or take the tram down to the city center" (NO-D2). This also affects others with disabilities. Universal design was also emphasized by one interviewee, which falls under the same category. We thus see that the energy transition can have a negative effect not only on older people, but also on other groups in society.

'Energy ageism' and the ongoing energy transition can also be linked to digital knowledge and the use of digital technologies. Although many seniors have a good working relationship with technology, digital development is very fast. More are dependent on help from friends and family to be able to 'keep up' with these developments and are unable to build up their own knowledge of today's technologies to the same extent. As a result, many also struggle to describe what they themselves need help with as they lack the right vocabulary and expertise. Despite some willingness to adapt to the rapid development, many find it difficult to break out of their own habits and attitudes when it comes to digital technology and electric vehicles. Several Norwegian respondents were members of pensioners' associations in Oslo and noted varying degrees of digital knowledge in the associations. Many of the members did not have e-mail addresses, which made it cumbersome and expensive to convey information as this had to be done by post. This problem is much more pervasive in Poland.

The increasing digitization of all aspects of life, including energy use, interaction with energy companies and authorities, as well as transport/mobility may make the obstacles to older people's participation higher as the

energy transition unfolds. Many companies and public agencies envision "smart" solutions to increase resource efficiency, and this requires a high and continuously growing digital competence among citizens. Furthermore, flexible and changing prices tend to result in higher prices during the day. Many elderly consumers are home most of the day and some live in large houses. These households may not have the same chance to smooth their consumption, and the result is higher costs of electricity for elders.

Many respondents in both Norway and Poland also expressed a distrust of electricity companies and pointed out that there was an unequal power relationship between seller and consumer. Whether this opinion has anything to do with age is uncertain, but it indicates a low degree of trust in energy companies anyway. Same can be said of distrust towards political decision-makers, stronger in Poland but also visible in Norway.

Discussion

Our research clearly indicates that financial issues and the lack of a sufficient sense of social security are the main barriers for seniors in Poland to fully benefit from the energy transition and use modern technologies for heating households. Lower economic capital and the lack of welfare provisions on the systemic level are not only real obstacles to the use of renewable energy sources but can also be a basis for supporting anti-climate and anti-environmental political ideologies. Economic exclusion goes hand in hand with the low level of internet use by seniors. There is also a spatial exclusion because most coal stoves in Poland are in rural areas and old tenement houses in large cities (usually in districts with a lower standard of housing). The responsibility for replacing heating sources in old tenement houses is individualized and put on residents, who are often older people with low incomes. A systemic modernization of heating sources in poor districts is often related to the commercialization and gentrification of these areas [54]. If the state is unable to provide seniors with welfare and market forces try to commercialize spaces inhabited by seniors, the role of a protective umbrella for vulnerable groups during the transition period may be played by civil energy society [55] composed of various bottom-up energy initiatives (cooperatives energy, local tenant agreements and prosumer movements).

The example of Poland shows that the phenomenon of energy ageism and the possible position of older people in the process of energy transition are directly related to both the economic capital of older people (their financial resources) and their cultural capital, which consists of general knowledge about new technologies, digital competences, as well as knowledge and availability of renewable energy equipment (heat pumps, PV and home energy storage).

On the other hand, it is quite clear that elderly people in Norway are not the vulnerable group in terms of energy policies and usage. One of the reasons may lie in the build-up of different European welfare states. Even though all welfare states aim to protect and promote the economic and social well-being of its citizens, not all consider the state to be households' primary provider. Welfare states like Italy and Spain leave this role to the households' respective families, while the Norwegian welfare state does not.

The Norwegian share of home ownership is among the world's highest, and the ownership of real-estate has a large influence on development. In addition to the fact that a home satisfies basic needs such as warmth and shelter, it also provides capital-gains and other economic benefits such as interest rate deductions and tax subsidies. By getting access to the government funded ever-growing "piggy bank" early on, many of today's elders has been able to capitalize and buy their way up in terms of square meters and socioeconomic status. This is reflected in the quantitative framework: elders report to live spaciously and to be overall satisfied with their well-being.

The primary socialization of today's elders may also play a part in the apparent absence of energy ageism in Norway. Until the 1970s, Norway was poorer and more dependent on the conservation of energy. This may have enhanced energy awareness and energy conserving habits. This supports the findings that the probability of owning a heat pump increases with age.

Other studies have found that older people may not be as 'homebound' or isolated as one might typically assume [33]. One participant in our study experienced being confined at home only after it became more difficult for them and their partner to travel to the city center due to lack of handicap parking spaces. This further shows that elderly people, including those with various impairments, value their freedom of having flexible interactions outside of their home. Still, the home is the main area for many, and as such new sustainable solutions must ensure that it is still possible to maintain already-existing lifestyles and quality of life. A large part of the population are today used to various electronic devices, the freedom which comes from driving a car, etc., and studies have shown that people are more reluctant to give up such commodities and freedoms if the current existing options are not improved and developed further [56].

In some instances, we see examples of de-scription, situations where the design of innovative technologies or modes of use is not appreciated, utilized and adopted by the senior users for whom it was supposed to be beneficial. We note for instance that our respondents were not

keen to monitor their own energy use and adjust it to fluctuating prices, a measure that is understood to benefit households with both higher use and more free time—so those with pensioners. Also, the respondents in our sample have not appreciated EVs, despite their merits as comfortable, easy to drive and maintain. This was either for obvious economic reasons (too expensive for Polish pensioners) or because of beliefs about their limitations.

In terms of technological innovation and digitalization a greater degree of consideration, training and facilitation is required for everyone to benefit from the energy transition. Several respondents had taken part in various courses on digital training, but at the same time it became clear that many see such participation as a defeat as it makes their lack of digital knowledge visible to others. In addition, it will be able to highlight a lack of social network—often in the form of children or grandchildren, which for many is important for mastering digital technologies. It also emerged that several believe there are too few incentives for older people to invest in the installation of renewable energy in their homes or to purchase an electric car. It should also be recognized that socioeconomic status has a lot to say for differences in the context of energy and age. It is not the case that differences diminish with age, which makes this increasingly relevant.

Conclusion

With the growing pressure for a transition towards carbon neutrality and away from fossil energy, including though energy efficiency, smart grids, renewable energy and electrification of transport, burdens will be unevenly distributed across society. A 'just transition' requires considering this when designing and evaluating policies for decarbonization and changes in energy use.

In this study, we explored comparative evidence of the participation of elderly citizens in Norway and Poland in ongoing energy transitions, understood primarily as uptake of new energy technologies, and looked at the barrier they faced, conceptualizing patterns of systematic exclusion as possible examples of energy ageism. Although this is only a comparison of two developed countries, the large differences between them in terms of socioeconomic standing, welfare state provisions and governance allow us to reach some more general conclusions. We found that the two societies differ greatly in terms of the senior citizens' capacity to participate, both in terms of economic means and digital skills, but this fact is primarily conditioned by their socioeconomic situation. Energy costs, which in Northern regions are particularly driven by heating, are a primary concern, and limit the possibility of taking part in an energy transition. Digital literacy is ultimately crucial to ensure the inclusion in future energy systems. Many new and energy-saving solutions require a significant degree of digital skills. At the same time, it is known that a significant proportion of older people by far have the experience and knowledge needed to master this, and they also have experience in managing household economies that allow them to plan better than vulnerable young groups. Contrary to our expectations, we also note that under the right conditions elders may even be better than younger generations at adjusting to energy policies.

We can learn some more general lessons from this analysis, implications of which go beyond Norway and Poland or even the Nordic and Central European region. The main finding related to the distributional justice aspects of energy transitions and the problem of energy poverty is that a robust and functioning welfare state and social policy are necessary for to ensure the inclusion of weaker groups in the energy transition. The example of the situation of seniors in Poland and their struggle with energy poverty confirms the opinion that environmental challenges are also social challenges: without state support and a guaranteed welfare policy for vulnerable groups, such as seniors, the goals of energy transition may not be implemented. Social assistance for seniors in the process of decarbonizing the heating systems they use in both provincial areas and large cities—which is of particular importance for the implementation of the UN's Sustainable Development Goals (SDGs) [57]—is an important condition for protecting the climate and air quality.

We should also understand why involving senior citizens is important, and here the lessons from Poland are telling, but these lessons may also be applied across Europe, going through an energy crisis. Energy exclusion, which hinders full participation in the energy transition, may lead older people to take a reluctant position towards both climate policy and the goals of the transition. Moreover, such an attitude may be inspired by climate skeptics and right-wing populists. The concern that one's financial situation will deteriorate due to energy transition (increasing expenditures on heating homes) may also spread the belief that the use of coal in the energy sector does not affect the natural environment and climate change and that these challenges are not as important as other issues (particularly those related to social and financial security) [58].

Norwegian seniors have a relatively good position compared to the same age group in many countries in the world, but nevertheless there is a need for conscious integration of social policy in energy policy, and monitoring of social inclusion in the energy transition. In terms of technological innovation and digitalization, what we find is that a greater degree of consideration,

training and facilitation is required for everyone to benefit from the energy transition. In this aspect, energy policymakers have more tools to ensure inclusive outcomes, but digital literacy also depends on socioeconomic factors, as skills alone will not bring about participation if vulnerable groups do not receive support in deploying new technologies.

Supplementary Information

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Supplementary Material 1.

Author contributions

K.S. contributed to the comparative design, oversaw the research in Norway and wrote the first draft of the main manuscript text. M.A.N. and C.A.B.W. conducted qualitative research in Norway and contributed to the literature review. H.T. gathered descriptive statistics and contributed to the literature review. Pa.Ż. contributed to the comparative design, edited the manuscript text, contributed to the theoretical framework and conducted the qualitative research in Poland. Pi.Ż. edited the main manuscript, contributed to the design and theoretical framework and the qualitative as well as background research in Poland.

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Availability of data

No supporting data are available for this article.

Declarations

Ethics approval and consent to participate

We confirm that the research conducted had prior ethical approval and was following the guidelines of the Norwegian Center for Research Data. All interviewees signed gave explicit consent.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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