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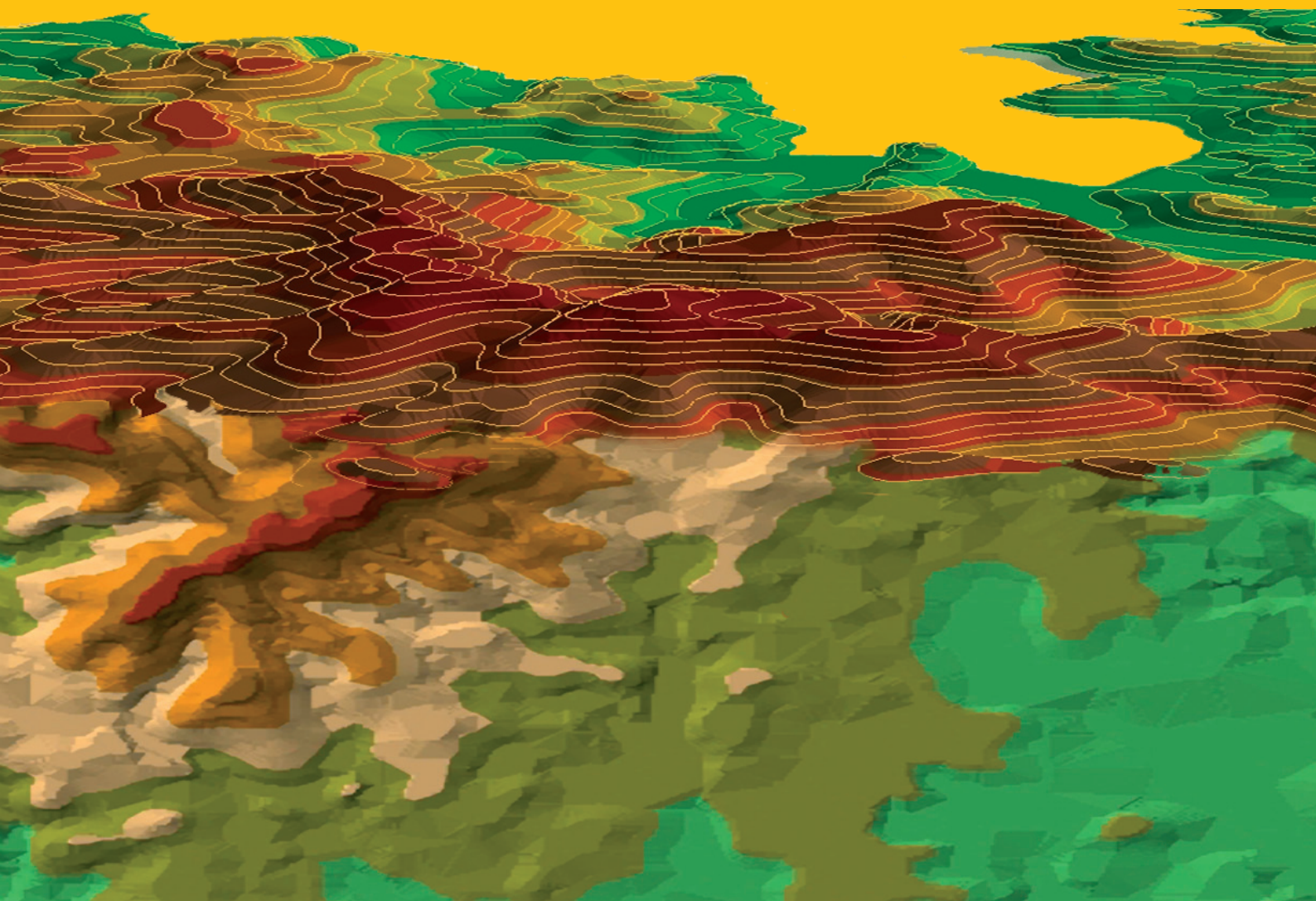

Fig. 11: Castle Moritzburg in Zeitz is a symbol of the long history the town has experienced and its rich cultural heritage (Photo: F. Görmar)

Fig. 12: There is enough space for experiments in the industrial brownfields of Zeitz, as e.g. here in the former pasta factory (Photo: F. Görmar)

Illustrations related to the paper by F. Görmar and N. Kinossian

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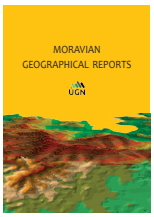

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The evolving energy landscapes of coal: Windows on the past and influences on the future

Martin J. PASQUALETTI [a], Bohumil FRANTÁL [b *]

Abstract

Coal energy landscapes have changed dramatically over the last decades, including geographic shifts in production and consumption, technological changes that have reduced labour demand and led to relatively new mining practices (e.g. invasive mountain-top approaches), changed economic footprints, a shutdown of capacities or a complete end of mining in many regions with massive impacts on regional and local economies, community well-being, social capital, et cetera. Then the Covid-19 pandemic and Russia´s invasion of Ukraine have fundamentally affected the global economy, disrupted energy markets, and shattered existing estimates about development trends, challenging the progress and speed of the low-carbon energy transition and coal phase-out. This article provides a brief reflection on the changing landscapes of coal and their possible futures, and serves as an introduction to the Special Issue of Moravian Geographical Reports on "The death of coal in the energy transition? Regional perspectives".

Keywords: *coal mining; energy landscapes; energy transitions; coal phase-out; energy crisis*

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1. Introduction

Energy dominates not only the lives we live but the land we use. For most of history, we assumed all rearrangement and damage to the landscape that energy development might cause were unavoidable ancillaries to the benefits that energy development provided. Despite our recent awareness that such attitudes are unsustainable, we still have legacy energy landscapes to address, old habits to break, and new sensitivities to establish. In concert with our more modern awareness, we have also realized the value of energy landscapes as windows on the past and influences on the future. They are all around us. We see them in the contaminated oil fields near Baku (Azerbaijan), the 'dead zones' around the Chernobyl and Fukushima nuclear power plants, the spectacular wind farms in Germany, the cleared forest lands above the oil sands in Canada, and the vast reservoirs along the Yangtze, the Paraná, and the Volta Rivers. Our need and use of coal, however, has produced the most profound and widespread record of reshaping the landscape. Coal energy development has most clearly revealed our cavalier brashness toward maintaining any semblance of landscape integrity.

The coal energy landscapes have changed dramatically over the last decades, including geographic shifts in production and consumption, technological changes that have reduced labour demand and led to relatively new mining practices (e.g. invasive mountain-top approaches), changed economic footprints, a shutdown of capacities or a complete end of mining in many regions with massive impacts on regional and local economies and a population's well-being and social capital (Betz et al., 2015; Ruppert Bulmer et al., 2021; Svobodová et al., 2022). While global coal consumption grew between 2010 and 2020 by roughly 6%, coal's share in the world's primary energy supply declined from 30% to nearly 26% over the same period, and its share in global electricity generation fell from 40% almost to 35% (Global Change Data Lab, 2022). The shale gas revolution in the United States, changes in China's economic structure and growth, the widespread adoption of climate change mitigation policies, and the immense development of renewables, resulted in changing the global coal industry and its "shift" from the USA and Europe to Asia (Alvarez and Arnold, 2020; Jewell et al., 2019). In the European Union, coal consumption decreased by almost 50%

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between 2010 and 2020, and the share of coal in electricity generation decreased from 25% to 13% in the same period (Global Change Data Lab, 2022). Similar reductions in the development and use of coal have also occurred in the USA. It might seem, at least in these two traditionally large markets that the bell is tolling for coal.

And then came two phenomena that fundamentally affected the global economy and disrupted existing energy markets and development trends: the Covid-19 pandemic and Russia's invasion of Ukraine. The pandemic caused drastic fluctuations in energy demand, oil price shocks, disruptions in energy supply chains, and hindered energy investments, while the war in Ukraine brought energy price hikes and unprecedented challenges for energy security, with great uncertainties regarding the future of energy transitions and climate change mitigation (see Zakari et al., 2022).

In autumn 2021, we started mapping the energy transition and fossil fuel phase-out processes in Europe and its effects on the development of regions and the lives of their inhabitants, and we announced a call for Special Issue of Moravian Geographical Reports (MGR) on "The death of coal in the energy transition? Regional perspectives". This was before the war in Ukraine, which has had huge impacts on the political, economic and energy situation around the world, and transformed the discursive space of the energy transition and introduced new aspects into it. This article provides a brief reflection on the changing landscapes of coal and their possible futures and serves as an introduction to this Special Issue.

2. Coal transforming lives and landscapes

Coal came to meaningful use relatively late in human history. While early energy landscapes were being produced as soon as we started reshaping the land for food, until the Industrial Revolution these impacts were of little concern. Once fossil fuels became more available and valuable, the human capacity to alter the land multiplied without restraint. While the use of fire and cultivated crops of the organic economy helped change where and how people could live on Earth, the use of fossil fuels of the mineral economy more fundamentally changed Earth itself. It was an uncompromising shift: instead of relying on the flow of renewable resources like water and wind that could be immediately available, people started depending on the stocks of mineral resources that had accumulated over vast periods. These were the 'fossil' fuels. Their greater energy density allowed them to be economically marketed over great distances. Such a shift in energy density broadened the geographic area of demand and the scale of production (see e.g. Fine, 1990; Clark and Jacks, 2007). At the time of this shift, the energy landscapes of coal began to take shape.

Greater demand for energy led to increased coal mining, first from the places where it was easily accessible at the surface and, later, from underground. Early mining near Ličge, Belgium and Ironbridge, England, was followed by mining in Poland, Germany, Russia, China, the U.S., Australia, and other countries. In most places, even when coal came from underground, the related mining activities created notorious energy landscapes on the surface. Much of England's gracious Midlands was turned inside out, and the bucolic scenes that once characterised the state of Pennsylvania in the U.S. lay littered with the detritus of noncombustible shale and slate (see Fig. 1).

But these activities were only partially responsible for the landscape changes that resulted. In addition to the direct impacts of the mines, workers by the thousands moved to where the jobs were and built houses, churches, shops, and factories. It was a sequence replicated everywhere coal was developed, and settlement patterns created during this period are still largely in place, even when coal reserves have been exhausted. Coal mining and environmental quality became a classic binary that set a pattern for what we continue to see today. With little understanding of how to soften the impacts of the coal, damaged landscapes that coal mining created were tolerated as a sign of progress. For those who lived amid the coal measures, there was no escaping the energy landscapes that mining coal produced. Central England, South Wales, eastern Belgium, the Ruhr and Saar regions of Germany, Appalachia in North America, the Donets Basin of Ukraine, and many other places became sordid, unsafe, and pathetic energy landscapes that included scars, pits, shafts, piles of waste, hulking machinery, and miserable assemblages of squalid housing. So notorious did coal landscapes become in Britain

Fig. 1: Noncombustible piles, called 'culm,' litter the old anthracite city of Wilkes-Barre, Pennsylvania, USA Photo: M. Pasqualetti

and France that they were used as the dismal backdrop for novelists such as Charles Dickens, George Orwell, Richard Llewellyn, Émile Zola, and many others.

Ironically, while early coal mining tarnished the natural landscape, it stimulated new inventions that were to intensify the form and scale of landscape damage even more. First, diggings had been in the form of shallow bell mines, named after their distinctive profile. Later, when improved equipment became available and water pumping more effective, mines became deeper, more elaborate, and more extensive. Even for underground mines, surface landscapes were changed due to the winding gear, ventilation shafts, spoils, and – in some places – surface subsidence (see Fig. 2). Our speeding desire for more and more coal was rapidly transforming the remaining natural landscapes into energy landscapes of coal. Yet, even then, it was only the beginning.

Technology continued to improve, and energy landscapes took on an even greater extent and impact. Massive and powerful machines eventually allowed the removal of extensive areas of overburden, exposing the coal seams beneath, heralding the era of open-cast mines that have, in several places, devoured towns as mining companies sought to reach the coal just under the surface (Montrie, 2003). For example, over a hundred of villages and parts of some larger cities have been destroyed and nearly 100,000 people were forcibly relocated due to the sprawling surface mines, construction of large thermal power plants and related infrastructural projects during the communist regime (1948–1989) in what was then Czechoslovakia (Říha et al., 2010). Infamously, the entire historic centre of the medieval city of Most was obliterated as a "decaying capitalist relic" to expose over 85 million tons of coal under the city (Glassheim, 2007) (see Figs. 3, 4a and 4b).

Most recently, especially in the Appalachian Mountains of the U.S., entire mountains are being demolished with nonchalant detachment (see e.g. Scott, 2010). Mountains in places like West Virginia are simply disappearing (see

Fig. 2: Abandoned house damaged by subsidence from underground coal mines in Wilkes Barre, Pennsylavia, USA. Photo: M. Pasqualetti

Fig. 3: One of the extensive open-cast coal mines that have reshaped the landscape near city of Most, Czech Republic in 2012. Photo: B. Frantál

Fig. 4: Historic Most in 1940s (left) and the same perspective in 2012, showing reclaimed land after coal mining (right). Source: The Archive of Regional Museum in Most; M. Pasqualetti

Fig. 5); up to 500 mountains in Appalachia have been lost so far. In the roughly 12-million-acre region of eastern Kentucky, southern West Virginia, western Virginia, and eastern Tennessee where mountaintop removal mining is concentrated, nearly 7% of all the land was disturbed between 1992 and 2012. For further information on mountaintop removal see Mary Anne Hitt (2007). One of many organisations that is attempting to slow the creation of energy landscapes from mountaintop removal is the National Memorial for the Mountains (www.ilovemountains.org).

Fig. 5: Mountain-top removal in Hobert 21 mine, West Virginia, USA. Photo: M. Farlow

The landscape impact does not stop with mountain top removal; the discarded overlying rocks, soil and vegetation must be dumped somewhere. Usually, it is tossed into nearby valleys. This practice can double the extent of the coal landscape produced, just as it also changes the watershed's hydrology and increases the risk of disastrous flooding and land slippage. While mountain top removal allows the retrieval of virtually all the coal underneath, it produces an especially vicious and lasting landscape insult. Even where reclamation of a sort can be practiced, landscapes are altered to an extent never witnessed in the long account of coal mining. Although public outcries have accompanied the use of this technique, they have failed so far to halt its practice (Fig. 6).

Cataloging coal landscapes can go on and on. It could consider much more than just the extraction phase. We could also include landscapes that are altered by railroads and conveyor belts, storage silos, washing apparatus, power plants, fly ash disposal, and even the indirect impacts of acid rain on forest cover. Our use of coal has transformed landscapes near and far in more ways than we usually imagine, and there seems no way to predict how long into the future they will persist or what new forms they may take.

Fig. 6: Protest placards against mountain-top removal in July 2005, Whitesville, West Virginia, USA Photo: M. Pasqualetti

3. Recycling, upcycling and rebranding coal energy landscapes

Over the centuries, energy development has largely been a linear enterprise, ending in landscapes disrupted, abandoned, poisoned, and forgotten. This "use, abandon, forget" approach is slowly being abandoned in favour of the more sustainable notion of "use, repurpose, reuse" (*cf.* Pasqualetti and Stremke, 2018). The ongoing low carbon transition – a transition from fossil fuels that underpinned the industrial age to a post-industrial era – is characterised by increasing competition between the land used for energy development and the land needed for cities, farms, recreation, and contemplation. In many countries, there is increasing pressure to regenerate, reclaim, and redevelop the abandoned, derelict and contaminated areas left behind – so called brownfields (see e.g. Martinát et al., 2018; Navrátil et al., 2018). These include abandoned mines, processing equipment, waste heaps, disused oil and gas wells, and other traditional energy landscapes.

The repurposing of these landscapes – and often disused buildings that rest on them – has become increasingly imperative and economically sensible as competition for land has increased and as emerging policies and economic instruments have grown to support the regeneration processes (e.g. the Re-powering America's land Initiative, see EPA, 2010). We have now reached a period when recycling energy landscapes is occurring with increasing frequency. While many energy landscapes are being recycled, we also witness the upcycling of energy landscapes, when the environmental integrity and performance of the present stage exceed those of the previous stage (Pasqualetti and Stremke, 2018). Examples of this new stage in land use development include converting opencast mines to recreational lakes, power plant buildings into museums, sites of mountain-top removal into golf courses, ash disposal piles into solar farms, canal paths into bike paths, and a wide assortment of energy infrastructure into destinations for the "energy tourism" (Frantál and Urbánková, 2017) (see Figs. 7 and 8).

The historical development of energy in a landscape, like other land uses, is an expression of changing relations between people and their living environment. Public perceptions of and attitudes to energy landscapes are prone to change with time, with some energy landscapes that induced opposition and social conflicts during construction and/or operation being now listed as UNESCO world heritage sites (this is also the case of coal mining landscapes, such as, for example, the utopian architecture from the early periods of the industrial era in Wallonia (Belgium), Sorachi coal-mining landscape in Hokkaido (Japan), the Ombilin mines in the mountains of West Sumatra (Indonesia), or recently listed sites in Erzgebirge/Ore Mountains region on the borders of Germany and the Czech Republic.

Various forms and materialisations of energy from fossils fuels to nuclear power and renewables have been perceived as being, among other things, dirty, clean, environmentally harmful, uncontrollable, dangerous, friendly, expensive, fascinating, or ghastly (see e.g. Truelove, 2012). Accordingly, new public relations and branding strategies (including various forms of energy tourism attractions and activities)

Fig. 7: Partially recycled coal energy landscape in Oslavany town (Czech Republic). An abandoned complex of coal-fired power plant (in the middle of the background), a big slag heap accumulated over decades of burning coal, and solar (PV) plant constructed on mining dump (left) – photographed from the Kukla mining tower, which is part of the former mining buildings regenerated into an amusement park for children (in the foreground). Photo: B. Frantál

have been introduced by energy companies and various interest groups in order to influence policy makers, energy policies and their support among the general public, social acceptance of energy projects, and even customer loyalty in liberalised residential energy markets (Frantál and Urbánková, 2017). For example, the Czech Coal Group company has been organising since 2009 so called "Coal Safari" guided off-road truck tours in an area of active open-pit mine near the city of Most, which has been already attended by tens of thousands of visitors. The aim of the tours, which include several stops introducing different types of minescapes, mining technologies and machines in regular operation, with examples of post-mining environmental restoration (including the Most Hippodrome (Fig. 9), the Matylda recreational lake created from a flooded quarry, vineyards and forests planted on coal dumps), was to improve the public image of coal mining in favour of lifting the current territorial limits on mining in the area (see also Frantál, 2016). How are global discourses concerning energy sustainability locally reproduced through specific energy tourism products and how are different narratives used by companies and operators to promote their products and to shape public opinion about energy are among the key questions in the energy tourism research.

Energy has been largely "invisible" in the consumption choices made in our daily lives, and people living outside energy landscapes were rarely aware of the spatial and environmental costs of the energy they consume (Pasqualetti, 2000). As Frantál and Urbánková (2017) suggest, the energy tourism can play a more important role than as just a kind of consumer experience-oriented industrial tourism (Mitchel and Orwig, 2002). By witnessing the real impacts of energy production on landscapes, energy tourism has the potential to improve people's energy literacy by raising awareness about the environmental cost of the energy we all use, and to motivate people to think about appropriate energy-related choices to tackle current energy challenges. While industrial heritage sites represent rather landscapes of history and nostalgia, new energy tourism sites with wind and solar farms represent authentic contemporaneity, or even the landscapes of a possible future, as we can assume further spatial diffusion of renewables. Energy landscapes

Fig. 8: Zollverein coal mine industrial complex (Essen, Germany) converted to museum and tourist attraction Photo: M Pasqualetti

exist over a wide temporal range in various forms. There are those that existed in the past but have disappeared due to reclamation or natural succession, there are those that exist at present and have an uncertain life expectancy, and there are those that will exist in the future, either created afresh or recycled from pre-existing energy landscapes (Pasqualetti and Stremke, 2018).

4. The death of coal in the energy transition?

In 2014, the Special Issue of Moravian Geographical Reports on "New Trends and Challenges for Energy Geographies" was published (see Frantál, Pasqualetti and Van der Horst, 2014) to contribute to the debates about the spatial scales and social dynamics of ongoing energy transition processes in the European context. The continued expansion of the renewable energy sector with wind farms, solar power plants and other energy facilities growing in number and size, has significantly altered landscapes and land use dynamics, and brought about new land use conflicts, socioeconomic disparities, and disconnections between policymakers and stakeholders (see e.g. Warren, 2014; Carley and Konisky, 2020; Frantál et al., 2023).

Fig. 9: Most Hippodrome – the racecourse with trail for in-line skating which was built on a recultivated coal dump, city of Most, Czech Republic. Photo: B. Frantál

Geographers contribute to understanding energy transitions by paying attention to settings (places), spatial configurations and the dynamics of the networks within which the transitions are embedded (Hansen and Coenen, 2015; Bridge and Gailing, 2020; Coenen et al., 2021). Since the capacity to take up different renewable energy technologies is related to geographical conditions, the locations, landscapes and territorialisations associated with energy transition can generate new patterns of uneven development (cf. Bridge et al., 2013). It is also important to understand how systems of places shape the reproduction of dominant socio-technical systems for energy (based on fossil fuels), by mediating the extent and efficacy of public engagement in decision-making and problematising political challenges to the social order (Cowell, 2020).

The energy transition posed challenges for regions that are still heavily dependent on the extraction of fossil fuels and related industries – the so-called coal and carbon-intensive regions (European Commission, 2017). Despite their centrality in energy provision chains during the 19th and 20th centuries, carbon-intensive regions are now considered peripheries – synonymous with landscape degradation, air pollution, and health and social deprivation. The phasing out of coal and the decline of related industries have resulted in stagnating local economies, declining populations, an overall sense of loss of identity and prospects, and the rise of populism rhetoric with nostalgia for the 'good old days' (Kojola, 2019; Mayer, 2022). On the other hand, the energy transition could be perceived as an opportunity for developing new lines of economy, rebranding identities, and for increasing the competitiveness of structurally depressed regions (Alves Dias et al., 2018; Stognief et al., 2019).

In 2017, the European Commission established the "Initiative for Coal Regions in Transition", to promote knowledge-sharing and exchanges of experiences between European coal regions. The aim of contributing to the sharing of experiences with energy transitions in different European regions and to highlight the role of geography in addressing current energy dilemmas, was the background of this Special Issue. The current energy crisis with disrupted energy markets, increasing prices of fossil fuels and electricity related to the post-Covid economic recovery and the war in Ukraine, have challenged the progress and speed of energy transition and brought another dimension to the coal-phase out debate: it is no longer just a binary "jobs versus the environment" discourse, but issues of national energy security and peoples' rights to affordable energy and heat that are being highlighted.

Zakeri et al. (2022) have suggested that both crises (i.e. the Covid-19 pandemic and the Russia-Ukraine war) initially appeared as opportunities for the energy transition, by showing the extent of lifestyle and behavioural change in a short period and the role of science-based policy advice on the one hand, and by highlighting the need for greater energy diversification and reliance on local renewable sources on the other hand. They, however, provide evidence that policymakers worldwide more likely focus on quicker and short-term solutions (such as supporting incumbent energy industries and searching for new fossil fuels supply routes) to save national economies and enhancing energy security. In this respect, they argue, the fossil fuel industry may emerge even stronger after this energy crisis, creating new lock-ins (Zakeri et al., 2022). Politicians' plans to extend coal mining (previously announced to end) are already echoing from many European countries. Recently, a plan to dismantle the Keyenberg wind farm in the western state of North Rhine-Westphalia (Germany), to expand the area of surface coal mining, has stirred up wider public opinion (Oltermann, 2022). The opening of a new deep coal mine after decades as announced at the beginning of December in Great Britain drew huge criticism from opponents (Reuters, 2022). The Woodhouse Colliery, to be developed by West Cumbria Mining in northwest England, should extract coking coal to be used in the steel industry and is expected to create up to 500 new jobs. This summer, the government in the Czech Republic decided to extend coal mining in the last open underground hard coal mine in the country, which was supposed to be completed in 2022, at least until the end of 2023. The Czech politicians, however, assume that coal mining will continue here even in the following years if it will be at least "economically neutral" (i.e. neither profitable nor unprofitable) (Czech Television, 2022).

The aim of the Special Issue was to address some of the following issues: What are the patterns of energy transition and renewable energy development in coal regions with different geographical development contexts and different

resource availabilities? How does geographical (spatial) proximity, remoteness or peripherality play a role in the socioeconomic and demographic changes of coal regions? How do people in carbon intensive regions perceive the energy transition processes and policies? Are people living in coal mining regions affected by energy poverty and how do they deal with it? To what extent are coal regions populist, anti-democratic, xenophobic? …and how do different regions reshape their image and collective identity based on coal mining traditions or alternative narratives? Our collection of articles includes European countries with a strong and long-standing tradition of coal mining and related industries: the Czech Republic, Germany, Poland, Romania, Spain, and Scotland. While the first three articles focus on the economic and social impacts of the energy transition in traditional coal mining regions, the next three articles examine public perceptions and attitudes towards the decarbonisation and development of specific forms of renewable energy systems at the community and individual level.

In the first paper, Bohumil Frantál, Jindřich Frajer, Stanislav Martinát and Lucia Brisudová provide new empirical evidence regarding the theories of the resource curse and regional resilience in the context of a coal phase-out, using statistical data for districts in the Czech Republic. They found that Czech coal mining and post-mining districts (in aggregate) show significantly worse indicators in terms of air quality, population vitality, labour market issues and social capital than non-mining districts. The authors, however, revealed significant intra-group differences in most indicators, and they conclude that coal mining itself and its decline is not a significant determinant of population decline, unemployment, and support for populism (which are determined by the geographical peripherality, rate of urbanisation, population density, education level and business activity in districts). The study demonstrates that it is problematic with respect to policy implications to consider coal mining regions as homogenous categories and that it is necessary to investigate and reflect differences in demographic and socioeconomic indicators at a sub-regional level.

Despite the political promises that the just transition will bring more democracy and prosperity, there are legitimate fears that, in some regions, the pre-existing inequalities will be reinforced rather than rectified. Focusing on Jiu Valley, a traditional coal-mining region in Romania, Sanda Nicola and Serge Schmitz question how community resilience can be stimulated prior to and during coal mining closures. Their study reveals shortcomings in implementing the just transition, including the issues of governance and mistrust towards local and national authorities, difficulties in orchestrating individual agendas to launch a collective action for the future of the region, and poor information and delays of the mine closures. Furthermore, they point out some of the mechanisms that explain the scarce preparedness of key actors for the coal phase-out and why the closure of mines and the socioeconomic transition were repeatedly postponed.

Oei et al. (2020) emphasised that, besides the economic reorientation, the change of regional identities is the most difficult aspect of the transition of coal mining regions. In the third paper, using a critical narrative analysis, Franziska Görmar and Nadir Kinossian explore how identity-forming discourses and local development activities co-constitute each other in the case of Zeitz, an industrial town located at the fringes of the Central German lignite exploitation area. As local actors try to make sense of a place's past and future, they select, contribute to, and mobilise various local narratives, which are part of a place's identity that defines a frame for possible development options. The authors suggest that the development of local narratives is a dynamic policy arena where collective and individual experiences influence each other and create structuring frames for options and local actors, and the narratives help to construct a coherent imaginary of a place linking the past, present, and the future.

Suburban neighbourhoods (not only in the UK) are characterised by high car-dependency and relatively large and energy inefficient homes, which pose challenges regarding their decarbonisation. Charlotte Bucke, Connor Smith and Dan van der Horst surveyed households in Perth (Scotland) about their perspectives on the adoption of measures for decarbonising homes and transportation in suburbia. While they found high levels of concern about climate change, energy costs, and growing engagement with cleaner technologies, most residents perceived their individual options for decarbonisation as limited, and they seem locked into high-carbon suburban lifestyles. The views that the state should take a stronger role in coordinating and implementing systemic changes required for energy transition and applying measures affecting residents directly (such as e.g. reducing car traffic into the city centre) have been also shared.

Quite similar findings about a wide awareness about renewable energies in general, but a rather shallow, imbalanced, and outdated knowledge on potentials, advantages and disadvantages of individual locally available sources are reported in the next paper from Poland, by Justyna Chodkowska-Miszczuk, Sylwia Kuziemkowska, Pramit Verma, Stanislav Martinát and Agata Lewandowska. The authors argue that to break deeply rooted carbon dependency and lock-in and to trigger mechanisms of change leading to more sustainable futures, practical, contextual, and place-based knowledge is essentially needed to shape responsive attitudes of people living in rural areas. They claim that personal experience of the effects of renewable energy facilities (together with distributional justice) can be a proxy for the change and scaling up. This is a key because it proves the leading role of an inclusive approach to developing renewable energy in rural areas.

Spain is among the world's leaders in wind energy implementation. Despite having one of the fastest rates of onshore wind power growth, the offshore development so far lags significantly behind – mainly because of strong local opposition. Marina Frolova, Belén Pérez-Pérez and Daniel Herrero-Luque in their paper explore factors affecting public perceptions of offshore wind farms in the coastal regions of Southern Spain. Their study shows that the conflicts surrounding offshore wind farms are linked to the perception of the sea and the wind as important local resources, and the perceived right of the coastal region to use these resources to generate wealth for their communities. They suggest that providing socioeconomic benefits for local communities and guaranteeing a joint use of marine resources can significantly increase the local acceptance of projects.

The few articles in this Special Issue present a width of geographical perspectives on the ongoing energy transition and a diversity of empirical research endeavours applying various methods and techniques, from participatory observation, interviews, focus groups and questionnaire

surveys to the content analysis of historical documents, critical narrative analysis and rigorous analysis of statistical data using multivariate statistics. Our articles do not give a clear answer to the question of whether and when will the death of coal occur in the energy transition, but they help to understand the complexities of this process, its driving forces, barriers, and consequences.

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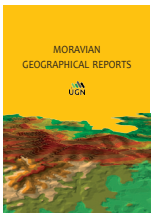

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The curse of coal or peripherality? Energy transitions and the socioeconomic transformation of Czech coal mining and post-mining regions

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Abstract

New empirical evidence regarding theories of the resource curse and regional resilience in the context of energy transitions is presented in this article. Our analysis aimed to answer the questions of what the principal differences are between coal mining and other regions in the Czech Republic, and what are the determinants of population decline, unemployment and populism as some of the key indicators of socioeconomic transformation. Unlike most current European studies focusing on NUTS2 or NUTS3 regions, we deal with data for districts (LAU1). The analysis revealed that (in aggregate) coal mining and post-mining districts are worse off in terms of air quality, population vitality, labour market and social capital indicators. It would be problematic for policy implications to consider coal mining and post-mining districts as homogenous categories, however, since there are significant inter-group and intra-group differences in most indicators. Coal mining itself and its decline did not prove to be a direct determinant of population loss, unemployment, and support for populism. The factors significantly affecting these phenomena are geographical (peripherality, urbanisation, population density) and socioeconomic (education level, business activity). In this respect, a provocative question is offered: to what extent is it effective and sustainable to economically support coal mining regions in their existing industrial production structures and population scales, and whether the current processes of reterritorialisation and depopulation can be considered a natural process. The fact that coal mining districts are at the forefront in the implementation of wind energy may be seen as positive, but it raises questions about spatial concentration, and the environmental justice of renewable energy development.

Keywords: *coal mining; coal phase-out; resource curse; regional resilience; Czech Republic*

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1. Introduction

"Ostrava city with the coal stands and falls"

Augustin Kliment
communist minister of heavy industry (1952)

The ongoing low-carbon energy transition poses particular challenges for regions that are still heavily dependent on the extraction of fossil fuels and related industries – so called coal and carbon-intensive regions (CCIR) (European Commission, 2017). Despite their centrality in energy provision chains during the 19th and 20th centuries, carbon-intensive regions are now regarded as peripheries synonymous with air pollution, land degradation, and health and social deprivation (see e.g. Zullig and Hebdryx, 2010; Frantál, 2016; Smeraldo Schell and Silva, 2020). The phasing out of coal mining and combustion and the decline of related industries have resulted in stagnating local economies, declining populations, an overall sense of loss of identity and prospects, and the rise of populism rhetoric with nostalgia and false political promises (Thorleifsson, 2016; Abreu and Jones, 2021; Mayer, 2022). On the other hand, the energy transition is considered as an opportunity for developing new lines of economy, rebranding identities, and for increasing the competitiveness of structurally depressed regions (Alves Dias et al., 2018; Oei et al., 2020a; Stognief et al., 2019).

In 2017, the European Commission established the "Initiative for Coal Regions in Transition", to promote knowledge-sharing and exchanges of experiences between

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EU coal regions and supported several research projects within the H2020 R&I Framework. The partial programme "Social Sciences and Humanities Aspects of the Clean-Energy Transition" (European Commission, 2019) focused on principal challenges facing coal and carbon-intensive regions, stressing the following issues:

i. What are the principal differences between regions that are coping well with the transition and those that are not?;
ii. To what extent have carbon-intensive regions experienced outward migration and how has this affected their social and demographic composition?; and
iii. What effect have these changes had on the rise of populism and of anti-democratic attitudes?

Most recent comparative studies assessing the impacts of coal mining on the health and socioeconomic well-being of affected areas (i.e. the resource curse literature), and searching for factors affecting the resilience and adaptive capacity of regional economies to transform (i.e. the transition studies) have dealt with either NUTS2 or NUTS3 regions (Alves Dias et al., 2018; Schulz and Schwartzkopff, 2018; Stognief et al., 2019; Drobniak, 2020; Esposito and Abramson, 2021; Everingham et al., 2022) or even with countries (e.g. Svobodova et al., 2020). While these studies provide useful international comparisons, however, they present quite generalised results which often ignore the fact that coal mining regions are not uniform and homogenous entities. There are both inter-regional (depending on their location, scale, and structure, the type of mining technology and industrial organisation, etc.) and intra-regional differences (between districts, municipalities and localities within regions). If these differences are ignored and coal mining regions are considered only in the aggregate, the analyses can give biased and discrepant results, the policies based on aggregate data may perpetuate both disadvantages and advantages in many local areas (Nord and Luloff, 1993; Williams and Nikijuluw, 2020a) and the measures taken (e.g. energy transition funds or retrofit subsidies) may be inefficient or even regressive, reproducing existing inequalities between the centres and the peripheries and others (see e.g. Willand et al., 2020; Frantál and Dvořák, 2022). The studies analysing the impacts of coal mining dealing with lower spatial levels, such as counties, shires or cities have been carried out almost exclusively in Australia or the United States (see e.g. Nord and Luloff, 1993; Hajkowicz et al., 2011; Tonts et al., 2012; Fleming et al., 2015; Wolley et al., 2015; Williams and Nikijuluw, 2020a, 2020b).

This paper seeks to partially fill the existing research gap and demonstrate the importance of investigating the relationships between coal mining, socioeconomic well-being and resilience to transitions at lower spatial levels, using statistical data for districts (Local Administrative Units (LAU1)) in the Czech Republic. Using the analysis of variance (ANOVA) and regression modelling, we test the effect of a wide range of variables, including geographical and environmental indicators, population vital and health statistics, labour market and income data, renewable energy production data, and social capital and social cohesion indicators. The research questions that have driven our exploratory research were defined as follows:

- In which indicators do coal mining, post-mining and non-mining regions differ significantly?
- Do coal mining regions differ with respect to renewable energy development? and
- What are the main factors and barriers that have enabled or slowed down the socioeconomic transformation of coal mining regions?

The remainder of the paper is organised as follows. The next section reviews the literature dealing with the issues and concepts of the resource curse, regional adaptive capacity and resilience in the context of the energy transition and coal phase-out, and the so-called extractive populism. The next section is concerned with a description of the regional context of the case study, the sources of data and methods of their analysis and processing. Results are presented and discussed in the following sections, which are structured according to the above defined research questions, including comparisons to previous studies from other countries if eligible. The concluding section highlights the main findings and provides some policy implications.

2. Theoretical background: The resource curse, regional resilience, coal phase-out and extractive populism

The historical role of coal for industrialisation, the creation of new jobs and regional economic development is indisputable (e.g. Domenech, 2008; Latzko, 2011; Ivanova, 2014; Berbée et al., 2022). The economic benefits of coal mining for host regions and local communities have been, however, in a longer-term view, outweighed by negative environmental, health and social externalities and unintended consequences (Lockie et al., 2009; Riva et al., 2011; Petrova and Marinova, 2013; Li et al., 2018; Esposito and Abramson, 2021). In this respect, the coal mining has been often associated with the resource curse theory, stressing that regions whose development has been strongly dependent on the extraction of natural resources (specifically non-renewable resources like minerals and fossil fuels) are characterised by economic vulnerability, demographic instability, negative health and socioeconomic impacts, increasing geographic isolation, a decrease in educational attainments, and imbalances of scale and power with respect to extractive industries (Freudenburg and Gramling, 1992; Morrice and Colagiuri, 2013, Betz et al., 2015; Esposito and Abramson, 2021).

Understanding the links between resource dependence and socio-economic wellbeing has long been a subject of interest amongst social scientists, particularly in North America and Australia (Freudenburg and Wilson, 2002; Mancini and Sala, 2018; Williams and Nikijuluw, 2020a, 2020b). Existing empirical studies have nonetheless provided inconclusive and/or contradictory evidence of the resource curse hypothesis. For example, Petkova-Timmer et al. (2009) and Hajkowicz et al. (2011) proved positive impacts of coal mining at the regional level in Australia, including effects on employment, incomes, housing affordability, the improvement in infrastructure and services. Hajkowicz et al. (2011) however pointed out that the highly localised disadvantages and inequalities from coal mining (e.g. uneven income distribution) were not detected due to the chosen scale of analysis. The earlier studies from the US suggested that mining-dependent counties are characterised by levels of socioeconomic wellbeing above the national average but striking regional differences among mining-dependent counties were masked when such counties were considered as a single category (Nord and Luloff, 1993). Perdue and Pavela (2012), Oxley (2014) and Betz et al. (2015) examined the effect of coal mining on the Appalachian regions and found positive associations between coal mining,

unemployment and poverty rates, and negative associations with entrepreneurial activity and population growth. The results of an international comparative study by Esposito and Abramson (2021) show that European former coal-mining regions are substantially poorer than comparable regions in the same country that did not mine coal, which can be explained by lower levels of human capital accumulation (particularly in men). They suggest that persistently lower levels of human capital in coal mining regions result from the crystallisation of negative attitudes towards education and lower future orientations (*cf*. Esposito and Abramson, 2021).

As Bebbington et al. (2008) pointed out, the contribution of mining to regional development is contentious and ambiguous at best. The effects of coal mining on regions and local communities differ between boom-and-bust periods and over the long run (Black et al., 2005; Shandro et al., 2011; Betz et al., 2015; Measham et al., 2019). Moreover, most of the socioeconomic impacts of the coal industry rely on its spillover effect, rather than direct effects (Williams and Nikijuluw, 2020a). The results and conclusions are dependent on the geographical context, the industrial organisation and social relations of production (e.g. differences between the "old coal" regions of the South, the "old coal and iron" regions of the Great Lakes, and the "new coal and petroleum" regions of the West in the US: see Nord and Luloff, 1993), the spatial level of analysis, the spectrum of used indicators, and the degree of data aggregation (Tonts et al., 2012; Betz et al., 2015; Williams and Nikilujuw, 2020b).

Furthermore, the coal mining industry has changed dramatically during the last two decades, including geographic shifts in production, technological changes that have reduced labour demand and led to relatively new mining practices (e.g. invasive mountain-top approaches), changed economic footprints, a shutdown of capacities or a complete end of mining in many regions (Betz et al., 2015). The decline or the end of mining can bring new or amplify already existing negative phenomena. For example, Scheuch (2020) reports that coal mining counties in the Appalachian region suffer from high rates of obesity, heart disease, diabetes, smoking, and drug abuse, leading them to have some of the lowest life expectancies in the country. Kratzer (2015) also shows that areas (in the Appalachian region) with high levels of coal mining experience have higher population loss. Abreu and Jones (2021) found that residents of former coal mining communities in the UK are highly politically disengaged, with low levels of trust and political efficacy, and low involvement in the political process.

The question "why, when faced with external transformative pressures, are some regional economies able to economically and socially renew themselves, whereas others remain locked in decline" is among the key issues in the regional studies literature (Campbell and Coenen, 2017). The ability of regions to cope with shocks or significant changes has been inflected in connection with the terms adaptive capacity and resilience (Robinson and Carson, 2016; Stognief et al., 2019; Everingham et al., 2022). Whether a region is resilient refers to the distinction between the short-term capacity to absorb shocks (i.e. to adjust) and its long-term capacity to develop new growth paths (i.e. to renew itself) (Martin and Sunley, 2015 as cited in Cambell and Coenen, 2017). A successful transition and renewal of mining regions and cities largely depended on timely economic diversification, developing new pathways of industrial development and innovation (Cambell and Coenen, 2017; Measham et al., 2019). Jonek-Kowalska and Turek (2022) document how the decommissioning of coal mines in cities of the Upper Silesian coal basin (Poland) had a negative impact on the balance of local budgets and the level of long-term debt. The impact was especially strong in cities where all mines were decommissioned and which did not replace the mining industry with economic alternatives, while cities with more diversified economic activity and sources of income were in a better economic condition.

The studies from Australia (as reviewed by Everingham et al., 2022) suggest that the adaptive capacity of coal mining regions is dependent on human and social capital (i.e. education level, community cohesion) as well as geographical location (remoteness) and the accessibility of infrastructure and services. The importance of combining not only policies addressing unemployment and the attraction of new energy corporations and investments, but also measures improving infrastructure, education, research facilities and soft location factors, has been highlighted also based on the experiences from the transition of German coal mining regions (Oei et al., 2020a, 2020b). Furthermore, Everingham et al. (2022) emphasise that transitions resulting from sectoral change are influenced by multidimensional patterns in surrounding contexts rather than coupled dynamics or single factors.

Oei et al. (2020) also point out that besides the economic reorientation, the change of regional identities is the most difficult aspect of the transition of coal mining regions. The place-based and class identities and social imaginaries linked to coal mining have recently become an important dynamic in an emerging political "extractive populism", not only in the United States (Kojola, 2019; Mayer, 2022) but also in Germany (Abraham, 2019), Poland (with an exemplary case of the Turow open pit mine conflict, see Żuk and Żuk, 2022) or the Czech Republic (Osička et al., 2020; Kuba et al., 2022). Kojola (2019) examines and describes how the support for coal mining among white, working-class, and rural residents in the US has been made meaningful through nostalgia for preserving mining as a way of life and anger at outsiders (and burdensome government regulations), disrupting their livelihoods and extractive moral economy (as exemplified in the rhetoric of Donald Trump's claims of ending the "war on coal").

Throughout modern history coal has played a key role in human development, it has transformed societies, expanded frontiers, and sparked social movements, redefined the role of workers, changed family structures, altered concepts of public health and private wealth and crystallised debates over national values (Freese, 2003), and it prevails as a symbol of broader cultural, geographic, and class divides to this day (Kojola, 2019).

3. Methods and data

3.1 Regional context of the study

The Czech Republic is a country with a significant coal mining tradition dating back to the Middle Ages. The industrial development of coal mining is associated with the construction of the railway network in the mid-19th century, which connected major industrial regions with the locations of coal deposits. The biggest mining boom, however, came in the second half of the 20th century. During the era of communism (1948–1989), coal was hailed as the "crown jewel of the land" and the "blood" of the metallurgical and energy-intensive heavy industries, which had been centrally supported as dominant sectors of the economy (Glassheim, 2007) (see Fig. 1). In that period, the production

of brown coal as the main source of energy increased about five times and electricity generation about twenty times (CZSO, 2012). This planning orientation affected the overall national economy and resulted in the environmental devastation of several regions, particularly in the North Bohemian coal basin and Ostrava-Karvina coal basin (Říha et al., 2011; Frantál, 2017).

After the change of regime in 1989, the newly established Federal Ministry of Environment prepared programs to restore the environment of the most environmentally affected areas. As a result, all operational coal power plants were required to be desulphurised or shut down and the so-called territorial ecological limits for mining were established by the Government Decrees No. 331 and 444/1991 (Říha et al., 2011). By restricting exploration, coal mining and other mining-related activities beyond certain spatial limits, the Government established a balance between economic and ecological interests, but it also ignited a fierce political debate and conflicts of interest that persist to the present (Černoch et al., 2019; Sivek et al., 2017; Shriver et al., 2022). The transition to a market economy, economic changes accompanied by a strong recession of heavy industries, the pressure to improve the environment and, following global trends, caused a gradual reduction in coal mining and the subsequent shutdown of capacities or a complete end of mining in some regions or localities (see Fig. 2).

More than thirty years after the change of regime, despite general economic restructuring, the decline of coal mining and heavy industries, and investments in environmental restoration, the coal mining regions still seem to suffer from the resource curse characterised by long-term exploitation and the commodification of the landscape through coal mining and combustion. The results appear to be clear: draining profits from energy sales out of the affected regions, negative environmental, health and socioeconomic consequences, the absence of realistic alternatives for future diversified

Fig. 1: "Soviet energy – our model". Communist propaganda sign in a current desolate building of a coal-fired power plant in Oslavany town, Brno-countryside district. Photo: B. Frantál

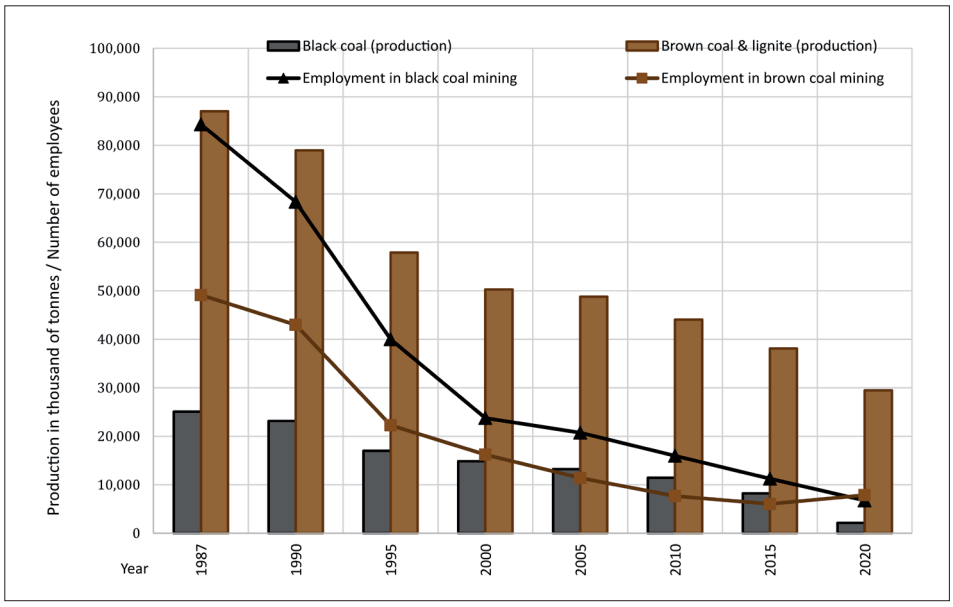

Fig. 2: The decline of the coal mining industry after change in the communist regime in 1989
Sources: Czech Statistical Office (2012): Historical yearbook of the energy statistics; Czech Mining Authority: Mining Yearbooks (1992–2015)

development, and persistent pressures from the industrial lobby to expand mining areas (Frantál, 2017; Shriver et al., 2022). The current Czech energy policy remains highly dependent on traditional resources, with overall electricity generation based predominantly on thermal or combined cycle power plants burning coal (40%), natural gas (8%), and other fuels (3%), nuclear power (36%), with renewable energy sources contributing less than 13% (ERU, 2022). While in 1990, coal mining took place in thirteen districts, currently mining is active in only five districts of the Czech Republic (see Fig. 3 and Tab. 1).

In relation to the future of coal mining and burning, the Czech public and its political representation are characterised by a high degree of ambiguity, fragmentation among decision-makers, stakeholders and opposition groups (related to their ideological cross-coalition membership and the heterogeneity of beliefs) (see Ocelík et al., 2019; Černoch et al., 2019) and the predominance of the aspects of employment, regional economic resilience and energy security over environmental and climate issues in the mass media (Lehotský et al., 2019; Osička et al., 2020). After years of hesitations and expert and political disputes, at the beginning of 2022 the new government announced in its programme statement to phase out coal by 2033. The plans assumed an increase in the share of nuclear power plants and renewables (particularly wind and solar installations) on electricity generation, with an increased importance of natural gas as a "transition fuel" to balance fluctuations in energy production and the decarbonisation of the heating industry (Government of the Czech Republic, 2022). These plans about coal-phase out have been, however, significantly questioned by the ongoing economic and energy crisis in connection with the war in Ukraine.

3.2 Data and statistical methods

As the spatial level of analysis, we have chosen districts (Local Administrative Unit – LAU1)[1] for which a relatively wide spectrum of data is available and, at the same time, they exhibit a high degree of variance in terms of the key socioeconomic indicators. We created a database of selected variables representing the geographical characteristics of districts, population statistics, local economy and labour market data, living standards and social capital indicators (see Appendix 1). To provide empirical evidence of the "curse of coal" hypothesis, a comparative analysis was made for selected variables for groups with active coal mining, post-mining, and non-mining districts. The statistical testing has been carried out using the analysis of variance (ANOVA) to analyse differences between group mean values, providing F-tests and Eta correlation coefficients. ANOVA has also been used for detecting significant differences between districts in the implementation of renewable energy technologies.

As dependent variables for a deeper analysis, we chose those indicators that are most often mentioned in the present literature as negative impacts of coal mining dependence (i.e. population decline, unemployment, and the rise of populism). To determine the relative strength of the effects of individual variables on the change in population during the last thirty years, the current unemployment rate, and the support of populist political parties, we carried out multiple regression analyses. For each of the three dependent variables, we created two regression models (one for the sample of all districts in the Czech Republic (N = 76), and the second for the sample of coal mining and post-mining districts (N = 13), including independent variables which proved to be significantly correlated with dependent variables and rationally considered as possible determinants affecting

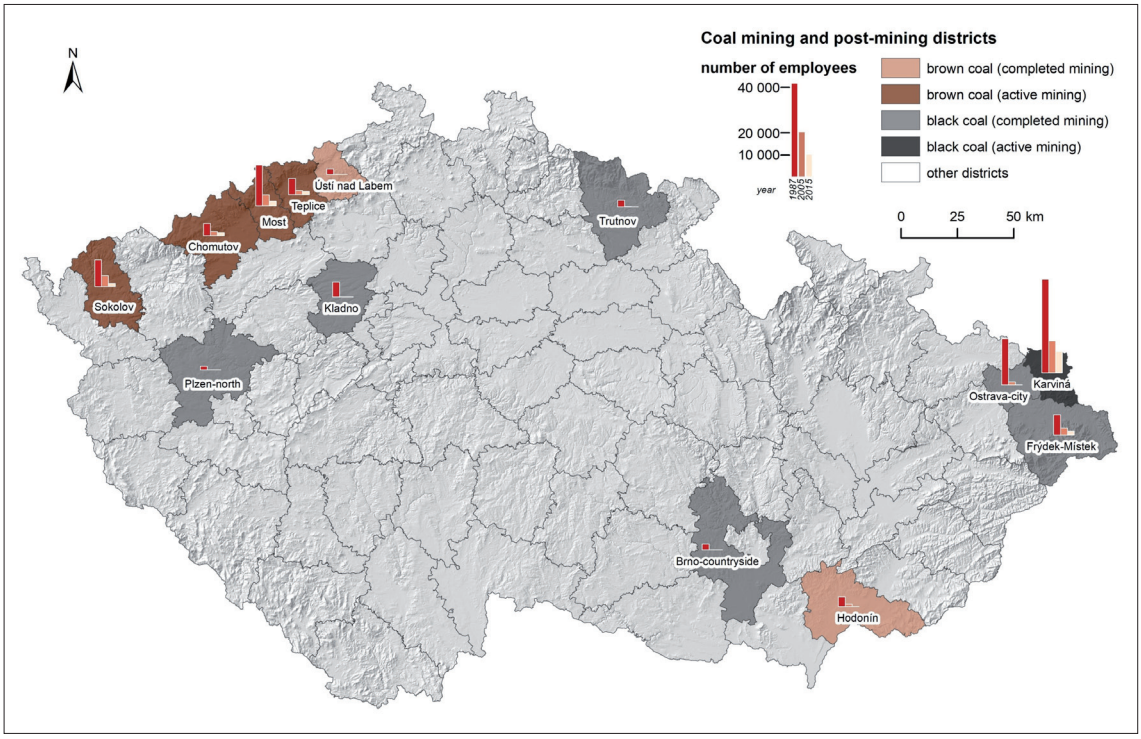

Fig. 3: Coal mining and post-mining districts in the Czech Republic
Source: authors' elaboration based on data from Czech Statistical Office and Czech Mining Authority (Mining Yearbooks, 1992–2015)

[1] There are 76 districts in the Czech Republic, the capital city of Prague does not belong to any of them and represents a specific unit. The areas of districts range between 230 and 1,946 km^2 (the mean value is 1,031 km^2).

District	Type of coal (mining)[1]	End of mining[2]	Number of employees in coal mining (% of productive population)		
			1987[3]	2005	2015
Brno-countryside	Black (UG)	1992	2,605 (2.3)	0	0
Ostrava	Black (UG)	1994	20,491 (9.1)	1,309 (0.6)	0
Trutnov	Black (UG/SF)	1994/2007	2,851 (3.4)	39 (0.05)	0
Plzeň-North	Black (UG)	1995	1,448 (2.8)	0	0
Ústí n/Labem	Brown (SF)	1997	2,446 (2.9)	0	0
Kladno	Black (UG)	2002	6,595 (6.2)	53 (0.05)	0
Hodonín	Lignite (UG)	2009	4,252 (3.8)	984 (0.9)	0
Frýdek-Místek	Black (UG)	2017	8,935 (5.6)	3,052 (1.9)	1,733 (1.2)
Karviná	Black (UG)	2023 (?)	41,392 (20.9)	14,086 (7.1)	9,522 (5.6)
Chomutov	Brown (SF)	2033 (?)	5,321 (5.9)	1,779 (1.9)	1,240 (1.5)
Most	Brown (SF)	2033 (?)	18,086 (21.6)	4,811 (5.7)	1,962 (2.6)
Sokolov	Brown (SF)	2033 (?)	11,884 (17.7)	4,888 (7.3)	1,403 (2.3)
Teplice	Brown (SF)	2033 (?)	7,133 (7.9)	1,863 (2.1)	1,441 (1.7)

Tab. 1: Basic characteristics of Czech coal-mining and post-mining districts (Notes: [1]In this paper we use a division of coal into types, which is usual in the Czech Republic, according to the carbon content and calorific value: lignite (30–50%, approx. 13 MJ/kg), brown coal (50–80%, 15–20 MJ/kg), black coal (80–90%, 18–30 MJ/kg), and anthracite (over 90%, 26–30 MJ/kg). The type of coal mining represents the dominant method of mining in the area: UG = underground, SF = surface; [2]In the district of Trutnov, the underground coal mining was terminated in 1994. After the end of underground mining, one mining area (Žacléř) was preserved, where localised surface mining began in 1998 and lasted until 2007. Production was very limited, and the number of employees included only a few dozen workers; [3]The number of employees is given based on the registered office of the mining company. Therefore, in 2005, for example, workers are registered in the district of Ostrava, although there was no active mining in that district at that time, but mining was done in neighbouring districts, and at the same time work related to closing the mines was underway.)

Source: authors' calculations based on data from Czech Statistical Office and Czech Mining Authority (Mining Yearbooks, 1992–2015)

the dependent variables. Thus, for example, the share of people with basic education, which strongly correlates with population decline, was not included in the regression model for population change, since it is more likely a consequence (outmigration of more educated people) rather than a cause of population change.

4. Results

4.1 Differences between coal mining, post-mining and non-mining districts

The coal mining districts show some geographical characteristics (see Tab. 2). They are mostly located in borderland areas, they have significantly smaller area, are more urbanised, and have a smaller share of agricultural land (which is logically related to the processes of industrialisation and urbanisation). On the other hand, the coal mining districts do not differ significantly in terms of the share of forests and landscape protected areas with respect to total area, not even in terms of the coefficient of ecological stability (the ratio of areas of stable and unstable landscape-forming elements), which is quite surprising considering the high level of urbanisation.

Coal mining and post-mining districts significantly exhibit much higher concentrations of emissions of the main air pollutants (i.e. of particulate matter and carbon monoxide, as well sulphur dioxide and nitrogen oxide which are not included in the table). From the long-term point of view, the district of Ostrava-city shows the highest concentrations of air pollutants among all areas in the Czech Republic. Air quality in this area is significantly affected by the location of the Liberty Steel factory (previously Arcellor Mittal), which is considered the largest polluter in the region. Although there has been a positive trend in decreasing emissions since the 1990s, the air quality in coal mining districts remains significantly worse compared to rest of the country (note that the latest air pollution data for districts was available only for 2015).

Czech coal mining districts do not differ significantly in terms of population density (although the analysis shows relatively large differences between categories in population density, they are not statistically significant), gender structure, the average age, and the index of aging. They do show significantly higher rates of abortions and infant mortality, and people living there have significantly lower life expectancy at birth (particularly men). These results are quite like data from Australia, where population and gender indicators show no significant differences between coal mining and non-mining areas (Williams and Nikijuluw, 2020b), but significant differences exist as regards life expectancy (Hajkowicz et al., 2011).

While the population in non-mining and post-mining districts has increased slightly on average compared to 1990, the population in districts with active mining has distinctly decreased (on average by 11% compared to 1990). Such differences between mean values of the categories of districts were not proved to be statistically significant, which indicates that there is a large variance in the change of population

within groups (see Fig. 4). While some coal mining and post-mining districts (Karviná, Sokolov, Most, Hodonín, Frýdek-Místek) are among the Czech districts that have lost the larger part of their population, some other post-mining districts (Brno-countryside, Kladno, Plzen-north) show some of the largest relative population gains in the country.

It is necessary to mention that the significant relative increase of the population in the district Brno-countryside was also affected by the administrative change of borders (i.e. incorporation of 50 municipalities from neighbouring districts in 2005 and 2007). Among the highest ranking 15 districts with the largest relative population decline in the country are three mining districts, two post-mining districts and ten non-mining districts. Twelve of these fifteen districts with the largest decrease in population are located in borderland areas. A deeper analysis shows that coal mining has not been the primary factor affecting out-migration and the decline of population in these districts.

During the transformation of society and the economy after the change of political regime in 1989, there were significant changes in the indicators of the labour market and wealth. While in 1991 the coal mining districts showed a significantly higher share of people working in the industrial sector as a whole (by almost ten percent on average), just ten years later (2001) the districts with still active coal mining no longer differed in the share of workers in industry from post-mining and non-mining districts. While in 1991, Czech districts did not significantly differ

Indicators	Mean values for districts			Statistics	
	Non-mining	Post-mining	Active mining	F test	Eta[1]
Geography and environment					
Total area (km^2)	1,075	962	596	4.188	0.321*
Share of districts located on country´s border (%)	40	50	100	–	0.292*
Urbanisation rate (%)	36.6	43.3	68.9	6.966	0.400**
Share of agricultural land on total area (%)	54.6	50.9	36.4	0.424	0.393**
Concentration of PM emissions (tons/km^2) (1991)	3.5	–	35.6	24.077	0.498***
Concentration of CO emissions (tons/km^2) (1991)	1.2	–	58.5	6.998	0.296*
Concentration of PM emissions (tons/km^2) (2011)	0.3	0.8	0.9	10.668	0.476***
Concentration of CO emissions (tons/km^2) (2011)	1.4	25.1	12.0	5.615	0.365*
Population and health					
Life expectancy at birth (males) (2006–2020)	75.8	75.4	73.5	14.045	0.527***
Abortions per 100 births (2018)	29.4	29.1	39.7	6.772	0.396**
Infant mortality (‰) (2018)	2.7	3.3	4.7	3.139	0.281*
Population density (inh./km^2) (2021)	143	260	277	1.558	0.202
Population change between 1990 and 2021 (%)	+ 2.6	+ 4.1	− 11.1	1.007	0.165
Labour market and economy					
Share of employees in industry (%) (1991)	27.4	–	35.9	12.297	0.380***
Share of employees in industry (%) (2001)	17.9	17.9	17.9	0.000	0.002
Unemployment rate (%) (1991)	4.7	–	4.4	0.28	0.062
Unemployment rate (%) (2001)	8.3	10.6	13.5	7.47	0.412**
Unemployment rate (%) (2011)	9.0	10.3	12.4	4.957	0.346**
Unemployment rate (%) (2021)	3.2	4.1	5.9	16.521	0.558***
Job vacancy rate (2011)	1.0	1.7	2.5	8.039	0.425***
Business activity (2011)	237.0	223.1	193.3	5.225	0.354**
Average monthly wage (CZK) (1991)	3,718	–	4,146	45.75	0.621***
Average monthly wage (CZK) (2001)	13,114	13,720	13,772	1.818	0.218
Average price of flats (millions CZK) (2010)	1.305	1.211	0.555	9.112	0.447***
Social capital and social cohesion					
Share of people with basic or no formal education (%)	13.9	14.4	18.6	15.655	0.548***
Share of ethnic minorities (%) (2011)	0.18	0.26	0.55	17.453	0.569***
Crime rate (2018)	13.9	16.0	20.0	4.842	0.342*
Turnout in parliamentary elections (%) (2021)	65.7	63.9	54.4	23.658	0.627***
Support for populist parties (%) (2021)	38.4	40.0	51.3	13.399	0.518***

Tab. 2: Principal differences between categories of districts
*Note: [1]Measures of association (Eta) are significant at ***p < 0.001, **p < 0.01, *p < 0.05*
Source: authors' calculation (for sources of data see Appendix 1)

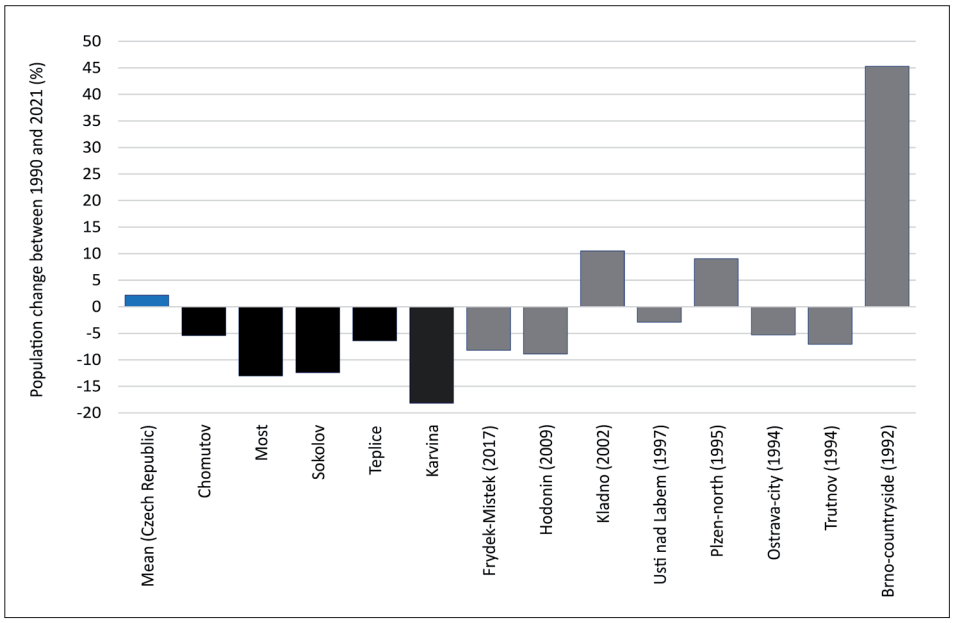

Fig. 4: Differences in population change in the period 1990–2021 between coal mining and post-mining districts
Notes: Grey colour indicates post-mining districts (the year of termination of coal mining in brackets), black colour indicates districts with active mining, and the blue column indicates the mean value for the entire Czech Republic
Source: authors' calculations

in the rate of unemployment, in the course of the following decades, statistically significant differences among districts became apparent, and they further deepened. The coal mining and post-mining districts have significantly higher unemployment rates (see Tab. 2), less job opportunities, and lower business activity than non-mining districts. In any case, there are again (as in the case of population change) significant differences between districts within the groups of both coal mining and post-mining districts, where some of them are below the national unemployment average, while most are well above the national average (see Fig. 5).

In 1991, the coal-mining districts showed significantly higher wages (the prevailing effect of above-average wages provided in coal mining and the industrial sector in general during the communist era), but already in 2001, the differences between categories disappeared. The latest available data about wages for districts is for 2005 and there were no significant differences between coal mining and non-mining district categories. Housing price data (by districts only available until 2010) shows a significant negative correlation between coal mining and housing prices, which probably indicates a generally lower standard of apartments (a large proportion of housing estates with prefabricated houses built during the 1970s–1980s – called "uniform socialist-realist cityscape" by Barton (2013)) and their worse marketability in the context of lower demand for living in districts characterised by a lower quality of life – evidence of which is also a significant loss of population during the last decades.

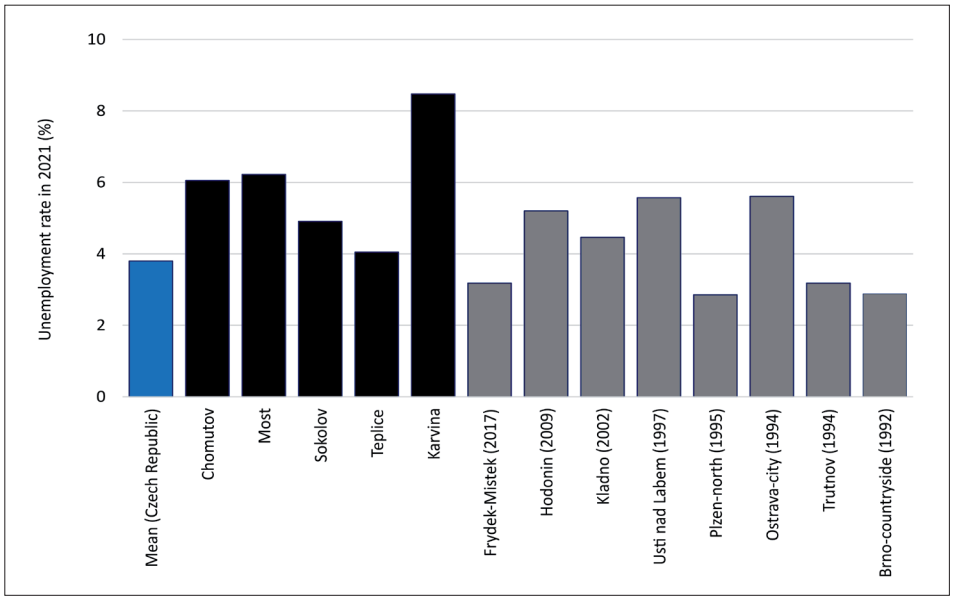

Fig. 5: Differences in the unemployment rate in 2021 between coal-mining and post-mining districts
Notes: Grey colour indicates post-mining districts (the year of termination of coal mining in brackets), black colour indicates districts with active mining, and the blue column indicates the mean value for the entire Czech Republic
Source: authors' calculations

Czech coal mining and post-mining districts are also characterised by worse indicators in terms of social capital and social cohesion. There is a larger share of people with incomplete or only basic education, a larger share of ethnic minorities (Roma people), and higher crime rates in the coal mining and post-mining districts. On the other hand, the categories of districts do not significantly differed in terms of the share of people with university education and the share of natives (people with permanent living at the place of their birth). The analysis revealed that in coal mining districts, there is a lower level of political engagement (participation in elections). Within the framework of the last parliamentary elections (autumn 2021), the trend of increasing support for populist political parties (the populist political parties are represented by the "Action of Dissatisfied Citizens" (ANO 2011) and "Freedom and Direct Democracy" (SPD) in our research) was also significantly manifested in all coal mining and most post-mining districts (see Fig. 6).

4.2 Energy transition in coal mining, post-mining and non-mining districts

Unsurprisingly, most coal-fired power plants have been located close to the coal mining areas. The mining and post-mining districts have about two thirds of the overall installed capacity of coal power in the country. Post-mining districts have five times larger and mining districts have twenty-five times larger installed capacity of coal power per area than non-mining districts (see Tab. 3). There are significant correlations between the installed capacity of coal power and population density, rate of urbanisation and industrialisation, concentration of air emissions and negative health and socioeconomic indicators. A detailed analysis of the relationships between the spatial distribution of coal-fired power plants and socioeconomic indicators has been published by Frantál and Nováková (2014).

The analysis of variance showed that coal mining and non-mining districts do not currently differ significantly in terms of the installed capacity of biogas plants and solar (photovoltaic) power plants. The correlation analysis, however, revealed some significant associations between the installed capacity of biogas and solar power and the geographical characteristics of districts. While biogas plants are more likely located in inland areas with larger shares of agricultural land and smaller shares of forests and landscape protected areas, the solar power plants (PVs) are more concentrated in more populated, urbanised, naturally less attractive areas with smaller shares of forests.

Wind energy is the only renewable energy sector for which data about the realisable potential of wind energy for districts is available (Hanslian et al., 2008). The realisable potential is the expert estimation how many wind turbines and what installed capacity can be potentially implemented in the district considering the technical wind potential and taking into account the limiting factors and exclusion of areas due to the nature and landscape protection, forestation, residential development, military purposes, and other restrictions. Our analysis revealed that while there are not statistically significant differences in the realisable wind energy potential between mining, post-mining and non-mining districts, there are significant differences in the installed capacity. While coal-mining districts have already implemented almost half of their overall realisable potential (48%), post-mining and non-mining districts have implemented only 13% and respectively 10% of their realisable potential.

The differences in the installed capacity of wind energy can be regarded as a good indicator of the social and political acceptance of renewables for the reason that while solar power plants and biogas plants have been constructed mostly on private land and their implementation has not been usually tied to the consent of the municipality and acceptance by the local community, so wind power projects are subject to the Environmental Impact Assessment (EIA) process and they required acceptance by local governments and local communities (see e.g. Frantál, 2015).

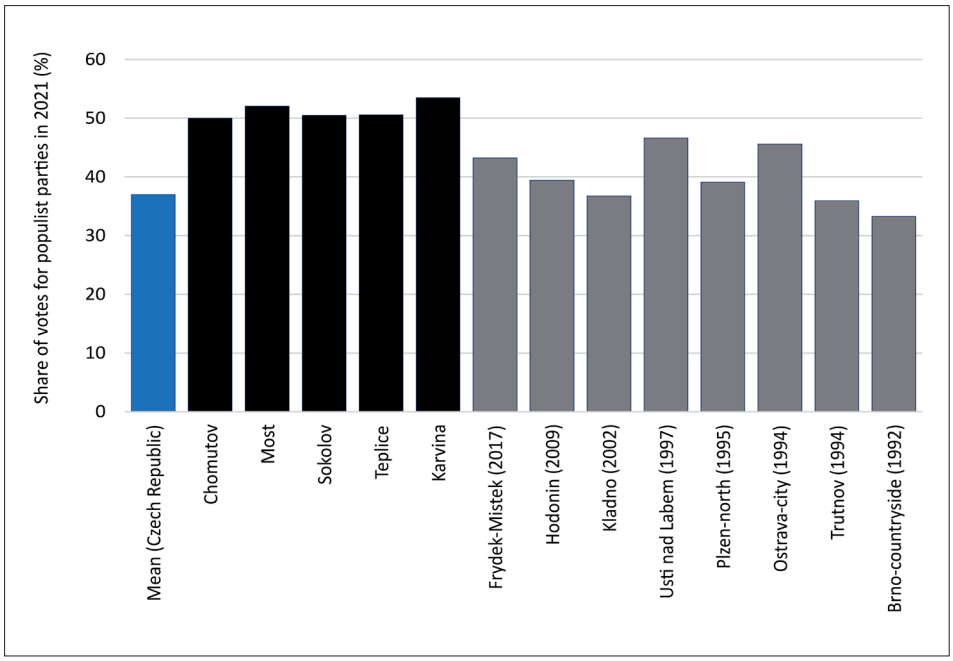

Fig. 6: Differences in the support of populist parties (2021) between coal-mining and post-mining districts
Notes: Grey colour indicates post-mining districts (the year of termination of coal mining in brackets), black colour indicates districts with active mining, and the blue column indicates the mean value for the entire Czech Republic
Source: authors' calculations

Indicators	Mean values for districts			Statistics	
	Non-mining	Post-mining	Active mining	F test	Eta[1]
Coal power plants					
Total installed capacity [MW]	3,363	1,222	4,823	–	–
Average installed capacity in a district [MW]	53.4	152.8	964.6	23.614	0.627*
Average installed capacity per area [kW/km^2]	61.4	303.7	1,535.8	44.262	0.740*
Biogas plants					
Total installed capacity [MW]	336	32	9	–	–
Average installed capacity in a district [MW]	5.3	4.0	1.8	1.868	0.221
Average installed capacity per area [kW/km2]	4.9	4.2	3.9	0.332	0.095
Solar (PV) power plants					
Total installed capacity [MW]	1,680	323	100	–	–
Average installed capacity in a district [MW]	26.7	40.3	20.0	1.343	0.188
Average installed capacity per area [kW/km^2]	27.4	38.4	32.6	0.669	0.134
Wind power plants					
Total realisable potential [MW]	2,139	151	246	–	–
Average realisable potential [MW]	33.9	18.9	49,2	1.033	0.166
Total installed capacity [MW]	204	20	118	–	–
Average installed capacity in a district [MW]	3.2	2.5	23.7	11.244	0.485*
Average installed capacity per area [kW/km^2]	2.8	3.4	32.8	25.033	0.638*
Utilisation of the realisable wind potential [%]	10%	13%	48%	–	–

Tab. 3: Differences in the installed capacity of coal power and renewable energy facilities
*Notes: [1]Measures of association (Eta) are significant at *p < 0.001.*
Sources of data: Czech Energy Regulatory Office (2021); Czech Wind Energy Association (2022); Hanslian et al. (2008); authors' calculations

4.3 Factors affecting the decline of population, unemployment and support of populism

For the sample of 76 districts, factors that have a significant effect on population decline are peripherality (location in borderland area), urbanisation rate, business activity, and average wage (in 1991, when coal mining regions showed significantly higher wages on average, but in the following years they started to decline). No significant correlation was found between population decline and variables indicating the intensity and type of coal mining (presence of active mining, type of mining, proportion of workers in mining in specific years, time that passed from the end of mining). Peripherality turned out to be the only significant variable affecting the differences in the change of population for the sample of coal mining and post-mining districts. In this respect, we can thus speak of a curse of peripherality rather than a curse of coal.

Predictors	Unstandardised Coefficients		Standardised Coefficients	t	Sig.
	B	S.E.	Beta		
(Constant)	− 171.541	34.709		− 4.942	< 0.001
Peripherality	**− 11.173**	**3.826**	**− 0.262**	**− 2.920**	**0.005**
Urbanisation rate	**− 0.419**	**0.134**	**− 0.401**	**− 3.134**	**0.003**
Share of employees in industry potential (MW)	− 0.448	0.261	− 0.180	− 1.717	0.091
Unemployment rate	− 3.638	2.639	− 0.218	− 1.379	0.173
Job vacancies rate	3.834	3.697	0.162	1.037	0.303
Business activity	**0.349**	**0.072**	**0.525**	**4.848**	**< 0.001**
Average wage	**0.036**	**0.008**	**0.439**	**4.295**	**< 0.001**
N (districts) = 76					
R^2 = 0.726; Sig. < 0.001					
Dependent variable: Change of population between 1990 and 2021 (%)					

Tab. 4: Regression model for the change in population (for the sample of all 76 districts)
Source: authors' calculations

Predictors	Unstandardised Coefficients		Standardised Coefficients	t	Sig.
	B	S.E.	Beta		
(Constant)	39.930	11.144		3.583	0.007
Peripherality	**– 18.423**	**6.889**	**– 0.545**	**– 2.674**	**0.028**
Urbanisation rate	– 0.046	0.142	– 0.083	– 0.324	0.754
Share of employees in industry potential (MW)	– 0.626	0.359	– 0.387	– 1.742	0.120
Job vacancies rate	– 2.017	2.694	– 0.165	– 0.749	0.476
N (districts) = 13					
R^2 = 0.870; Sig. = 0.014					
Dependent variable: Change of population between 1990 and 2021 (%)					

Tab. 5: Regression model for the change of population (for the sample of 13 coal mining districts)
Source: authors' calculations

Predictors	Unstandardised Coefficients		Standardised Coefficients	t	Sig.
	B	S.E.	Beta		
(Constant)	0.767	1.456		0.527	0.600
Peripherality	0.059	0.240	0.023	0.245	0.807
Population density	**0.002**	**0.001**	**0.307**	**2.665**	**0.010**
Urbanisation rate	**0.017**	**0.007**	**0.269**	**2.232**	**0.023**
Active coal mining	– 0.190	0.319	– 0.088	– 0.595	0.554
Share of employees in coal mining	0.063	0.049	0.210	1.291	0.201
Share of employees in industry	– 0.011	0.015	– 0.075	– 0.751	0.455
Business activity	**– 0.009**	**0.004**	**– 0.232**	**– 2.466**	**0.016**
Education level (basic)	**0.292**	**0.070**	**0.482**	**4.161**	**< 0.001**
N (districts) = 76					
R^2 = 0.800; Sig. < 0.001					
Dependent variable: Unemployment rate (2021)					

Tab. 6: Regression model for the unemployment rate (for the sample of all 76 districts)
Source: authors' calculations

Predictors	Unstandardised Coefficients		Standardised Coefficients	t	Sig.
	B	S.E.	Beta		
(Constant)	12.310	2.477		4.970	0.008
Peripherality	0.844	0.475	0.249	1.777	0.150
Population density	0.002	0.001	0.332	1.790	0.148
Urbanisation rate	0.023	0.010	0.404	2.204	0.092
Active coal mining	– 1.935	0.875	– 0.601	– 2.211	0.092
Years since the end of mining	**0.141**	**0.035**	**1.125**	**4.028**	**0.016**
Share of employees in coal mining	– 0.016	0.038	– 0.069	– 0.427	0.691
Business activity	**– 0.104**	**0.017**	**– 1.421**	**– 6.025**	**0.004**
Education level (basic)	**0.691**	**0.168**	**1.077**	**4.105**	**0.015**
N (districts) = 13					
R^2 = 0.986; Sig. = 0.007					
Dependent variable: Unemployment rate (2021)					

Tab. 7: Regression model for the unemployment rate (for the sample of 13 coal mining districts)
Source: authors' calculations

As for the unemployment rate, it is significantly determined primarily by the level of education (or the share of population with only basic or no formal education) and the level of entrepreneurial activity. These two variables proved to be significant factors in both the sample of all districts and of coal mining and post-mining districts. Within the sample of all districts, the unemployment rate is also significantly affected by the population density and rate of urbanisation: in other words, the greater the population density, concentrated mainly in larger cities, the higher the unemployment rate.

In the sample of mining and post-mining districts, the population density and urbanisation are not significant determinants of unemployment, but the rate of unemployment is significantly affected by the time which has passed since the end of coal mining. Like the case of population decline, coal mining itself has not proved to be a statistically significant determinant of unemployment either. These two models worked with unemployment data for the year 2021. However, as a check, we also performed the analysis for data from 2011, when the unemployment rate was more than three times higher than today. Nevertheless, regression models for the 2011 data give similar results.

The last two regression models focus on evaluating the significance of variables affecting the support for populist parties. A higher support of populist parties is in districts with a higher age index, a higher share of people with basic education, a lower level of business activity and higher rate of crime (see Tab. 8). The only two statistically significant variables that can explain differences in populism support in a split sample of coal mining and post-mining districts are peripherality and crime rate (see Tab. 9). The coal mining variables (i.e. active mining, share of employees in coal mining, the time since the end of mining) did not appear in the regression models as significant determinants of populism support.

Predictors	**Unstandardised Coefficients**		**Standardised Coefficients**	**t**	**Sig.**
	B	S.E.	Beta		
(Constant)	11.648	5.809		2.005	0.049
Peripherality	− 0.608	0.876	− 0.049	− 0.695	0.490
Urbanisation rate	0.049	0.031	0.160	1.560	0.124
Active coal mining	− 0.214	2.789	− 0.009	− 0.077	0.939
Share of employees in coal mining	− 0.053	0.162	− 0.036	− 0.323	0.748
Age index	**0.084**	**0.026**	**0.209**	**3.208**	**0.002**
Unemployment rate	0.003	0.431	0.001	0.008	0.994
Business activity	**− 0.062**	**0.015**	**− 0.320**	**− 4.084**	**< 0.001**
Education level (basic)	**1.755**	**0.278**	**0.598**	**6.311**	**< 0.001**
Crime rate	**0.314**	**0.146**	**0.238**	**2.153**	**0.035**

N (districts) = 76

R^2 = 0.901; Sig. < 0.001

Dependent variable: Support of populism (2021)

Tab. 8: Regression model for the support of populism (for the sample of all 76 districts)
Source: authors' calculations

Predictors	**Unstandardised Coefficients**		**Standardised Coefficients**	**t**	**Sig.**
	B	S.E.	Beta		
(Constant)	44.687	12.668		3.527	0.017
Peripherality	**8.844**	**2.840**	**0.621**	**3.113**	**0.026**
Urbanisation rate	− 0.201	0.092	− 0.858	− 2.195	0.080
Active coal mining	− 1.247	4.579	− 0.092	− 0.272	0.796
Unemployment rate	0.322	0.875	0.077	0.368	0.728
Business activity	− 0.149	0.077	− 0.488	− 1.933	0.111
Education level (basic)	0.612	0.699	0.227	0.875	0.422
Crime rate	**1.421**	**0.403**	**1.270**	**3.530**	**0.017**

N (districts) =

R^2 = 0.979; Sig. = 0.003

Dependent variable: Support of populism (2021)

Tab. 9: Regression model for the support of populism (for the sample of 13 coal mining districts)
Source: authors' calculations

5. Discussion

The results of our analyses are in line with the recent studies from Australia and the United States showing the spatially diverse and in-time changing effects (from positive to negative) of coal mining during periods of growth and decline (see e.g. Hajkowicz et al., 2011; Betz et al., 2015; Williams and Nikijuluw, 2020b; Scheuch, 2020). While the positive effect of coal industries on employment and wages was still reverberating in the early 1990s in the Czech Republic, the negative impacts of coal mining and burning on the environment (as indicated by air pollution) and population vitality (evidenced by higher rates of infant mortality and abortions, and lower life expectancy), and negative consequences of the economic transformation for labour market, business environment and the quality of life (manifested in significantly above average rates of unemployment, poverty, criminality, etc.) began to characterise coal mining regions over the following decades.

Our analysis showed relatively large differences between aggregate categories of districts in terms of population changes. While the population in 2021 increased slightly compared to 1990 in non-mining districts (by an average of 2.6%) and post-mining districts (by an average of 4.1%), it decreased significantly in districts with still active mining (by an average of 11.1%). The differences in mean values between categories, however, proved not to be statistically significant, indicating a high degree of variance in population changes both between and within categories. Significant determinants of the outmigration and population loss are both of geographic nature (peripherality, urbanisation) and economic nature (lower rate of entrepreneurial activity, less job opportunities, and wages). If we look separately only at the group of coal mining and post-mining districts, then the key determinant of the population decline is geographical peripherality (location at the border of the country). These results support the assumption that there is not a direct (causal) link between coal mining decline and population loss, and that migration patterns and population changes are determined by geographical conditions and affected by other factors and their cumulative effects. While Kratzer (2015) provides evidence that counties in the Appalachian region with high levels of coal mining experience have higher population loss, Mayer (2021) suggests (based on the data from Colorado) that the collapse of the coal industry will likely not lead to significant out-migration. In this respect, however, the problem of data aggregation and the existence of significant differences at the intra-regional level must be taken into account.

Although Czech non-mining districts show a long-term lower unemployment rate, on average, than post-mining districts, and those in turn lower rates than districts with active mining, regression analysis showed that coal-related variables are not significant determinants of the unemployment. The rate of unemployment proved to be dependent on the rate of urbanisation, population density, education level, and business activity in districts. The only exception is the time that has passed since the end of coal mining that is a significant variable explaining differences in the unemployment rate in the sample of mining and post-mining districts. These results are of course limited by the spectrum of analysed indicators, and there might be other variables which can have an influence on the unemployment and job offers at both regional and sub-regional level (Freudenburg and Wilson, 2002; Schulz and Schwartzkopff, 2018).

Our analysis shows that Czech coal mining districts have a higher proportion of people with only basic education and early school leavers and also a higher proportion of ethnic minorities (specifically Roma people). Such results might suggest that coal energy is socially unjust. This finding, however, does not confirm the theory of disproportionate siting, which suggests that polluting industries and toxic facilities (such as coal-fired power plants) are deliberately planned and localised in areas with higher concentrations of poor and minority populations (see e.g. Pastor et al., 2001). The coal mines and coal power plants have been located mostly in borderland regions (see Fig. 3). These border areas were characterised by distinct depopulation (caused by the displacement of the German population after World War II), and by the growing demand for labour for the massively expanding mining and metallurgical industries in the second half of the 20th century. As a result, less educated and minority populations migrated to extensively industrialised and urbanised areas with relatively affordable housing in new prefabricated housing estates (i.e. disproportionate minority move-in). Moreover, the migration of Roma population from rural areas to large cities in Northern Bohemia and Northern Moravia during 1970s and 1980s has usually had a form of forced resettlement (see e.g. Glassheim, 2006).

Our data about the differences in voter turnout (significantly lower in coal mining districts) are in line with the study of Abreu and Jones (2021), who found that residents of former coal mining communities in the UK have lower levels of political engagement, trust and political efficacy. As documented by a recent study of local anti-coal mining resistance in the Most region in the Czech Republic (Frantál, 2017), political efficacy is significantly determined by the level of education and place attachment (which are in the long term both negatively affected by coal mining and related processes of forced resettlement, uprooting, etc.).

The low level of social capital is considered as one of the main indicators of the resource curse and a barrier for economic renewal and sustainable development. Esposito and Abramson (2021) suggest that the problem of a low level of human capital accumulation in coal mining regions lies in the long-term negative attitudes towards education and lower future orientations (particularly among males). The low social capital and the reproduction of social inequalities through the education system have been often associated with the issue of low aspirations (towards economic prosperity) of children from working class families, particularly in heavily industrialised areas. However, Bright (2011, p. 63) suggests (based on an ethnographic study of teenagers growing up in former coal mining communities in the north of England) that working class teenagers "rather than suffering a failure of aspiration, often angrily and powerfully aspire – but for something contrary to the dominant model". He calls this phenomenon a resistant aspiration (cf. Bright, 2011).

The environmental degradation together with negative economic and social phenomena (unemployment, limited job opportunities, crime) are a breeding ground for populism and resistance to the central "establishment". Our analysis shows that there is significantly higher support for populist political parties in districts with active coal mining. However, the regression analysis revealed that coal mining related variables are not direct determinants of populist support, which is determined by the age index, education level, business activity, and crime rate in districts. In the sample of coal mining and post-mining districts, also peripherality proved to be significant determinant of populist support.

Dvořák et al. (2022) suggest that regional peripheralisation processes are a key contextual condition driving populist attitudes, especially in post-communist settings. The results of their analysis (based on data from the Czech Republic and Eastern Germany) indicate that while individual-level characteristics do not alone drive populist attitudes, living in peripheral areas (which are characterised by unfavourable economic conditions and demographic decline) increases the likelihood of having populist attitudes. Similar evidence on the relationship between peripheries and populism was provided by Lysek et al. (2021).

In the Czech Republic, coal mining is not among the (explicitly pointed out) key topics on the agenda of populist parties, as it was recently articulated by political leaders, for example, in the United States or Poland (Kojola, 2019; Żuk and Żuk, 2022). The issue of decarbonisation and its consequences, however, resonates within the anti-European and anti-elitist narrative: considering climate policy, the Green Deal and other initiatives and directives of the European Commission as a result of decisions made by transnational elites that go against national interests and socioeconomic wellbeing of "ordinary people". Havlík and Spáč (2022) suggest that the more one holds such anti-elitist populist positions, the more they are likely to support coal energy and be against green policy. They did not find, however, significant differences in populist attitudes between people living in districts with and without coal power plants. This finding is in line with our results. Martinát et al. (2014) and Frantál (2017) also document that employment in the coal industry, lower education, higher income, and lower place attachment are predictors of the support for coal mining expansion at the individual level.

As concerns the real implementation of energy transition, our analysis found that coal-mining and non-mining districts do not differ significantly in terms of the installed capacity of biogas and solar power plants, but they do differ significantly as regards the exploitation of wind energy. The confirmed relationship between the presence of coal industries and the number and installed capacity of wind farms may indicate several things. First, we can assume that in environmentally deprived areas, wind energy is being adopted more positively as an alternative source to fossil fuels. This is in line with the findings of Balta-Ozkan et al. (2015), who found that households in highly polluted areas in the UK are early adopters of solar installations. Van der Horst (2007) discusses other case studies showing that the existence of heavy industry and large stacks in the area appears to make residents more likely to support wind farms as an improvement of the image of the area. Furthermore, the higher rate of wind energy implementation in Czech coal mining districts may also indicate that the economic motivation (i.e. financial compensation for local communities from developers) can have greater effects on local acceptance (see Frantál and Kunc, 2010, Frantál and Nováková, 2019). Crowe and Li (2020) surveyed residents in Illinois, Texas, and Vermont (US) and found that residents of places with historical attachment to coal mining have positive attitudes toward coal, but at the same time they have even more positive attitudes toward renewable energy sources. On the other hand, Olson-Hazboun (2018) interviewed representatives of fossil fuels-dependent communities in Utah (US) and found prevailing overall negative views of renewable energy development, driven mainly by the perceived threat to the existing local economy, the feeling that renewable energy is incongruent with local identity, and anger about policy incentives favouring renewables. These incongruous findings suggest that even though renewable energy development may offer an economic boost to declining fossil fuels-based communities, it may still be rejected in these places for different reasons. Van der Horst (2007, p. 2709) also points out that the lack of organised opposition to wind farms does not directly mean that people are in favour of them and support them. The passive acceptance can be just an indicator of low political self-efficacy and resignation, which is a common occurrence in environmentally and socially deprived areas (see also Frantál, 2017).

Regarding energy policy and planning, these results suggest that the spatial targetting of new energy projects (not only wind farms but also other energy facilities) towards environmentally and economically depressed coal mining regions will be an easier way for developers to reduce the risk of vocal public opposition. The concentration of power plants and other polluting and risky facilities (such as refineries, incinerator plants or nuclear waste disposal sites) in the landscapes "sacrificed for national energy security", raises questions of environmental and energy injustice, and the uneven spatial and social distribution of benefits and costs of energy production (see e.g. Sovacool and Dworkin, 2015; Sovacool et al., 2017). It has been suggested that renewable energy with community-based distributed generation offers unique opportunities for addressing energy justice issues, such as access and energy security, with less environmental impact (Outka, 2012). It does seem, however, that new energy systems (which should replace fossil resources) as they are currently being implemented in many countries share some characteristics with their predecessors (such as spatial concentration, procedural injustice, lack of trust, etc.) and may reproduce existing patterns of environmental injustice (Ottinger, 2013; Frantál et al., 2023).

6. Conclusions

Our study has demonstrated the validity of the resource curse hypothesis in relation to coal mining in the Czech Republic, at least as it concerns selected environmental, health and socioeconomic indicators at a sub-regional level. When considered in aggregate, coal mining and post-mining districts have significantly worse air quality, lower life expectancy and higher rates of infant mortality and abortions than non-mining districts. While thirty years ago, there was still visible a positive effect of the coal industry on employment and wages, in the following decades coal-mining and post-mining districts regularly showed higher rates of unemployment, lower business activity, and less job opportunities. Both coal mining and post-mining districts show significantly lower levels of social capital and social cohesion (greater proportion of uneducated people and ethnic minorities, higher crime rates, lower political engagement, and higher support of populism). Coal mining districts (together with other peripheral districts) are also losing population significantly. It would be wrong and problematic regarding policy implications, however, to consider coal mining districts and regions as homogenous categories.

Naturally, there are significant differences among districts within all three categories (coal mining, post-mining and non-mining). While the post-mining districts, which are in the metropolitan areas of Prague, Brno and Pilsen, are among the highest developing and population-growing districts in the country, the others (located in borderland areas) are among the worst in the country in this respect. Coal mining itself did not turn out to be a significant determinant of the unemployment and population loss in the Czech districts.

The key factors affecting these phenomena proved to be both geographical (peripherality, urbanisation, population density) and socioeconomic (education level, business activity). In this respect, we can thus speak of a curse of peripherality rather than a curse of coal. Anyway, we are aware that our conclusions are limited by the selection of available indicators and the spatial level of analysis. Other (both "hard" and "soft") factors at the regional level can have an influence on the investigated phenomena and, in addition, as Williams and Nikijuluw (2020a) emphasised, most of the socioeconomic impacts of the coal industry rely on its spillover effect, rather than direct effects.

It turns out that coal mining districts are at the forefront in terms of renewable energy developments, specifically the implementation of wind energy potential. This can be perceived as a positive phenomenon and a manifestation of higher social and political acceptance, but there is a need to address issues of spatial concentration of new energy systems, and procedural and distributive justice in this context.

From a methodological point of view, this study confirms the importance of investigating the relationships between coal mining, socioeconomic well-being, and adaptive capacity at a sub-regional level. The problem with most recent EU projects and comparative studies is that they deal with regions (NUTS3) or so-called cohesion regions (NUTS2) and consequently their results and conclusions lack greater sensitivity. More detailed analyses can reveal that there are significant differences both within coal mining regions (where there are districts or cities that are relatively stable economically and demographically), and that within a generally prosperous regions there are districts or municipalities that show some of the worst economic indicators in the country (typically the peripheries, see also Jeřábek et al., 2021). These intra-regional differences must be considered when distributing money and subsidies (e.g. from the Just Transition Fund), so that existing spatial inequalities do not deepen, or new inequalities do not arise. In the context of a "just transition", it should also not be neglected that there are areas even outside of coal mining regions that require targeted economic support.

In this context, however, a provocative question is offered: to what extent is it effective and sustainable to economically support coal mining regions in their existing industrial production structures and population scales? Czech coal mining regions and their urban agglomerations experienced dominant development in the second half of the 20th century during the period of communism characterised by the processes of centralisation and concentration (of power, production, housing development, etc.). Then the current processes of reterritorialisation and depopulation in heavily industrialised and urbanised regions can be seen as a natural process and a return to a (maybe) sustainable state. The problem, of course, is the structural nature of population changes, when environmentally and poor regions are left more often by young and highly educated people, which further limits social capital and development potential of these regions.

The ongoing energy crisis with increasing prices of fossil fuels and electricity related to the post-Covid economic recovery and the war in Ukraine, have brought another dimension to the coal-phase out debate – and not only in the Czech Republic: it is no longer just a binary "jobs versus the environment" discourse, but issues of both national energy security and peoples' rights to affordable energy and heat that are being highlighted (Mayer, 2022, Żuk and Żuk, 2021). There are even efforts (supported by the industrial lobby and some regional politicians) to reverse the process of coal phase-out. Recently, a plan to dismantle the Keyenberg wind farm in the western state of North Rhine-Westphalia (Germany) to expand the area of surface coal mining has stirred up public opinion (Oltermann, 2022). This summer, the Czech Government decided to extend coal mining in the state-owned ČSM mine in the Karviná district, which was supposed to be completed in 2022, at least until the end of 2023. The politicians however, assume that coal mining will continue here even in the following years as long as it will be at least "economically neutral" (i.e. neither profitable nor unprofitable) (Czech Television, 2022). Such speculations can bring false hope to coal mining regions and delay more radical steps towards transformation. Even though not all experiences and solutions are transferable, the studies from Germany (Oei et al., 2020b; Hermville and Kiyar, 2022) show that preventing radical changes and protecting a declining industry for decades caused increased transition costs compared to an earlier phase-out.

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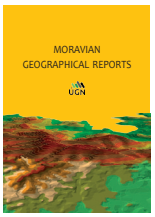
Appendices

Appendix 1: List of variables included in statistical analyses

Category[a] / Variable	Measure[Source of data]
Geography and environment	
Area	Total area (km^2)[1]
Peripheral location	District is located on the country´s border (yes/no)[1]
Agricultural land	Share of agricultural land on total area (%)[2]
Forests	Share of forests on total area (%)[3]
Landscape protected areas	Share of national parks & protected landscape areas on total area (%)[1]
Coefficient of ecological stability	Ratio of areas of stable and unstable landscape-forming elements[1]
Air pollution (PM)	Concentration of particulate matter (PM) emissions (tons/km^2)[1]
Air pollution (CO)	Concentration of carbon monoxide (CO) emissions (tons/km^2)[1]
Population & health	
Population density	Population per km^2
Urbanisation rate	Share of urban population on total population (%)[1]
Population change	Change (%) in the number of inhabitants between 1990 and 2021[2]
Average age	Average age of the population (years)[1]
Index of aging	Number of persons aged 65+ per 100 persons aged 0–14[1]
Coefficient of femininity	Share of females on total population (%)[1]
Life expectancy	Male life expectancy at birth (2016–2020)[1]
Infant mortality	Infant mortality (‰)[1]
Abortions	Number of abortions per 100 births[1]
Respiratory diseases	Deaths of respiratory diseases per 100,000 population[1]
Labour market and economy	
Employment in coal mining	Share of employees in coal mining on productive population (%)[4]
Employment in industry	Share of employees in industry on productive population (%)[1]
Unemployment rate	Unemployment rate (%)[1]
Job vacancy rate	Number of job applicants per one job vacancy[1]
Business activity	Total business units registered per 1,000 population1[2]
Average monthly wage	Average monthly wage (CZK)[1]
Property value	Average price of flats (millions CZK)[5]
Social capital & social cohesion	
Education level (basic)	Share of persons with basic or no formal education (%)[1]
Education level (university)	Share of persons with university education (%)[1]
Share of natives	People with permanent living at the place of their birth (%)[1]
Share of ethnic minorities	Share of Roma ethnic people on total population (‰)[1]
Crime rate	Ascertained offences per 1,000 population[1]
Voter turnout	Turnout in parliamentary elections 2021 (%)[1]
Support of populism	Share of people voting for populist parties (SPD+ANO)[b] (%)[1]
Energy production	
Coal power capacity	Installed capacity of coal-fired power plants (MW)[6]
Biogas capacity	Installed capacity of biogas/AD plants (MW)[7]
Solar power capacity	Installed capacity of solar/PV power plants (MW)[8]
Wind power potential	Realizable potential of wind power (MW)[9]
Wind power capacity	Installed capacity of wind power plants (MW)[10]

Notes:
[a] *The categorisation of variables is only indicative as some variables may belong to several categories.*
[b] *The populist political parties are represented by the "Action of Dissatisfied Citizens" (ANO 2011) and "Freedom and Direct Democracy" (SPD) in our research.*
Sources of data:
[1] *Czech Statistical Office (2021): Census 2021; Districts of the Czech Republic, 2018; Census, 2011;*
[2] *Ministry of Agriculture (2021): Public Register of Land (pLPIS));*
[3] *State Administration of Land Surveying and Cadastre (2011): Share of forests in districts in the CR;*
[4] *Czech Mining Authority: Mining Yearbooks (1992–2015);*
[5] *Institute of Regional Information (IRI) (2010): Prices of flats in the districts of the Czech Republic*
[6] *Energy Regulatory Office of the Czech Republic (ERU) (2021): Yearly Report on the Operation of the Czech Electricity Grid for 2021. For the purpose of this analysis, we created a database of selected thermal and combined-cycle power plants which met the following conditions: (i) have a total installed capacity of at least 100 MW; and (ii) the major fuel is brown or black coal (altogether 28 power plants were included, with total installed capacity nearly 10,000 MW which is more than 80% of the overall installed capacity of thermal power plants in the country).*
[7] *Czech Biogas Association (2021): Map of biogas stations in the Czech Republic [online]. Available at: https://biom.cz/cz/produkty-a-sluzby/bioplynove-stanice*
[8] *Energy Regulatory Office of the Czech Republic (ERU) (2015): Database of the photovoltaic power plants connected to the grid.*
[9] *Hanslian, D., Hošek, J., Štekl, J. (2008): Estimation of the realizable potential of wind energy in the Czech Republic. Praha, ÚFA AV ČR.*
[10] *Czech Wind Energy Association (2021): Wind energy in the Czech Republic: Statistics [online]. Available at: https://csve.cz/en/clanky/statistika/281*



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Discordant agendas on a just transition in Romanian coal mining areas: The case of the Jiu Valley

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Abstract

Despite the promises that the just transition will bring more democracy and prosperity, there are legitimate fears that, in some regions, the pre-existing inequalities will be reinforced rather than rectified. Questioning how community resilience can be stimulated prior to and during coal mining closures, this paper focuses on Jiu Valley, a coal mining region in Romania. Using empirical and action research methodologies, this case study underlines the importance of considering the level of agency and different agendas of stakeholders regarding both the vision of their common future and the timeline for implementation. The article stresses shortcomings in implementing a just transition, including the issue of governance and mistrust towards local and national authorities, difficulties in orchestrating individual agendas to launch a collective action for the future of the region and, not least, poor information and delays of the mine closures. Concerning the hypotheses about awareness, preparedness and transition delays, this study pointed out some of the mechanisms that explain the scarce preparedness and why, both closure and transition, were repeatedly postponed. Furthermore, the research profiled the different actors and highlighted the challenges to address and roles of stakeholders to contribute to a just transition.

Keywords: *coal mining, community resilience, Jiu Valley, just transition, Romania*

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1. Introduction

The negative implications of the transition towards a green economy for communities living in coal basins range from harmful socio-economic repercussions (Snyder, 2018) to cultural consequences, such as loss of embedded local identity (Della Bosca and Gillespie, 2018). Hence the need for a "Just Transition" (Harrahill and Douglas, 2019) as a guarantee that environmental policies will not be detrimental to the social or economic well-being of those traditionally dependent on the fossil fuel sector (Robins et al., 2018). The aims of budget allocations and guidelines issued by the European Commission (Cameron et al., 2020) are not only to replace one economic model with another, but also to produce profound changes in societal practices, the ultimate goal being to steer the transition towards a predefined model of society (Kelemen, 2020), where the resilient community (Nicholls, 2012) is embracing the upcoming changes as opportunities for renewal and thriving (Campbell and Coenen, 2017).

The Just Transition Fund (JTF) is set to have a budget of € 17.5 billion, and allocations to Member States are made on the following basic criteria: a) the level of greenhouse gas emissions in regions with high carbon intensity; b) employability in carbon-intensive industries in those regions; c) employability in the coal and lignite extraction industry (Jourde and Widuto, 2021). Regarding climate and decarbonisation targets, governance is ensured through a combination of nationally and sub-nationally determined contributions under international monitoring and verification. The Paris Agreement explicitly stated, however, that the success of decarbonisation activities depends mainly on local factors, including some non-state actors (Bernstein and Hoffmann, 2018). In other words, no matter how good political discourse may sound, promising that no one will be left behind, the outcome of the just transition is not up to Brussels, but it will come down to the endogenous potential of each community (Harfst et al., 2020).

Community resilience is determined by local resources, relying heavily on the involvement of community members as active agents and their agency to initiate collective action (Magis, 2010). Beyond natural resources and material assets that are quantifiable and largely determine the potential

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for community resilience, however, two immaterial triggers contribute decisively to the mobilisation of the agency: a) sense of place, which begins with awareness, continues with attachment to place, and then with a use of this attachment (Schmitz, 2012); and b) social memory, serving as a reservoir of practices, knowledge, values and worldviews, which will ultimately strengthen the vital role of human agency in adaptation (Colten, 2019). Although it has been assigned a key role in the success of the just transition, resilience has rarely been predicted before a shock, stress, or disaster has occurred (Weichselgartner and Kelman, 2015). Therefore, designing appropriate tools to anticipate the degree of resilience of a community is crucial to scientific progress in this area of research (Brand and Jax, 2007). The need for a better understanding of adaptability is also heralded by the emergence of a line of research in the regional study literature that investigates why some regions can overcome shocks while others cannot (Campbell and Coenen, 2017).

Mining should be seen from the very beginning as a temporary activity – the exploitation ceases with the depletion of resources or when their use is no longer considered beneficial (Bowie and Fulcher, 2017). Therefore, the communities in these urban industrial regions are doomed to live in "boom-bust cycles" (Sewell, 2019), and always run the risk of shrinkage after mine closure. All over the world, mining companies have been the driving force behind creating new towns. Providing housing, infrastructure and services during their boom period, these cities fulfilled an important social function, forming new communities and landscapes with specific features (Marais et al., 2018). The mine closure and the separation of communities from their "mother" company is a disruptive event ("the shock"), often followed by a period of shrinkage. The shrinkage may be transient, and, sometimes, a new "boom" is possible (Stryjakiewicz and Jaroszewska, 2016), depending on territorial assets, constraints, and the degree of resilience manifested by the community in all stages of the transition. Shrinkage is a period of recoil and conservation, as well as preparation for a bounce back, as shrinking cities can take advantage of the context to renew, restructure and become even more attractive than before (Bănică et al., 2017).

Lessons learned from the experience of regions that have already made the transition from coal showed that the more quickly state or non-state actors anticipate, accept, and implement steps to cushion the transition shock, the better the results (Caldecott et al., 2017). Mining companies, however, as well as mining communities, sometimes have strategies to avoid or at least postpone the implementation of those measures designed to result in sustainable closures, and each day of postponement adds to the cost of the transition for the whole community and prolongs the downturn (Edwards et al., 2019).

This paper scrutinises how a coal mining region in Romania addresses international and national demand regarding energy production and orchestrates external guidelines, local and individual visions of the future. Focusing on the Jiu Valley coal basin, given that Romania is one of the largest beneficiaries of the budgetary allocations from the Just Transition Fund[1], this research project questions how community resilience can be stimulated prior to, during and after the mine closure, paying close attention to local actors' perceptions of the transition from coal and their level of agency. This case study emphasises the importance of considering the different agendas of stakeholders in terms of both their common visions and implementation timetables to better anticipate the potential community resilience better. After a theoretical background based on a literature review highlighting the key elements for enhancing resilience of a community facing mining closure, the paper introduces the Jiu Valley in its historical and geographical context. Afterwards, it explains the methodological aspects of the action research we conducted in the last two years and examines the perceptions, vision and level of agency shown by different actors. Finally, the discussion underlines the key points challenging a just transition in the Jiu Valley.

2. Theoretical background

The transition from coal is in full swing worldwide, with 36 governments and 28 global companies committed to eliminating coal-fired energy production by 2030 (European Commission and Directorate-General for Energy, 2019), but the approach differs significantly from one state to another, even within the European Union. Frantál et al. (2018) consider that these differences arouse legitimate interest in international comparisons, warning that the possibility of benchmark learning can be misleading given that the energy transition occurs in different economic, legal-procedural, socio-political, and cultural-historical contexts. All over the world, the coal transition poses serious challenges for mining communities, which are often totally dependent on this industry, and some are more vulnerable than others (Carley et al., 2018). Communities achieve different results in managing the energy transition because their local capital differs (Castle, 1998), thus influencing their adaptation capacity, a precondition for resilience (Norris et al., 2008). Having the capacity to adapt, however, does not automatically mean that the community is resilient. It requires awareness, sense of place, know-how and agency to set local capital in motion, aiming to achieve structural transformations meant to produce more equity, democracy and prosperity, the values that the just transition is supposed to entail.

In the earlier stages of the community resilience study, it was argued that resilience is a network of adaptive capabilities that, once put into the right dynamics, will allow a community to bounce back after a shock (Norris et al., 2008). Subsequently, a clear distinction was made between resilience as an outcome and resilience as a process (Van Breda, 2018), while within the context of disaster studies, the construct of resilience is generally understood as a trait (Cox and Perry, 2011; Prayag et al., 2021). When defining community resilience, scientists from different fields agree that it is the ability of a group/system/organisation to withstand severe conditions, absorb shocks, and thrive in the face of change (Lindberg and Swearingen, 2020; Weichselgartner and Kelman, 2015). From the need for a better response in emergencies, a broad, transdisciplinary term was born, containing several stages of action when a potential hazard occurs: a) planning for the impact; b) resisting and absorbing the shock; and c) recovering, as stressed by Koliou et al. (2020). When we talk about communities in mono-industrial areas that are transitioning to another economic model, however, it is appropriate to import from the ecological literature one more stage of resilience, that is d) renewal (Berkes and Ross, 2013).

[1] See: https://www.europarl.europa.eu/thinktank/infographics/JTF/index.html

The renewal capacity of a community is shaped by the duration and performance of the recovery (Bevington et al., 2012). Ideally, the measures taken at this stage will generate a bounce forward (Bănică et al., 2017), that will make the shrinkage transient and will set premises for the region to relaunch (Stryjakiewicz and Jaroszewska, 2016). On the same note, research over the last decade delivers a tripartite vision of what community resilience aims for: a) to reduce the impact of a shock; b) to reduce the recovery time; and c) to reduce future vulnerabilities (Koliou et al., 2020).

According to Magis (2010), the key element in achieving community resilience is adaptive capacity, but this is not enough without the agency to act. Wilson (2013) insists on the right timing in implementing measures. In summary, the *sine qua non-conditions* for a community to obtain and strengthen its resilience are:

1. the capacity to adapt;
2. the agency to act; and
3. to act on time.

Ways to build community resilience have been increasingly explored in the study of risk management, also emphasising the adaptive capacity that requires access to relevant and timely information (Liu and Agusdinata, 2021). The role of risk management in building community resilience is to ensure sufficient resources (Pasteur, 2011) and to increase awareness and preparedness by creating an early warning system that will monitor local resources and stimulate endogenous potential (Harfst et al., 2020). To ensure sufficient resources, it becomes essential to strengthen community organisations and facilitate local people's access to skills and technologies designed for monitoring and evaluation. However, they can only prove effective if they are customised to suit local culture and translated into local forms of communication (Uddin et al., 2020).

Communication is, therefore, a central component of most models of community resilience, because adaptability can be increased or decreased by the strength of media narratives, the existing media infrastructure, the accessibility to reliable, independent sources, and the skills and responsibility of the actors dominating the public agenda (Houston et al., 2015). Resilience is closely associated with good two-way communication, facilitating both the transmission of public interest messages from the authorities to the population, and information about the community's needs to leadership (Nicholls, 2012). Collective action is another defining feature of social resilience. It relies on building a collaborative relationship between stakeholders, allowing them to co-produce frameworks that will ultimately influence change to provide equity (Luke and Evensen, 2021). To achieve collective actions a strong social capital based on trust between actors is crucial (Bauwens, 2017; Greenberg, 2014).

In managing the closure of coal mines, these data provide benchmarks for phasing the transition, if synchronised with the stages of community resilience. To achieve a successful transition, pre- and post-mine closure measures must follow a specific timetable designed to stimulate the community's adaptive, recovery, and renewal capacity throughout the process. Moreover, measuring resilience would allow decision makers to intervene at the right time with the right tools when the community is going through distress. Jordan and Javernick-Will (2012) observed that disaster relief organisations are the ones that have developed tools and methodologies for measuring community resilience over time, but these were often checklist tools to track resources, vulnerabilities, and capacities necessary in disaster response and recovery. Lindberg and Swearingen (2020) noted two directions of investigation as paramount: a) identifying the factors that will facilitate thriving; and b) assessing the degree of resilience in different locations at different times (Lindberg and Swearingen, 2020). This is what McCrea et al. (2019) have done when measuring the impact of the industrial transition on the well-being and resilience of a community by modeling quantitative data (McCrea et al., 2019). According to Cretney and Bond (2014), community well-being and resilience can both be measured objectively and subjectively. Edwards et al. (2019) addressed the issue of mining communities stating that measuring resilience should start by determining the current degree of dependence on mining, from the household level to the local business level. Morelli et al. (2021) have a similar point of view, stating that the most appropriate tool for detecting co-dependencies would be the mapping of local actors to understand the network of stakeholders and the nature of relationships within the network in each context.

The need for political-administrative institutions to evaluate and allocate resources may justify the ambition to quantify resilience. Nevertheless, this may lead to a decontextualisation and further, to obtaining an erroneous picture of the communitarian ability to respond when a hazard occurs. Therefore, placing all indicators in the same index could prove futile because it would lose the contexts and subtleties of community dynamics (Weichselgartner and Kelman, 2015).

3. Regional context: The Jiu Valley – the lab of transitions

Jiu Valley is a carboniferous microregion located in southwestern Transylvania, Hunedoara County, Romania. With a total population of approximately 132,000 inhabitants, the region is currently facing uncertainty about what will happen after the closure of the last four coal mines. This research began in November 2020, when the post-mining development strategy of the Jiu Valley had been put up for public debate, aiming to scrutinise how a coal mining region in Romania addresses international and national demand regarding energy production, while orchestrating external guidelines, regional interests, and individual visions of the future. Relying on the conclusions of Brock et al. (2021), which have shown that people's perceptions of the potential risks and vulnerabilities in the just transition may be influenced by previous experiences, we considered it appropriate to restore an historical background of the Jiu Valley, thus facilitating an understanding of the local perspectives and the reading of our findings.

In the last forty years, this community has undergone structural changes generated by three intertwined transitions: from oil and gas to coal; from socialism to capitalism; and currently facing the total phase-out of coal, but in a framework that, at least in theory, should provide protection to the community, if not new development opportunities. All these transformational processes are of exogenous origin, with the differences that: the first brought economic and demographic growth to the region ("the boom"); the second caused social disruption ("the bust": the region has been in continuous shrinkage since the late 1990s when mine closures began); and the third has the potential to produce the bounce back and maybe a bounce

forward ("recovery" and "renewal"), if the local community manages to access the funding lines set out in the just transition framework for sustainable development projects. By local community we mean all local actors – authorities, former and current miners, other professional groups, non-governmental organisations, academics, media outlets, and virtually everyone who can be called a "stakeholder" in the just transition and should be part of the decision-making process.

3.1 The transition from oil and gas to coal: The boom

The Jiu Valley consists of six urban localities: Petroşani, Petrila, Lupeni, Lonea, Aninoasa and Uricani. The region is the gateway to Retezat National Park, surrounded by the Retezat and Parâng Mountains (2,500 m, highest peak) and crossed by the Jiu River (see Fig. 1). Coal has been mined in this depression for over 150 years, but the region's rapid growth, the "boom", was closely linked to the oil crisis in the late 1970s (Holloway, 2021), when Iran stopped delivering crude oil to Romania. The communist dictator Nicolae Ceauşescu then decided to turn the coal industry into the most important component of the energy industry, launching a national program aimed at accelerating coal production and reducing the amount of oil and natural gas in the energy mix from 50% in 1981 to 5% in 1990 (Dicu, 2015). As the centrally planned economy steered away from oil and gas – following the oil shocks – coal became the central element of energy production in socialist Romania. This created opportunities for the intensified exploitation of coal from the Jiu Valley. The national program had a mobilising slogan saying "more coal for the fatherland"(Ţoc and Alexandrescu, 2022), while underground work was glorified in epic performances by which communist propaganda carefully constructed the myth of "the hero miner", the one who sacrifices himself to preserve the country's energy independence (Horghidan-Anghel, 2019). The dictatorial ambitions allowed for the creation of even more jobs, increasing the area's attractiveness; thus, the total population of the Jiu Valley reached a record of 167,456 inhabitants (Davidoiu, 2017). Not least, as the importance of mining increased in the Romanian economy, as did the community's dependence on this industry, the Jiu Valley gained all the traits of a community living in a "boom-bust cycle" (Sewell, 2019), plagued by the danger of shrinkage after mine closure (He et al., 2017).

3.2 The transition from socialism to capitalism: The shrinkage

Strictly for the Jiu Valley region, the Romanian Revolution of 1989 was the disruptive event that put an end to growth. Shortly after the fall of communism, the myth of the "hero miner" collapsed as well when trade unionists put themselves in the service of the new regime, with miners repeatedly acting as repressive forces. The first decade of democracy in Romania was marked by several violent episodes, in which miners were at the forefront, especially during their repeated marches on Bucharest, *mineriade*[2] (Kideckel, 1996). They threatened Bucharest five times (January 1990, June 1990, September 1991, January 1999, and February 1999), their interventions resulting in the death of several people and the injury of more than 1,300, while hundreds of people were illegally detained and subjected to physical and mental abuse (Gledhill, 2005).

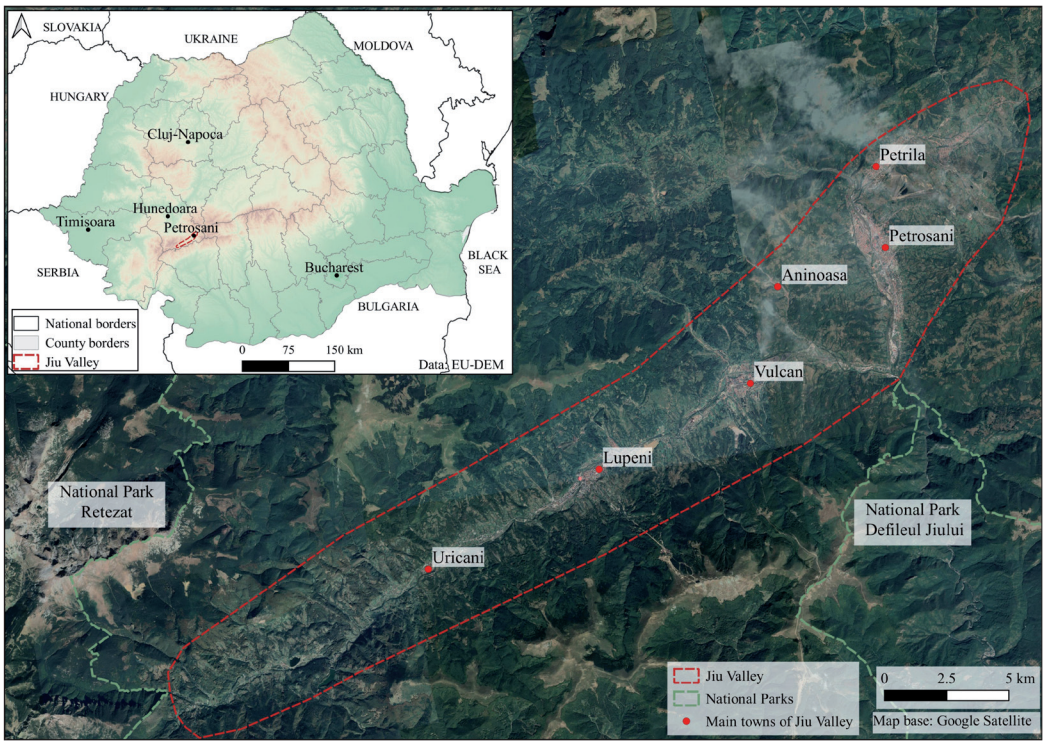

Fig. 1: location of the Jiu Valley in Romania
Source: authors' elaboration

[2] *Mineriade* is a Romanian term describing the marches of the miners from the Jiu Valley on Bucharest, where they interfered with Romanian political life by expressing their opposition to democratic and market reforms and their support for the neo-communist regime in the 1990s. The most violent "mineriadă" was the one on June 13–15, 1990, when thousands of miners suppressed a student demonstration and vandalised the headquarters of opposition parties. For his alleged involvement in those events, the President of Romania at that time, Ion Iliescu, is currently under criminal investigation.

Once the authoritarian political system was removed, it turned out that the "boom" of the Jiu Valley was unsustainable, and the coal industry was underperforming in a free market. Deindustrialisation led to a decrease in energy consumption (Deacu, 2016), and the price of imported coal was lower than the cost of domestic production; therefore, restructuring could not be avoided. Nevertheless, by partnering with the new neo-communist political power, the trade unionists managed to delay the restructuring, obtaining state subsidies to keep the mines operating for many more years. It was not until 1997 that mining restructuring began (Haney and Shkaratan, 2003) and, at that point, the overconnectivity of the economic sectors proved to be very detrimental for the region when transitioning to capitalism.

The closure of the coal mines in the Jiu Valley started in 1997 when a program of voluntary downsizing was launched[3]. Thousands of people have been persuaded to accept voluntary layoffs, offering them up to 22 compensatory salaries, depending on their seniority (Haney and Shkaratan, 2003). Since 1997, thirteen out of seventeen mines have ceased to operate, and the number of mining employees has fallen from 45,000 in the early 1990s to less than 4,000 in 2019 (see Fig. 2).

As the mines closed, other economic agents fell one after the other, as in the 'domino effect', and that was the beginning of an economic and social decline from which the community has not yet recovered. As shown in Figure 3, the closure of mining operations and the stigma brought by the violent actions of the miners have considerably reduced the attractiveness of the Jiu Valley as a place to live. According to data from the Romanian Institute for Statistics, the decrease in the region's attractiveness and an increase in emigration rates have led to a population contraction in Jiu Valley by approximately 35,000 people between 1992 and 2020.

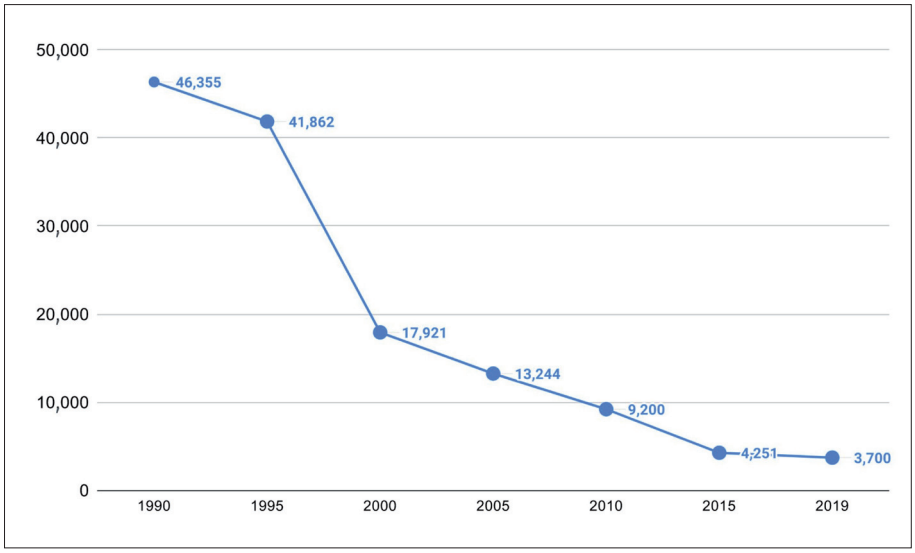

Fig. 2: Employment in the coal mining sector in Jiu Valley (1990–2019)
Source: Data: Romanian National Institute of Statistics, authors' elaboration

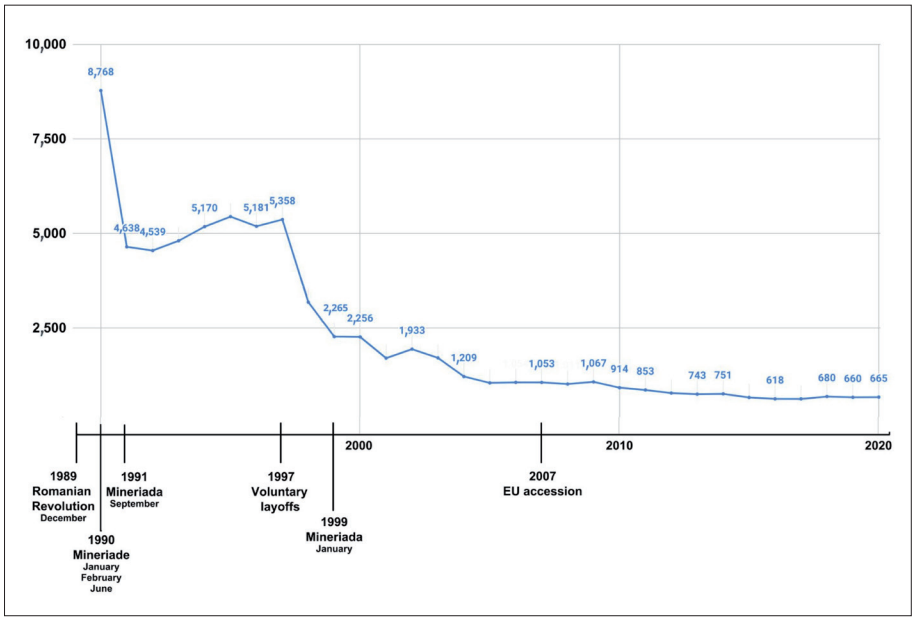

Fig. 3. Number of persons living in Jiu Valley from 1990 to 2020
Source: Data: Romanian National Institute of Statistics, authors' elaboration

[3] See Law No. 216/1997 for the approval of Government Ordinance No. 22/1997 on protection measures granted to personnel in the mining industry and the activities of geological prospecting and exploration.

3.3 The just transition: The prospect of a bounce-back

As shown in Figure 4, today's demographics of the Jiu Valley do not indicate accelerated ageing or the prospect of depopulation. Nevertheless, many of those aged between 40 and 60 (the best-represented age group) are either retired or on the verge of retiring from the mining sector, meaning they are no longer part of the active population.

There are four mines still active in Jiu Valley with approximately 4,000 employees: Lonea, Livezeni, Lupeni and Vulcan, supplying the Paroşeni power plant, which is already working intermittently, at a much-reduced production capacity. The closure of Lonea and Lupeni was initially scheduled for 2018; later, the deadline was postponed, and the closure of all four was announced for 2024 (Burlacu et al., 2019). In the latest version of the post-mining strategy for the Jiu Valley (PwC, 2021), the deadline mentioned is 2030.

4. Methodology

A relevant feature of the methodology used in this project is the positioning of the authors with respect to the subject. The first author is of Romanian origin, having close ties with the analysed community, acknowledging that she sometimes behaved like a stakeholder during the study. The second author is a Belgian geographer from Liège, a region which until forty years ago it had an industrial profile similar to Hunedoara County, based on mining and steel. The design of the methodology starts from the observations made by the Romanian researcher monitoring the coverage of the transition in national and local media between January and October 2020, analysing the political discourse, as well as the legislation in force regarding the coal transition in the Jiu Valley.

Subsequently, we formulated the following research hypotheses:

1. Even though mining activities have been decreasing in Jiu Valley since late 1990s, the level of awareness and preparedness for the coal phase-out is low;
2. Actors with an elevated level of agency do not benefit from a high level of trust and vice versa; and
3. Certain stakeholders intentionally slow the transition down. These findings lead us to question how resilient the community can be under these circumstances.

To start an in-depth analysis of the transition in the Jiu Valley and evaluate the implemented measures' performance, we needed benchmarks. Reviewing the pre-existing literature provided us with the necessary markers. From comparative analyses delivering frameworks for a successful just transition (Brauers and Oei, 2020; Campbell and Coenen, 2017; Felli, 2014; Harrahill and Douglas, 2019; Kelemen, 2020; Kern and Rogge, 2018; Oei et al., 2020), we extracted the information to develop the survey questionnaire and the focus group protocol. The data thus obtained became grids for assessing the implementation stage, the quality of stakeholder consultations and their attitudes towards the imminent closure of the mines.

Purposive sampling was performed for the survey, selecting 105 well-informed participants: former or current mining employees, academics, local journalists, local authorities, community leaders, and representatives of NGOs. The survey included closed, open-ended, multiple-choice questions and a series of Likert-scale questions. The questionnaire was structured in four parts:

- Part I – profile data indicating the category of stakeholders and beliefs related to the necessity of mine closure;
- Part II – beliefs related to the vulnerability of the community and their capacity to adapt;
- Part III – their sources of information on the transition and their perception about the influence and credibility of the incumbent actors; and
- Part IV – their vision on the economic profile of the region in the postmining stage.

The purpose of the questionnaire was to test hypotheses and collect data that would inform a stakeholder mapping, illustrating their positioning about the transition: supportive, passive, or against. At the same time, we aimed to determine the degree of perceived influence that each of the following categories of actors exerts on the transition process: European Commission, national authorities, local authorities, NGO activists, national media, local media, academics, entrepreneurs, unions, and former miners. The questionnaire was written in Romanian and was administered online[4] between December 2020 and April 2021.

The subjects were recruited from all categories of stakeholders – current or former miners, activists in local NGOs, university and high school teachers, journalists, civil servants, local authorities, and entrepreneurs, some wearing

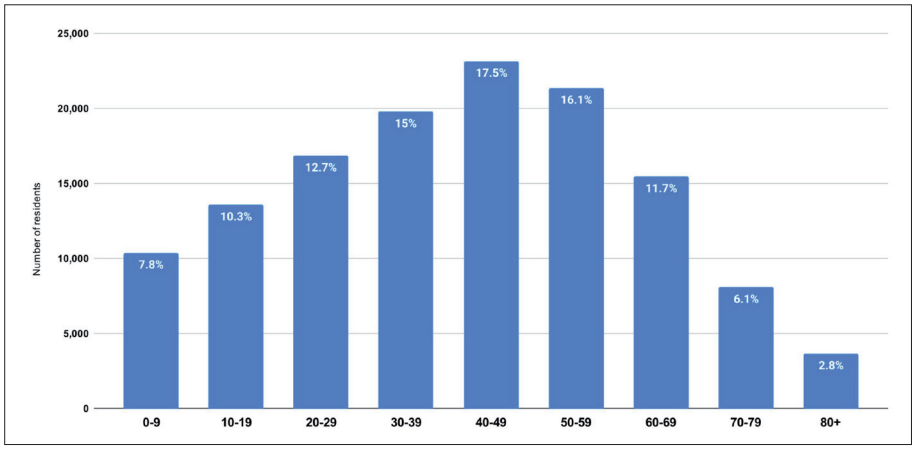

Fig. 4: Jiu Valley population, by age groups, in 2020
Source: Data: Romanian National Institute of Statistics, authors' elaboration

[4] This choice was due to travel and social gathering restrictions during the Covid 19 pandemic.

several "hats". For example, 26% of survey respondents said they were NGO activists, but we found out later that some of them were former miners, others had entrepreneurial initiatives, and local government representatives included mining retirees. When processing the collected data, we considered that the most relevant categories for this study are the following groups: current employees in mining – 22%, mining retirees – 29%, and others – 49%. Respondents to the questionnaire were between 25 and 65 years old; a majority of 83% are native and still live in the region, while others know the issue through the lens of their professional activities – consultants, journalists, Romanian government employees or officials in the European Commission and European Parliament, with duties in implementing or reporting the just transition.

The questionnaire results provided clues to investigate further who and why is slowing down the transition in the Jiu Valley. From now on, the work of the two authors is separated. The first author valued her connections with the community, embracing action research methods that allowed her to behave as a participant and facilitator, thus co-producing with the locals' 'warm' data that provides more context for understanding the specifics of the coal transition in the Jiu Valley. The objectives of action research are twofold: on the one hand, action research aims to construct new pieces of knowledge with the participants, researchers, and actors; on the other hand, it helps to achieve practical targets by reflecting on the processes and trying new methods (Schmitz, Lekane Tsobgou, 2016). While the first author is very close to the community she observes, the other author will be observing the observer, drawing her attention to her blind spots and acting as an advisor to identify patterns. The first author goes in-depth and reports the local context, and the second author places the findings in a broader context, restoring the balance between the subjective and the objective.

Fifteen people belonging to different categories of stakeholders participated in the semi-structured interview stage – eleven men and four women – aged between 35 and 65, with secondary and higher education. The interviews followed a structure through which we sought to determine what each respondent thought about: 1. the sense of place and attachment to the Jiu Valley; 2. climate change and the need for decarbonisation; 3. relations with other stakeholders; and 4. consultations for the development of the postmining strategy of the Jiu Valley. Each interview, however, was customised beyond the few standard questions based on the respondent's profile. The average duration of an interview was 45 minutes, and the discussions were conducted in Romanian via an online video application in February–March 2021.

On April 14, 2021, the first author participated as an observer in consultations between stakeholders, representatives of the Romanian government and PwC, the consulting company mandated by the European Commission to elaborate the postmining development strategy of the Jiu Valley. The preliminary results of this research were presented and debated in two focus group sessions. Within the focus group, the subjects reflected on the notions of transition, vulnerability and resilience at the community and individual levels. Twelve men and eight women aged between 19 and 55 completed or nuanced the data we had previously collected. The conclusions of the debates were corroborated with the results from the previous stages and included in the results of this article. To assign the quotes used in the results section, we used culturally appropriate pseudonyms.

5. Results

5.1 Perceptions and beliefs about the mine closure

The online questionnaire was the first step in collecting data and, as some of the participants stated in the later stages of this research, many of them did not have a clear opinion at the time as to why the mines needed to be closed. In the absence of complete and unbiased information, many respondents chose options that they were not necessarily sure about but seemed plausible. Not having much certainty, the vast majority avoided the "Disagree" option, most often choosing "I tend to disagree" (Fig. 5). We find it conclusive that for the participants in this study, however, it was just as plausible that the mine closure plan is an unfair measure against mining employees (47% tend to agree and 27% agree), but at the same time, a necessity for the economic recovery of the region (52% tend to agree and 29% agree). Although only 6% of survey participants fully agree with the option of closing coal mines as a necessary measure for achieving the global carbon footprint reduction targets, 66% of respondents tend to agree that it would be beneficial. The apparently contradictory responses highlight the difference between necessity and fairness. Some actions are considered necessary, considering general environmental and economic reasons, but unfair due to poor accompanying measures at local and personal levels.

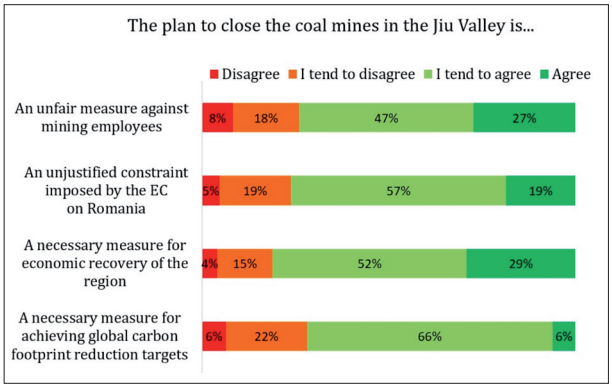

Fig. 5: Responses on the plan to close coal mines in the Jiu Valley. Source: authors' survey

Given that the deadline for closing two of the coal mines had already been exceeded, we wanted to find out how much favourability there is among the respondents regarding the delay. We found that a total of 47% of respondents do not think that the mines should have been closed, therefore, almost half are in favour of the delay, while 37% think that the closure process should have ended by now, and 16% do not have a clear opinion. A deeper analysis of this result, broken down into specific stakeholder groups (current employees in mining, mining retirees, and others), indicates that they have a discordant agenda. Predictably, most of those currently employed in mining (77%) answered that the mines should not have been closed, while the participants in the study belonging to other professional groups are equally divided between those who believe that the process of mine closure should have ended (38%), and those who oppose the closure (38%). This split highlights the point of view of mining retirees, a group of stakeholders who know the system as well as current employees but who, unlike them, are no longer dependent on the income obtained in the extractive industry. As seen in Figure 6, almost half of the surveyed retirees believe the mines should have been closed already and only 39% are in favour of the delay.

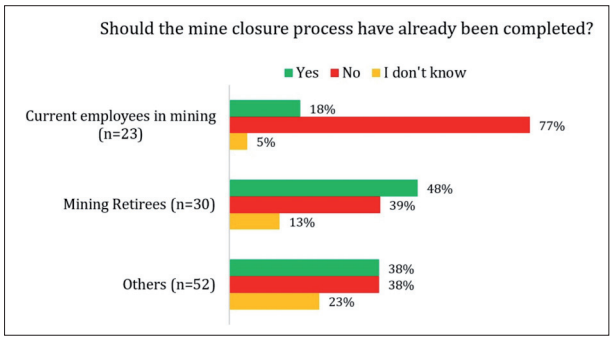

Fig. 6: Differences in the attitudes of stakeholders to the mines closure process. Source: authors' survey

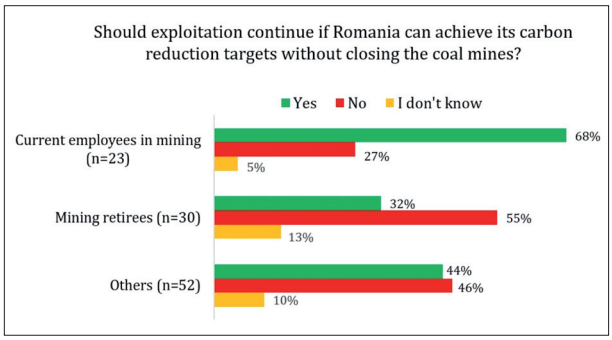

Fig. 7: Differences in the attitudes of stakeholders to the potential future of coal mining. Source: authors' survey

Whether or not they agreed with the closure, the explanations given by the retired miners for slowing down the transition converge in the same direction: delaying the closure is a form of social protection in the absence of a reconversion plan. The following excerpts from interviews with stakeholders support these statements:

> "The deadline had to be met, as in Germany. They closed the last coal mine in 2018, according to the plan. Most likely, the company wants a gradual decrease in the number of employees in mining and there are delays because no alternatives have been created in time. By postponing the closure, more and more people will retire, and the problem will resolve itself. The company, the authorities, no longer must worry about professional conversion programs." (Cornel, retired mining engineer).

> "It is a good thing they didn't close them! Other jobs should be created first and only then can we close the chapter called "mining". Where would the laid-off people go if the mines closed in 2018? They would be unemployed today" (Ovidiu, retired mining engineer).

> "I am almost 38 years old now, in three more years, I would already have the necessary seniority in underground work that would allow me to retire at 45. Obviously, this is the option that suits me the most and I hope that the union will be able to postpone mine closures at least until 2030." (Marian, a current employee in mining)

The different views of former and current miners were even more evident when we discussed the rather low share of coal in Romania's energy mix (between 10% and 20% of daily energy production, according to Transelectrica[5]) and Romania's ability to achieve carbon footprint reduction targets without having to shut down coal mines. In this situation, 46% of all respondents say that the exploitation of coal mines in the Jiu Valley should continue, compared to 45% who say that mining should stop anyway. Once again, the split into groups stresses that former miners are more in favour of closure than the other groups (see Fig. 7).

Being aware of the outdated technology and the production and distribution chain deficiencies, 55% of surveyed retirees believe that mining should stop regardless. At the same time, 68% of currently active miners believe that mining should continue. Valeriu, a former mining engineer, explained:

> "A depleted field is now being exploited in a market that does not need this expensive energy. No matter how painful it may be, we cannot remain miners just because we were miners "from father to son". Today, more stone is extracted than coal, but we fool each other that something can be restructured. We must understand that mining has no longer a future in Jiu Valley, and we should make use of all the European money allocated for territorial and professional reconversion."

5.2 Perceptions about vulnerability and the stage of preparedness

More than four in ten (42%) of the participants in this study believe the community is vulnerable and 41% say it is very vulnerable, although most are convinced that the Jiu Valley has considerable potential for revitalisation through sustainable development projects (37.5% – remarkably high; 35.5% – high). Their pessimism is justified by the absence of information and awareness of actions on decarbonisation at the local level, as well as by the lack of assistance programs for those who will be affected by the dismissals that could follow. Trying to determine, during the focus group discussions, if the missing information is a problem of bad communication or rather unavailable data, it turned out that both explanations were valid. Communication from leadership to the community as well as from the community to local leadership was limited, public policies are still being developed and a clear timetable for the implementation of the transition has not existed for a long time, therefore nothing clear could have been reported by the media, the survey reinforcing these findings. To the multiple-choice question "What kind of assistance has been provided to mining employees so far?", 61% said they were unaware of any assistance program, while 40% said that the only option considered would be early retirement. About 8% believe that there could be financial incentives for those who want to become entrepreneurs, and 6% say they have heard about the option of relocating to a region where there is a shortage of labour.

The accompanying measures that should be taken before the actual closure of the mines to mitigate the shock to the community have been the subject of deep reflection at all research stages. With the chaotic layoffs of the late 1990s in mind, research participants are convinced that mines should not be closed before other jobs are created (50% Agree; 20% tend to agree) and by no means before establishing the subsequent land use (35% Aagree; 38% tend to agree) (Fig. 8).

Vocational retraining programs must be started only when the new economic profile is clear, aiming to qualify workers for the jobs that will be available in the post-mining stage, in order not to repeat what happened in the 90's, when

[5] See daily update at: https://www.transelectrica.ro/ro/web/tel/home

consulting companies organised qualification courses in trades that were not sought in the area. Loredana, a local journalist, commented:

> "Regarding professional reconversion, it is true that some courses were organised but with insignificant outcomes. Mining engineers followed specialisation courses as mine managers for closures, but very few were hired, and cooking classes were organised for miners. 5 out of 500, at most, succeeded in changing their profession."

5.3 Credibility, influence, and positioning of the actors

Based on the idea that awareness and preparedness play a pivotal role in the outcome of the just transition, we considered it important to find out who are the most trusted and the most influential stakeholders in the Jiu Valley, thus identifying who can inform and shape public opinion. In a ranking of trust, the European Commission is leading, followed by local NGOs and academics (see Tab. 1). In contrast, authorities, and the media, both national and local, are credited with a significantly lower level of trust.

The participants in the semi-structured interviews and focus groups justified this result by mentioning the financial dependence of the media institutions on the authorities, the companies in the energy sector and even on trade unions. In these circumstances, the objectivity of public communication on the just transition is severely affected and the community is thus deprived of the basic means to increase resilience. Besides, 73% of the locals who participated in this survey believe that the media should better explain the Green Deal and its consequences for the Jiu Valley. Furthermore, 65% say they expect the media to monitor how the authorities will assist those who lose their jobs, and 50% of respondents call for more debates on this topic. In fact, at all stages of this action research project, the subjects invoked the need to have more data to be better prepared for the closure than they were in the 1990s.

The credibility of a stakeholder, although virtuous, loses its importance if it is not accompanied by influence upon the transition process. The survey revealed that those local stakeholders (particularly local NGOs) perceived as credible are not necessarily considered influential, which raises questions about who dominated the decision-making process. Tab. 1 summarises perceptions of each stakeholder's ability to influence the transition process. National media and trade unions are perceived as the most influential actors in the just transition in the Jiu Valley, followed by local media, national authorities, local authorities and European Commission, while local NGOs and academics score significantly less.

In producing a mapping that informs the role played so far by each of the stakeholders in the Jiu Valley in the just transition, we chose to group them on the criteria of perceived influence, credibility, and attitude towards the transition from coal. Their positioning on the map (see Fig. 9) is primarily based on the results obtained in the survey, but in the interview and focus group stages, two sub-groups of stakeholders stood out and we consider it more appropriate to treat them individually:

a. former miners – whom we found the best-informed stakeholder, knowing the industry well, from the inside, but also freed from the relationship of subordination with the union that represents the current miners; and
b. local entrepreneurs – although in small numbers and with different positions, difficult to put in a single frame, they are the category of stakeholders with great potential

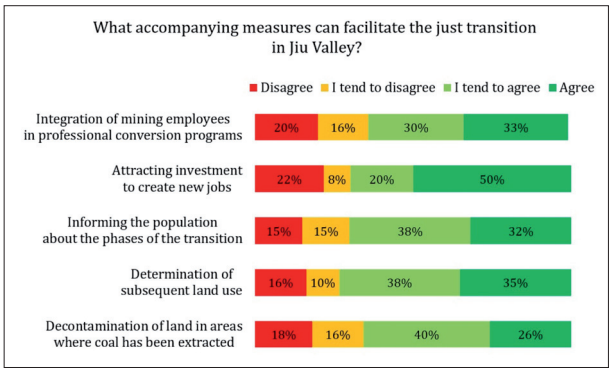

Fig. 8: Stakeholders' preferences of the measures that can facilitate the just transition. Source: authors' survey

Level of trust		Level of influence	
Actors	(%)	Actors	(%)
European Commission	68	National media	79
Local NGOs	65	Trade union	76
Academics	54	Local media	72
Local media	34	National authorities	69
Local authorities	33	Local authorities	61
Trade union	32	European Commission	58
National media	29	Local NGOs	29
National authorities	21	Academics	21

Tab. 1: Ranking of actors according to the respondents´ level of trust and perceived influence (Notes: The level of trust represents the percentage [%] of respondents who trust the specific actors very much or a lot (in contrast to those who trust them little bit or not at all). The level of influence represents the percentage [%] of respondents who consider the specific actors being very much or a lot influential (in contrast to those who consider them little bit or not at all influential). The actors are ranked according to the descending levels of trust and influence.) Source: authors' survey

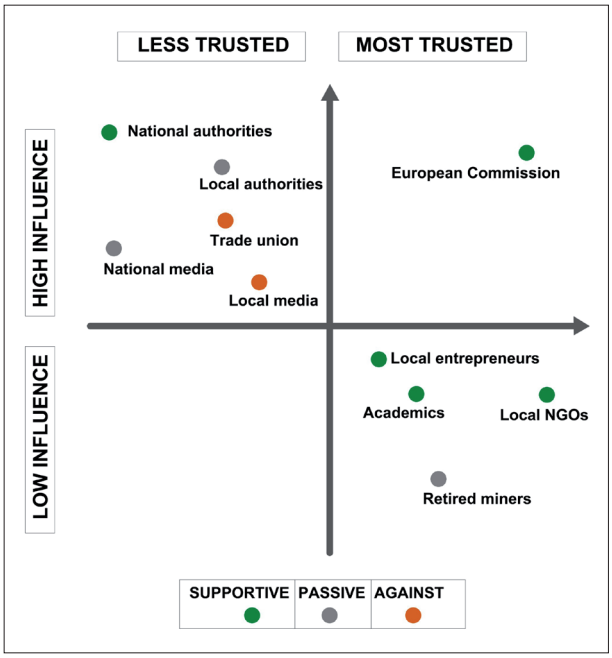

Fig. 9: Classification of stakeholders Source: authors' conceptualisation

to influence the outcome of the transition if they could create more jobs. Their positioning was conducted after individual discussions and after debating all the results within the focus group.

Among the stakeholders in the Jiu Valley, we identified actors who support the transition and who have already shown the agency to be actively involved in awareness and preparedness, such as representatives of the 21 non-governmental organisations from "Valea Jiului Implicata" coalition, local entrepreneurs, professors and researchers at Petroşani University. As shown in the chart above, however, they have little influence on the transition process. Despite their elevated level of influence, national authorities have no credibility in this matter. The Romanian government is indeed an international signatory to greenhouse gas emission reduction agreements, but it communicates almost nothing domestically. In this regard, political instability in Bucharest must be signalled as a factor altering the credibility and delaying the transition. Since 2015, when the Paris Agreement was adopted, and until the end of 2021, Romania had seven prime ministers with different priorities in the governing act.

The local administration, the holder responsible for transition management, has had so far, a passive but very detrimental attitude because leaving things in an area of ambiguity and not exercising arbitration during stakeholder consultations, has favoured those who slow down the transition. By placing the European Commission remarkably high on the scale of trust and influence over the transition in the Jiu Valley, the survey respondents showed that confusion persists regarding who is doing what in just transition. EC allocates budgets and sets the framework, while strategies are made and implemented locally. Local and regional authorities are credited with less influence, although technically, they are the most powerful in this specific situation.

A special category of stakeholders is the former miners, now retired, who proved to be the best-informed actors in the Jiu Valley at all stages of our methodology. Knowing from within the system dysfunctions, the forms of pressure exerted by unions on employees, the community and governments, mining retirees are the first to understand why a structural change in societal practices is needed. They play no role in preparing or managing the transition, however. Participants in our study identified the labour union as the incumbent actor who intentionally slows down the transition, as Mihail, a former miner, explained:

> "I have no qualms about saying that unions have always been a brake on the development of the region. They controlled many workers and blackmailed politicians for years. This is how they manage to postpone the closure of the mines, and the post-mining development strategy is long overdue. I am safe, I already have a good pension, but my children have no future here. We have to find solutions for them, but we are still postponing the start."

5.4 Visions of the future of the post-mining region

Asking them about their visions for the future of the region and the economic model that will replace mining, our respondents believe that further mono-industrialisation should be avoided, therefore diversification is necessary, and they are relying the most on Tourism (preferred by 43%), followed by Renewable energy (25%) and Light industry (24%) and at least on Agriculture (8%).

The belief that the territory has enormous potential for reconversion is, however, overshadowed by the lack of confidence in the authorities' ability to devise such a good strategy to attract all the European funding available for a just transition in the Jiu Valley.

As a result, 41% of participants in this study fear that this (weak development strategy failing to attract all available funding) is the biggest challenge for their community in the transition from coal, while 37% doubt that the post-mining strategy will aim for sustainable development.

As Radu, an NGO activist, pointed out:

> "There are a lot of opportunities for agrotourism, equestrian tourism and more, but the authorities need to set the framework for these projects and put them into a comprehensive, integrated strategy. Otherwise, they will remain just some ideas that locals discuss when they meet for a beer."

In addition, Florentina, a high school teacher, suggested:

> "Consultants have come to ask us what sustainable development projects can be done, but in my opinion, all these discussions are nothing but empty words on a lot of European money, without any real effects on our lives. A small group of people will again earn millions of euros claiming to have provided us with consultancy and retraining, but we remain just as poor, and the Jiu Valley will continue to be an underdeveloped region."

Apart from these two main problems, one fifth (20%) of respondents was most concerned about the inadequate transition assistance for the redundant employees, while the issues of the outbreak of protests of the mine closure and depopulation of the region are considered a greatest concern only by individual respondents.

6. Discussion and conclusions

As Kelemen (2020) explains, a just transition is not just about replacing one economic model with another but has clear goals of sustainability and spatial justice, which means that new industries are clean, jobs are green, and goods, services and opportunities are evenly distributed. Therefore, in an optimistic scenario, within the framework created by the European Commission for the transition from coal, the shrinkage may finally stop, and a stage of recovery and renewal could begin for Jiu Valley.

In theory, locals in many regions will say they support the energy transition, but when facing the negative perceived consequences, some will choose to preserve the current status quo, especially in coal mining communities. Like other post-mining areas in the past, Jiu Valley is marked by a strong social memory, remembering the golden age of mining communities during the dictatorship that shaped their identity and put the area in a positive light. Why should they speed up mine closures, especially when very few horizons are opened for their home Valley, and the climate agenda seems far from their remote Transylvanian towns? Only the retiree miners have a clearer view of the issue of maintaining coal mining. Even if some local assets could be harnessed, however, the transition does not have much public acceptance, mainly due to delays in getting started. Moreover, the lack of influential and dependable active agents does not play in favour of a just transition. Beyond that, the more time lost, the less opportunity there is for recovery and renewal.

Nevertheless, some recommendations emerged from this action research project. The mapping of stakeholders emphasises that, among the strong actors, the local community trusts only the European Commission, but the EC has so far seemed distant and ignorant of the local context. Other powerful actors are unreliable, especially because of corruption, leading to the difficulty of coagulating around a common vision for the territory. Unlike the spectrum, some new actors, such as NGOs and retired miners, have gained the trust of the community, however, they should be recognised and empowered in managing the transition.

During this project, co-producing information with locals and revisiting the research questions at various stages of the analysis, better informed each time, provided the subtlety and context needed for understanding the challenges that may arise when European directives encounter local realities. Interviews and focus groups also helped the community to consider other political, spatial, and temporal levels of the transition. It has been emphasised that, if individual solutions can be found, it is essential to reflect collectively on the future, especially out of concern for the younger generations.

When we compared local realities with theoretical concepts and examples of good practice described in the literature, we diagnosed several problems that may weaken the community's resilience in near-future hardships. Firstly, the risk management is delayed. There is too little awareness and preparedness for the community to be able to allocate the necessary resources aiming to mitigate the impact of mine closure. Consequently, this would be negatively reflected in the recovery stage, which, the longer it lasts, the lower the chances for renewal. Communication, essential at all stages of building community resilience, is deficient both from the authorities to the population and from the population to the leadership. Most of the locals feel underrepresented in the public discourse. This has a demobilising effect, exacerbating their feeling that they have been abandoned by everyone: politicians, the media, and the rest of Romanian society.

Secondly, the vacuum of reliable information, the traumatic experience of the transition from socialism to capitalism and the mistrust of leadership have turned most locals into passive spectators who do not consider themselves capable of changing their fate. This situation is detrimental because it leads to an underutilisation of resources, be they material assets, landscape, cultural or intangible heritage. Therefore, the community has little agency to act and judging by the delays in risk management, it is unlikely that actions will be taken in time, a prerequisite for both strengthening community resilience and the success of the just transition.

Third, collective action may prove problematic if stakeholders continue to have different and sometimes divergent interests. We believe that this shortcoming also has its origins in poor preparation for impact – risk management would also have involved establishing stronger collaborative relationships.

The case study of Jiu Valley underlines some shortcomings in implementing just transitions, including the issue of governance and mistrust towards local and national authorities, difficulties in orchestrating individual agendas to launch a collective action for the future of the region and, not least, poor information and delays of the mine closures. Concerning the hypotheses about awareness, preparedness and transition delays, the research pointed out some of the mechanisms that explain the scarce preparedness and why, both closure and transition, were repeatedly postponed. Furthermore, the research profiled the different actors and highlighted the challenges to address and roles to contribute to the just transition. We found people who are strongly attached to the region, determined to create a more sustainable future, with or without the European funding. For a post-mining community, being resilient is not just an adaptation to absorb the shock but requires a structural transformation of the economy and society. This transformative process is only possible by manifesting a level of agency that may be lacking in a post-socialist system. The population needs adequate information, taking into account local specifics, and the information must be disseminated by actors considered to be reliable. Therefore, we believe that such action research supplements the official initiatives, especially in this state of suspicion toward the authorities from all levels and recalling the bad memories of previous unjust transitions. Our findings may help to increase the capacity to adapt, the agency to act, and the necessity to act on time.

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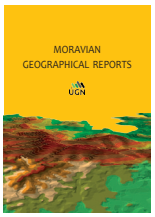

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Industrial forever? Narratives, place identity, and the development path of the city of Zeitz, Germany

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Abstract

There is a growing interest in understanding development processes and opportunities in small and medium-sized towns that so far did not attract much attention in mainstream urban theory. Conventional growth-oriented approaches fail to capture the complexity of local development and policy-making processes because they prioritise production factors and underrate the role of discourse and place-based identity. This paper aims to explore the linkages between narratives, place identity, and local development. As local actors try to make sense of a place's past and future, they select, contribute to, and mobilise various local narratives. Multiple narratives feed into and are part of a place's identity that defines a frame for possible development options. The paper uses the case of Zeitz in Saxony-Anhalt (Germany) to analyse the evolution of local development narratives from the 1970s until today. The paper concludes that: i) narrative-making is not a linear process; narratives, spatial imaginaries and local identity are complex, dynamic, and interconnected with each other; ii) local narratives help to construct a coherent imaginary of a place and are mutually intertwined with local development and policies; and iii) local narratives are interdependent with external events and strategies requiring a multiscalar relational perspective on local development processes.

Key words: *narrative; place identity; past; coal mining; small town; local development, Germany*

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1. Introduction

There is a growing interest in expanding the current understanding of the urban via engaging with a variety of geographical scales, histories, and types of urban settlements, and encouraging dialogues between various world regions. Leading theorists have argued for a long time that the "paradigmatic city" approach has limitations (Jacobs 2012, p. 908), suggesting that urban theory must be "provincialized" in order to "address a much wider range of modes of urbanism" (Parnell and Robinson, 2012, p. 600), and that "cities have to be theorised as open, embedded and relational" (Ward, 2010, p. 481).

While the focus of current debates has been shifting beyond large cities and western domains (Bell and Jayne, 2006; Brenner and Schmid, 2014; Bryson et al. 2021; Hamdouch et al., 2017), there is a need and scope for a more nuanced understanding of development processes in smaller, peripheral, and disadvantaged places (Carter, 2016; Servillo et al., 2017). The complex dynamic of urban development "under the conditions of deindustrialisation and (sometimes) subsequent regeneration" (Bell and Jayne, 2009, p. 693) deserves more research attention, especially about understanding the role of non-economic factors, such as local identity. Research should "delve into the spatial and historical contexts in which economic [and political] change has unfolded and economic [and political] agents have made key decisions" (Martin and Sunley, 2022, p. 12). This paper responds to these calls by exploring the role of local identity and local narratives about a place's development in forming a specific development path.

Old-industrial places and particularly those strongly connected to mining activities often have experienced economic and demographic decline as a result of changes in global production patterns and technology. After mining has lost its relevance, such places often find themselves in a precarious economic and social position (Wirth et al., 2012). Finding new economic roles poses a formidable challenge because of the structural conditions and various lock-ins, including structural, institutional, and cognitive factors (Grabher, 1993; Hassink, 2010). Intertwined processes of economic restructuring, demographic change, disinvestment, and the collapse of social fabric often result in a very

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particular image associated with decay, marginality, and abandonment (Edensor, 2005). On the other hand, industrial legacies and specific industrial cultures are also associated with endogenous economic potential and new opportunities (Görmar and Harfst, 2019; Harfst, 2015; Tiran et al., 2022).

As the industrial past often constitutes a foundational element of local identity and a major reference point in current local narratives and future imaginaries, its role and implications for development prospects requires a better conceptual and analytical grasping. Traditional imaginaries may compete with alternative visions leading to a so-called "crisis of definition" (Cruickshank et al., 2016), or in other words a crisis of local identity, and doubts about which kind of development path to pursue. A feasible strategy requires joint efforts of actors in the fields of planning, place making and economic development (Nathan et al., 2019; Albrecht and Kortelainen, 2020; Van Hoose et al., 2021).

Local narratives affect the ways future development opportunities are perceived and what political decisions are made (O'Dowd and Komarova, 2013; Sandercock, 2003; Shanahan et al., 2013; Willett, 2016). We employ the term here in the sense of stories which are told about past events and future visions impacting the development of a particular place in the perception of the narrator(s) decisively. They serve as sources of strategic intervention entailing material effects. At the same time, they are also the outcome of these activities as through narratives people make sense and meaning of actual events and local development processes (Jessop, 1997; Garud et al., 2010; Groth, 2019). Drawing on these debates and the idea that local development is an "ongoing attempt to construct the identity of place" (Cruickshank et al., 2016, p. 151), this paper explores how identities (expressed via narratives) shape a local development path.

The paper aims to understand how identity-forming discourses and local development activities co-constitute each other. We focus on local narratives and spatial imaginaries that contribute to a particular 'sense of place' and constitute elements of social agency in local development, using Zeitz, a medium-sized older industrial town in Saxony-Anhalt, Germany, as a case study (see Fig. 1). The research is guided by the following question: How do local narratives and perceptions of a place's imaginary and identity, influence policies and development options? This is followed by three empirical sub-questions:

1. How do official narratives in urban development and marketing documents change over time?;

Fig. 1: The location of Zeitz in Germany
Source: Leibniz Institute for Regional Geography

2. What future did the municipality at different points in time imagine?; and
3. How has this been translated in actual development measures in the town and subsequently influenced its development path?

The research uses Critical Narrative Analysis (CNA) – a novel methodological approach that allows the researcher to contextualise the unfolding local narratives and changing imaginaries of old-industrial places in time and space, and consider their specific political, social and cultural settings (Souto-Manning, 2013; Gavriely-Nury, 2017). This approach is based on a strategic-relational perspective on place(s) and local development that emphasises the mutual constitution of agency, discourses and structures across time and different scales (Görmar et al., 2022; Jessop, 1997).

By researching narratives and imaginaries, we offer a better understanding of connections between changing economic environments, local development processes and community responses by identifying three different functions narratives have in local development:

1. Explaining and making sense of situations;
2. Structuring options and actors; and
3. Imagining futures and facilitating discussion.

The paper is organised as follows: the following section outlines the conceptual frame, while section 3 introduces CNA. Section 4 gives a detailed overview of the different local narratives from 1970 up to today, which will be discussed in form of a synthesis in Section 5. Section 6 concludes the argument.

2. Narratives in local development and identity building

We depart from the standpoint that places are laden with meaning "which is not only attached to materialities, but also to experiences, practices, feelings and narratives" (Glorius and Manz, 2018, p. 29). According to Massey (1995) narratives are not pre-given, instead they should be understood as "constantly shifting articulations of social relations through time" (Massey, 1995, p. 188). A powerful narrative combines both discursive and material factors "that give them a more or less coherent imagined identity and social structuration" (Jessop, 2012, p. 13). It is important for agents involved in local development to use their capacity to frame discourses, and more specifically local narratives, through which past experiences are mobilised and futures are imagined (Martin and Sunley, 2022; Garud et al., 2010).

Spatial imaginaries and local narratives can be seen as constitutive parts of local development (Paasi, 2013) and identity building transforming "urban [and rural] spaces into territories and places while constituting both as part of social identity" (O'Dowd and Komarova, 2013, p. 540). While spatial imaginaries are understood as "mental maps representing a space to which people relate and with which they identify" (Boudreau, 2007, p. 2596), local narratives are conceived of as their political and discursive articulations that both shape a place's identity and culture and are representations of it (Paasi, 2013, p. 1207). Imaginaries can be considered as operating in the background as abstract world views influencing decision-making processes. Yet, they are rather elusive and hard to grasp.

Narratives offer a useful entry point for their identification. They are used by people to make sense of the complex processes in the world and their implications for specific localities. They establish coherent and logical plots which link a sequence of (potentially or actually) transformative events and actions and the involved human or non-human actors to each other (Gadinger et al., 2014; Groth, 2019). This sequencing or emplotment is a highly selective practice both on the sender's as well as recipient's side and has an inherent political dimension as it implies a certain causality between these events (Ameel, 2016; Jessop, 1997). The same applies to references to specific timeframes and socio-spatial relations. The past, present, and future are inextricably intertwined as "different visions of the future will lead to the mobilisation of the past in different ways" (Garud et al., 2010, p. 768), creating space for current policies. Massey (1995, p. 186) links place identity to "the histories which are told of them, how those histories are told, and which history turns out to be dominant". As there is a multitude of potential narratives, they represent different interpretations of a place's identity "based on the different socio-geographical position of groups which promote them" (Massey, 1995, p. 185). Which ones will become dominant is contingent but entails the emergence of strategically selective visions about a place's future (Jessop, 1997; Pike et al., 2017). Hence, narratives should be seen as "internally complex and contradictory [and] incorporating multiple resistances [which nevertheless] engage in a dialogue with each other and even partially overlap" (O'Dowd and Komarova, 2013, p. 540). Control over narratives brings about political advantage and shapes agents' capacities "to frame political [here: urban development] processes according to one's view" (Groth, 2019, p. 2).

Narratives are deeply linked to our affects and emotions as they resonate with former experiences made and are expressions of the creative agency of actors within specific structures. They are hence drivers of human agency (Garud et al., 2010) which is particularly visible (but not only) in place making and planning processes. The latter can be even described as processes of "writing a narrative" (Paasi, 2013, p. 1214) or "persuasive storytelling" (Throgmorton, 2003). At the same time, narratives as well as place identity are historically contingent. They might change even to the extent that they are not anymore present in successive planning or marketing documents.

When studying development and change in older industrial places, three interrelated aspects of development appear particularly relevant (see Grabher, 1993; Hassink, 2010): firstly, changes in the local economy including processes of regional restructuring and renewal, path creation and path contingency (e.g. Miörner, 2020; Isaksen et al., 2018; Martin and Sunley, 2006); secondly, changes in local culture and identity (Glorius and Manz, 2018; Cruickshank et al., 2016; Cooke and Rehfeld, 2011; Byrne, 2002); and finally, changes in local governance and institutions including planning policies and practices (Sotarauta and Suvinen, 2018; Kinossian, 2018; Dale, 2002). In this regard, spatial imaginaries and local narratives are important in multiple ways, for example, by setting the basis for place making and branding strategies (e.g. Van Hoose et al., 2021; Albrecht and Kortelainen, 2020; Van Assche and Lo, 2011) thereby giving symbolic meanings to a place and shaping its identity (see also Vainikka, 2015), by legitimising urban development projects (e.g. Ameel, 2016, 2021; Jensen, 2007) or new industrial pathways (Mackinnon et al., 2019; Garud et al., 2010) or by empowering (or suppressing) specific actors in such emerging industrial paths (Miörner, 2021).

In summary, narratives can be understood as strategies or tools for social action (Groth, 2019), spatial imaginaries as the underlying worldviews. They are created, diffused or contested by different political, social and economic agents at specific points in time and foster (intentionally or intuitively) competing political and economic interests and coalitions thereby shaping a place's development "both in relation to its external positioning and its internal differentiation" (Healey, 2006, p. 534). Narratives that are told in the right way motivate and organise collective actions either by reaffirming dominant imaginaries and hence the hegemonic order or by contesting it. As such, spatial narratives are always normative and political although they may be presented as 'facts'. They promote images, identities and/or normative assumptions on what is good or bad, (un) important, (im)possible or (un)desirable to inspire people to act (or refrain from certain actions). Hence, they shape agents' imaginaries about a place and their visions of how a place should develop in future, which will be negotiated in distinct political arenas and lead to specific local development policies and measures. Planning narratives are particularly important as they aim to "explain, legitimise and produce change in a city that went through a process of urban transformation" (Walter, 2013, p. 7).

3. Research design: A critical narrative analysis

As shown above, narratives and imaginaries are constitutive elements of local development and identity. Hence, their analysis offers a useful entry point to the discussion on what a place or a region aims to 'become' in the future (Willett, 2016). Local actors 'texture', intentionally or not, stories and discourses in certain ways to push their agendas forward. Discursive change is achieved by varying themes and topics, foregrounding, or backgrounding specific aspects, which potentially leads also to social and material change. Socio-material and discursive processes in local development can be understood as mutually constitutive, impacting on and transforming particular social relations (van Heur, 2013), which requires a suitable research design. We rely here on Critical Narrative Analysis (CNA) (Souto-Manning, 2014; Gavriely-Nury, 2017) that builds upon elements of two approaches:

1. Narrative Analysis (NA); and
2. Critical Discourse Analysis (CDA).

So far, this novel approach has not been used in geographical studies, yet it proves to be suitable for such a complex endeavour.

Both NA and CDA are concerned with evaluating transformations by focussing on processes of sense- and meaning-making (either through semiosis in general or through narration) (Fairclough, 2005; Jessop, 2010; Varró, 2014). Both can link institutional systems with social and cultural contexts (Fairclough, 2003; Souto-Manning, 2014). CDA is especially concerned with the relationship between language and discourse on the one hand, and social structures and non-discursive elements of social actions on the other hand (Fairclough, 2013). It offers a three-dimensional framework that treats discourse as text (in a linguistic sense), discursive practice, and social practice (Fairclough, 1992), allowing one to link texts and narratives to actual development outcomes. Narrative approaches in turn offer an additional conceptual perspective on texts as (written or oral) stories. CNA is not only suitable to show how individual narratives are shaped by powerful institutional discourses (Souto-Manning, 2014), but also to look at collective narratives and how they could contribute to the construction of a group such as an organisation, community or even an economic or political system and related identities (Gavriely-Nuri, 2017).

In this study, we look at collective local narratives and processes of local identity building, providing a link between local development processes and their linguistic representations through emplotment (see above). A change in narrative plots or vocabulary may indicate processes of variation, selection and retention leading to changes in both the discursive and material elements of a place, in short in local development processes (Fairclough, 2005).

3.1 Data collection

The research relies primarily on an analysis of policy documents, marketing and tourist brochures that have been published in Zeitz since 1970. This is complemented by the analysis of data collected via 23 semi-structured interviews with local actors.

We adopt this mixed methods approach as narratives are created, stored, and transmitted by both oral communications, such as interviews (Czarniawska, 2004), but also policy or planning documents (Shanahan et al., 2018; Ameel, 2016) and other texts e.g. place marketing materials (Lichrou et al., 2017). Such official documents can be understood as "institutionalised traces" (Wolff, 2009) of activities by actors or organisations such as city administration and regional development agencies. They indicate values and principles that are prevalent in local development at a specific moment and point to the nature of existing power relations, because drafting such texts is a simplifying, complexity-reducing process, whereby dominant actors enforce their imaginaries, narratives and associated values and principles.

We start the empirical work with the analysis of policy documents to trace changes in the official narratives as articulations of a publicly promoted local identity and the underlying power relations. Documents have been selected in several rounds of desk and archival research and by asking interviewees for additional sources. They have been deemed relevant for this study when they:

1. Disclose strategic potentials to further the development of the selected case study towns;
2. Include a specific development vision for the municipality, one of its parts or the region within which it is embedded;
3. Have a potential to foster a local or regional identity; or
4. Refer specifically to an already existing local and regional identity (for a comprehensive list of the documents used: see Appendix 1).

The interviews were carried out between July 2020 and May 2021 during face-to-face meetings or via video conferencing. Interviewees were representatives of the city authorities, local entrepreneurs, and civil society actors, and have been chosen on the basis of extensive desk research as well as snowballing (a table on the interviews is provided in the Appendix 2). Interviews gave insights into different interpretations of past development processes, as well as actual results of former narrative building and hinted towards underlying power relations. They served hence to contextualise the official narratives and imaginaries, allowing the researchers to dig deeper into the analysis of the documents as social practices (see below).

3.2 Data analysis

Following Fairclough's (1992) three-dimensional analytical framework that understands discourse as text, discursive practice, and social practice, we aim to connect changes in the analysed texts and to identify local narratives with changes in actual development processes. The first dimension, discourse as text, is concerned with concrete linguistic and literary features, such as narrative structures, characters, settings, and events linked to each other by emplotment, and leading to 'lessons' drawn from the narrative (e.g. Shanahan et al., 2018). Specific vocabulary, metaphors or textual structures that give hints of underlying values and imaginaries, as well as temporal and causal relations, link different events and place them in the broader local narrative and identity discourse (Ameel, 2016). In this paper, we analyse the narratives of each text separately before relating them to each other in a second step.

The second dimension, discourse (or narrative) as discursive practice, is concerned with socio-cognitive processes of text production and interpretation. By focussing on intertextuality and interdiscursivity, we can assess the narrative repertoire and associated common knowledge, internalised structures, norms and conventions mobilised in the production and interpretation of texts (Fairclough, 2003). By adopting a long-term perspective in assessing documents from a period of 50 years and relating them to each other, we go beyond a simple narrative analysis of each text.

The third dimension, discourse (or narrative) as social practice, is concerned with the social, institutional, biographical, and situational context of texts (Marxhausen, 2010). For a nuanced interpretation of the material, Fairclough (2005) proposes in this step of an analysis to recontextualise the analysed texts with texts of other genres (e.g. interviews, further documents) and with reference to other scales (e.g. individual, regional, or state level).

Figure 2 shows how we apply the method outlined by Fairclough to the narratives which are inherent in planning and marketing documents. One novelty includes contextualisation and further interpretation by triangulating the analysis of documents with interview results. This enables an assessment of the "relationships between discursive and social change" and allows the researcher to systematically relate the "detailed properties of texts […] to social properties of discursive events as instances of social practices" (Fairclough, 1992, p. 8). In the following analysis the different dimensions are already synthesised to give a detailed account of the results of the analysis.

4. Results: Changing development narratives of Zeitz

Zeitz is a medium-sized town located in the south of Saxony-Anhalt, situated at the fringes of the Central German lignite exploitation area. The mine of Profen is approximately 15 km away; the village of Theißen belonging to Zeitz, is the headquarters of MIBRAG, the Central German lignite mining company. Besides the core town and Theißen, seven other villages belong to the municipality. Zeitz has a long history of more than 1,000 years but has had to cope with considerable challenges regarding demographic and economic developments since 1990.

Although lignite mining continues, Germany's proposed exit from carbon energy and the post-2022 exposure to energy security risks, created a lot of uncertainty about Zeitz's future. Table 1 summarises the main characteristics of Zeitz. The analysis demonstrates changes in the narratives which can be traced in the official documents from the 1970s up to today. Table 2 shows the timeline of key events as well as the narratives which prevailed during associated periods. We identified four main narratives presented here in a linear form. Yet, we want to point out that narratives may overlap, coevolve, borrow elements of former narratives, or incorporate new elements which we want to show with the analysis of the individual narratives below.

4.1 The socialist "Town of labour" (1945–1990)

In GDR, Zeitz was home to large manufacturing enterprises, including the pushchair manufacturer ZEKIWA, a sugar factory, the sweets factory Zetti, a piano factory, a cosmetics producer, and a hydrogenation plant nearby. Deposits of lignite (brown coal) were (and still are) exploited in the surrounding areas. This was particularly important for the GDR goal of energy self-sufficiency. Mining and the development of energy-intensive industries created a need for adequate housing of the workers, which was met by the construction of modern 'socialist' quarters of prefabricated

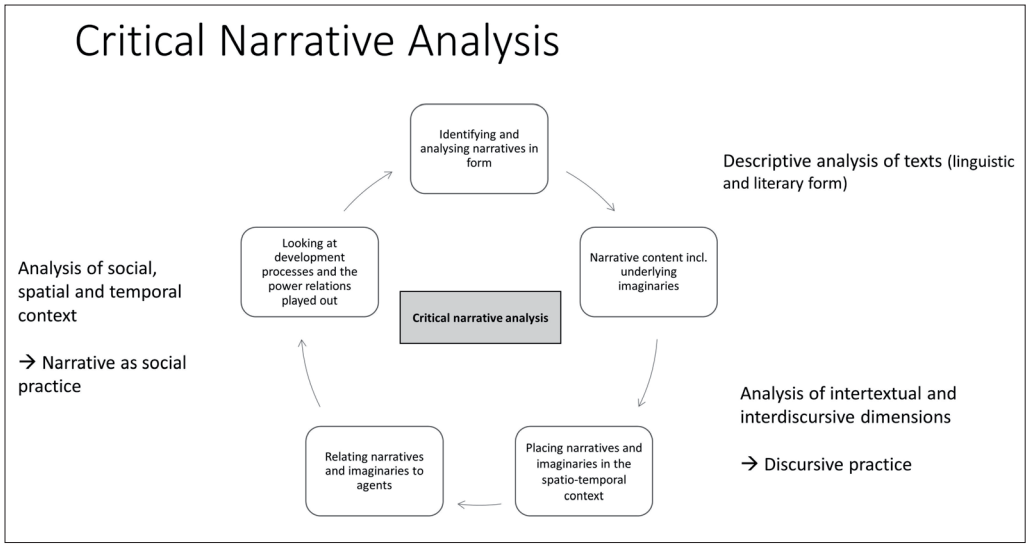

Fig. 2: Critical Narrative Analysis – analytic dimensions
Source: Authors' elaboration; with reference to Fairclough (1992, 2003)

houses (most notably in Zeitz-East). Investment in the inner-city areas stagnated. According to older interviewees, socialist enterprises also dominated completely the social life as they took care of cultural and sports events, health care and kindergartens. Hence, it is no surprise that these enterprises have been important identity markers (Interview ZZ_IN_11).

The tourism brochure from 1977 reflects these developments (see storyline in Fig. 4). Being inspired by the communist ideology, it interprets local history and development through the overarching narrative of class struggle, leading to the foundation of a new socialist state. It lists important dates of the town history like the town's first mentioning in 967, the works of the last bishop Julius Pflug and Martin Luther, its time as residence of the Duke of Saxony-Zeitz or the period of industrialisation.

Yet, these are embedded in the storyline of social progress towards a socialist society and intertwined with events deemed of national importance, like the peasant struggles, the role of the Russian Cossacks during the Napoleonic Wars, the revolutions of 1848 and 1919, and finally the merger of the socio-democratic party and the communists into the Socialist Unity Party (SED) or the Party Congresses of SED.

Population	**Significant population loss since 1990**	
1990	47.732	
2000	38.991	
2010	31.556	
2019	27.601	
2021	27.003	
Migration balances	**Since 2019, positive trend in migration balance, especially due to decreasing outmigration numbers**	**Migration balance Zeitz–Leipzig (from the perspective of Zeitz)**
1991	– 546	Not available
2000	– 483	– 47
2010	– 284	– 63
2019	+ 38	– 36
2021	+ 325	+ 23
Historic development	• Foundation in 967 • Seat of bishops (11th c.) and dukes (17th c.) – building of the castle Moritzburg • Development into a diversified industrial town from the 19th century on, Zeitz was one of the industrial centres of GDR • Main industries until 1990: pushchair production (ZEKIWA), mechanical engineering, piano manufacturing and sugar production, lignite extraction, hydrogenation plant and refinery • Closure of a great share of industrial enterprises – from 1995 to 2001 the number of industrial enterprises decreased by more than 50% from 52 to 25 – since then this number is stagnating	
Local economy	• Manufacturing, extraction and processing industries: Sugar and sweets industries (Südzucker and Zetti), diversification of sugar plant integrating bio-ethanol, carbon acid and starch production • Lignite mining (MIBRAG) > end of lignite mining in 2035, 22 largest enterprises in Saxony-Anhalt (2018) • Chemical and industrial park in Elsteraue > specialisation in biochemistry ("green chemistry"), planned to be expanded; Zeitzer Guss – metallurgy • Number of employees considerably lower than in former times • Services with increasing importance, a small number of creative enterprises, tourism is seen as a complementary potential for the region	
Numbers of tourists	The number of guests arriving in Zeitz increased until 2019, decreasing numbers in 2020 and 2021 were influenced by the COVID-19 pandemic (not represented in table)	
	Arrivals	**Number of nights spent in Zeitz**
2010	6,565	12,092
2015	7,731	17,181
2019	10,802	20,050
Current and recent debates	Zeitz is heavily affected by the closure of lignite mines and power plants in the region → currently several discussions and participatory processes take place on various scales (local, regional, federal state level in Saxony-Anhalt) • since 2021: elaboration of a master plan, office "Town of future" • 2020: Integrated urban development concept (ISEK 2035) • 2019: elaboration of mission statement (Leitbild) • Urban renewal process (Stadtumbau) since 2002	

Tab. 1: Overview of the characteristics of Zeitz
Sources: Statistical office Saxony-Anhalt, Statistical Office City of Leipzig

Time	Events	Narrative
1949–1990	Division of Germany. Post-war recovery. Growing competition with the west. Zeitz appears one of the major industrial centres in GDR with great diversity of industrial branches. Physical degradation of the old city centre.	The socialist "town of labour"
1990	German reunification	The story of change and adaptation. Linked to the hope to overcome the crisis soon
	Restructuring of local economy, closure of many of the manufacturing enterprises (e.g. hydrogenation plant, piano producing plant, pushchair factory ZEKIWA); few enterprises could survive with fewer employees (e.g. sugar factory Südzucker, sweets factory Zetti) > consequences are high unemployment, out-migration, increasing housing vacancies	
1994	Decision on new district "*Burgenlandkreis*" of which Naumburg will be county capital; with that, Zeitz loses its status as county capital and seat of regional administration which it had since the 19th century	
1996	Foundation of "*Pakt für Arbeit*" (Pact for labour) to fight against high unemployment; members are the municipality, labour unions and enterprises (still active today)	The story of loss and uncertainty. Realisation of market economy realities
End of 1990s	Highest number of unemployed people with approximately 30% unemployment rate in Zeitz	
2002	Start of urban regeneration process ("*Stadtumbau*")	
2004	1st garden exhibition of Saxony-Anhalt (*Landesgartenschau*) which resulted in the new creation of the castle park, demolition of former industrial buildings and renovation of a few industrial buildings ("*Klinkerhalle*n")	
2009/2010	Incorporation of adjacent municipalities, including Theißen which is the headquarters of lignite company MIBRAG	
2013	Flood of river Weiße Elster; damages of many buildings in environments, e.g. railway station, former ZEKIWA factory > reconstruction and reuse of some of these buildings possible by using flood support funds (on-going)	
Since 2013	Foundation of an association dedicated to developing the monastery Posa as place of culture and education (Kultur- und Bildungsstätte Kloster Posa e.V.)	The potential "phoenix from the ashes" story. New uncertainties.
2020	Law on exit from coal-based energy production and Law on recompensating for regions affected by "coal exit"	

Tab. 2: Overview of events and narratives shaping local development in Zeitz
Source: authors' compilation

Fig. 3: Postcard from 1989 showing several sites of Zeitz including the newly built Zeitz-East (below centre) and the "boulevard" (below right and left)
Source: Archive for Geography at Leibniz Institute for Regional Geography

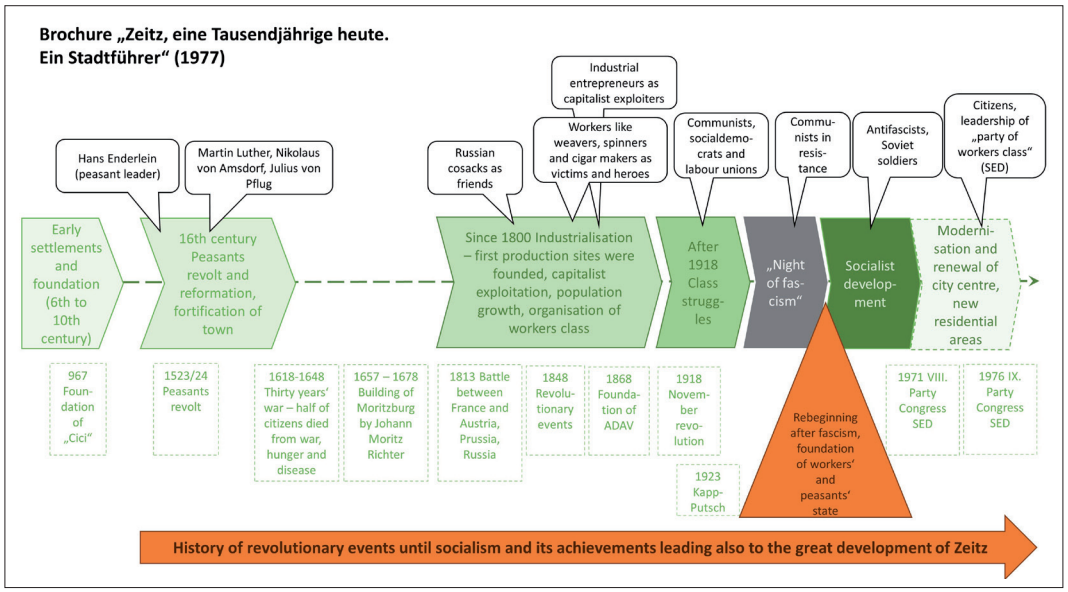

Fig. 4: Storyline in 1977
Source: authors' elaboration based on city guide brochure "Zeitz, eine Tausendjährige heute"

The 'heroes' in this storyline are seldom individual persons. Instead, the "workers" and "peasants' state" appealed to the class identity of peasants and workers and members of socialist and communist organisations. Not even the Duke of Saxony-Zeitz was mentioned (in contrast to the builder of his Moritzburg castle). By demoting the former noble elites and promoting the figure of the builder, the authors presumably aimed to foster a sense of empathy and shared identity within the contemporary working population. A strong emphasis was put on social and economic achievements of the socialist state by promoting stories of a modern industrial economy, turning the inner city into an area of consumption (called "Boulevard") as a symbol of the progress of the socialist state and in building the new housing quarters promising social equality to all workers. In this narrative, Zeitz is portrayed as a new socialist industrial town and administrative centre with a long and interesting history as can be illustrated by the following quotation:

> "Zeitz [...] is not only an interesting old town, but also a modern, new district metropolis [...]" (Rat der Stadt, 1977, p. 32; authors' translation).

But the decay of the inner city was already happening at this time (ZZ_IN_03; ZZ_IN_23). The focus was on the modern city, not on the old buildings, reminiscent of a bourgeois past, although the long history has been used to strengthen the official narrative.

4.2 The story of change and adaptation (the early 1990s)

After German reunification, Zeitz was hit hard by enterprise closures and the restructuring of still existing enterprises, leading to an increase in unemployment numbers, outmigration, and considerable demographic shrinkage. Yet, in the early 1990s, hope still seemed to be evident that successful change could be achieved in an adequate time-period. Large projects had been announced but unfortunately rarely been realised (ZZ_IN_18).

The documents of that time, as for example the marketing brochure "Stadt Zeitz", developed a storyline which emphasised the continuous changes and hard times Zeitz experienced in its long history (see Fig. 5). The first of these changes was the end of the long period as a Bishop's residence, which resulted in the loss of independence of the bishopric Naumburg-Zeitz being set under the administration of the Elector of Saxony. The period as Bishop's residence has been considered as time of growth and prosperity, when trade relations developed and several monasteries and churches still existing today were built. The heroes of this time were, besides the Emperor Otto I. who decided on Zeitz as seat of the Bishopric, the citizens of Zeitz and the clerks. The following period was marked, inter alia, by a time as an independent duchy Saxony-Zeitz (1653–1718), which resulted in the construction of Moritzburg Castle by Duke Moritz and a blossoming local culture.

The second drastic change was the transfer of the territory of Naumburg-Zeitz to Prussia after the Napoleonic Wars in 1815. First critically received by Zeitz's inhabitants, the subsequent period was marked by increasing industrial development and a growth in wealth and population, which is still important today as part of the local narrative (ZZ_IN_01; ZZ_IN_11; ZZ_IN_15). During World War II and the subsequent GDR time, industry remained strong whereas historic buildings had already decayed.

Reunification and the subsequent economic and political changes have been then considered yet another, third change which could be handled with courage, energy and confidence (Zeitz, 1994, p. 7). Yet, from today's perspective one can see that enterprises did already close or struggled heavily and unemployment rates were on the rise. Still, the narrative was nurtured by hope, pointing to the importance of the community and conjuring a "blooming town" (Zeitz, 1994, p. 1), which resonated with Helmut Kohl's metaphor about the "blooming landscapes" in Eastern Germany used in several speeches in the 1990s (Kohl, 1990). These promises were not to hold, however, as the opening to western markets and privatisation destroyed many of the enterprises in the town and especially the public agency that was responsible for privatisation, the Treuhand, is considered today as the villain in this story (ZZ_IN_03; ZZ_IN_11; ZZ_IN_14).

The documents from the 1990s particularly emphasised the historic time periods when Zeitz had a central role either as a bishop's or as a duke's residence, which went along with

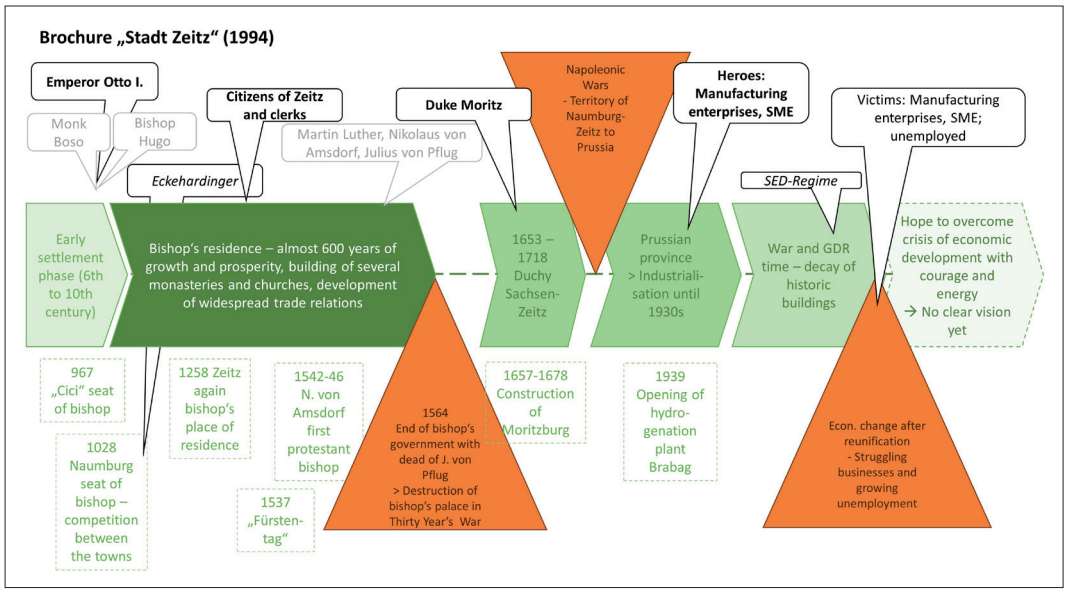

Fig. 5: Storyline in 1994
Source: authors' elaboration based on brochure "Stadt Zeitz"

a certain cultural importance. This is also clear from its quantitative weight, with three quarters of the historically oriented part of the document speaking about this period. It seems that the cultural flourishing of the town during these times could have served as a model for future development, without being very clear about a concrete vision. Zeitz was compared with an "old lady" which will have again a "countenance full of culture" (*kulturvolles Antlitz*) and a certain power (Zeitz, 1994, p. 1). The metaphor of Zeitz as beautiful, but as a shy and neglected lady (even considered as a Sleeping Beauty or Cinderella), has also been conjured recently by our interviewees (ZZ_IN_01, ZZ_IN_18) or in public presentations (SPD Zeitz, 2018).

Further on, its economic and administrative role was emphasised in the documents, the latter, however, being reduced in 1994 by the merger of the counties of Zeitz, Nebra, and Naumburg to the new Burgenlandkreis, with the county seat being in Naumburg. This decision hit the town hard and reanimated the long competition between the two towns, going back to the decision to relocate the seat of the bishopric from Zeitz to Naumburg in 1028 (a decision which at least regarding the place of residence, was revised in 1285). Still today, this rivalry can be witnessed, e.g. in decisions about the closure of administrative authorities in Zeitz, about the hospital with seats in Zeitz and Naumburg, or about cultural sites like the theatre (closed in 2003) (ZZ_IN_03, ZZ_IN_06, ZZ_IN_11). Even the decisions about financing current development measures with money from the current coal funds are scrutinised under the perspective of intermunicipal competition and mistrust towards federal and regional authorities (ZZ_IN_03, ZZ_IN_15).

Economic development, particularly during industrialisation has been mentioned as leading to a diverse economic landscape, but was not at the centre of the narrative. Interviewees also emphasised the great scepticism of the mayor of that time towards external investments, hindering potential development projects like the conversion of a landmark building into a care home (ZZ_IN_01, ZZ_IN_03). Lignite mining, although still present in the region and one of the major job providers, did not appear strong in the researched documents. This may be due to the nature of the documents selected (touristic and marketing documents) but also because the acknowledgement of environmental damages and their devastating impacts on landscapes in East Germany, created by mining and industries in general, led to changes in public attitudes towards lignite exploitation and processing.

4.3 The story of loss and uncertainty (late 1990s – early 2010s)

From the late 1990s until mid-2000s unemployment rates peaked in Zeitz (as in many parts of East Germany). Still at that time, important enterprises like Zemag had to close. Additionally, the relationship between the mayor and its administration on one side and city council on the other side, deteriorated noticeably up to his deselection in 2008, as the interviewees who already were active at that time told us.

In 2002, the first urban development concept of Zeitz was elaborated as a prerequisite for access to the federal funding under *Stadtumbau Ost* (Urban Redevelopment East) (for storyline see Fig. 6). The concept describes the history of Zeitz only briefly and in rather technical terms: important landmarks were mentioned: 967 (the date of first mentioning of the town as a prospective seat of the bishop); Zeitz as a protestant town with the first protestant bishop and the place of Luther's heirs; and the XIXth–XXth century industrialisation and lignite exploitation. The actual and perceived losses of the town, particularly the processes of deindustrialisation (with subsequent losses of many jobs) and depopulation, received most attention in this document, also the reason for the envisaged changes in urban development, namely the deconstruction of prefabricated panel houses in Zeitz-East, a quarter built in GDR times, and the suggested improvement of the inner city area. The main idea was to redevelop a compact town by concentrating on the inner city and dismantling buildings at the outskirts. Following that, almost 3,000 flats have been demolished up to today in Zeitz, albeit not always strictly following the idea of starting at the outer limits of the city but also in the city centre. Still today, the idea is prevalent in the urban planning department where the model of the 15-minute-city is upheld (ZZ_IN_02, ZZ_IN_04).

Not only the urban development concept but also other documents in this period emphasised two main points (e.g. Burgenlandkreis, 1997; Stadtbuchverlag, 2000). First, the need to increase the attractiveness of the town by offering

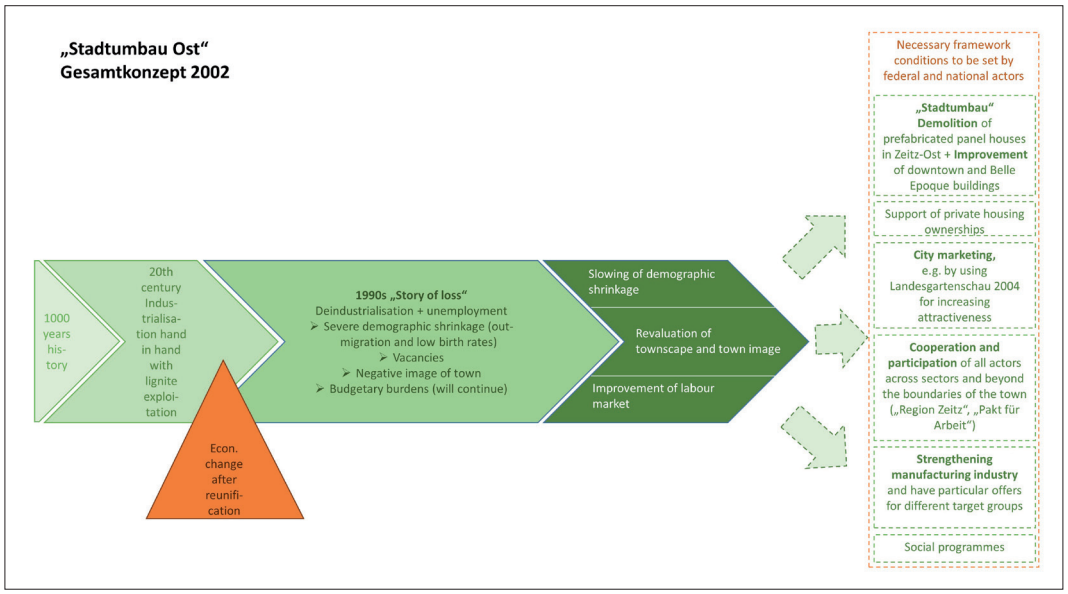

Fig. 6: Storyline in 2002
Source: authors' elaboration based on urban development concept 2002

cultural and touristic amenities in the town and its environs. That would include the lighthouse project of the garden exhibition in 2004. Second, the need to create new jobs in order to curb outmigration and slow down the demographic decline. Some local measures have been carried out in this regard, like the foundation of the "*Pakt für Arbeit*" (Pact for jobs), an association meant to foster development of the labour market, which was meant to assume a central role in economic redevelopment (ZZ_IN_03). Local actors also called for adequate measures by federal, state and national actors, however, to set the necessary framework conditions in terms of infrastructure and business acquisition.

In this way, the town could have become a new node between Saxony, Saxony-Anhalt and Thuringia (Stadtbuchverlag, 2000). Additionally, the need for cooperation across sectors and in the region beyond the territory of the town was very much emphasised, although only partially implemented. The documents of this time also emphasised the need to build a new identity for the town and to give its inhabitants new self-confidence. Also in this regard, the garden exhibition under the title "*Zeit(z)-Reise*" (Travel across time and Zeitz) was deemed to play a crucial role (Stadtbuchverlag, 2000) and is still considered of great significance for the development of the town (ZZ_IN_03, ZZ_IN_08, ZZ_IN_09, ZZ_IN_11). In many of the documents from this period, passive voice and impersonal structures have been prevalent. This is an indication that agency is not foregrounded – rather the feeling that Zeitz is affected by developments beyond its control, a feeling of (self-) victimisation which still today can be witnessed among Zeitz' older population (ZZ_IN_18, ZZ_IN_23).

The "story of loss and uncertainty" was still prevalent in the 2nd urban development concept elaborated in 2009 (see Fig. 7). The search for a new identity still did not end, although three potential main pillars were identified: (1) the still existing industrial function; (2) its historical heritage which was also foregrounded by the title "1,000 years old cathedral and residence town"; and (3) the landscapes of the villages which were incorporated in 2009 and 2010 into the municipal territory. A clear vision, however, was still missing. Instead, the document focused on processes of adaptation to past developments.

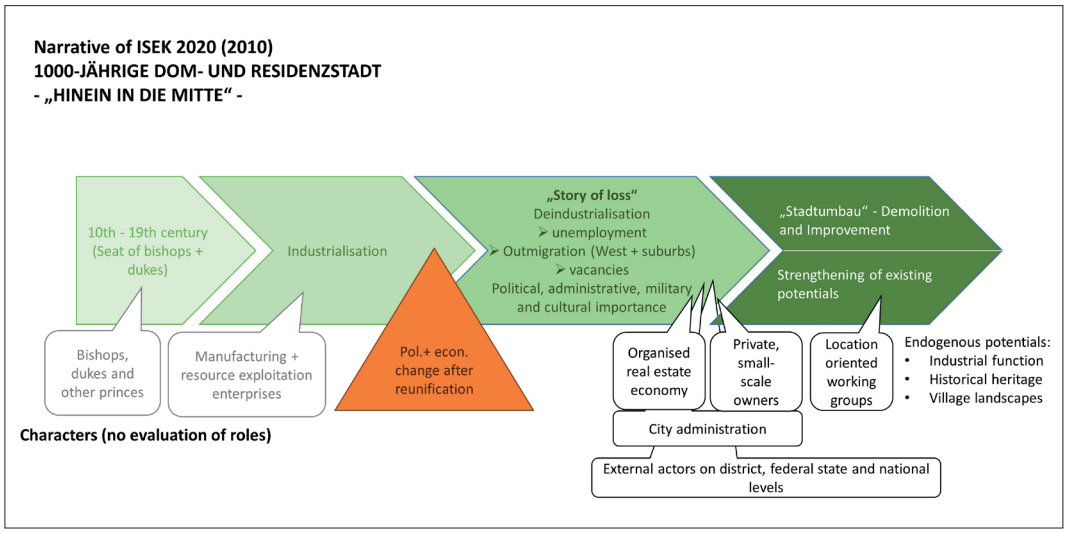

Fig. 7: Storyline in 2010
Source: authors' elaboration based on urban development concept 2010

> "For about two decades, the city of Zeitz has been undergoing a fundamental transformation during which it is striving to develop a new identity. Since it is foreseeable that no single unique selling point will be able to convey the city's future identity, the city's future must be built on multiple pillars. For this purpose, the existing historical reservoirs and the rural peripheral zones should preferably be used alongside the city's remaining industrial function." (City of Zeitz, 2010, p. 56).

Additionally, the imaginary of a compact city, as promoted by the Leipzig Charter, was again taken up by the authors of the urban development concept who were the same as for the first one, aiming to continue the renewal process which started in 2002. This is particularly visible with the subtitle "Into the centre" (Hinein in die Mitte) of the 2010 document. Once again, the main goals were the demolition of mainly prefabricated panel houses on the periphery of Zeitz and an improvement of the inner-city areas with punctual clearance of so-called "junk real estate" (*Schrottimmobilien*) to gain more space in this area. This was meant to go, however, hand in hand with a strengthening of existing economic, historic and leisure potentials. It seems to be no coincidence that in parallel to the development of an "industrial belt" (*Gewerbeband*), the concept speaks also about a "belt of cultural sites in Zeitz" (*Zeitzer Band der Kulturstätten)* and about a "blue belt" (*Blaues Band*) for water tourism measures. Portrayed as relevant actors of the urban development process have been, besides the city administration, big housing cooperatives and private small-scale housing owners, and specific location-oriented working groups, which has been in line with the focus on urban renewal, and, once again, external actors on district, federal state, and national levels, illustrating the town's dependence on external decision making.

4.4 A potential "phoenix from the ashes" story (from 2016 to the future)

While the "story of loss" still has been told by many people up to today (ZZ_IN_03, ZZ_IN_15, ZZ_IN_21), the narrative gradually has changed towards an emphasis of the potentials of the town and the first signs of recovery which became visible at the latest since 2015/16. After the garden exhibition in 2004, two other decisive events in Zeitz have been the election of a new mayor in 2009 and the flooding of 2013. The flooding damaged many buildings along the river (e.g. the railway station and the main building of the former ZEKIWA factory) but also created some opportunities connected to funding for reconstruction and flood prevention measures (ZZ_IN_10). The mayor and the city council seized the opportunity by purchasing the railway station and redeveloping it into a business and service centre, as well as converting the ZEKIWA building into a city archive (restoration of buildings to be finished in 2022). A third event with long-lasting, albeit not immediately visible effects, was the foundation of a culture and education association at the Posa Monastery (Kultur- und Bildungsstätte Kloster Posa e.V) by two former inhabitants of Zeitz and their friends. The association aims at diversifying the cultural landscape of Zeitz, offering events and education programmes for young people, and contributing to a sustainable and participatory local development in the town and the region. During the last decade, they attracted attention of other creative- and culture-oriented actors as well as the media towards Zeitz which in recent times lead also to a change in external perceptions of the town (Eckel, 2021; ZZ_IN_08, ZZ_IN_13, ZZ_IN_20, ZZ_IN). Yet, the above-described developments took time and were not particularly visible until 2017/18, while already in 2016 another new mayor was elected. In the meantime, debates about appropriate measures against climate change gained momentum in Germany, resulting in the decision to exit from coal-based energy production and close all lignite mines by 2038 (in Central Germany by 2035).

This new structural change within the region is seen both as a risk for employment and economic development but also as an opportunity to restructure the local economy and receive the necessary support for local infrastructure and economic development projects. Dilapidated buildings of both industrial and residential use are not only considered as a burden but also an asset that could be rediscovered and revalorised (e.g. ZZ_IN_08, ZZ_IN_11, ZZ_IN_17) (see also Fig. 8). The growing number of tourists (which has grown considerably between 2010 and 2019 – before the COVID19 pandemic, see Tab. 1) and people in creative occupations coming from the wider region and even from Leipzig have been identified as markers for future change. In the third Urban development concept (ISEK 2035, 2020), Zeitz is portrayed as a town offering enough open spaces for experimentation, physically but also ideationally ("Stadt der Freiräume"). By illustrative metaphors and a description of several actors as either heroes (e.g. young creative people) or villains (e.g. media representatives), the concept aims to foster further identification of the residents with their town as the quotation below shows.

> "Particularly older citizens find it difficult to identify with today's Zeitz. [...] However, something has happened in Zeitz for a few years now: an increasing number of tourists discovers the city's treasures and young creative people from the surrounding area – especially from Leipzig – have realised the town's potential and revitale the cultural landscape. They discover open spaces that are awaiting a new utilisation – residential buildings, brownfields and industrial landmarks. Hence, vacancies are not only a great burden, but also a treasure to be recovered. Many young residents are no longer interested in what Zeitz once was, but in what Zeitz one day will become - their home." (City of Zeitz, 2020, p. 1)

The Urban development concept calls for novelty but also refers to the founding myths of the town (see Fig. 9). Being founded as a town of Bishop's residence in the 10th century, it witnessed a first reinvention in the 19th century when it became an industrial town based on energy-intensive industries and mining. Today, it has to reinvent itself again after the 1990 juncture by developing a new, rather complex identity entailing creativity, innovation, and climate consciousness which integrates different storylines of historical and contemporary developments, while at the same time leaving enough space for individuals to elaborate their own stories. Not only the new mayor but also young entrepreneurs and civil society actors are weaving this new narrative, which is not anymore referring to the lost past but to the potentials to become a more liveable city (e.g. ZZ_IN_10; ZZ_IN_12). Storylines are drawn, for example, from innovative entrepreneurs in the 19th century to today's culture and creative industries and other innovative enterprises which the mayor want to attract to the town (own field work documentation; ZZ_IN_11). The designation of certain areas as "areas of change" (Wandelgebiete) and symbolic projects along Rahnestraße may serve as an illustration of the "rise from the ashes" metaphor. In the Rahnestraße, a first development project has been approved

Fig. 8: Facade in Zeitz – part of the urban space gallery showing landmark buildings of Zeitz
Photo: Franziska Görmar

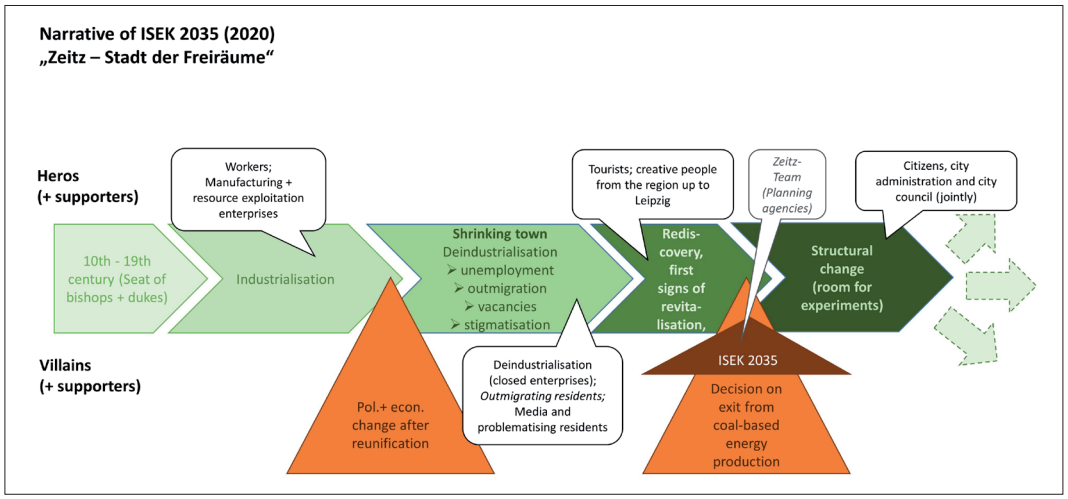

Fig. 9: Storyline in 2020
Source: authors' elaboration based on urban development concept 2020

by the federal and regional governments and a student is developing another building on their own. The change of the perspective towards a liveable future seems to materialise at least partly, which is also noticed by potential in-migrants. At least, in 2020 and 2021, more people moved from Leipzig to Zeitz than vice versa, maybe a first sign for the often-expressed expectation to benefit in future from Leipzig's growth (Stadt Leipzig, 2022).

5. Summary of the narratives and discussion

By looking at the local narratives in Zeitz over time some clear themes can be identified. First, during the past decades, Zeitz has been strongly dependent on external political and economic decisions, such as the GDR government pursuit of energy self-sufficiency, German reunification and subsequent privatisation and deindustrialisation, territorial reforms, funding decisions or the decision to exit carbon energy (followed by the post-2022 doubts).

At the same time, local narratives have been also influenced by local challenges and struggles, e.g. between mayor(s) and the city council resulting in a standstill in local decision making in the 2000s, which could only be overcome after the election of a new mayor.

The dependency on external centres of power is reflected in local development narratives that changed from (self) representation as a modern socialist industrial town to that of a place forced to adapt to unstable environments associated with uncertainty about the future and the feeling of powerlessness. Recently, a vision of an innovative and creative town offering enough space for experimentation has emerged in response to globally prevailing discourses of the creative city (Landry, 2008). We can see that arts and creative industries (including digital technologies) have been posited as transforming forces by external or returning actors, including the association behind the monastery Kloster Posa project, the developer of the arts centre in the former pasta

factory, or the current mayor himself. Yet, the fact that some of them are returnees or plan to settle in Zeitz for a longer time, allows one to think that the narrative will be adopted also by local residents, despite their current scepticism.

At the same time, an emphasis of political strategies of re-industrialisation and the transformation of energy-production has been broadly taken up, when local governments and economic actors aim to develop business districts and engage in bioeconomy or hydrogen strategies as recently discussed in Germany and particularly in mining regions such as Central Germany or Lusatia (ZZ_IN_05, ZZ_IN_11, ZZ_IN_12, ZZ_IN_22). Hence, local narratives take up broader transformative narratives developed in debates for climate action (Hinkel et al., 2020).

Secondly, we can see changes in the emphasis on specific historic events and of specific actors feeding into narratives and imaginaries about the future of both economic development and tourism. While during the GDR times, the focus was on class struggles and reaching socialism, documents in the aftermath of reunification emphasised the residential heritage of bishops and dukes and highlighted both the role of individual elite actors (e.g. an emperor, bishop, duke) but also the power of citizens in the development of the town. Considering the drastic changes of the 1990s, this is not surprising. There has been a long-lasting hope to attract one or more large industrial enterprise(s) as saviour(s) of the town (ZZ_IN_07), while aiming at the same time to valorise the historic heritage and expand touristic development to compensate for the losses. These approaches can be associated to widespread strategies of town embellishment resulting in the famous "blooming landscapes" (in Zeitz, materialised in the form of the garden show) but also to privatisation strategies which were meant to create a second chance for the formerly state-led enterprises in East Germany. Yet, for a couple of years now, different actors (albeit not all) increasingly acknowledge that Zeitz will not be again an "industrial town". Instead restructuring will most likely happen on a small-scale basis, with smaller businesses and innovative experimental approaches which may lead to the emergence of new development paths, e.g. in the creative or digital industries, but also economic diversification in traditional branches of the chemical and food industries, being in line with current rather endogenously oriented place-based approaches to local development.

Against this background, lignite mining was always seen as the precondition for industrial development, but given a greater diversity of economic branches since the 19th century, not particularly emphasised on the local level while it always had a greater importance for the region (Burgenlandkreis, 1997). This has changed just recently when the foreseen closure of the mines and the subsequently expected structural change have brought about new risks but also new opportunities for the local economy and the municipality, e.g. in terms of funding for restructuring and renovation measures. The fear of another "structural break" has been conjured by local and regional politicians alike as a bargaining coin in negotiations about the conditions of the lignite mining closures, placing the development in Zeitz within broader debates about a just transition.

Thirdly, the changing narratives point also towards changes in local identity which have been confirmed by the interviews. In all documents, both physical heritage as well as the industrial past have been considered as potential points of reference for local identity, albeit with different emphasis put on one or the other. Yet, the story of loss symbolised by the still existing ruins threw its shadow over former narratives which had highlighted residents' capacities to adapt to change and actively shape the town's destiny. Today, a more future-oriented narrative has taken up the story of change and reinvention again. Without replacing other narratives, current stories have become more complex. Culture, for example, is not anymore considered only in terms of cultural heritage but includes new storylines of creative entrepreneurship and sustainable development.

Finally, particularly those interviewees coming from the outside emphasised the simultaneity of different storylines integrating both the decay of the past and the departure into the future. Yet, this multiplicity also results in a mental divide between different generational groups of people in the town which needs to be overcome (ZZ_IN_10, ZZ_IN_23). The elaboration process of the current urban development concept carried out by a team of four complementary development offices is here symbolic for the attempt to establish an inclusive narrative jointly elaborated by city administration, politicians, and citizens alike and resonating with the emotions of Zeitz' residents to initiate stronger cooperation on all levels.

Material symbols of these competing narratives are the city centre and especially the rather dilapidated Rahnestraße, which are still places of identity both in a positive as well as a negative sense. The actual development of the last years led to decreasing importance of the city centre, both as residential and shopping area, with the highest share of housing vacancies in this area and a lot of empty shops. Yet, there are first attempts to reverse this development with revitalisation measures from the local government like the railway station, the former ZEKIWA factory or a former clothing store which will be developed into a coworking space. There are also some bottom-up approaches with the Old City library, which is used as an arts house now, and some privately renovated houses (see Fig. 10). The future is still uncertain but there are some first signs that Zeitz might stabilise or even rise again like "phoenix from the ashes".

6. Conclusion

This study contributes to the growing literature on smaller, peripheral, and disadvantaged places that are seen as legitimate sources of knowledge for advancing urban theory beyond the focus on large cities. In a small town, specific narratives and economic processes are often affecting local development as a whole and are hence particularly visible. This applies even more to localities heavily dependent on the mining industry: any changes in market conjuncture or government regulation tend to have a considerable impact on a city's fortunes. The study also attempts to complement our understanding of urban processes by engaging with topics of local narratives and identity. They appear as important as conventional economic factors because they create mental spaces where local narratives are identified, elaborated, and deemed attractive, acceptable, innovative, or otherwise.

This research has been inspired by the observations of economic decline, shrinkage, and emerging new development paths in the town of Zeitz. These processes require explanations, which we have tried to find by exploring changing narratives of local development. Instead of a somewhat static view that suggests that the most powerful actors in the fields of planning, place-making and economic development use narratives about a place's development and spatial imaginaries to frame policy options and promote

Fig. 10: Rahnestraße, house No. 7 will be renovated soon and developed into a multigeneration house
Photos: Franziska Görmar

their interests, we have tried to draw a more complex and dynamic picture where narratives are conceptualised as an element of local identity that forms the time-space specific context of decision-making processes. The continuity of narratives is important, as they exist beyond the current interest of living actors. For instance, socialist era enterprises are long gone but the expectations of a certain format of business-community ties may be still present. Further on, local narratives have the potential to link local discourses to overarching broader discussions, as e.g. debates about transformation and climate action (Hinkel et al., 2020).They show strong interdependencies with prevailing strategies of state and business actors calling for a strategic-relational and multilevel perspective when looking at local development processes (Görmar et al., 2022; Jessop, 2012).

In Zeitz, it is particularly visible how complex the discursive layers of development are, and that imaginaries and narratives create on one hand a frame of expectations where specific decisions can be inserted, while on the other hand they are influenced themselves by local and trans-local events and decisions. The main narratives, in our case that of continuous change and reinvention and that of loss and uncertainty, comprise different storylines that might be competing or mutually exclusive and that actors strategically select to legitimise their actions and evoke emotions in support of them. The same event of a certain period can be elevated or forgotten in the discourse or interpreted in various (novel) ways. We tried to show this by focussing on the changes in local narratives over a period of 50 years and by employing the novel methodological approach of Critical Narrative Analysis. We combined the narrative analysis of urban development and marketing documents with an intertextual analysis of interviews and a broader consideration of the spatial and temporal context, allowing for a more nuanced understanding of local narratives, spatial imaginaries and their co-constituting role in local development.

We argue that current urban debates would benefit from integrating such cultural approaches revealing non-economic motivations and expectations in local development processes (McCann, 2002; Jessop, 2010). The policy process appears as rather complex and embedded in place identity, the latter functioning as a stabilising factor in decision making. Various stories feed into the 'composite' narrative of a place and relate to its 'identity'. Yet, these multiple narratives may change over time, overlap, and contradict each other. Narratives also give legitimacy to development options which open up or are actively created by local actors. Development plans must fit into a narrative's frame to avoid social tension or discontent. In that sense, narratives may be 'pregnant' with future development options. They may also derive, however, from actual development or external ideas and take up new options which have not been considered before, as in the case of the attraction of creative industries. In these cases, it needs time for people to familiarise themselves with such stories, digest, and accept them before they materialise.

For this study, the focus has been on official narratives in publications issued by the city of Zeitz, amended with current interpretations by our interviewees. Yet, there is still further potential in the new approach of Critical Narrative Analysis in examining, for example, how local narratives, e.g. linked to the closure of enterprises and connected social infrastructures but also to emerging new economic opportunities, are connected to biographic narratives, to feelings of belonging, collective and individual experiences of place. It would be worthwhile to look deeper into alternative narratives about future development paths to be taken or about the narratives of minorities and other disadvantaged groups and expand more on their interrelations with overarching meta-narratives.

To summarise, we suggest that narratives about a place's development and derived spatial imaginaries help to explain and make sense of complex situations, especially during recent times. Secondly, the example shows that the development of local narratives is a dynamic policy arena where collective and individual experiences influence each other and create structuring frames for options and actors on multiple scales. Finally, narratives help to construct a coherent imaginary of a place linking the past, present, and the future and feeding into a particular local identity. Hence, local policy and development processes should be considered as relational processes within a broad volatile environment but rooted in the 'stabilising' element of identity.

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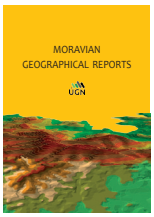
Appendices

Appendix 1: List of analysed documents. Source: authors' compilation

Publishing year	Document	Publisher
1977	Brochure "Zeitz, eine Tausendjährige heute. Ein Stadtführer"	City Council Zeitz
1994	Brochure "Zeitz und seine Region im Süden Sachsen-Anhalts"	Tourist information Zeitz and Landratsamt Zeitz
1994	Brochure "Stadt Zeitz"	NovoPrint VerlagsGmbH (in collaboration with City of Zeitz)
1997	Brochure "Eine Region mit Profil. Der Burgenlandkreis"	District administration Burgenlandkreis
2000	Brochure "Ortsumgehung Zeitz/Theißen. 1. Planungsabschnitt"	Stadtbuchverlag W + I (edited by Straßenbauamt Halle)
2002	"Stadtumbau Ost – Gesamtkonzept" (Urban development concept until 2010)	City of Zeitz (elaborated by architectural office Weber, Gera)
2009	Flächennutzungsplan (Land use plan)	Planungsverband Zeitz und umgebende Gemeinden (Burgenlandkreis) (elaborated by Gesellschaft für Planung und Vermessung mbH, Leipzig)
2010	"1000-jährige Dom- und Residenzstadt. Hinein in die Mitte'" (Urban development concept until 2020)	City of Zeitz (elaborated by architectural office Weber, Gera)
2013	Brochure "Zeitz" with map	Städte-Verlag E. v. Wagner and J. Mitterhuber (in collaboration with City of Zeitz)
2018	Leaflet "Zeitz – Stadt an der Weissen Elster"	City of Zeitz
2018	Brochure "Willkommen in Zeitz. Dom- und Residenzstadt im Burgenlandkreis"	Städte-Verlag E. v. Wagner and J. Mitterhuber (in collaboration with City of Zeitz)
2019	Leitbild für die Stadt Zeitz – 2035 (Mission statement)	City of Zeitz
2020	"Zeitz – Stadt der Freiräume" (Urban development concept until 2035)	City of Zeitz

Appendix 2: List of interviews. Source: authors' compilation

Interview ID	Occupation and Function in town	Date of interview
ZZ_IN_01	Retired; former member of city council, current member of one of the committees	16.07.2020
ZZ_IN_02	City administration – urban planning	21.10.2020
ZZ_IN_03	Coordinator of regional network for metal business, member of city council	21.10.2020
ZZ_IN_04	Member of city council	13.01.2021
ZZ_IN_05	Manager of industrial enterprise	15.02.2021
ZZ_IN_06	Cultural actor, former member of city council	24.03.2021
ZZ_IN_07	Member of city council, mayor of one of the villages	24.03.2021
ZZ_IN_08	Independent project manager in the field of culture	24.03.2021
ZZ_IN_09	City administration – economic development	29.03.2021
ZZ_IN_10	Event manager, member of city council	20.04.2021
ZZ_IN_11	City administration	20.04.2021
ZZ_IN_12	Local entrepreneur	20.04.2021
ZZ_IN_13	Project manager of civil society organisation	23.04.2021
	Freelance project manager of civil society organisation	
ZZ_IN_14	Former member of city administration	28.04.2021
ZZ_IN_15	Public utilities company, member of heritage association, member of city council and district council	28.04.2021
	Member of heritage organisation and village council	
ZZ_IN_16	Federal state Saxony-Anhalt	29.04.2021
ZZ_IN_17	Real estate developer	07.05.2021
ZZ_IN_18	Retired, member of city council, voluntary editor of internet portal about Zeitz	07.05.2021
ZZ_IN_19	Director museum	12.05.2021
ZZ_IN_20	District Burgenlandkreis	18.05.2021
ZZ_IN_21	Entrepreneur, initiator of citizen's initiative	19.05.2021
ZZ_IN_22	Manager of industrial enterprise	26.05.2021
ZZ_IN_23	Urban planner	27.05.2021



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Decarbonising suburbia: Homeowners' perspectives on home retrofits and travel mode shift in Perth, Scotland

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Abstract

Suburban neighbourhoods pose challenges to decarbonisation, due to high car-dependency and relatively large and energy inefficient homes. Home ownership dominates suburbia, thus putting responsibility on households to adopt measures to decarbonise their domestic lives and transportation. This paper examines household perspectives on the feasibility of such measures. We ran a survey and focus groups in Perth (Scotland) during the energy crisis. Whilst we found high levels of concern about climate change, energy costs, and growing engagement with cleaner technologies (e.g. heat pumps), most residents felt decarbonisation options were limited. Barriers like technologies' up-front costs, worsened with the cost of living crisis. Participants had low familiarity with sharing economy approaches like car clubs. Despite high (non-electric) bike ownership and prevalence of storage space (garages), cycling was more perceived as a leisure activity than a regular transport mode. There were shared views that the state should take a stronger role in coordinating and implementing systemic changes required for energy transition, including measures affecting residents directly, like reducing car traffic into the city centre. We conclude that despite the economic privilege of high home and car ownership in suburbia, few felt financially able to decarbonise and most seem locked into high-carbon suburban lifestyles.

Keywords: *Suburban; energy efficiency; mobility; active travel; neighbourhood; Perth*

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1. Introduction

The Paris agreement sets out economy wide decarbonisation by 2050 (UNFCCC, 2015). Achieving these challenging targets will require radical and systemic changes to all sectors where significant amounts of energy are consumed. A quarter of the European Union's greenhouse gas (GHG) emissions are from transport, and road transport accounted for 72% of that proportion in 2019 (EEA, 2022). Buildings are responsible for 36% of the EU's GHGs (European Commission, 2020a), while residential buildings were responsible for 16.8% of total GHGs in Europe in 2014 (Gaglia et al., 2019). Yet, there is considerable scope for these sectors to reduce their carbon emissions through improved mobility services and energy efficiency in the home.

In the global north, the overwhelming majority of the population live in cities, where most of the energy consumption takes place. Literature shows that suburban areas have a greater impact on carbon footprint and GHGs per capita than larger, more densely populated areas (Dodman, 2009; Jones and Kammen, 2011; Jones and Kammen, 2014; Short and Farmer, 2021; Quinio and Rodrigues, 2021). Low- and middle-income countries exhibit higher carbon emissions per capita in urban areas (Grubler et al., 2012; York et al., 2003; Parikh and Shukla, 1995; Poumanyvong and Kaneko, 2010; Zhang et al., 2016; Moran et al., 2018; Liu et al., 2011; In: Munoz, Zwick, and Mirzabaev, 2020) while upper-middle and high-income countries exhibit lower carbon emissions per capita in urban areas (Li and Lin, 2015). Ottelin et al. (2019) analysed household carbon footprints in 25 European Union countries, finding that carbon footprints increase with urbanisation in Eastern Europe but decrease with urbanisation in Western Europe. This phenomenon is created by socio-economic variations between the economically less developed East and the rest of Europe, rather than the degree of urbanisation, which enable higher energy efficient urban areas in Western Europe.

Where suburban areas are more polluting, mobility patterns are the main culprit causing high emissions. Compared to people who reside in city centres, amenities and places of work are further from suburban residents' homes, causing longer travel distances made predominantly by private petrol/diesel cars (Macintyre, Macdonald and Ellaway, 2008; Quinio

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and Rodrigues, 2021). Additionally, suburban homes tend to be larger, less energy efficient and less spatially concentrated (i.e. more stand-alone buildings, surrounded by gardens) (Quinio and Rodrigues, 2021). Therefore, there is high energy consumption for space heating, resulting in high carbon footprints per capita. Due to similar suburban sprawl patterns seen across the global north and considering the pressure of meeting global climate change mitigations target, European cities face a mutual challenge of reducing their urban and semi-urban emissions.

Research on public perceptions of and citizen engagement with low carbon energy technologies (LCETs) for homes and transport, can help to guide innovation and accelerate adoption. Conversely, negative perceptions and lack of engagement may slow the deployment of LCETs (Peterson, Stephens and Wilson, 2015). In the UK, "Energy use at the country level is largely influenced by residential energy use, and therefore, understanding household behaviour can contribute towards improving energy efficiency." (Taneja and Mandys, 2022, p. 1). The aim of this paper is to explore suburban homeowners' perceptions of home retrofitting options and sustainable mobility changes. We undertook a survey and subsequent focus group discussions in a single suburb, rather than a multi-city or national survey. This meant that participants could relate to (and hence we could study) the same place-based (as opposed to generic) challenges and opportunities associated with decarbonising existing homes. There is value in a place-based study as it puts focus on perceptions collected in one council area. Whereas, in a national study, perceptions would be collected from multiple council areas that are implementing various decarbonisation measures. Our geographical case study was the western outer suburb of the city of Perth, Scotland – an area focussing on new build projects providing low carbon living, as opposed to those for existing residents (see for examples, Perth Transport Futures, 2022; Perth West, 2021; and Public Contracts Scotland, 2021). The energy crisis, exacerbated by the Russo-Ukrainian war, has made societies more aware of and engaged with their energy use (Castanho Silva, Wäckerle and Wratil, 2022; Findlay, 2022), thus making our research (in spring 2022) particularly timely and the questions we asked, less abstract.

2. Literature review

2.1 Suburban transport: the European challenge

EU road transport emissions increased by 28% in 1990–2019 (EEA, 2022) and are projected to fall by only 35% by 2050 compared to 1990 levels (EEA, 2022). The 'Sustainable and Smart Mobility Strategy' aims to reduce transport emissions by 90% by 2050, (European Commission, 2020b). This follows the Green Deal funding for sustainable multi-modal urban mobility and clean-transport commitments in the New Leipzig Charter (European Commission, 2022). This strategy highlights actions to achieve sustainable suburban mobility; enhanced affordable high-speed rail, (via the European Rail Traffic Management System) abundant recharging and refuelling infrastructure for zero-emission vehicles, and promoting green active mobility (i.e. non-motorised) (European Commission, 2020b). This strategy acknowledges that additional guidance at local and regional levels alongside public and social acceptance is key.

66% of the European metropolitan population lives in the suburbs of Europe's 99 largest metropolitan areas (Arual Mobility Observatory, 2021). Public transport coverage is lower in European city peripherals than in city centres, with more private vehicles in suburbs (European Court of Auditors, 2020). For example, only 17% of Amsterdam's residents use private vehicles for trips within the city centre while 50% use their private vehicle to travel to and from the city (Eurocities, 2021). Ramos et al. (2019) found that the main barriers to using public transport were problems with buying tickets, low user-friendly interfaces, lateness, infrequency during off-peak hours, uncomfortable, lack of space, unsanitary WCs, poor weather, and private vehicles being more convenient. As car-sharing business models are typically designed for profitability and scalability, there is concern about the geographical scope for car-sharing as there may not be an adequate (local) mass of users (Sarasini and Langeland, 2017). In Greece, a new dockless bike-sharing scheme (DBSS) adequately serves the city centre and suburbs of Rethymno and is affordable (Bakogiannis et al., 2019). However, barriers to using the DBSS are low traffic safety, lack of cycling infrastructure, and physical exertion. In suburban Northern Poland, barriers to using e-bike-sharing schemes include the need to transport children, cost, and distance to docking stations (Bielinski et al., 2020).

2.2 Suburban transport: the UK challenge

In 2019, transport accounted for 27% of the UK's GHG emissions (Department for Transport, 2021). In 2022, Scotland's transport accounts for 36% of its total GHG emissions, 40% of that coming from cars (Green, 2022). Transport emissions are expected to increase due to new housing developments around the UK on greenfield sites on the outskirts of cities and towns which are designed for private car travel (CCC, 2019). These developments will have little or no access to public parking, few amenities, and poor or no walking and cycling routes (CCC, 2019). This is already the case for existing suburban and rural areas in the UK (Macintyre, Macdonald and Ellaway, 2008), resulting in suburban residents relying on private car use, thus increasing their emissions.

Lorenzoni, Nicholson-Cole and Whitmarsh (2007) found that, in three UK studies, many individuals perceived public transport in their area as unavailable and inaccessible. This, alongside the habitual use of private cars, is perceived by the UK public as contributing towards inadequate low-carbon transport adoption. Results from Davis and Whyte's (2020) workshop highlighted that organisational leadership across all sectors, political will, and follow-through action were required for sustainable transport change in Scotland. Additionally, the workshop revealed the need for a budget shift towards active travel, making private car use the most expensive mode of transport, highlighting availability of public transport, integrating car shares with public transport, incentivising businesses to encourage staff to car share, and, making public transport free for all. Alternative bus ownership models were favoured by the workshop with suggestions of returning bus ownership to the state. Davis and Whyte (2020) reviewed the challenges associated with making transport more environmentally sustainable in Scotland. These are: the habitual use of cars; only 3.3% of Scotland's budget for transport being allocated to active travel (i.e. walking or cycling); low availability, accessibility, and affordability of active transport; operational barriers such as slow public consultations and regulation setting; and varying socio-economic statuses. The pandemic has made the situation worse for public transport, leading to low usage and a subsequent fall in revenue (*ibid.*).

The sharing economy offers an important adoption route for LCETs for public use, like bike and electric car-sharing schemes (Gu, 2022; Ma et al., 2018). It allows residents to bypass the barriers of high up-front costs and it reduces their exposure to risks (perceived or observed) of technical problems with new technologies. However, there is evidence that bike-sharing benefits are unevenly distributed across socio-demographic groups (Ricci, 2015). Clark and Curl (2016) found that car- and bike-sharing schemes were located in areas allowing commercial advancement, resulting in most users being white, male, middle classed individuals – an unequal distribution. This suggests that there are tensions between environmental sustainability and social justice. Until economies of scale apply to both, reducing this tension will be a challenge as, ultimately, operators will consider the commercial viability of serving locations which tend to be outside suburban areas. In 2016 in the UK, car-sharing was a marginal activity due to low public awareness and varying attitudes held by policy-makers (Rodrigues, Cooper and Watkins, 2016). Rodrigues, Cooper and Watkins (2016) found that car-sharing was challenging in areas with lower population density in the UK. Kamargianni et al. (2018) found that, in London, car owners and non-car owners favour car-sharing schemes and car clubs over peer-to-peer (P2P) car rental. 20% of car-owners were willing to rent their cars via peer-to-peer (P2P) and willingness increased if they received financial benefits. Younger individuals were more willing to participate in car-sharing schemes.

2.3 Suburban retrofitting in Europe

Over 75% of European buildings are energy inefficient resulting in high energy consumption and high carbon emissions (Zhang et al., 2021). GHG emissions from buildings decreased by 29% between 2005–2019, via the EU decarbonisation strategy enacting electrification in the residential sector, decarbonising the electricity sector and improving building energy efficiency, (EEA, 2021). Despite European countries introducing residential retrofit policies, retrofit rates are still low due to implementation complexity, this is also true internationally (Zhang et al., 2021). Before the current energy crisis, 34 million Europeans could not afford to heat their homes (European Commission, 2020a). Although retrofitting can reduce energy bills and improve resident well-being, the affordability of retrofitting can be a challenge, which the EU seeks to address through policies like the 'Social Climate Fund' and 'Renewed Sustainable Finance Strategy' (European Commission, 2020a). Considering suburban homes are generally larger and less energy efficient, retrofitting is a particular challenge there.

Barriers to residential retrofitting across Europe fall into four categories. Firstly, technical problems – lack of skilled workforce (Galvin and Sunikka-Blank (2013); Weiss, Dunkelberg and Vogelpohl, 2012), poor accessibility to skilled workers (Neuhoff et al., 2011; Sebi et al., 2019), lack of collaboration between differently skilled workers (Galvin and Sunikka-Blank, 2017); and difficulty in identifying which retrofit measures apply to individual properties (Wu et al., 2017). Secondly, financial problems – initial investments are unaffordable (Myhren et al., 2018; Ortiz, Caquero-Modrego and Salom, 2019; Tsoka et al., 2018); there is uncertainty around investment returns (Galvin, 2012), and there is a lack of financial support (Sebi et al., 2019). Thirdly, management problems – tensions can arise between landlords and tenants if the property owner is unwilling to invest in high energy-efficiency retrofits; this means tenants are unable to benefit from lower energy bills and more sustainable living (Lang et al., 2021). The rebound effect is prominent as residents who have retrofitted tend to use more energy due to financial savings, therefore the environmental benefit is not as high as it is claimed to be (Gram-Hanssen, 2014; Lopez et al., 2018). Lastly, lack of knowledge and awareness – residents have limited awareness of and knowledge about energy efficiency and retrofitting causing unwillingness to start (Caputo and Pasetti, 2015; Christensen et al., 2014; Ebrahimigharehbaghi et al., 2022). There is a lack of motivation to learn about the process and go through the upheaval of retrofit (Karytsas and Theodoropoulou, 2014).

2.4 Suburban UK retrofitting

The UK has the oldest and (thus) one of the least energy-efficient housing stocks in Europe (Bennadji et al., 2022; Paddington et al., 2020), a key causal factor of UK homes being responsible for 16% of UK GHGs (UKGBC, 2022). Researchers have examined the impact of UK policies, such as the Green Deal, on retrofitting. The general consensus is that policies are failing to deliver at the pace needed to ensure alignment with climate targets and legal obligations (e.g. the 2008 Climate Act and Carbon Budgets) (Putnam and Brown, 2021). For example, the 'Zero Carbon Homes and Code for Sustainable Homes' policy has been removed (CCC, 2019). The remarkable lack of UK government ambitions to address energy efficiency in the built environment stands in clear contrast with the efforts made by the devolved administration in Scotland (Wade et al., 2022; Webb and van der Horst, 2021), but in general, low carbon housing funding priorities seem to go towards flats, social housing, the fuel poor or towards low carbon new builds thus paying insufficient attention to the housing category of existing owner-occupied suburban homes (Alexander and Gleeson, 2018; Frantál and Dvořák, 2022).

Decarbonising the housing stock requires installing heat pumps, which requires skills (CCC, 2019). However, the instability of UK Government policies has stunted enrolment of skills development in housing design, construction, and heat pump installation (*ibid.*). Policy failure is caused by underdeveloped supply chains, due to a lack of policy support and inconsistent demand caused by retrofitting challenges (CCC, 2019; O'Keeffe, Gilmour and Simpson, 2016). Underdeveloped supply chains create a lack of trust in contractors to install LCETs (O'Keeffe, Gilmour and Simpson, 2016). This concern is accelerated by concern for LCET reliability, outcome quality, and cost-savings, even when there are motivations for retrofitting (Wilson et al., 2015). Fylan et al. (2016) argue that the lack of trust in LCETs is compounded by the existing homogeneity of policies and technologies offered by contractors who rarely consider residents' quality of life. Hansford (2015), Brown et al. (2018), and Lowe and Chiu (2020) argue that contractors and policymakers must view and incentivise houses as a whole system, eradicating the current way of viewing retrofitting; single technology replacements/ instalments. The challenge with this is the complexity of coordinating multiple contractors and technologies to minimise financial and disruption risks (Brown, 2018; Kieft, Harmsen and Hekkert, 2020). Akin to the European context, there is a lack of public awareness and knowledge of retrofitting options, due to ineffective public engagement programmes (Brown et al., 2018; CCC, 2019; Marchand Koh, and Morris, 2015). Also, financing and concerns for disruptive installation challenge retrofitting (CCC, 2019;

Rosenow and Eyre, 2016). An additional barrier is a lack of appropriate modelling tools that do not accurately convey the complexity of potential futures looking towards 2050 (Eames et al., 2014).

Literature reveals systemic challenges of retrofitting homes compound social challenges. Pelenur (2013) described retrofitting barriers similar to Europe: upfront cost; property structure; behaviour (e.g. lack of time, convenience, forgetfulness, and laziness); landlord-tenant associations; inter-occupant opposition; lack of knowledge; and institutional distrust. Pelenur (2013) also found seven motivating factors: saving money; environmental benefits; resource efficiency; comfort; aesthetic; health and safety; and convenience. Williams et al. (2013) presented challenges of retrofitting English suburbs, including the size of the suburban estate, lack of climate change adaptation awareness, lack of finance, and lack of clarity on those responsible for suburban change. Trotta (2018) found barriers to accepting household retrofit in England are credit constraints, lack of information, questioning the rationale of retrofitting, retention of the status quo, heuristic decision making and inconvenience. Trotta (2018) revealed that older individuals, women, and residents of flats are more likely to invest in retrofits than younger individuals, men, and residents of other properties. Furthermore, pro-environmental behaviour did not correlate with investment, suggesting a trade-off between environmental value and cost.

Table 1 summarises the key findings from the 11 existing empirical studies on suburban perceptions of home retrofitting and low-carbon transport that we found. Table 2 provides methodological and case study details of these studies. As these tables illustrate, our paper stands out in addressing both retrofitting and transport. It also adds to the diversity of empirical literature in terms of geography (Scotland) and the smaller case study urban area (Perth).

Authors	Key Findings
Suburban retrofitting	
Williams et al., 2013	Residents believe that comfort, cost and health should be priorities when implementing suburban adaptation measures.
	Damage to homes and degradation of greenspace must not occur.
	Adaptation options are different for different types of suburbs facing different threats; local approach required.
	Both residents and stakeholders were unfamiliar with many adaptation options. Most had basic knowledge on mitigations measures (e.g. solar PVs and insulation).
	Some residents have already implemented changes (e.g. roof insulations, triple/double glazing, and trickle vents) but motivated to do so due to cost savings, not environmental benefits.
	Unacceptable measures: External wall insulation, extended eaves, external render, flood-proof door, flood gate, air brick covers.
	Measures which have mixed perceptions: Solar panels, internal shutters, shaded outdoor space, internal thermal mass, green roof, white roof and walls, blue infrastructure, drought-resistant trees, community cool room, reconfigure street drainage.
	Measures already implemented or will be considered: Solar PVs, double/triple glazing, roof insulation, external solar shading, solar film, lock-open windows, water butt, street trees, shading in green space, energy efficient street lighting.
Mortensen et al., 2014	Energy savings do not motivate homeowners to implement home energy retrofits.
	Financial cost of energy retrofits is often why homeowners do not implement energy retrofits.
	Motivations to retrofit include home comfort and architecture.
	Knowledge of non-energy benefits and consumption increase retrofits, therefore there is a need for a strategy to improve knowledge.
Qui et al., 2014	Urban and suburban homes are less likely to have conducted energy efficiency measures.
	Households' perceived mobility as measured by the probability of moving within five years, can amplify the negative impact of risk aversion on the adoption of energy efficiency retrofitting technologies.
	High upfront cost was a common barrier for the diffusion of efficient technologies.
	There were uncertainties about the benefits an individual can receive from efficient technology adoption.
	Risk aversion has a negative influence on the diffusion of energy efficiency retrofitting.
Sunikka-Blank and Galvin, 2016	Homeowners are reluctant to compromise heritage or aesthetic components of their homes for retrofits.
Tsoka et al., 2018	Installation costs and maintenance, aesthetics, insulation efficiency and risk of wall dampness were significant factor influencing decisions to implement retrofits.
Suburban low-carbon transport	
Ogilvie et al., 2008	Active travel was associated with being younger, living in owner-occupied accommodation, not having to travel a long distance to work and not having access to a car.
	Active travel increased with close proximity to shops.
	Environmental characteristics may have limited influence on active travel in deprived urban populations characterised by a low level of car ownership, in which people may have less capacity for making discretionary travel choices.

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Authors	Key Findings
Suburban low-carbon transport (continued)	
Barton et al., 2012	Places and communities vary to a degree which makes generalisations based on average figures potentially very misleading for any particular locality.
	New suburbs and commuter settlements are generally more car dependent than older suburbs and areas on urban edges.
	Flat areas are less car dependent, and see more walking and cycling than hilly areas.
	Areas with extremely high car use are those with cul de sac layout.
	Areas with highest levels of active travel are those with cell-type or linear layouts.
	Areas with high public transport use are those with better quality public transport services.
	Active travel was perceived as more important for health than for environmental reasons.
	Barriers to walking included high traffic and unsafe streets.
Aldred et al., 2019	The intervention programme in the suburbs have a measurable and positive early impact on active travel uptake and perceptions of the local cycling environment.
Biehl et al., 2019	A barrier to walking and cycling is fear for personal safety.
	Active travel is viewed as conduits of leisure fulfilment rather than a utilitarian activity.
	Public transport is viewed as top priority to meet utilitarian needs of the community as jobs are located outside of the neighbourhood.
	Social status is perceived as a barrier to travel behaviour change; public transport for low social status in Evanston but as utilitarian in Humboldt Park. Cyclists in Evanston are perceived to be 'looking down' on others, while in Humboldt Park, cyclists are 'scoffed' at as it is only seen as leisure. However, participants in both areas express interest in reduced car travel.
	Demonstrates the need to capture individual and neighbourhood level variation in attitudes.
Delgado Jalón et al., 2019	The underground and buses are perceived as expensive and for the 'working class', which prevents middle-upper class individuals from using them.
	The metro is preferred over busses for its speed. However, if the traveller has more time, making the trip for leisure or is elderly, the bus is preferred as it is perceived as more pleasant.
	Public transport is perceived as a healthy option for the city, money saving and time saving as there was difficulty in getting into the city by car and poor parking availability.
	Older people opt to use public transport due to lack of a car or driving licence.
Ramos et al., 2019	Public road transport was, at times, perceived as polluting, being late, and expensive.
	Some prefer private car use for several daily trips due to poor coverage of transport network.
	Perceptions of affordability of public transport vs private car were divided.
	Transit users outside Lisbon municipality mainly use "pollutant", "traffic" and "expensive" to describe road transport.
	For the trains outside Lisbon municipality, the most prominent words are "Hygiene" and "Reliable".
	Public transport usage would increase if the level of service was brought in line with users' expectations.

Tab. 1: Key findings from empirical studies of perceptions of home retrofitting and sustainable transport in suburbia Source: authors' compilation

Fig. 1: A) Case study location in Perth, Scotland. B) Map placing Perth in Scotland. Blue lines indicate Perth and Kinross Council area. Source: authors' compilation

Authors	Study Location	Research Focus	Research Methods
Suburban retrofitting			
Williams et al., 2013	Oxford, Bristol, and Stockport (England)	• To identify a range of adaptation options for different types of suburbs in England • Focusses more on retrofitting than transport • Focusses on both individual home and neighbourhood action	• 3 different models to model the effectiveness of adaptations measures • Data on neighbourhood characteristics gathered from maps, literature, on-site assessments, and home-owner questionnaires • 7 workshops with residents, professionals, and institutional stakeholders to test acceptability of adaptation measures (6–15 people in each, recruited through postal invitation)
Mortensen et al., 2014	Suburbs of Aalborg, Aarhus, Odense, and Copenhagen (Denmark)	• To determine how Danish homeowners can be motivated to conduct energy retrofits	• Questionnaires
Qui et al., 2014	Arizona and California (USA)	• To investigate the relationship between homeowner risk preferences and the decision to improve the energy efficiency of a home	• Online surveys • The multiple price list (MPL) method to elicit and measure homeowner risk preferences
Sunikka-Blank and Galvin, 2016	Cambridge (England)	• To provide new knowledge on the attitudes and motivations of UK homeowners and uncover possible resistances to thermal retrofits	• Interviews with retrofitting owners, many of whom reside in typical suburban homes
Tsoka et al., 2018	Greece, Italy and Spain	• To investigate the public and professional attitudes towards an innovative energy efficient façade refurbishment system, in suburban multi-storey buildings in Mediterranean countries	• Two multiple choice questionnaires.
Suburban low-carbon transport			
Ogilvie et al., 2008	Glasgow (Scotland)	• To examine the contribution of putative personal and environmental correlates of active travel and overall physical activity in deprived urban neighbourhoods in Glasgow, Scotland	• Postal survey
Barton et al., 2012	12 suburbs and exurbs in London, Newcastle, Cambridge and Bristol (England)	• To determine neighbourhood accessibility and active travel to local facilities	• Postal household survey • GIS to locate post code centres • Ordnance Survey Meridian dataset to determine actual trip distances • Focus groups
Aldred et al., 2019	Suburbs in Enfield, Waltham Forest, and Kingston ('mini-Holland' programme area)	• To examine whether and how proximity to active travel interventions is associated with changes in travel behaviour and attitudes	• Longitudinal survey
Biehl et al., 2019	Humboldt Park neighbourhood and suburb of Evanston (Illinois, USA)	• To uncover the local mobility culture, embedded norms and values associated with acceptance of active travel modes in different communities	• Focus groups
Delgado Jalón et al., 2019	Madrid (Spain)	• To study user's perceptions of urban and suburban transport to compare the social value of various means of transport. (Comparison of urban and suburban was not clear)	• Face-to-face survey
Ramos et al., 2019	Suburbs of Lisbon (Portugal)	• To obtain a deeper understanding of attitudes towards public transport and to explore perceptions of the public transport service	• Ethnographic interviews • Focus group discussions • Content and inductive thematic analysis

Tab. 2: Details of the empirical studies mentioned in Table 1. Source: authors' compilation

3. Methodology

3.1 Case study: Perth

Our research took place in the western (outer) suburb of the city of Perth, Scotland (Fig. 1 – see p. 292). Perth is a small but growing city, located almost entirely on the west bank of the river Tay. The city is situated in central Scotland, at a key crossroad of national motorways which separate the city's existing suburbs from planned urban extensions further to the west. With approximately 50 thousand inhabitants, Perth is the only city and largest population centre within the local authority area of Perth and Kinross Council (PKC) which has a total population of 151,910 (National Records of Scotland, 2021).

For our case study, we chose an existing suburban area on the western edge of Perth, some 3–4km travel distance from the city centre. The ring road (A9) borders our case study area on the west side. On the south side our case study area is bordered by a key road running into the centre of town (A93 Glasgow road). PKC staff advised us on locally perceived neighbourhood boundaries on the northern and eastern sides and the prevalence of social versus private sector housing. We were interested in targeting the latter, as we wanted to know what homeowners consider to be relevant and appropriate measures to reduce energy use and lower their energy bills. Google street view and a site visit ensured the properties on selected streets did not vary hugely in age and architectural type; they date mostly from the 1970s and younger (NLS, 1970), and consist of bungalows and two-story houses, mostly detached. Perth and Kinross council area was among seven Scottish local authorities whose levels of extreme fuel poverty were higher than the national average (12%). 18% of Perth and Kinross' population lived in extreme fuel poverty – a result of the average EPC (Energy Performance Certificates) being quite poor, namely F or G (Scottish Government, 2021).

Surveys (summarised in Table 3) were distributed to every second or third home across the neighbourhood. Of the 480 surveys distributed, 120 were completed and sent back to us by post. In addition to the largely quantitative survey, we undertook two focus group sessions with local residents. Whilst quantitative survey data is effective in understanding what participants think about a particular topic, the qualitative nature of focus groups enables greater exploration regarding why participants think as they do (Wilkinson, 1998; Nyumba et al., 2018). Thus, we hypothesised that combining these two methodologies enables greater insight into social issues than would otherwise be possible if either were utilised in isolation.

3.2 Research Methods

In addition to quantitative survey data, qualitative data was obtained with the survey through open-ended questions and the free association method which reflects the "implicit ways of thinking about energy technologies" (Devine-Wright, 2005, p. 10) by eliciting qualitative responses that are not constrained in choice. Responses to association questions were cleaned and homogenised to create a list of semantic associations. Survey respondents' associations were subject to deductive thematic analysis as we were familiar with the data and literature, aligning with Rivas (2012) criterion for deductive analyses. This allows researchers to tailor the analysis based on previous research and theory (Braun and Clarke, 2006). The deductive thematic analysis was guided by the 6 stages of thematic analysis by Braun and Clarke (2006) and Kiger and Varpio (2020). The themes in this analysis were inspired by key external factors that influence successful implementation of cleaner energy technologies. Moreover, successful adoption and diffusion of innovations were often assumed to be merely an issue of securing the techno-economic dimension." (Valet, 2008, p. 8). However, aligned views of various stakeholders (social acceptance) are necessary for successful technology developments (*ibid.*). Additionally, stable political coalitions which are supportive of renewable energies (Van Est, 1999) and strong, early policy support have been discussed as crucial for successful renewable energy development (Krohn, 2002). Valet (2008) advocates for the inclusion of socio-economic factors when considering the deployment of renewables. Research also suggests that environmental awareness and environmental impacts of technology deployment are among the many factors that influence public perceptions of renewable energy (Tsoutsos, 2002). In short, existing literature highlights several influential factors that fall within the following themes: political (e.g. government in support of renewable energies); economic; social; technological; environmental; and legal (policy support), making up the coding framework. The coding framework was ultimately subjected to inter-rater reliability tests (see for example Belur et al. (2018), yielding a 96.2% rater agreement).

Quantitative survey data was analysed in statistical software, SPSS. Frequencies and descriptive statistics provided an overview of the survey population. Subsequently, parametric tests, such as independent t-tests and bivariate correlations, were conducted. Qualitative data was transcribed, coded and analysed. Focus group participants were recruited via a question in the survey asking respondents if they were interested in participating in further research. A total of eight residents participated, four in each group. Both sessions were conducted online via the Zoom platform and lasted approximately 90 minutes each. Thematically, discussions were split into two parts: part one focussed on how Perth can become more sustainable and living sustainably in Perth, whilst part two explored home retrofit and sustainable mobility options. After transcription and anonymisation, high-level themes were identified through thematic analysis (see Braun and Clarke, 2006). Subsequently, tables were created and populated with qualitative data relevant to each of the corresponding themes. Drawing upon this, we were able to weave together a narrative for the identified themes; what local residents think about living sustainably in Perth, home retrofit, sustainable mobility, and why.

4. Results

4.1 Properties

55% of survey respondents lived in detached houses while 26.7% lived in detached bungalows, 11.7% lived in semi-detached houses, and 5% lived in semi-detached bungalows. All survey respondents had the space to park cars on their own property; 81.7% of respondents used both a garage and driveway, and 10.8% used driveways only. 5.8% used garages only. Only one person had no car. We observed that the roads were relatively narrow and public parking spaces were rare. This would make it more challenging to create bike lanes for example.

4.2 Household energy and energy efficiency

The area is served by the national gas grid. 97.5% of survey respondents reported that they used a gas boiler with

Topic	Question
Socio-demographics	Age (eight age brackets), Gender ('male', 'female', 'non-binary', 'other' & 'prefer not to answer').
Household, property and parking type	Length of time lived in home (11-point scale, 5 years each).
	Property type ('detached house', 'detached bungalow', 'semi-detached house', 'semi-detached bungalow').
	Parking ('garage only', 'driveway only, 'on-street only', 'no parking', 'both garage and driveway', 'garage, driveway, and on-street').
	Home ownership ('I own my home', 'I rent my home', 'other').
Energy in the home	Heating system ('gas boiler & central heating', 'gas fire(s)', 'electric heating', 'wood stove', 'other').
	Using more energy during CV19 lockdown, worried about rising energy bills and cost of living crisis. For each, 4-point scale ('yes, a lot', 'somewhat', 'not really', 'not at all').
Energy efficiency and retrofitting perceptions	Satisfied with home insulation ('no', 'yes', 'if no, why not?').
	Invested in energy efficiency ('no', 'yes', 'if yes, what investment?).
	Energy Performance Certificate (EPC).
	Perception of retrofitting options – roof insulation, cavity wall insulation, double/triple glazing, air source heat pump (ASHP), ground source heat pump (GSHP), solar panel (PV), solar water heater (for each, 'I am not sure what this is', 'I have this already', 'I would consider this', 'I would not consider this', 'If you would not consider option, why not?').
	Free associations with "renewable energy for heating your home".
Transport habits and perceptions	Vehicles at household - total number and how many are electric ('car', 'motorbike/scooter', 'bicycle', 'other').
	Regular trips ('work', 'school', 'shopping/groceries', 'sport/recreation', 'other') – approximate distance (miles), frequency (no. of days per week), main and secondary mode of transport ('car', 'bus', 'bike', 'walk', 'car share', 'motorbike/scooter', 'e-bike').
	Perceptions of changes to private petrol/diesel vehicle use:
	Reducing petrol/diesel private vehicle use.
	Getting rid of petrol diesel private vehicle.
	Replacing petrol/diesel private vehicle with an electric vehicle.
	Replacing petrol/diesel private vehicle with bike/electric bike.
	Replacing petrol/diesel private vehicle with car-sharing/bike-sharing scheme.
	Specify conditions for the change.
Environmental action and concern	Partaken in neighbourhood/community environmental activities ('no', 'yes', 'if yes, please specify which activity').
	Take part in future neighbourhood/community environmental activities ('no', 'yes', 'if yes, please specify which activity').
	Concerned or unconcerned about global climate change ('very unconcerned' to 'very concerned': 5-point scale).

Tab. 3: Survey topics and questions
Source: authors' compilation

central heating, 9.2% reported that they used gas fires, 9.2% also used electric heating and 6.7% used wood stoves. The remaining 4.8% reported that they used 'other' systems: the four individuals mentioned solar panels, "solar thermal panel for hot water", an Aga cooker, and coal respectively. Given the climate, a house in Perth would have to be designed to eco-home standard (a rarity in Scotland) in order to be heated alone by roof-mounted solar panels (presumably running a heat pump) or by solar thermal (presumably with thermal storage). Using dirtier and more expensive heating options like coal fires or an Aga (which usually runs on oil) is more frequently found in rural Scotland, beyond the national gas grid.

A majority of survey respondents had used more energy during the COVID-19 lockdown, ranging from a lot (18.3%) to somewhat (42.5%) (Fig. 2). Reflecting back on the autumn of 2021, i.e. before the Russian invasion of Ukraine triggered huge energy price rises, 30% of respondents had been worried about their energy bills (7.5% 'a lot'; 22.5% 'somewhat'). At the time of the survey in spring 2022, with rising energy bills going hand in hand with high inflation and a wider cost of living crisis (COLC), this number has nearly tripled; 45% 'a lot' and 40.8% 'somewhat'. Only 3.3% reported to be 'not at all' concerned, a fivefold drop from the 17.5% in the autumn.

There was a statistically significant correlation between the number of people in households and how worried respondents were about rising energy bills and COLC, albeit weak ($r(117) = -0.214$, $p = 0.019$, two-tailed); as the number of people in the household increased, concern for rising energy bills and COLC also increased. The majority of focus group (FG) participants had already invested in energy efficiency upgrades, notably various forms of insulation and double/triple glazing windows. This aligns with our survey results which found that 65.8% of respondents had invested in energy efficiency upgrades, while 16.7% had not. 65.8%

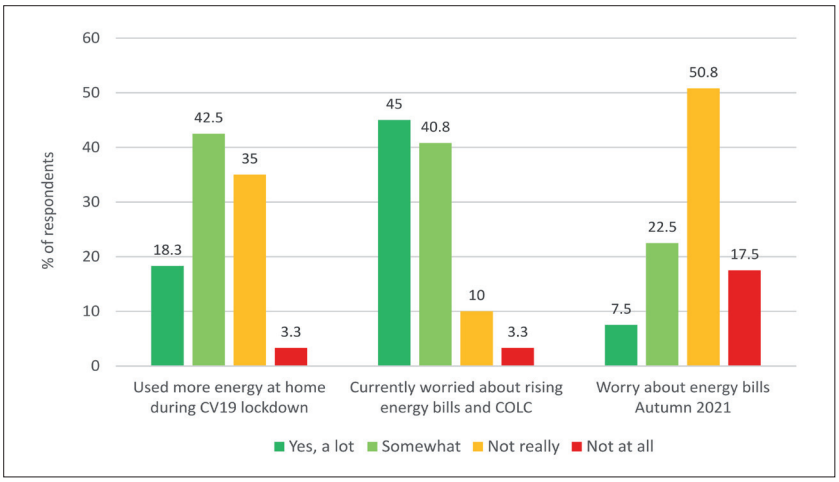

Fig. 2: Levels of concern for energy scenarios for the entire survey population
Source: author's survey

of respondents were happy with their home insulation and 31.7% were not. Table 4 lists the reasons why survey respondents were not happy with their home insulation. Table 5 lists the investments which survey respondents have made to improve their home's energy efficiency. There was no statistically significant difference in the mean level of satisfaction with home insulation between survey respondents who have and have not invested in the energy efficiency of their homes.

4.3 Environmental action and concern

As a proxy indicator of a sympathetic view towards collaborative or collective responses to decarbonisation and energy use reduction, we asked if people had participated in community activities for the common good. 91.7% of survey respondents had never partaken in community activities designed to improve their community's environmental friendliness while only 6.7% had. 65% of survey respondents would not like to partake in future community activities to help their local area become more environmentally friendly, and 27.5% would. Survey results show one focus group participant was somewhat unconcerned about climate change, one was somewhat concerned and the remaining six were very concerned. Only 53% of survey participants were concerned about climate change, a response which seemed unconnected to attitudes about collective local environmental action. A correlation between opinion on partaking in future environmental community activities and age was statistically significant ($N = 120$, $r = -0.199$, $p = 0.029$); older people were less keen. It would make sense to assume that physical fitness plays a key role here.

4.4 Retrofitting

Table 6 shows survey respondents' top 10 associations with "renewable energy for heating your home". This shows that the top 10 associations are dominated by negative economic factors, neutral technological statements, and positive environmental associations. Survey respondents were asked if they would consider various retrofitting options if money was not a barrier (Fig. 3).

One respondent expressed that underfloor insulation would be an additional retrofitting option to consider and one respondent expressed that they would consider wall cladding Respondents were least sure about ASHPs and GSHPs. The retrofit option that was already implemented the most was double/triple glazing. The option which respondents

Reason	No of respondents who expressed reason
Require roof insulation	6
Would like underfloor insulation	5
Would like better insulation	5
Home is cold (despite energy efficiency measures)	5
Require cavity wall insulation	3
Home is still draughty despite energy efficiency measures	3
Require new windows	2
Would like cavity wall insulation but it is not possible	2
Over insulated loft	2
Windows too large	1
Require new doors	1
Lose heat	1
Areas hard to insulate	1

Tab. 4:Reasons why respondents were not happy with their home insulation
Source: authors' survey

Investment	N of respondents who made investment
Loft/roof insulation	41
Double/Triple glazing (upgraded windows)	38
Installed new boiler	21
Installed cavity wall insulation	14
Underfloor insulation	6
Upgraded doors	6
Installed more insulation	3
LED bulbs	3
Smart radiator valves	2
Draught excluders	2
New heating system	1
Installed new radiators	1
Installed solar panels	1
Installed energy efficient lighting	1
Smart meter	1
Smart thermostat	1

Tab. 5: Investments respondents made to improve their home's energy efficiency. Source: authors' survey

Association	N of respondents who expressed same association
Cost/Price	20
Expensive/too expensive/costly	16
Solar/Panels/Solar panels	13
Wind/Turbine/Windfarm	11
Environment/Environmental	9
Cheap/Cheaper	7
Clean/Cleaner	7
Sustainable/Sustainability	6
Eco/Eco-friendly	6
Efficiency	6

Tab. 6: Respondents' associations with "renewable energy for heating your home". Source: authors' survey

would consider the most suitable was solar PVs. The option respondents considered the least suitable for their home was cavity wall insulation. There were several reasons given for why respondents would not consider different retrofit options (Tab. 7). Survey respondents' opinions on different retrofit options were organised based on their property type (see Tab. 8 and Appendix 1). We tested for a correlation between concern for global climate change and consideration of retrofitting options but found nothing significant. Nor were there statistically significant independent t-tests showing differences in the mean level of concern for global climate change among those who would and would not consider each retrofit option.

Focus group (FG) participants' survey responses can be seen in Appendix 2. FG participants mentioned some barriers to replacing their gas boiler central heating system with an ASHP or GSHP, in some cases complimented with a wood stove or gas fire. These included the upfront cost and disruptive installation of heat pump technologies. This aligns with our survey findings (Fig. 3); only 42.5% would consider ASHPs and 39.2% would consider GSHPs. FGs revealed that several residents had recently considered and researched the possibility of replacing gas boilers with heat pumps, only to find out that unaffordable or inappropriate for their property. Another challenge for (FG) participants was getting a qualified engineer out to visit their property in Perth.

Additional concerns regarding heat pumps included: the aesthetics of the equipment in gardens; and noise emitted by heat pumps which could be problematic when installed close to neighbours' bedrooms. One FG participant expressed that heat pump barriers would be significantly diminished if they were already installed and included in the overall price of new build properties. This chimes with the overall consensus of FGs suggesting that the transition to low-carbon heat in homes should be led and enabled by local and national governments. In other words, the idea of relying on individual adoption of cleaner technologies and more sustainable behaviour was challenged; people (who tried to make their individual contributions too) thought that there were structural and infrastructural issues that really had to be addressed at a higher level, with more urgency and vision. Consistent failure by 'the Government' was mentioned by many while trying to avoid political discussions. This is an example of FGs providing additional insight beyond survey responses.

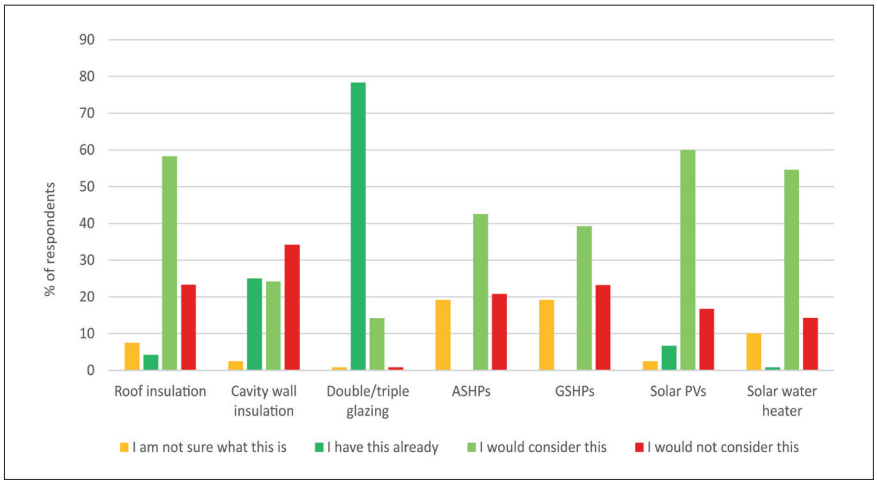

Fig. 3: Percentage of respondents who expressed each opinion about different retrofit options if money was not a barrier Source: authors' survey

Roof insulation	Cavity wall insulation	Double/triple glazing	ASHP	GSHP	Solar PV	Solar water heater
• Cost (1)	• House not suitable (20)	• No reasons given	• Cost (8)	• Cost (7)	• Cost (5)	• Cost (5)
• Not worth the hassle (1)	• Cavity is there for a reason (2)		• Recent new boiler (2)	• Not enough ground space (5)	• If problem with roof, may be a barrier (2)	• Too much change and hassle at my age (1)
	• Cost (1)		• Insufficient knowledge (1)	• Too much hassle at my age (1)	• Too much change and hassle at my age (1)	• Wrong climate (1)
	• No benefit to my house (1)		• Yet to be convinced (1)	• Concern regarding the longevity (1)	• Wrong climate (1)	
	• Not worth the hassle (1)		• Too noisy (1)	• Don't understand system (1)	• No south facing roof (1)	
	• Concerned about damp bridging (1)		• Not suitable to make home really warm (1)	• Not suitable to make home really warm (1)	• Ugly on roofs (1)	
	• Bad reviews about it (1)			• House not suitable (1)	• Not effective (1)	

Tab. 7: Reasons why retrofit options were not considered (N of respondents who said reason)
Source: authors' survey

Retrofit option	Property type least knowledgeable on retrofit option	Property type which owns the most of retrofit option	Property type which would consider retrofit option the most	Property type which would least consider retrofit option
Roof insulation	Detached bungalows	Detached bungalows	Semi-detached bungalows	Detached houses
Cavity wall insulation	Detached bungalows	Semi-detached houses	Detached houses	Semi-detached bungalows
Double / triple glazing	Detached bungalows	Detached bungalows	Semi-detached bungalows	Detached houses
ASHP	Semi-detached houses & detached houses	No respondents own	Detached houses	Semi-detached bungalows
GSHP	Detached houses	No respondents own	Detached houses	Detached bungalows
Solar PV	Semi-detached bungalows	Semi-detached houses	Detached houses	Semi-detached bungalows
Solar water heater	Detached bungalows	Detached houses	Detached houses	Semi-detached bungalows

Tab. 8: Property types which are the least knowledgeable of retrofit options, own the most of each retrofit option, would consider and would not consider each retrofit option the most
Source: authors' survey

FG participants were more technologically knowledgeable than we anticipated; many knew about heat pumps and had clearly researched them prior to the FG. In subsequent FG discussions, we confirmed that, currently, heat pumps are significantly more expensive to purchase, install, and operate than gas boilers. Perceptions of these negatives, unsurprisingly, outweighed the positive perceptions, i.e. carbon emission reductions. Despite having some technological knowledge, residents were unaware of organisations that provide free information regarding grants and interest-free loans (e.g. Energy Saving Trust). Finally, FG participants indicated an interest in Peer-to-Peer energy trading (e.g. by selling or gifting energy generated through Solar PV/Battery Energy Storage Systems (BESS) to neighbours), which could be an avenue for further research.

4.5 Vehicles Owned

As expected in suburbia, car ownership was ubiquitous. 51.7% of households had one car, 33.3% had two cars and 5.9% had more. Only 7.3% of cars were electric. To compare, 3.3% of cars in the UK were electric, including plug-in hybrids, in 2020 (Pickett et al., 2021). Three survey participants had camper vans and two participants had a scooter or motorbike. In addition, bike ownership turned out to be fairly common; a third of households had multiple bikes and a further 10% had a single bike. 9.6% of bikes were electric.

4.6 Regular Trips

To gather data on the survey respondents' use of transport, we asked them about regular trips made by each member of their household (Tab. 9). The trip made most among the 249 individuals living in the 120 respondent households was for shopping/food groceries. Overall, the mean distance travelled for regular trips made by the 249 individuals was 18.7 miles (30.01 km), the median was 4 miles (6.4 km), and the mode was 2 miles (3.2 km). The mean number of days per week travelled for all regular trips was 2.7 days, the median was 2 days, and the mode was 1 day. The modal average primary mode of transport for all regular trips was private car. The modal average secondary mode of transport was the bus. Table 9 shows dependence on private cars for all trips, aligning with UK and European literature on suburban mobility.

See Table 10 for the distance travelled to work in PKC, according to the 2011 census data (National Records of Scotland, 2011). In Perth and Kinross, 26.2% of journeys to work and place of study were less than 2 km, of these, 66.6% of journeys involve active travel methods. 45.6% of journeys to work or place of study were less than 5 km, of these, 41.7% were taken by car or van (PKC, 2018). 21% of the Perth and Kinross population do not have access to a car or van (PKC, 2018).

4.7 Petrol/Diesel private vehicle use change

See Figure 4 for the percentage of survey respondents who would consider different changes in their private petrol/diesel vehicle use. Survey respondents had the opportunity to share any conditions required for them to consider the changes. The conditions mentioned, followed by the number of respondents who mentioned them, are: conditions regarding the cost and affordability of EVs and EV charging (21), conditions regarding EV charging infrastructure accessibility (8); conditions regarding the technology of EVs (6); and conditions regarding convenience (i.e. more bus routes required around Perth not in and out of Perth, current car not needing to be replaced) (6). Respondents also shared comments/opinions related to changing their private petrol/diesel vehicle use, which give further insight into public perception of transport changes. There were six comments related to lifestyle convenience, for

Purpose of trip made	N (%) of individuals who made this trip	Mean distance travelled for this trip (miles)	Mean N of days per week travelled	Dominant (modal average) primary mode of transport	Dominant (modal average) secondary mode of transport
Shopping/Groceries	109 (43.8%)	4.18	2	Private car	Bus
Sport/Recreation	101 (40.6%)	17.1	2.4	Private car	Bus
Work	62 (24.9%)	48.05	1.5	Private car	Private car
School	22 (8.8%)	1.5	4	On foot	On foot
Caring duties	9 (3.6%)	58.4	2.7	Private car	N/A
Unknown activities	4 (1.6%)	19.5	1.5	Private car	N/A
Church	2 (0.8%)	6	1.5	Private car and bus	On foot and private car
Family visits	2 (0.8%)	17.5	1.5	Private car	N/A
Volunteering	2 (0.8%)	45	3	Private car	Bicycle
Doctor/Dentist	1 (0.4%)	2	1	Bus	Private car
Miscellaneous activities	1 (0.4%)	6	1	Private car	bus

Tab. 9: Regular trips made by respondents and individuals they lived with
Source: authors' survey

	Work from home	Distance [km]							
		0–2	2–5	5–10	10–20	20–30	30–40	40–60	>60	Other
% of PKC employed population	14.5	19.6	15.2	9.5	11	9.3	4	3.3	2.8	10.8

Tab. 10: Distance travelled to work in Perth and Kinross council area
Source: National Records of Scotland (2011)

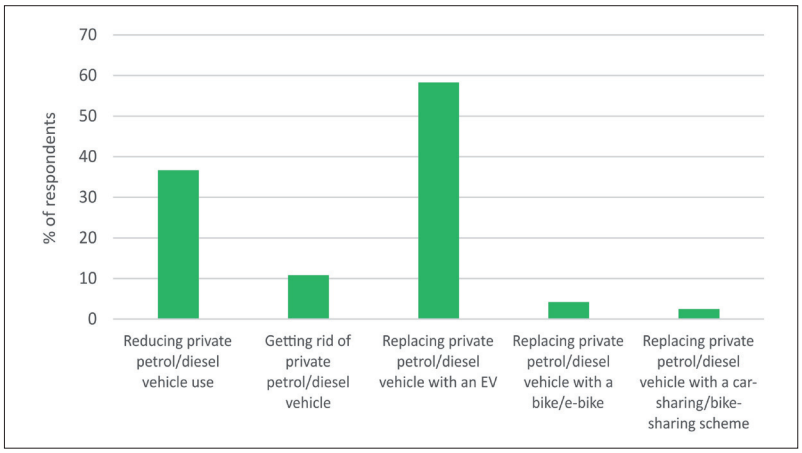

Fig. 4: Percentage of respondents who would consider reducing or ending their use of a private petrol/diesel car
Source: authors' survey

example, "this is my last car" and "rail network inadequate". There were also three comments related to cost, for example, "public transport is too expensive" and "would like to buy an EV but can't afford" (see Appendix 3 for full list of conditions and comments).

The most preferential mobility change among FG participants was the replacement of their petrol/diesel private vehicle with an EV. However, for many, obtaining an EV was financially prohibitive. This demonstrates that openness to transition is influenced by on-the-ground contexts. Nevertheless, several FG participants suggested that they would make the transition to EV ownership if and when prices come down. These findings align with our survey findings. It should be noted that two FG participants owned EVs, one of whom was considering reverting back to a petrol/diesel vehicle due to a change in circumstances related to his parking habits in Edinburgh or Glasgow, and commuting habits to the Far North and West Highlands where charging availability is scare.

The general consensus in both FG discussions was that the steep local landscape made cycling locally not ideal. Upon the researchers asking if e-bikes would lessen this challenge, participants were sceptical. However, many were intrigued by the experience of a fellow participant who owned an e-bike finding it greatly helpful in navigating the steep local landscape.

Several FG participants suggested that cycling into Perth's centre was dangerous and undesirable. One participant noted a painful accident that he was recently involved in whilst cycling that route. FG participants suggested that the city centre was not conducive to cycling and that the Scottish weather was also prohibitive. It became clear that FG participants desired a retrofit of Perth's cycling system to improve the safety and desirability of cycling. However, they expressed that this could increase congestion which they feel is bad enough.

One FG participant expressed that cycling safety issues are national, rather than solely local issues. At this point of the FG, an international comparison was drawn between the UK, where few people cycle and where the onus is on cyclists to make themselves more visible (hi-vis clothing) and protect themselves (helmets) *vis-à-vis* countries where cycling is far more common and popular, benefitting from an integrated cycling infrastructure that physically separates cycle lanes from the road space used by cars. This could be a contributing factor leading to the FG participants' perceptions of cycling being primarily a leisure activity, as opposed to a mobility option.

Car clubs were presented to FG participants hypothetically as this provision is currently unavailable in Perth (to the best of our knowledge and that of FG participants). Participants were interested but concerned about the extent to which they would actually use such a service; for example, one resident cited care duties which mean that they need access to a vehicle at all times. In addition, this line of investigation may have been somewhat hampered by the fact that only 25% of the FG participants owned a second car: in the research design, we hypothesised that the replacement of a second private petrol/diesel vehicle with car club membership may be an attractive, sustainable, and relatively affordable change to mobility habits (survey results found that 39.2% of respondents had more than one private car at their household). Nevertheless, and notwithstanding the above concerns, the level of initial interest shown by residents suggests that this could constitute a topic worthy of additional investigation.

Most of the FG participants perceived public transport as unattractive due to it being not great value for money, elongated routes, not enough routes (especially to parts of the wider city), and infrequent services, similar to findings from European studies in the literature review. COVID-19 was suggested as a contributing factor to this perception, not the root cause. For one FG participant, improved public transport was a must; the displacement of combustion engine vehicles with EVs was perceived negatively due to the fact that it will not get cars off the road. Survey responses also suggested that public transport provision is not currently attractive enough to residents, referring to costs, and to the convenience of car use. FG discussions revealed that the one bus route through the neighbourhood had changed during the pandemic and it now took much longer to get into the city centre.

Regarding active travel, several FG participants indicated that they walk regularly and that this can sometimes be just as quick as the bus. However, walking, like other forms of active travel (e.g. bicycle; e-bike), was deemed inappropriate for many situations and is therefore unlikely to constitute a full replacement of private vehicle use. For example, one FG participant stated that she is always carrying bags and that walking or cycling everywhere is therefore unfeasible; this point was also highlighted as an additional comment in a survey response.

5. Discussion

The focus groups were demographically and responsively very similar. Focus group and survey results were very well aligned, despite FG participants having the advantage over survey respondents of in-depth discussions amongst themselves. Our findings generally confirmed that suburban homeowners by and large engage with energy concerns and have improved their homes' energy efficiency, but that they do not feel they can take that much further due to lack of finance. Results suggest this is largely because they are worried about the cost of living crisis and energy bills.

Many people also report that they would be interested in switching to EVs and there is evidence to suggest that they appreciate that the energy transition is likely to imply systemic challenges that may affect them. The example of reducing car traffic in the centre of Perth suggests that residents are not selfish individuals but that they recognise and value efforts to revitalise their city centre. From the FG discussions emerged a clear recognition that the state should lead and do more to help unlock further action by residents.

Our findings are broadly consistent with pre-existing literature regarding various barriers to decarbonisation and to reducing energy use in everyday life, including the barrier of up-front cost, concerns about household disruptions which may limit retrofit options, and the convenience factor of private cars. Adoption of technologies is predicated on a conducive context and is different to a willingness to transition in principle. Therefore, upfront cost being expressed by FG participants as a barrier to replacing gas boilers with ASHPs and GSHPs, for example, could be interpreted as suggesting a lack of "willingness to pay", or rather, an inability to afford such technologies, suggesting the need for policy mechanisms. Some findings were perhaps slightly more surprising, like the relatively low levels of climate change concern (just over half our respondents – versus national surveys which tend to show that 75–80% of the population is concerned about climate change (Boyes et al., 2014; Office for National Statistics, 2021) and the relatively high ownership of bikes. Since we cannot assume that Perth West residents are in all respects representative of suburban residents across Scotland, and given the likelihood of selection bias in survey respondents, we cannot draw broader conclusions from such potential anomalies. However, our data is novel to the area and Scotland, thus providing meaningful contextual understanding for implementing decarbonisation policies in suburban Perth. Our study also seems to be the first that addresses suburban home retrofitting and mobility simultaneously. It is also worth noting that in the current economic and political context, a reported low concern about climate change (or the environment more broadly) can still go hand in hand with strong support for renewables, as these are domestically produced (energy security) and cheaper than oil and gas at the time of writing. However, both the specific timing of the research, i.e. the current energy crisis and cost of living crisis, and the specific setting in suburbia, open up some avenues for further discussion.

It is clear that residents were more concerned about energy costs at the time of study than they were before. It was noticeable that people were not only concerned but arguably also more knowledgeable about some of the material investment options available to them than anticipated, including for example the price of EVs and the suitability of heat pumps. This focus on the costs of energy and interest in low-carbon technologies should make it easier for government to engage citizens in the future and provide new policy support to reduce energy waste and adopt lower-carbon behaviours and technologies.

We also observed some areas where the knowledge of residents was less clear, or largely absent. Knowledge of the exact current state of their home's insulation provides an example of the former. Examples of the latter include a lack of experience with e-bikes and lack of knowledge of more collective approaches to adopting cleaner technologies (EV car clubs; peer-to-peer energy trading). This potentially limits resident interest and subsequent uptake. Again, there are policy lessons to be gleaned from this; where more collective decarbonisation approaches make engineering and/or business sense, there will be a need to increase awareness amongst members of the public, before a more proactive and dynamic engagement could take place to locally tailor and implement such approaches. Dual concern for home energy bills and cost and convenience of sustainable mobility suggest a need for policies which address both simultaneously.

Recommendations to avoid carbon lock-in and leaving behind suburban residents in the energy transition include allocation of regulation and responsibility. For example, issues concerning distributional justice could be alleviated by each nation and member state having a regulatory and governing body responsible for climate change mitigation and adaptation in suburban areas which address low-income households. Such pro-justice policy monitoring frameworks would prioritise schemes, such as bike-/e-bike-sharing, car-sharing, and high-quality public transport, located not only in wealthier areas. Incentives and discounts could be applied; discounts for EVs, bikes/e-bikes, rail, and bus passes if one invests in retrofitting (and vice versa to varying degrees) or discount off one retrofit if you invest in another. Additionally, councils, policy-makers, industry experts, and educators could collectively host community engagement, education, and experience-sharing programmes/events (in town halls, available online). Such programmes could combat industry distrust and increase awareness of the effectiveness of retrofitting and sustainable mobility.

We recognise that in practice, the implementation of local collective approaches is complicated by the dire financial state of local authorities in the UK, as well as by the need for adoption at scale. It can be argued that such approaches should be much easier to design and implement in newly built neighbourhoods than retrofitted into existing neighbourhoods where the physical infrastructure will need to be adapted and where enough existing residents would have to adopt such measures. If and when these measures are well established (demonstrated to the public that they are) and successfully operating in a new housing development, they could be gradually scaled up (and retrofitted) into adjacent, older neighbourhoods. It is of vital environmental and social importance that low carbon greenfield developments are not designed and managed in geographical isolation, but that they act as catalysts and enablers for adjacent older neighbourhoods to decarbonise in a just manner.

Regarding existing physical infrastructure, our case study neighbourhood represents a typical suburban mix of older streets with straight rows of bungalows, and newer developments of houses clustered around short and bendy dead-end roads (cul de sacs). Most homes have sizable gardens on the sides and (especially) the back, and a lot of the privately owned space is dedicated to the car; large paved-up forecourts and garages, most of which are not actually used for parking the car these days. In principle, there would seem

to be plenty of space for homeowners to accommodate PV panels, heat pumps, EV charging points, EV bike storage etc. However, FG participants having difficulty to get a qualified engineer to visit their property suggests a need to develop local supply and maintenance chains if significant roll-out of heat pumps is to occur. This aligns with the literature review on weak UK policies and supply chains. Additionally, as cycling safety issues were expressed, there is an opportunity to improve cycle routes to be used by both incoming and existing residents. It is feasible that improved cycle routes would improve perceptions of cycling as a regular suburban and urban transport mode. Moreover, improved connectivity to the town centre could alleviate fears that new retail developments on the outskirts of town will displace the (already struggling) high street. However, the public roads seem to be too narrow for retrofitting bike lanes, or for making space for bus lanes and bays or for public parking places with EV charging points. It may require some clever engineering, physically and politically, to 'free up' a mixture of public and private space to retrofit a more sustainable infrastructure for active, public or shared transport.

Finally, in terms of transitions, it is important to recognise that demography matters. Within the survey, we were unable to account for the full extent to which answers were 'coloured' by people's life phase. The FG discussions made it clear that some options are not suited for people who have children they have to taxi around, or who are carers, or who are facing age-related health concerns themselves, or are living on a pension and expect their purchasing power to diminish over time. Many elderly people are property-rich but cash poor. They are emotionally attached to their home and thus reluctant to sell their house (Kerbler, Sendi and Filipovičhrast, 2017; Pani-Harreman et al., 2020) that often becomes too expensive to heat (Longhurst and Hargreaves, 2019; Xin, 2021). Even if they can finance it, they may not think it worthwhile to have disruptive retrofits or to accept long payback times. As everywhere in the global north, ageing (and 'ageing well') presents an immense societal challenge, and our study illustrates some of the ways in which it intersects with the challenges of low carbon transitions. There is clearly scope for additional research and innovation with respect to this nexus.

6. Conclusions

In terms of reducing energy use in daily life, people living in more densely populated urban areas in Europe have the benefit of access to well-developed public transport networks and short travel distances which enable active travel. These people are also more likely to live in flats, which require less energy to heat, and are easier to retrofit at scale. At the other end of the spectrum, living in rural areas will often come with higher energy footprints due to transport needs, but for domestic energy use and increasingly for (electric) mobility, there is often scope for developing and utilising local renewables. By comparison, decarbonising suburban areas can be particularly challenging because larger privately owned, individual homes predominate and for transport needs, residents are highly dependent on their cars.

The findings from our work suggest that many suburban residents are very concerned about energy costs. They are engaged with their energy use but feel that their individual options are rather limited to reduce their energy use and carbon emissions in a feasible way. First, they observe that some material interventions are not suitable for their current travel needs or for their home (e.g. property structure unsuitable for cavity wall insulation), and that other options are currently not affordable due to the high up-front cost or cannot be utilised due to or lack wider infrastructure (for example EV charging). It is very clear that decarbonising suburbs cannot be realistically portrayed as a job that is best left to individual households, acting as proactive and autonomous agents of change. We did not find evidence to suggest that local suburb residents are resistant to state interventions for the common good. Despite their somewhat privileged socio-economic position as homeowners and vehicle owners, residents of suburbia can also be seen as being trapped by their own material possessions with the package deal of suburban house and car, acting to lock people into a higher carbon lifestyle, with spiralling costs during this energy crisis.

Whilst there is a growing interest in, and literature about, living off-grid, developing community energy and embracing energy democracy, this does not reflect the daily reality of the majority of the population who live in and around cities. Engaging with suburban citizens in Perth has illustrated, yet again, that there is a key role for (national and local) government to play in facilitating and coordinating interventions that can unlock a more proactive role of citizens; individually and collectively. The cost of living crisis, energy crisis, the unprecedented calls to cut gas demand this coming winter by 15% (European Council, 2022), and the big current state interventions to help people pay their energy bills, altogether conspire to create a uniquely powerful need and opportunity for the state to step up and provide leadership. As we have seen with the pandemic (Eurostat, 2022), there is a risk of returning to business as usual if and when Russian gas supplies to Europe are restored. The challenge for researchers is to determine and advise government and other key stakeholders on how responses to the energy crisis can be designed and implemented in such a way that they deliver deep and permanent cuts to the use of fossil fuels. If we do this well, it will almost certainly also bring substantive and systemic changes to suburbia as we knew it. We also conclude that there is value in discussing home retrofitting and personal transport in conjunction as they are the highest emitters in civil society and regard the affordability of two key components of life – living comfortably in your home and commuting to nearby places and people. Our contribution, therefore, opens lines of a joint inquiry into transport and retrofitting in the suburban context which could help various stakeholders, especially policymakers and residents, to better understand how suburbia and their situated lives can be decarbonised in a socially just manner.

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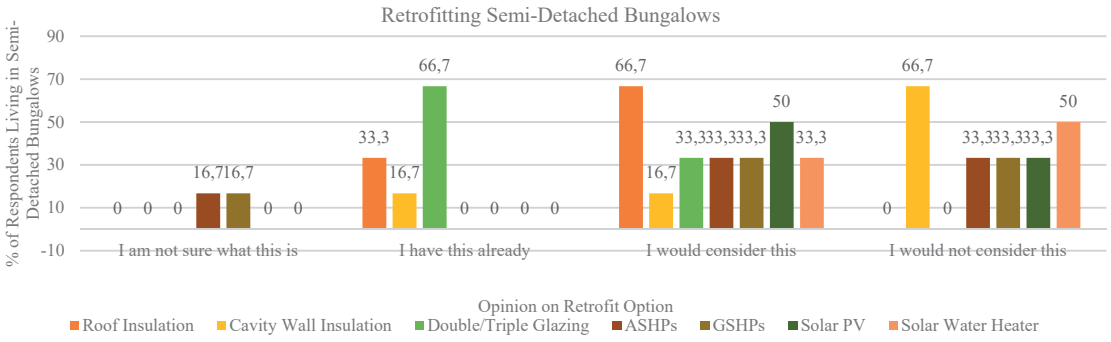
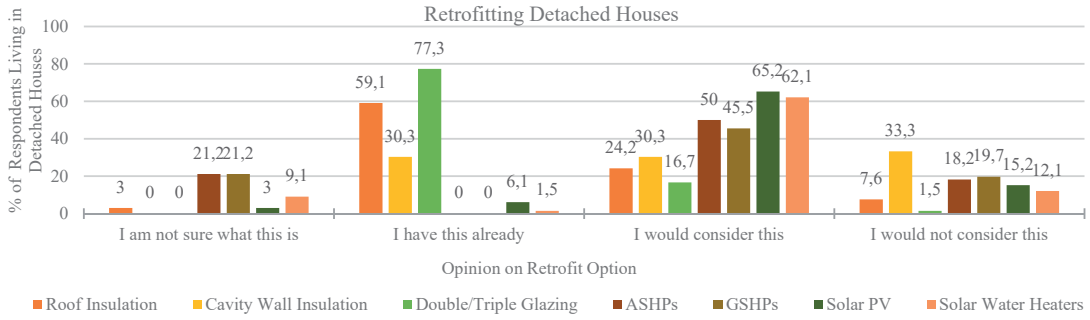
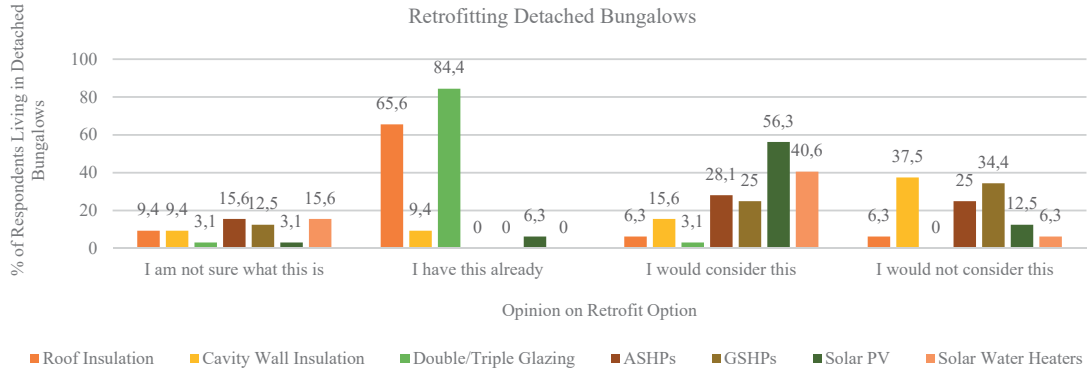
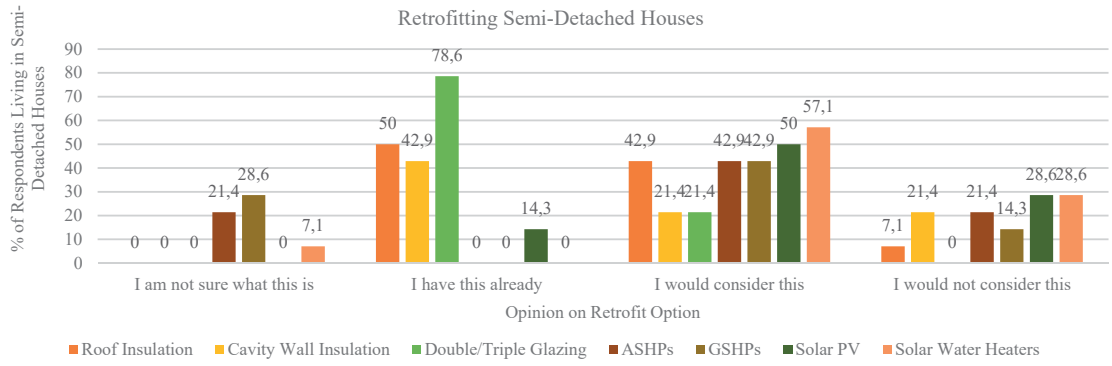
Appendices

Appendix 1 – Property types which are the least knowledgeable of retrofit options, own the most of each retrofit option, and would consider and would not consider each retrofit option









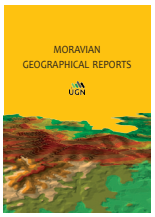
Appendix 2: Focus group participants' key survey responses

Focus Group Participant	No. of residents in home	Heating system	Worried about cost of living crisis	Satisfied with insulation	Energy efficiency investments	RE heat (would consider)	Type of vehicle	Number of drivers	Cut down vehicle use?	CC concern
FOCUS GROUP 1										
1	2	Gas Boiler & Central Heating	Yes, a lot	Yes	roof insulation; double glazing	ASHP, Solar PV, Solar WH	1 x EV	1	n/a, has EV	Somewhat unconcerned
2	2	Gas Boiler & Central Heating	Not really	Yes	loft insulation; double/ triple glazing	ASHP, Solar PV, Solar WH	2 x cars 5 x bicycles	2	Would consider getting rid for public transport	Somewhat concerned
3	2	Gas Boiler & Central Heating Wood Stove	Yes, a lot	No, attic insulation difficult to implement	Cavity wall; double/ triple glazing	Roof insulation; ASHP, Solar PV, Solar WH	1 x car 3 x bicycles	2	Would consider reducing & getting rid (but needs to tow caravan?)	Very concerned
4	2	Gas Boiler & Central Heating	Yes, a lot	Yes	loft insulation; double/ triple glazing	Cavity wall; ASHP; GSHP; Solar PV; Solar WH	1 x car	2	Would consider replacing with EV	Very concerned
FOCUS GROUP 2										
1	1	Gas boiler/ central heating	Not really	Yes	Draught excluders, double/ triple glazing	ASHP; GSHP; Solar PV; Solar WH	2 x bicycle	1	n/a	Very concerned
2	2	Gas boiler/ central heating; gas fire	Yes, a lot	No	Loft insulation, double glazing, energy efficient lights	ASHP; GSHP; Solar PV; Solar WH; Cavity wall	2 x cars 2 x bicycles	n/a	"Reducing petrol/ diesel vehicle use; Replacing with EV; Getting rid altogether"	Very concerned
3	4	Gas boiler/ central heating; Wood stove	Yes, a lot	No	Double glazing, new (more efficient boiler), loft insulation	ASHP; GSHP; Solar PV; Solar WH	"1 x car 1 x camper van"	2	"Reducing petrol/ diesel vehicle use; Replacing with EV; Replacing with EB"	Very concerned
4	4	Gas boiler/ central heating; Wood stove	Yes, a lot	Yes	Roof insulation + rigid insulation underfloor	ASHP; GSHP; Solar PV; Solar WH	"1x car 4x bicycle"	2	"Reducing petrol/ diesel vehicle use; Replacing with EV"	Very concerned

Appendix 3: List of examples of conditions and comments respondents expressed related to changing the use of their petrol/diesel private vehicle.

Conditions for Vehicle Use Change Expressed by Survey Participants		
Theme	**Example of Conditions**	**Count**
Cost & Affordability	"Cost"	21
	"Cost neutral"	
	"Trade in and running costs"	
	"Cost of charging facilities"	
	"Make them more affordable"	
	"At present changed to hybrid but not consider electric again until cheaper to buy"	
	"Money to buy electric car"	
	"Electric car prices need to reduce significantly"	
	"As and when price of an electric care compares with that of a petrol/diesel car"	
	"price would have to reduce"	
	"Lower cost of electric vehicles",	
Technology of Vehicle	Improve range, e.g., "Will not consider electric car until they can cover 600 miles"	8
	"Better technology/lifespan"	
	"Be able to tow caravan"	
Charging Infrastructure	"More public charging points"	6
Convenience	"When current car needs replaced (Not routine 3 yearly replacement)"	6
	Convenience	
	"I would not consider giving up private vehicle if I could use public transport"	
	"More bus routes around Perth, not in and out of Perth"	

Comments on Vehicle Use Expressed by Survey Participants		
Theme	**Comments**	**Count**
Cost	"Would like an electric car but can't afford, too expensive"	3
	"Providing it makes economic sense"	
	"Public transport expensive"	
Convenience	"Because of my age private vehicle use is necessary and helpful"	6
	"I currently need a vehicle available at all times due to caring duties"	
	"My car is very rarely out (11-year-old Honda) this is my last car"	
	"Rail network inadequate"	
	"None applicable to me at 77 years old"	
	"Our car usage is already minimal"	



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To know is to accept. Uncovering the perception of renewables as a behavioural trigger of rural energy transition

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Abstract

Our research aims to reflect on rural communities' awareness and perceptions of various energy sources, particularly focusing on renewable energies. We argue that there is an urgent need to expand the knowledge base on the perspectives of rural communities directly and indirectly affected by renewable energy installations. From an empirical point of view, our study focuses on the Lipno county in the Kuyavian-Pomeranian Voivodeship (Poland), where a relatively unique constellation of renewable energy and local community is emerging. Our findings indicate a wide awareness about renewable energies in the community, but a rather shallow, imbalanced, and outdated knowledge on potentials, advantages and disadvantages of individual locally available renewable energy sources was detected. To break deeply rooted carbon dependency and lock-in and to trigger mechanisms of change leading to more sustainable futures, practical, contextual, and place-based knowledge is essentially needed to shape responsive attitudes. We claim that personal experience of the effects of renewable energy installation (especially small-scale ones) can be a proxy for the change and scaling up. This is a key because it proves the leading role of an inclusive approach to developing renewable energy in rural areas. Locals undertake new energy investments, which is the basis of spatial (territorial) distribution justice – they not only bear the costs of operating new energy installations but also derive tangible benefits from renewables.

Key words: *rural energy transition, renewables, awareness, perception, Poland*

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1. Introduction

As tensions in the global political situation connected to Russia's aggression in Ukraine rise, so do the issues related to the fossil fuel market. Currently, the world seems to have come to a crossroads regarding the energy production (United Nations, 2022). The war in Ukraine has forced countries worldwide to rethink their use of traditional energy sources and was a kind of "wake-up call" for our society that we are still highly dependent on fossil fuels. Even though many strategic documents, such as The Paris Agreement (2015) or the European Green Deal (2020), stressed out the need for immediate action towards reducing the human impact on climate change by, among others, changing the energy mix from fossil fuels to renewables, still, traditional energy sources such as coal, gas and oil play an important role in the energy supply worldwide. The current geopolitical situation revealed how undifferentiated the world's energy is and how much this affects us (World Food Programme, 2022). The problem with diversification of energy resources is particularly visible in post-socialist countries such as Poland, where the consequences of a centrally planned economy can be noticed to this day. One of the signs is that the economy is dependent on fossil fuels. In Poland, the share of coal on electricity generation is still very high, around 70% (Transformacja…, 2022).

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The global economy and rapid changes therein have prompted a call for action to develop local, green, and resilient renewable energy sources (RES). Rural areas must bear the brunt of such development as traditionally, and even now, they have been the site for renewable energy facilities. The present global situation, however, has revealed that the development of local renewable energy resources can support energy security and help develop rural areas (Duarte et al., 2022). One of the most crucial actors in this transition are the locals – the inhabitants, with their specific awareness, attitudes, and behaviours (Chodkowska-Miszczuk et al., 2021). In addition to the presence of dedicated energy infrastructure, public support, and systemic actions, among the key issues affecting social acceptance of renewables are the knowledge, previous user experiences, and personal benefits (Dwivedi et al., 2022). Therefore, this research aims to understand the rural communities' awareness and perceptions of energy sources, particularly renewables. The comparative studies considered the opinion of rural communities that experience the effects of the operation of renewable energy facilities daily and directly and those that are indirectly affected by renewables. From the empirical point of view, this study was conducted in the Lipno County (Powiat Lipnowski in Polish) (LAU1, formerly NUTS4) in the Kuyavian-Pomeranian Voivodeship in Poland. The research questions that have driven the empirical research were defined as follows:

- Q1: How do local communities perceive renewable energy sources?
- Q2: Is there any difference in the perception of specific renewable energy installations?
- Q3: Does the distance of the place of residence from the renewable energy installations affect the perceptions, awareness, and attitudes of local communities toward them?

The rest of the paper consists of four main parts. The following section provides the theoretical and methodological framework of the study. The next part focuses on the methodological aspects of the research and presents the outcomes of a survey conducted among the selected inhabitants of the Lipno county. The last sections of the paper are a discussion, where the issues presented in the paper are revisited, and a conclusion.

2. Theoretical departures

2.1 Energy transitions: From the global to the local dimension

Compared to the 2018 levels, global energy consumption is expected to increase by 150% in the next 30 years largely driven by the growth of developing countries (World Energy Outlook, 2019). Several countries are investing in renewable energy systems to offset the adverse environmental effects of fossil-fuel-based energy and at the same time ensure economic growth. Considering the higher cost of renewable energy transitions compared to fossil fuels or nuclear power, their inclusion into the policy and practice is challenging (Kim et al., 2020). The types of energy transition research can be divided into scientific or policy implementation, macro (national or regional level) to microscale (local or individual level), or, theoretical to empirical. Broadly, such typologies have focused on the macro scale of national or regional energy transitions. Most of the studies are based on analysing carbon emissions and developing empirical or theoretical models of the energy efficiency, costs, generation, performance and consumption, and environmental impacts. Or they have dealt with types of energy resources, their benefits and adverse effects, management, or policies (Kanger, 2021; Chang et al., 2021; Edomah et al., 2020; see Fig. 1).

Relatively less attention has been put on the actual uptake of policies or the energy literacy of communities and individuals, which would determine energy sustainability and transition to renewables. This is evident from the example of the implementation of renewable energies in rural areas of Poland (Fig. 2). It has led to uncertainties in "public-related issues with respect to using energy facilities and services in communities" (Kim et al., 2020) magnified from local to national scales. Thus, the perception and awareness of the public are critical towards driving energy transition in this time of energy crisis (Devine-Wright, 2012; Larson and Krannich, 2016; Kim et al., 2020). The perception and awareness of the public towards renewable energy transitions, however, and their consideration into policy instruments has been recognized as one of the "more challenging, albeit essential, duties of both researchers and government officers in the energy and electricity production sectors" (Chung and Kim, 2018; Kim et al., 2020).

2.2 Energy transitions in the East-Central European rural context

Energy availability and consumption are instrumental for local socioeconomic development. The transition from fossil fuel-based to renewable sources has largely been the focus of renewable energy research in the Global North, associated with better accessibility, availability of renewable energy sources and better living conditions (Frankowski and Herrero, 2021). The discussion has also been vastly developing around a sustainability shift of traditional energy systems already in place towards improved efficiency (Vujanović et al., 2021). It is well known that renewable energy installations require land and also a large investment for implementation but undoubtedly, their location possess many co-benefits, although certain possible drawbacks too. These co-benefits have been enumerated and quantified at the macro-scale to estimate the non-climatic monetary benefits (Dranka et al., 2022). Research from developing

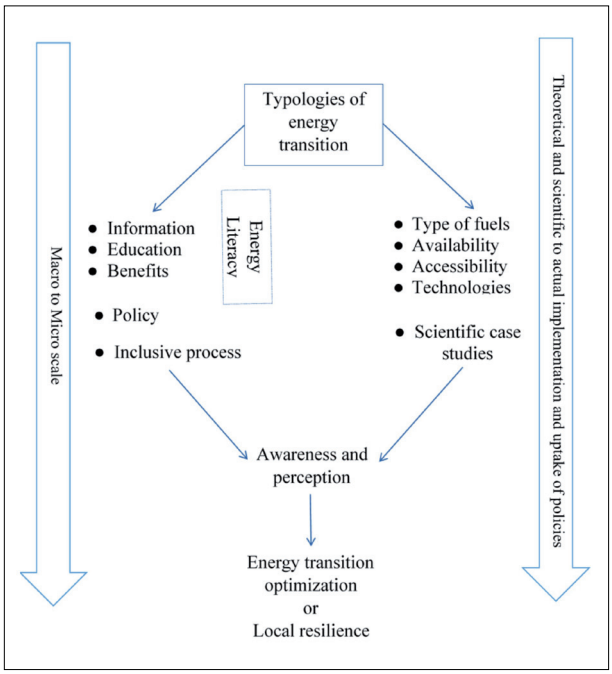

Fig. 1: Types of energy transition research
Source: authors' compilation

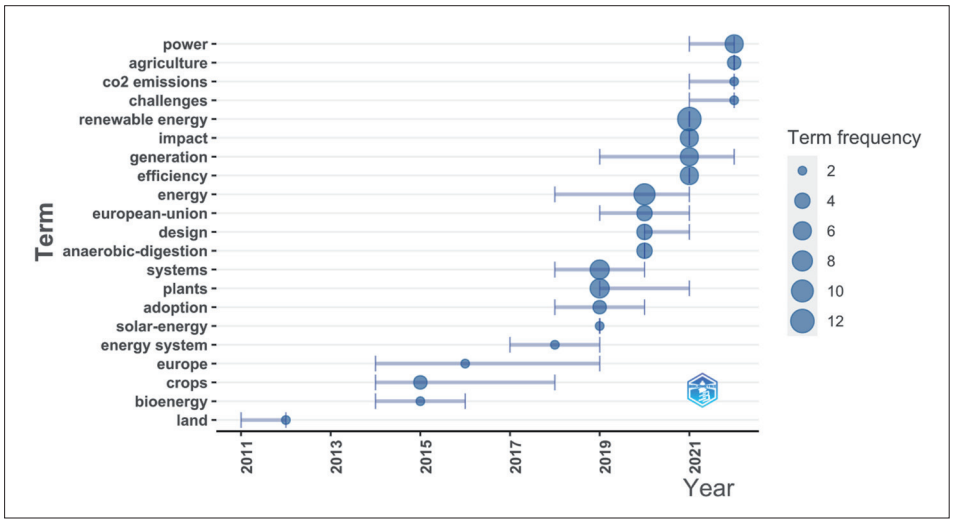

Fig. 2: Term trends of renewable energy in rural areas of Poland
Source: authors' study based on Web of Science review

countries, such as India and China, has largely focused on the indoor and outdoor health co-benefits of fuel switching (Maji and Kandlikar, 2020; Liu et al., 2022). On the other hand, empirical evidence from the Global North, however, is surprisingly lacking the mentioned co-benefits, but instead, driving force of co-benefits is rather seen in terms of environmental benefits, environmentally friendly perceptions and increased awareness of local communities (Frankowski and Herrero, 2021).

The Global North, and Europe in particular, has achieved a certain degree of energy security due to mass electrification and expansion of the natural gas grid during the industrial era. At the household level, however, many people still rely on the traditional types of fuel (coal, wood, oil, etc.). This is especially visible among poorer population living in peripheries and even more frequently can be observed in Central and Eastern European countries. Particularly in this part of Europe, it is very hard to persuade laypeople that apart from direct environmental benefits, renewable energy systems have a high potential to create economic opportunities, better living conditions and other co-benefits. This is especially case in rural areas (Standar et al., 2021). In this respect, energy transition and rural resilience certainly also depend on energy literacy (Chodkowska-Miszczuk et al., 2021) that is still far below standards in comparison to western European rural counterparts. It´s beyond a doubt that rural areas provide potentially the most suitable sites for renewable energy installations due to the availability of proper land, technical feasibility and also feedstock available (Kaya et al.,2019). On the other hand, an increased competition for land among different uses tend to reveal land use conflicts even in stabilised rural communities (Raška et al., 2022).

We already know that rural areas, especially those in Central and East European countries, exhibit a unique and highly diverse pattern among public perception, local development, and renewables (Standar et al., 2021). There is no doubt that every single rural community has potential to develop and utilise several local renewable sources of energy that may reduce their dependence on national power grids, improve local resilience and also energy security. In Poland for example, it is widely known that rural areas experience more frequent and longer energy disruptions. At the same time, a higher number of rural households depends on fossil fuels for heating if compared to urban areas (Kaya et al., 2019), so there is plenty of place for improvements. Additionally, about 45% of Polish households were using coal for space heating in 2018 (Kerimray et al., 2017), which signals that this problem tends to be concentrated in the rural with all environmental and health consequences. It needs to be highlighted that Poland has a long history of coal dependence which is exacerbated by the economic, political, technological and natural dimensions that need to be overcome. However, unfortunately, recently started warfare in Ukraine has changed a lot (Ahmed et al., 2022).

Understanding the perception and awareness of rural communities towards renewable energy systems is a backbone of successful energy transformations. Poland, which has reported to have one of the worst air qualities in the European Union (maybe even globally), is enormously promising research landscape for studying attitudes of local communities towards renewable energy transition. There have been detected significant shifts in the attitudes in Poland towards renewable energy, but these are considering solely other than in macro-level (Mroczek et al., 2011), Eurobarometer (2014) or Wojciechowska-Solis and Soroka (2018). If we turn our attention to rural communities, the response is extremely varied, regionally differentiated and context-specific. For example, Eiser et al. (2010) in their study reported that people living near wind farms in rural Poland tend to be less supportive for wind energy development, and generally less convinced about the benefits of locally sourced renewable energy installations and their positive impact on the local economy and the environment. On the other hand, some studies are highlighting that expectations of the public from renewable energy projects often go far beyond possibilities (Frantál, 2015) which may lead to a disillusionment. Local socio-cultural environment seems to be the key driver for acceptance of renewable energy projects (Lamy et al., 2020).

A set of studies has focused also on the potential of biogas plants and anaerobic digesters in rural areas (Martinát et al., 2020, Martinát et al., 2022; Chodkowska-Miszczuk et al., 2019). However, even this particular type of renewable energy system, though very well suited for rural areas, can raise local controversies when acquiring feedstock for anaerobic digestion (Chodkowska-Miszczuk et al., 2021).

Thus, the evidence from Central and East European countries has broadly focused so far on the fuel switching and identification of co-benefits of energy transition at

a macro scale. Other than macro scale is rarely studied. The household-level co-benefits have not been investigated at all, which is especially case of rural communities. Further, the energy transition literature seems to be limited to economic, technological, and institutional drivers (Cherp et al., 2018) and systematically avoiding the research of social spaces beyond technology. Highlighting technological and institutional challenges of energy transition, its speed of adoption and cost for various options, are very much a typical example of contemporary renewable energy research. On the other hand, the role of end-users and their lived experience is vastly under-research or even missing. As such, the absence of a human factor or the agency of users, and their inclusiveness in the energy transition, has led to structural research outcomes (Shove, 2003). Social theorists have argued that further research is needed to include the sociological dimensions which determine the uptake of policy and the creative agency of users for sustainable energy transition (Frankowski and Herrero, 2021). The agency of users can be defined as "improvisation, tinkering, bricolage, and repair work, and technology 'domestication' as important mechanisms for socio-technical change" (Geels et al., 2018). Thus, studies on household consumption, perception and awareness of individual users have gradually become the most important in determining and catalysing energy transitions. This finding seems to be far more important in rural areas, where society is closely knit and with apparently more direct links between human and natural components (Chodkowska-Miszczuk et al., 2021a).

There is an urgent need to focus research beyond technological and its limitations to support the transition from a human perspective. In other word, to thoroughly understand the perception and awareness of individuals. We structure these needs into two broader categories:

i. Beyond accessibility and availability – perception: The availability and accessibility of alternative and renewable energy resources, however, is not the sole criteria for optimal renewable energy transitions. This can be better understood by an example. In Poland, households typically rely on coal for heating due to its historical availability, and perceived risks associated with the natural gas supply. Furthermore, most households use low-efficiency stoves to burn coal and switch to wood in case of coal shortages or on colder days (Kerimray et al., 2017). Therefore, the easy availability and accessibility of coal and the perceived risk associated with alternative or renewable sources contribute the perception that renewable energy sources are rarely used. Such perceptions are in Poland deeply rooted in the information provided by the media and individual real--life experience, and consequently, people who hold this view cannot be held accountable for refusing to switch to renewable sources. The authors want to highlight, however, that along with the availability and accessibility, we urgently need to work with the perception of individual energy sources. We believe the perception of renewable energy needs to be shaped and gradually changed at the household or individual level especially in rural areas, where the energy transition is still struggling to sufficiently progress.
ii. Beyond climate change mitigation – Awareness of co-benefits: These changes in perception can be mediated by highlighting the co-benefits of switching to renewable energy sources that are directly related to everyday life. Benefits articulated as mitigation of climate change or reducing air pollution seem to be more impactful when people see them through the lens of their everyday lives (Křištofová et al., 2022). In other words, there is a need to go beyond the direct benefits of renewable energy systems and highlight the more relatable co-benefits. In this sense, improved awareness about co-benefits can be helpful and speed up and sustain energy transition, especially articulated as benefits to lifestyle, time consumption, energy costs or even distribution of subsidies. We are persuaded that managing of renewable energy systems may get additional impulse if co-benefits are suitably communicated (Stober et al., 2021).

3. Methodology

3.1 Methods, data and limitations

To address the research objectives, set in this paper, we proposed a four-stage research procedure, including:

i. the phase of constructing the conceptual and theoretical frameworks;
ii. the phase of desk research;
iii. the phase of empirical research (on-site query and survey); and
iv. the phase of data analysis, interpreting and discussing results and formulating conclusions.

After the initial stage of developing the research concept, we began the search for an answer to the research problem by means of literature studies and Internet searches: we analysed current strategic, national, regional, and municipal documents concerning renewable energy in Poland, and obtained the necessary data and information. Bibliometric analysis was performed in R-software using the 'bibliometrix' package (Aria and Cuccurullo, 2017). The Web of Science database was explored to search for relevant peer-reviewed literature. The key stage of this research procedure consisted of an empirical analysis, which was carried out in the selected study area (see section 3.2). The survey was conducted during a challenging time of the COVID-19 pandemic – the first quarter of 2022. This situation translated into difficult on-site contact with potential respondents, as well as their sceptical attitude towards participating in a subsequent online survey, as this type of research had proliferated during the lockdown.

The constraints of the pandemic situation necessitated the use of a hybrid method of eliciting responses to the survey questionnaire. A computer assisted web interviewing (CAWI) method was used, i.e. a Google web form was employed and widely distributed through social media, including community forums bringing together residents of the study area. At the same time, the pen-and-paper interviewing (PAPI) method was used when questionnaires were filled in on paper in contact with the interviewer. In both cases, the test sample was selected using the snowball method, so that the results achieved saturation levels (Guest et al., 2006). A total of 110 questionnaires were obtained, including 60 in electronic form and 50 on paper. Using two channels to distribute the survey helped the survey to reach a diverse range of backgrounds, both young people for whom the Internet is their natural environment, and older people who prefer direct contact for communication (Wylon et al., 2018). The sample is regarded, for our purposes, as random and large enough (considering the central limit theorem) for conducting statistical analysis. We are aware of the boundary conditions of the study. The research has some limitations regarding the reference to a case study and survey

conduction, which qualifies the opportunities to generalise. It is difficult to come to a clear interpretation of the results of analyses on a local scale based on the received research sample. Nevertheless, the local context, including social awareness of rural residents, is pivotal in the renewables development and broader – energy transition. It can be explored through social research methods only. In essence, the study's conclusions support solving the research problem raised in this paper and expand the conceptual framework discussed issue.

The socioeconomic structure of those who responded is presented in Table 1. Of the 110 respondents, 69 were women (62.7%) and 41 were men (37.3%). The largest group who took part in the survey were residents in the 20–29 age bracket (38.2%). This group was more likely to complete the survey online than in the traditional paper form. This was followed by those aged 40–49 (20% of respondents). These individuals, in turn, were more willing to complete PAPI-type surveys. The smallest groups of participants in the survey were those under 20 years of age (1.8% of total respondents) and those over 70 years of age (3.6%). An important issue in the context of the research on the perception of renewables is the potential use of one's own home, which clearly demonstrates the need for fuel – sources of heat. Most respondents lived in detached single-family houses (84.3%).

The IBM SPSS Statistics Data Editor software was employed to analyse the survey data obtained, including basic descriptive statistics, frequencies and cross-tabulation analyses. In the final stage of the research procedure, which consisted of compiling the results and formulating conclusions, the following software was used to support this process: Libre Office Draw, Inkscape, and QGIS as a mapping tool.

3.2 Area under study

The empirical research was carried out in the Lipno county (*Powiat Lipnowski*; LAU1, formerly NUTS4, with total area of 1,015.6 km^2) in the Kuyavian-Pomeranian Voivodeship (Województwo Kujawsko-Pomorskie in Polish) (NUTS2) in central Poland. It is a unit of territorial administration and local government, comprising nine independent municipalities with a significant predominance of rural areas and agriculture in the functional structure. The county is sparsely populated by ca. 65 thousand inhabitants (70% are rural inhabitants), which makes up 3.2% of the overall population of the voivodship. The Lipno county is a border area within the voivodship (see Fig. 3), peripherally located and distant from the main cities of the region (Bydgoszcz, Toruń, Włocławek, Grudziądz) and thus representing an internal periphery marked by several socio-economic problems and inequalities, including a negative migration balance, depopulation, progressive pauperisation, and marginalisation (see Tab. 2).

Characteristic	**Representation in the sample (%)**						
Age (years)	< 20	20–29	30–39	40–49	50–59	60–69	70+
	1.8%	38.2%	14.5%	20.1%	13.6%	8.2%	3.6%
Gender		Females				Males	
		62.7%				37.3%	
Education	Primary		Basic vocational		Secondary		Higher
	3.6%		21.8%		39.1%		35.5%
Domicile	Detached single-family house		Single-family terraced house		Apartment in a tenement house		Flat
	84.3%		0.9%		1.9%		12.9%
Financial situation	Bad		Average		Good		Very good
	1.9%		44.4%		49.1%		4.6%
Occupation	Student	Professional work		Own business	Own farm	Pensioner, parental leave	
	12.7%	57.3%		3.6%	10.0%	16.4%	

Tab. 1: Socio-economic structure of respondents
Source: authors' survey (N = 110)

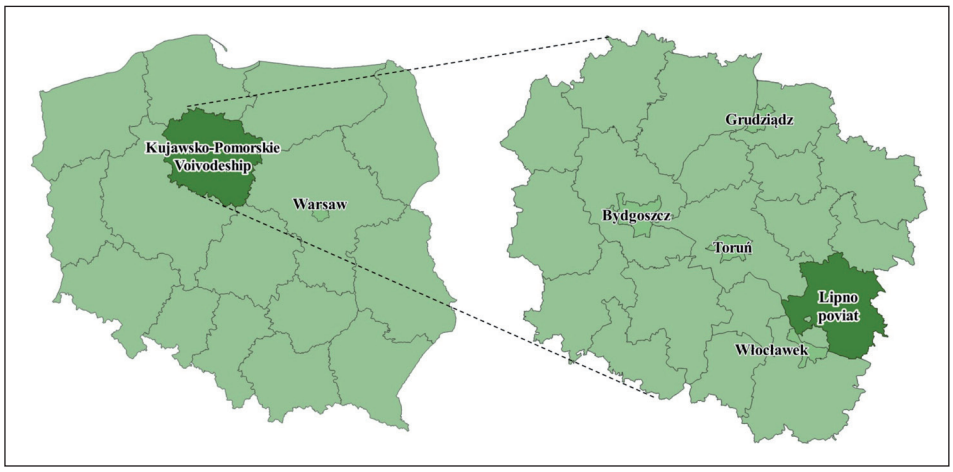

Fig. 3: Area under study – The location of the Lipno county in the Kuyavian-Pomeranian Voivodeship (right) and the location of the voivodship in Poland)
Source: authors' elaboration

	Lipno county	Kujawsko-Pomorskie Voivodship	Poland
Population	64,975	2,047,900	38,080,411
Feminisation rate	101	106	107
Migration balance	– 2.65	– 1.07	0.09
Density of population	64	114	122

Tab. 2: Sociodemographic characteristics of the area under study (2021)
Source: authors' compilation based on Statistics Poland (2022)

We can stress that this is an agricultural and environmentally valuable area (28% of the county´s area is legally protected), but at the same time, the natural conditions of the area are well suited for the development of renewable energy. According to the Kuyavian-Pomeranian Office for Spatial and Regional Planning in Włocławek, there is a high potential for renewable energy generation in the Lipno county (some of which is already in operation). Wind energy and, more recently, solar energy have been notable at the scale of the voivodship. It is worth noting here that the voivodship is the second in Poland in terms of energy production from renewables (Strategia…, 2020). Therefore, the choice of this research area allows us to take a closer look at the energy transition, its manifestations and mechanisms in regions that are peripheral but for renewable energy highly relevant, both for the region and on a wider supra-regional scale.

4. Results

4.1 Energy sources in rural areas: Knowledge and awareness

Renewable energy sources are considered as the best alternative to coal fuel by 67% of rural residents surveyed, followed by nuclear energy, which was supported by 12% of respondents. At the same time, respondents are quite positive about their knowledge of renewables, with 58% of them declaring average knowledge, 34% declaring good knowledge, 6% declaring very good knowledge, and only about 2% declaring poor knowledge. Among the fundamental premises that characterise this knowledge is the general linking of renewables with pro-environmental measures. This significant level of generalisation of the knowledge held is also reflected in the identification of the best power plants from an environmental point of view, i.e. solar (63%), wind (56%), and hydroelectric (38%). These are the most common renewable energy facilities, also known in the literature as the WSW (water, sun and wind) triad (see Krupnik et al., 2022). On the other hand, shortcomings in terms of detailed knowledge are reflected, for example, in the difficulties encountered in deciphering the acronym RES or the term 'unconventional energy'. Respondents are also unaware of possible investment plans to build new energy facilities in their immediate area.

There were opinions among respondents that the most appropriate power plants from the point of view of implementing pro-environmental measures are those using fossil fuels: nuclear (7%) and coal (2%). Analysing the demographic and social characteristics of those indicating nuclear power plants, they are aged between 20 and 40 (63%), with a university education, and professionally employed. They describe their financial situation as good or average and live in detached single-family houses. For respondents supporting coal, the characteristic most strongly correlated with this indication is the fact that they all live in a single-family home, which may indicate that the choice of coal is directly related to the fact that it is used primarily as a heat source in these homes. Habits, routine, and having the infrastructure to burn coal have undoubtedly influenced the final assessment of this source.

The structure of responses on the question on the impact of renewable energy facilities on respondents' physical and mental health, depending on its distance from their place of residence can also yield a vector of the extent of knowledge and perception of RES. Among respondents living within 1 km from the facilities, almost 60% denied any health impact. On the other hand, as the distance to facilities increases, the share of responses declaring the existence of impacts on well-being and health increases, which seems to confirm that the clichéd and schematic perceptions of renewable energy facilities is still strongly present (see Fig. 4).

When comparing respondents' answers to the question on the impact of renewable energy facilities on the quality of life and the landscape, a very interesting picture emerges, shaped by variables related to the respondents' level of education and social status. Overall, far more respondents indicate a positive impact of renewables on the quality of life compared to the number of responses stating a positive impact on the landscape. In contrast, the negative assessments of renewables are far more related to the landscape than the quality of life (see Fig. 5). Among these effects of concern to the public, the following are mentioned first: effects associated with the operation of wind turbines, which are numerous in the study area, including threats to birds' migration, shadow flicker effect, noise annoyance, but also unpleasant odour (applies to biogas plants). A positive assessment relating to the impact of renewable energy facilities on the landscape characterises those with a secondary education, who are in employment, while those with a higher education, including young people still improving their qualifications, are more likely to see a negative impact. Those with higher education also give a negative assessment in terms of the impact of renewables on the quality of life. The group perceiving this negative impact is diverse; its members range from the working population to farm owners and those still in education. In contrast, a positive assessment in this respect is expressed by respondents with basic vocational and secondary education.

4.2 Is knowledge enough?

It is not only the knowledge, awareness, and perception regarding energy sources and technologies, that shape attitudes and behaviours, but also habits resulting from the prevailing energy (carbon) culture in a given area (Bole, 2021). The experiences resulting from each individual exploration of different energy technologies and their confrontation with one's own expectations and needs are also highly relevant (Chodkowska-Miszczuk, 2021). Those living near renewable energy facilities are in this situation. The study area (Lipno

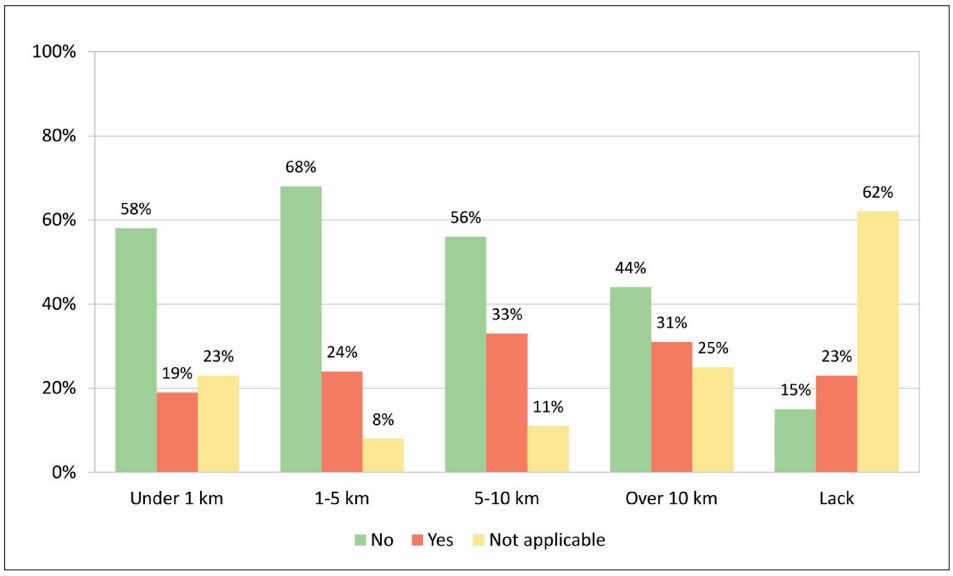

Fig. 4: Structure of responses regarding the impact on health depending on the distance of residence from renewable energy facilities. Source: authors' survey

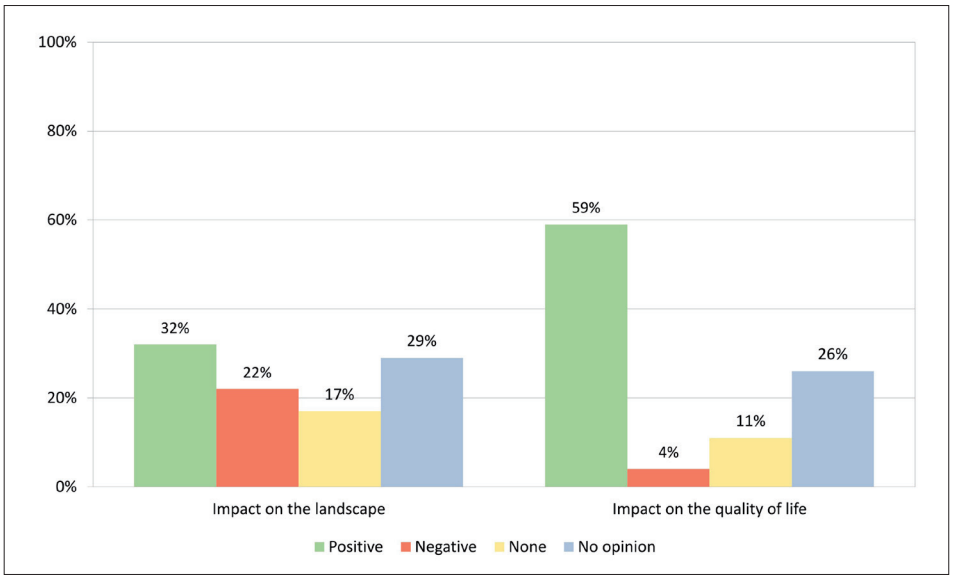

Fig. 5: Structure of responses to the question on the impact of RES on the landscape and quality of life Source: authors' survey

county), which covers an area of approximately thousand square kilometres, is abundant in wind farms (according to the Energy Regulatory Office (2022), there are 21 wind farms consisting of all together 53 wind turbines). The wind turbines are scattered, often located close to residential developments (see Figs. 6 and 7). Hence, nearly three fourths of respondents (74%) live within 5 km of a wind turbine. As the previous research results illustrate, respondents articulate much more negative opinions about RES' impact on the landscape and place than on residents' quality of life and health (see Figs. 4 and 5). This situation is also reflected in the perception of wind farms. Those living within the neighbourhood of wind turbines indicate problems with low noise, a reduction in property values, a negative impact on wildlife (fauna), and an adverse change in the landscape. At the same time, there is a lack of indication of health consequences (Fig. 8).

Personal experiences of renewable energy facilities that shape attitudes and behaviour are also acquired during the direct use of renewable energy technologies. More than 43% of respondents own and use renewable energy technologies and a further 13% of respondents are seriously considering such investments. These are small-scale projects, including photovoltaics (71% of all renewable installations owned), solar panels, and heat pumps. It indicates that the users of one such technology are opting for another, so as to provide electricity and heat production in parallel. The most popular are the 'solar sets', including PVs and solar collector (14% of users) and photovoltaics and heat pumps (9% of users). Sixty percent of owners of renewable energy technologies are satisfied with the investment undertaken, and among the main reasons for investing in their own renewable energy system they indicate a general factor of concern for the environment, but above all individual reasons such as caring for health (smog reduction), building their own energy independence, and receiving financial support for this investment (see Fig. 9).

The individual (and almost immediate) benefits in terms of real savings, building one's own energy security and the financial effects that are associated with the use of individual

Fig. 6: Wind farm in Sumin village, Lipno county
Photo: S. Kuziemkowska

Fig. 7: Wind farm in Dobrzyń nad Wisłą village
Photo: S. Kuziemkowska

renewable energy solutions, are key considerations in shaping knowledge, awareness, attitudes, and energy literacy. Photovoltaic panels, so prevalent in prosumer energy, and solar energy more broadly, are also becoming a vector shaping the structure of large-scale renewable energy. When asked if they would like to replace an existing wind turbine nearby with another plant mode, almost73% of respondents indicate a solar power plant. A further 17% point to hydropower and only 1% are happy to accept a biogas plant. What is extremely important is that only less than 2% of respondents would prefer a traditional power plant (coal or nuclear) in place of a nearby wind power plant. From the newly planned renewable energy facilities, respondents would be most likely to see the afore-mentioned solar power plants in their immediate surroundings (58%), and the least indicated was the biogas plant (2%). It is significant that 13% of respondents do not want to be adjacent to any renewable energy facility (with women predominating in this group).

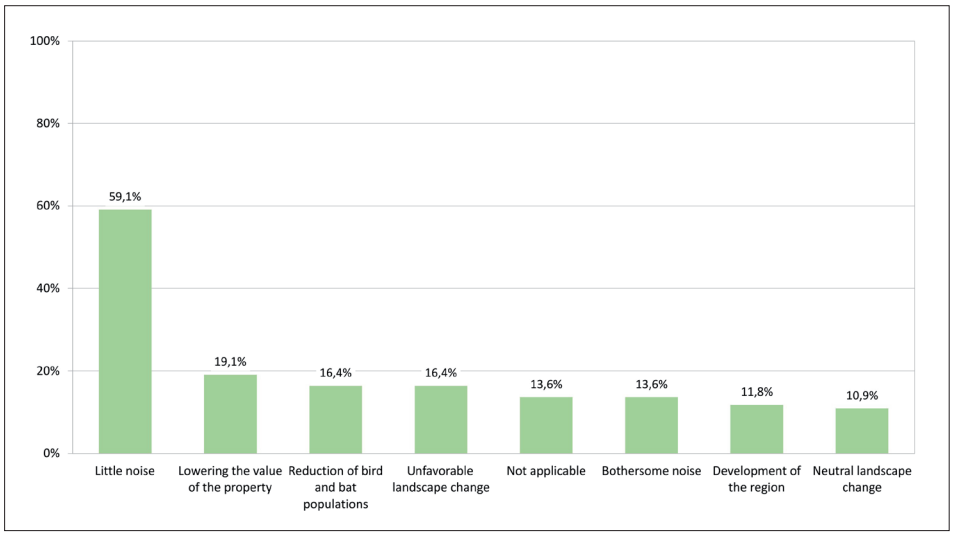

Fig. 8: Structure of responses to the question on the impact of the location of a wind farm near the place of residence Source: authors' survey

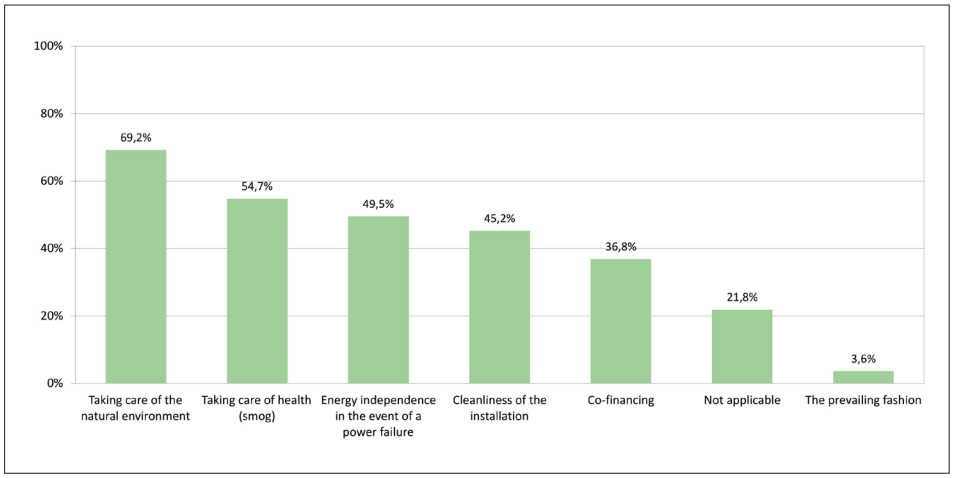

Fig. 9: Structure of responses to the question on the reasons for the decision to purchase and install RES technologies Source: authors' survey

One third of them are, on the one hand, representatives of generations Z and Y (20–30 years old), and another third are, on the other, people between 50 and 60 years old. Half of them have a secondary education and another 30% have a basic vocational qualification. They are mostly employed (57%), but also receiving social support.

5. Discussion

Most of the rural residents surveyed declare that they have knowledge of renewable energy sources, which is quite promising indication for the further energy transition (Zabaniotou, 2018; Chodkowska-Miszczuk et al., 2019). The responses on the question of identifying the diverse types of renewable energy technologies centre on the well-known water-sun-wind triad (Krupnik et al., 2022). Nonetheless, this good, or self-perceived satisfactory, level of knowledge of the local public primarily means that RESs are positioned within the general group of ecological and pro-environmental measures contemporarily promoted and resulting from the implementation of current climate policies and commitments (Furmankiewicz et al., 2021). It is characteristic for the respondents to use vague statements, also borrowed from the media narrative. Clichéd, schematic, and even stereotypical thinking prevails, as evidenced, for example, by the fact that negative opinions about wind power plants are articulated to a much greater extent by people living outside the 10 km zone from the wind power plant than by those directly adjacent to such a facility, who experience the effects of the location of the plants in their surroundings daily. These negative opinions, both in terms of the impact of wind turbines on the landscape and on health, are characteristic of people with a university education, including young people who are still improving their qualifications. Their opinion is based on information obtained from various sources rather than personal experience. It is also worth mentioning here that when asked about their acceptance of possible new power plants, 13% of respondents, mostly women aged 20–30 and 50–60, declare that they do not want to be adjacent to any power plant. And of course, this fact can be directly associated with the NIMBY (Not In My Back Yard) syndrome, but as we know from research (Wolsink, 2007), this idea is too simplistic, static, and unjustified. It is an attractive facade, often used in public discourse. Opposition to energy projects cannot be defined solely by the criterion of physical distance because other factors play a crucial role: social and cultural (Wolsink, 2007, Chodkowska-Miszczuk et al., 2021). In this context, gender and the division of traditional social functions should be considered. Concern for energy security is more the domain of men than women, which is related to a different

awareness of this issue (Chodkowska-Miszczuk, 2022). General declarations of knowledge of renewable energy are not borne out by a more detailed and specialised range of knowledge. So, they are familiar with the popular term 'windmills' used for wind power plants, or 'solar' for PVs and solar thermal collectors, but they have problems correctly deciphering the acronym RES. They do not know what the investment plans are in this field in their immediate vicinity, both defined by the lowest administrative levels (LAU2 and LAU1). And yet the rural area under study is predestined for the development of renewable energy sources, as the already existing plants seem to confirm. Undoubtedly, this local energy awareness would be strengthened by people acting as local leaders – change leaders (Kola-Bezka, 2020). To break the carbon lock-in and trigger the mechanisms of change, practical, contextual, place-based knowledge is needed to shape responsive attitudes. And this is what local leaders have: investors and owners of RES installations (Chodkowska-Miszczuk, 2022) can also play their role.

Knowledge and, more broadly, awareness can be formed through direct and long-term experience as an owner of the operation of new energy technologies using renewable energy sources. This change is most clearly expressed by the popularisation of prosumer PV installations in recent years and intensified in recent months, obviously as a result of public support (Energy Market Agency, 2022). In Poland, the first two months of 2022 alone saw an increase of PV capacity by more than 1 GW, guaranteeing a place on the European podium in terms of PV capacity. It is estimated that three fourths of the installed capacity in Polish photovoltaics are prosumer solutions (Instytut Energetyki Odnawialnej, 2022). The benefits of having small-scale PVs as part of the household, especially in a hybrid version providing heat and electricity production, clearly provoke an approving attitude towards this type of generator and solar energy. These favourable and convincing effects have gained prominence and strengthened in recent months, i.e. since the beginning of the energy and economic crisis, because in addition to real financial savings, the presence of one's own renewable energy solutions guarantees the building of individual independence. And it is the individual benefits and gains that come with the development of renewable energy projects that are key to creating mechanisms for change, as they are primarily responsible for the effective transposition of policy objectives and targets (e.g. on building climate neutrality) from general slogans and messages to the local level and local needs and opportunities.

The positive reception of small scale PV projects also translates into favourable views on large-scale solar farms. It is photovoltaic farms that are desired by rural residents, eager to see them replace the existing wind farms, which have a much longer history in the Polish rural space than large-scale photovoltaics. And according to the survey, the perception of wind turbines is generally positive rather than negative, both in terms of their impact on quality of life and the landscape. This raises the question of whether a unidirectional vector of change, focused on the use of a single energy source (solar energy) can lead to multifaceted and non-obvious consequences and ultimately prove unreliable. The asymmetric development of the renewables portfolio may bring further challenges, such as the need to ensure continuity of electricity production, which is not so obvious in the case of PV. It can also lead to the emergence of socio-spatial conflicts regarding land use changes in the form of the exclusion of large areas of agricultural land from agricultural production and their allocation for industrial (energy) activities. The extremely tempting option associated with the rapid development of large-scale PV farms in rural areas, as those with public support, may highlight the weakness of the transformation so conceived. We are already seeing such problems with wind farms, once equally strongly promoted. Rural areas are primarily the location of large-scale RES power plants, which incurs investment and subsequent operating costs, while the energy generated there can be and is consumed in another, often remote area, such as a city (Buechler and Martínez-Molina, 2021). Therefore, Faulques et al. (2022) highlight the spatial distributive justice as one of the fundamental motivators of renewable energy development. The fact that rural society unilaterally bears the costs that result from locating energy production sites in rural areas is not compatible with sustainable development and a just transition.

It is worth considering at this point whether building public awareness as a key driver of the social change that is the energy transition (Krupnik et al., 2022) by providing direct experience of the effects of small-scale RES systems might be a proxy for larger-scale change. If the involvement of one renewable source in prosumer energy brings such benefits in terms of public acceptance and perception of this source on a larger scale, perhaps this is the right way to familiarise people with other types of renewable energy technologies? Of course, this process requires system support, just as with photovoltaics. What is needed here is an adaptive mechanism that would allow energy needs to be flexibly adapted to the possibilities offered by a variety of sources and technologies. The energy mix can be created both by WSW and other sources, e.g. biogas, whose raw materials (including waste) are produced and available almost everywhere (Chodkowska-Miszczuk et al., 2021). Differentiation is undoubtedly the key here, as this is the only way to build and increase individual financial, energy, and logistical benefits that lead in a broader sense to sustainable system changes. In the current times of crisis, building energy security is also taking on a new dimension, as it turns out that coal (which is the backbone of the Polish energy sector, including households) is becoming a niche commodity, both due to its rising price and limited availability. Hence, there is a need for greater attention to local action but carried out in such a way as to address the barriers to building local energy security arising from the presence of administrative borders (Perrin, Bouisset, 2022). In our view, therefore, the local level represented in our study by the county (LAU1), which brings together several or even more than a dozen smaller units (municipalities/LAU2) is an excellent area for joint energy actions tailored to the needs of local society. This is because it does not lose local context, but bypasses the restrictions of administrative arrangements and, above all, strengthens local potential and social capital through cooperation.

6. Conclusions

The overall aim of the research presented in this paper was to better understand rural communities' awareness and perceptions of energy sources, particularly renewable energy facilities, as these occur among the population of the Lipno county in central Poland. The survey that included diverse groups of the population was conducted so that as many perspectives as possible could be covered. Our findings are summarised below. Renewable energy sources are referenced by two thirds of our respondents as an optimal alternative to traditional sources of energy. This is a rather optimistic result that we believe is affected by widespread use of

renewables in the Lipno county. Our respondents are also quite positive about their knowledge concerning advantages and disadvantages of individual renewable energy sources, but as shown in our findings, the reality is very different and rather limited. To illustrate the limited level of awareness about renewable energy, most respondents supported the simplifying premise that renewable energy is principally linked to pro-environmental measures (than to cover their basic energy needs). This finding is surprising and deserve further clarification.

As the most suitably renewable energy facilities from an environmental point of view, solar power plants were mentioned the most frequently by nearly two thirds of respondents (63%), followed by wind turbines by more than half of respondents (56%), and hydroelectric (38%). On the other hand, the lowest environmental benefits were connected to nuclear (7%) and coal (2%) power plants. We find the extremely low support for nuclear energy surprising given to the ongoing geopolitical situation and energy crisis evolving in Eastern Europe since early 2022. This finding also deserves more in-depth inquiry. Among the surveyed respondents living within 1 kilometre of any renewable energy facility, almost 60% denied any impact on their health. On the other hand, two fifths of our respondents declare that some health impact is possible, which is a worrying finding. We are aware of a relatively small sample of respondents, however, that might have affected our results.

Overall, far more respondents indicated a positive impact of renewable energies on local quality of life when compared to those stating a positive impact on the landscape. It seems that the population of the Lipno county is more sensitive and rather conservative as for landscape protection, which might be a consequence of numerous renewable energy facilities installed in the region in the last years without truly in-depth consultations with local people. For example, the effects frequently associated with the operation of wind turbines, which are numerous in the study area, included threats to bird migration, shadow flicker effect, noise, but also unpleasant odour (applies to biogas plants).

Another surprising finding is that more positive assessment of the impact of renewable energies on the landscape was detected by respondents with a secondary education than with respondents with a higher education (and young people) who are more likely to see negative impacts. Additionally, those with higher education negatively assessed the impact of renewable energy on the quality of life. This group is diverse; its members range from the working population to farm owners and those still in university education. In contrast, a positive evaluation is expressed by respondents with basic vocational and secondary education. This result is an alarming finding that needs to be taken into consideration when planning further renewable energy projects and planning awareness campaigns.

Almost three quarter of our respondents live within 5 kilometres from a wind turbine. The neighbourhood experience was measured far more negative than positive. To be clear about the factors feeding the negative attitudes, noise is mentioned primarily, although the levels of noise are described as low, followed by a threat of reduction of their property value. Our findings from the Lipno county also suggest a negative impact on faunae, and an adverse change in the landscape. Our respondents would be most likely to see in their neighbourhoods the solar power plants (57.8% of responses), while just 1.8% indicated their willingness to live in the proximity of biogas plant.

We believe that our findings contribute to building the knowledge base about the attitudes about renewable energy in peripheral regions, where renewable energy facilities are frequently operating on a large scale but mutual communication between the investors and local populations is traditionally lower. We argue that although just transition principles are leading our way towards more sustainable futures, unjustifiable regional differences still can be found in rural peripheries. In other words, there is undoubtedly a need for decision-makers to pay more attention to addressing the issue of equitable energy transition in rural areas.

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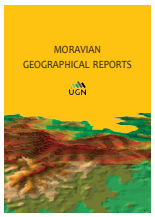

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Diverse responses of coastal communities to offshore wind farming development in Southern Spain

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Abstract

Despite having one of the fastest rates of wind power growth in Europe, offshore wind power development in Spain has been relatively slow. One of the factors affecting its deployment is strong local opposition. In this paper, we explore the main factors affecting local perceptions of offshore wind farms in the coastal regions of Southern Spain. We also compare local opinions of on-land and offshore farms, their impacts on local landscapes/seascapes, and their compatibility with local practices and values. To this end, a multi-phase research approach was applied, based on several stages of data collection and analysis and on surveys conducted between 2012 and 2022. Our study shows that the conflicts surrounding offshore wind farms are linked to the perception of the sea and the wind as important local resources and the perceived right of the coastal region to use these resources to generate wealth for their communities. The coastal communities' values, perceptions, and practices regarding the sea have a fundamental influence on their opinions. Our research indicates that local people are more likely to accept offshore wind farms if they provide socioeconomic benefits for their communities and if joint use of marine resources can be guaranteed.

Keywords: *coastal communities; local resources; seascape; perceptions; wind energy; offshore wind; Spain*

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1. Introduction

Wind power in European countries has enjoyed significant growth over the last twenty years. The total installed wind power capacity in Europe in 2021 was 236 GW, of which 207 GW were installed onshore and 28 GW offshore (WindEurope, 2021). By 2026 offshore wind energy could meet 24% of Europe's electricity needs, with over 341 GW of installed capacity (WindEurope, 2021). Although still a relatively young industry, offshore wind farming has become a key element in renewable energy generation in many European countries such as the UK and Germany, who led the ranking with more than 12,700 and 8,000 MW respectively, followed by the Netherlands (3,000 MW), Denmark (2,000 MW), Belgium (2,000 MW) and Ireland (less than 40 MW).

Numerous studies have showed that the preference for offshore wind farms in these countries, as compared to onshore, was related to their supportive regulatory framework, the fact that landscape impact was perceived as less significant than that caused by onshore wind turbines, and the limited onshore space for windmills and other competing land uses (see for instance: Bilgili et al., 2011; Ek, 2006; Esteban et al., 2011; Westerberg et al., 2013). Opposition due to other siting issues, such as visual and noise impacts, can limit the number of acceptable locations for onshore wind farms. Offshore wind farms (OWFs), by contrast, can be installed closer to coastal cities and require shorter transmission lines, while being far enough away to reduce the negative visual and noise impacts (Esteban et al., 2011). Finally, offshore winds tend to blow at higher speeds in comparison with onshore winds, so allowing turbines to produce more electricity. This, in turn, enables offshore turbines to use shorter, less visible towers (Bilgili et al., 2011). All these advantages mean that larger wind farms can be installed offshore with each unit producing more electricity (Esteban et al., 2011).

Despite all these advantages and the forecast of a huge increase in renewable energy (RE) in Europe for 2030, offshore wind energy (OWE) is growing in relatively few European countries at present (WindEurope, 2021). This is

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due to various factors. Firstly, OWE installations are more technically complicated in terms of design, construction, and operation (Esteban et al., 2011), which leads to higher costs, sometimes two or three times higher than onshore costs (Zhixin et al., 2009). Secondly, offshore development is enormously dependent on a favourable energy policy framework and social support in these countries. These vary greatly from one country to the next and even at different times within the same country.

The current energy crisis, with high prices and supply uncertainty, is causing EU countries to try to become more self-sufficient in energy terms by accelerating the development of domestic renewables. OWE is gaining support in many countries due to its rapidly falling costs (Qu et al., 2021). OWFs may give rise to conflicts and opposition from coastal communities with unique sociocultural values linked to the sea, however, which is also vital for their economies. It is important to avoid these conflicts because, as European Commission recommendation 2022/822 makes clear, delays in processing RE project authorisations could jeopardise the timely reaching of energy and climate targets and increase the cost of the projects.

This paper traces the ambivalent responses to offshore wind farming projects in coastal communities in Southern Spain. Surveys carried out by the authors in previous years (between 2012 and 2022) indicated a divided response in local communities, which has been changing over time. The aim of this paper is to explore the main driving forces behind the perception of OWFs in rural coastal communities and compare their views of on-land and offshore facilities, their impacts on the landscape and the seascape, their opinions regarding their compatibility with local territorial practices and socioeconomic values. In addition, we aim to work towards a new understanding of the seascape as a dynamic entity characterised by changing social relationships, rather than as a visually static backdrop to our lives. We argue that local visions of OWFs are less affected by the specific characteristics of these installations or by the overall perception of wind energy, and are much more a product of the, often complex, set of relations linking coastal communities with the seascape and marine resources. The potential emergence of new seascapes in which this renewable energy resource plays an important role is therefore closely linked to public perceptions of the seascape, which, in turn, are linked to the specific social, political, economic, and cultural characteristics and values of the coastal regions and their local communities.

After reviewing the theoretical background (Section 2) and explaining the current situation of renewable energy development in Spain (Section 3) below, Section 4 describes the case study area and explains the methodology applied. Section 5 considers the main factors influencing the perception of OWFs by coastal communities in rural areas. Section 6 offers a discussion of the results in the light of relations between coastal communities and seascape and marine resources. The paper concludes with compelling findings and recommendations for future OWF development (Section 7).

2. Theoretical background

2.1 Offshore wind farms, marine spatial planning and coastal communities

In recent years, the appearance of fixed structures, such as OWFs, in the sea is viewed as a sign of its growing industrialisation and of a conceptual shift away from a natural environment to a cultural landscape, i.e. one that is being visibly altered by society. Besides the usual 'developer' vs. 'local population' syndrome, larger scale issues such as the conflict between energy policy/planning and spatial/land use planning processes need to be addressed at varying scales (Greer-Wootten, 2017). This is manifested, for example, in the emergence of a spatial planning perspective of the sea, defined as a normative approach to develop, order, and secure marine space (Douvere and Ehler, 2009; MABL, 2005), and the designation of large-scale "suitable areas" for offshore wind farming. But this rational "spatial" perspective of the sea as a renewable energy seascape run by politicians and planners is often completely unrelated to that of local residents (Gee et al., 2017; Todt et al., 2011; Wolsink, 2010). Moreover, as Saunders et al. (2019) pointed out, maritime spatial planning is largely devoid of social context, avoids meaningful inclusion of dissenting stakeholders, is based on limited, mainly technical knowledge input, and is "mostly concerned to give effect to a state agenda that privileges elite or powerful groups, and lacks meaningful consideration of the distribution of the cost and benefits of marine use" (see also: Flannery et al., 2016; Flannerye et al., 2018; Jentoft, 2017; Kidd and Ellis, 2012; Ritchie, 2014; Tafon, 2018).

Offshore wind farming can cause changes in sea-related activities and values (Gee and Burkhard, 2010; Busch et al., 2011). Its potential benefits must be balanced against possible drawbacks, as there are still many questions regarding the compatibility of large-scale OWFs with nature conservation, shipping, and fishing (Busch et al., 2011; Todt, González and Estévez, 2011), and with tourism (Westerberg, Jacobsen and Lifran, 2013). There is also growing divergence between the conception of the sea of those who experience it first-hand daily (such as fishermen) and those with a more remote, more distant perspective (such as OWF planners).

Therefore, despite its considerable growth and active promotion at national levels, OWFs are often a question for debate within the local community. Relations between society and the sea are underpinned by a broad array of religious, aesthetic, economic and place-based values (McKinley et al., 2019). Although our perceptions of the sea have changed over the centuries in response to greater technological control, our relationship with the sea remains ambiguous. Coastal communities, particularly on rural parts of the shoreline, often depend on fisheries, tourism, and agriculture, and have developed their own unique cultural activities and traditions, and the necessary resilience to cope with and adapt to developments and changes on the coast over generations (Lange and Cummins, 2021). There can be a strong sense of belonging to the sea, "not so much a landscape, not a sense of geography alone, nor of history alone, but a formal order of experience in which all these are merged" (MacKinnon and Brennan, 2012, p. 7).

Several reasons have been put forward to explain the negative reactions from coastal communities to OWF projects. Some research suggests it is due to the fact there is no community ownership of OWFs (Haggett, 2008; Bush and Hoagland, 2016). After initial resistance, some communities in the UK now accept "their" OWFs, after receiving compensatory payments to community funds. Other research suggests that visual aspects are paramount and the question of whether OWFs will be visible from the coast (Ladenburg and Dubgaard, 2009). Thus, landscape impact assessment becomes essential for local communities, especially if the deployment of OWFs could come into conflict with other economic activities in the area (Mehdi et al., 2018; Qu et al., 2021).

2.2 Renewable energy landscape and seascape

The different approaches to landscape policy and planning have different visions of the landscape. It has been variously regarded as a visual surface to be protected from visual interferences that might alter it (picturesque paradigm); as a part of the environment to be protected via the management of protected areas of different sizes (environmental paradigm); and as a part of the environment that has been shaped and endowed with shared meaning and values through cultural representations and territorial practices (cultural paradigm) (Bouneau and Varaschin, 2012). This third approach reaches beyond the expert view of landscape as a purely material entity and considers the opinions of the people who share, value and use it (Olwig, 2007). This way of conceiving landscape has affected the approach to energy landscapes in Europe. Initially viewed as de-naturalised, instrumental space, energy landscapes are increasingly perceived not only as material objects, but also as "containers" of deeply rooted local perceptions and sensitivities. Paraphrasing Calvert (2016, p. 110) the concept of a "renewable energy landscape" helps us to understand how different modes of sustainable energy production, distribution and use underpin both material (i.e. landscape form and livelihood arrangements) and immaterial relationships (i.e. perception and representation).

A "renewable energy seascape" is now emerging, as happened earlier with renewable energy landscapes. Just like any energy landscape, an energy seascape is the result of heterogeneous, multi-dimensional – i.e. material, social, institutional, political and historical – processes that take place above all within the local realm (e.g. Frolova et al., 2019; Nadaï and van der Horst, 2010). Such approaches are interesting when it comes to understanding the relationships between the physical, social, economic, and cultural processes that underlie the energy transition and the issues raised by the transformations they induce. A renewable energy seascape might be viewed as "a process itself in reconfiguring, in turn, the entities and relations that underlie its evolution" (Greer-Wootten, 2017, p. 63). Although it is not a "dwelling place", the sea has long-standing links with cultural practices such as fishing or trading and has a deep cultural meaning as a place of local, regional, and national identity. In discourse terms, like any other energy landscape, the renewable energy seascape is interwoven with socio-spatial identities such as "community", "nation", "home", "local" and "region" (Calvert, 2016).

As offshore wind-power develops, it seems likely that abstract, planning-oriented views of the sea from an essentially industrial, rational perspective will collide with these more emotional interpretations of the sea as a seascape. For those who live by the sea or come to visit it as tourists, it cannot simply be regarded as an abstract, empty space available for industrialisation, and instead must be viewed as a place that carries different meanings and which represents a point of identification for coastal communities. McKinley et al. (2019) emphasised a significant lack of consideration of social values, perceptions, and attitude-based data in the literature on Marine Spatial Planning (MSP). While most publications on MSP focus on societal relationships with the sea through resource use, the blue growth agenda, etc., it is also necessary to take the less tangible aspects of these relationships into account. Public perceptions need to be taken into consideration in OWF planning and consulting with stakeholders, and must be a critical issue in the decision-making process (Chen et al., 2015).

3. Wind energy development in Spain

By the end of May 2022, Spain had an installed wind-power capacity of 28,831 MW, producing 54.899 GW/h in 2020 (see Fig. 1) (REE, 2021b). A stable regulatory framework has been a key driver behind the rapid development of wind power in Spain. The structure of the sector and the scale of the developments have also played an important role. Between 1998 and 2012, Spain's renewables policy was based exclusively on quantitative targets and economic incentives (feed-in tariffs), and the Spanish Government paid no attention to qualitative, spatial planning-related issues (Frolova et al., 2015). As a result, wind power developments have tended to be large scale and implemented in a centralised, top-down, technocratic fashion, an approach that has been promoted by the private-public partnership model (Frolova and Pérez, 2011; Alonso et al., 2016).

Despite having one of the fastest rates of wind power growth in Europe, offshore wind power development in Spain has been relatively slow. A huge increase in offshore wind power capacity was expected. The initial target of 3,000 MW by the year 2020, however, set out in the National Plan on Renewable Energies (Ministry for the Ecological Transition, 2011) was first scaled back to 750MW, and ultimately completely abandoned.

Although 32 OWF projects were planned prior to the economic crisis of 2008 (17 in Andalusia, 7 in Galicia, 3 in Valencia, 4 in Catalonia and 1 in Murcia) by companies such as Acciona and Iberdrola Renewables, Endesa, Unión Fenosa, Enerfín and Capital Energy (AEE, 2009), in the end they were all shelved, and today there is only one commercial operating OWF (ELISA) in the whole of Spain, with an installed capacity of 5 MW. A range of different factors have obstructed the deployment of OWE in this country: the character of the seabed, which limits the technical and economic viability of installations with bottom-fixed anchorage in Spanish waters; the lack of support for experimental offshore projects; the withdrawal of economic incentives by 2012 due to the economic crisis; a complex regulatory framework; unwieldy bureaucratic processes; limited availability of information; and strong opposition from local authorities and residents in some municipalities (Quero et al., 2021).

The general context is changing, however, and the current Spanish Government is strongly committed to renewable energy development. As a result, a new wave of expansion of green energies is taking place. Spain's National Integrated Energy and Climate Plan (PNIEC) 2021–2030 has set a target of 50 GW of installed wind power capacity in 2030 from both onshore and OWFs. To achieve this goal, the current capacity

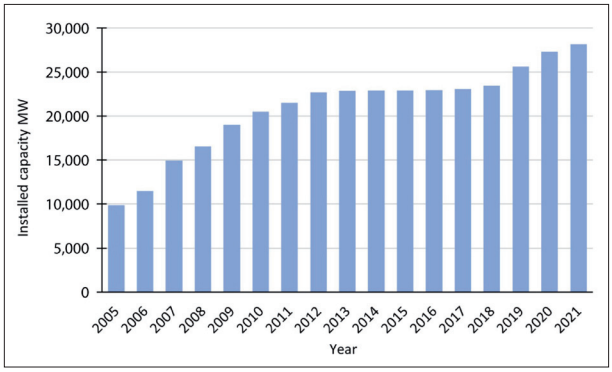

Fig. 1: Cumulative wind power capacity in Spain from 2005 to 2021 (MW). Source: Asociación Empresarial Eólica (AEE) (2022); authors' elaboration

of 25.7 GW would have to be almost doubled. The targets for 2030 are from 1 to 3 GW of offshore wind and 40–60 MW of marine energy. The Roadmap for the Development of Offshore Wind and Marine Energy in Spain, however, published in 2021 (Ministry for the Ecological Transition, 2021), does not set out a timetable or specify the power to be installed. This lack of precision has nothing to do with a lack of potential energy, in that according to the Study on the Gross Potential of Marine Energies on the Andalusian Coastline of the Andalusian Energy Agency (AAE, 2009), up to 11,000 MW of OWE could be produced in the Andalusia region alone.

Marine spatial planning in Spain remains the responsibility of the central government, and public participation regarding OWF planning has so far consisted of formal consultations during the regulatory phases as part of the preparation and environmental assessment of the project (Frolova and Pérez, 2011; Quero et al., 2021; Suárez de Vivero and Rodríguez, 2012). Royal Decree (RD) 1028/2007 (which was complemented in 2009 with the Strategic Environmental Assessment of the Spanish Coast for OWFs Installation) identified 72 areas, which were classified as either: (i) suitable; (ii) an exclusion zone; or (iii) suitable but with environmental impact of the OWFs. Decision making in offshore wind power planning was left in the hands of a committee made up of representatives of several ministries, and the participation of the regional governments (known as Autonomous Communities) was limited to one representative of the region concerned (Frolova and Pérez, 2011). In 2021, the Spanish Ministry of the Economy issued Plans for the Management of Marine Spaces (POEMs), with spatial planning based on five marine demarcations, identified by Law 41/2010 and two types of area for the possible deployment of OWFs, namely:

1. areas considered of priority use for OWE (ZUPER); and
2. areas with high potential for OWE development (ZAPER).

The POEMs were criticised for their overly general geographic scale of planning, which does not correspond to the characteristics and the density of the marine space in some demarcations. There were also calls for specific plans with a smaller scale and a higher level of detail for certain marine areas that are intensively used for various purposes (Quero et al., 2021).

4. Data and methods

4.1 The case studies

The case studies are the result of long-term research over the last ten years in municipalities on the Atlantic Coast of the province of Cadiz in the Autonomous Region of Andalusia (Fig. 2). This area was chosen because of its long history of intensive deployment of on-land wind energy projects, the failure of several OWE schemes and a recent application for a new offshore project.

Due to its almost constant exposure to winds from the Atlantic, this province is extremely well suited to wind energy development and is the leader in wind energy production, in Andalusia. There are 71 onshore wind farms currently in operation in the Province of Cádiz (out of a total of 155 in Andalusia as a whole) with an installed capacity of 1,395.97 MW. This represents about 39.7% of the total installed capacity in Andalusia (3515.47 MW) (AEE, 2009). In the municipality of Tarifa alone, there are 32 wind farms with a total installed capacity of 548.20 MW, while in Vejer there are 7 wind farms with a capacity of 107.88 MW. These farms are concentrated in coastal areas (around 80% of the

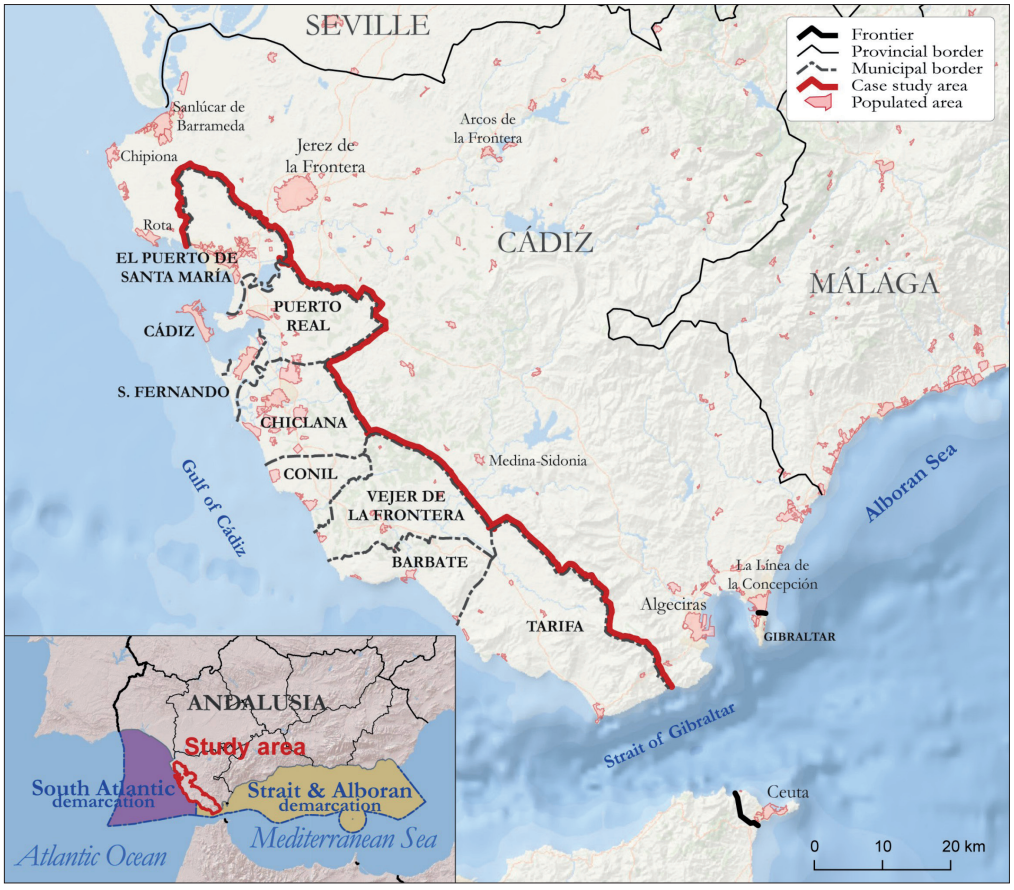

Fig. 2: Study area in the province of Cádiz
Source: authors' elaboration

capacity on the entire Andalusian coast is in the Province of Cadiz). In Tarifa alone, there are about 1.33 wind turbines per km^2 (Díaz-Cuevas et al., 2016).

Cádiz is a large province (743,585 ha) with important natural resources. Over 30% of its total area is covered by Natural protection status (IECA, 2021), and there are several military bases in which land use is subject to severe restrictions. This is particularly evident in the municipality of Barbate, where protected areas and military bases make up over 82.8% of its total area, considerably limiting possible land uses for the local population.

At the same time, the province of Cádiz has the second highest unemployment rate in Spain (about 26% in 2021). These figures are even higher in the municipalities that depend on shipbuilding and fishing, such as Barbate (about 40% in 2021). Its traditional socioeconomic structure is based above all on the primary sector (agriculture, extensive livestock faming and fisheries), and includes artisanal fishing of bluefin tuna using a method known as *almadraba*, applied in the area since ancient times. The situation has been changing a great deal recently, however, and tourism and related activities are now a mainstay of the local economy. Many jobs have been lost in the shrinking agricultural, livestock, forestry, and fishing sectors.

On-land wind energy installations developed early in Cadiz (from the 1980s), compared to the rest of Spain and indeed Europe. These were centred above all in Tarifa, the municipality with the highest wind power capacity in Spain (REE, 2021a). The province of Cádiz is situated in the south-west corner of Andalusia and has a huge coastline running along the Atlantic Ocean and the Mediterranean Sea (including the Gulf of Cádiz, the Strait of Gibraltar, and the Alborán Sea). Its marine area is divided into two POEM demarcations (the South Atlantic Demarcation and the Strait of Gibraltar Demarcation). These demarcations contain the Gulf of Cádiz, the Strait of Gibraltar and the Alborán Sea, marine areas which are densely occupied and used for a multitude of different purposes: shipping (with busy traffic in the Strait of Gibraltar), fishing, recreation and tourism, the quarrying of aggregates, military activities, oil fields, transport, and mariculture.

The seascapes and coastal landscapes in these areas vary greatly: the northern part of the Gulf of Cádiz has an industrialised seascape with ports, intense shipping traffic and a developed, urban coastal area, while its central and southern sections have a more natural open seascape, with large, relatively undeveloped beaches. The Strait of Gibraltar is a very narrow (just 13 km wide in some places), densely occupied shipping lane with busy ports and excellent views of the North African coast.

Some parts of the sea, which offer a natural habitat for birds and marine fauna and flora, are designated as protected marine areas. The Strait of Gibraltar is an important flight path for migratory birds travelling from Europe to Africa. There is also considerable archaeological heritage in the sea off Cape Trafalgar, a fact that bears witness to past naval and shipping activities produced by the increase in commercial relations and military expansion. These diverse uses and values coincide with the multiple, often diverging interests of the various stakeholders involved, and the way they use the different resources offered by the sea. The parallel existence of multiple constructs is instrumental in the emerging conflicts of use. It is also important to stress that the role of some traditional activities in the local economy is changing due to both internal and external factors. The contribution made by fishing, for example, to the economy of the Cádiz region has been declining for several decades, although its associated cultural and social values remain important. The very local scale of many of these uses and values does not fit well with the much larger scale used in maritime spatial planning for these two demarcations, which inevitably overlooks specific, local characteristics.

Figure 3 shows a map of the various pilot OWF projects proposed in the Bay of Cádiz (most of them in the 2000s). In the end, none of these projects went ahead because of the withdrawal of economic incentives for renewable power installations in Spain and the strong opposition of the municipalities concerned. The Forum for Offshore Wind Energy and Suitable Development, created by local stakeholders, was the first example of active participation by the public in OWF planning in Spain (Todt et al., 2011). Now, a new offshore wind project between Rota and Cádiz ("Bahía de Cádiz" wind farm) is again generating a controversial debate on OWFs in the local media (Diario de Cádiz, 2022b).

4.2 Methods

We applied a multi-data approach, based on several stages of data collection and analysis, including previous documentary analysis, field observation, and in-depth interviews. Our research involved the following phases.

1. We analysed the planning tools for wind energy at national and regional levels and their evolution over the period 2003–2022. Case studies were identified and selected based on available literature/media documents. This included secondary literature and direct documentary information on wind power development in Spain since the 1980s, policy documents, the websites of the organisations involved, local newspaper articles, and academic literature on the opposition to these projects over the period 2003–2009 (Díaz, 2016; González and Estévez, 2005; Todt et al., 2011, etc.). On the basis of the sub-regional territorial plans and the literature on the Cadiz province coastline landscapes, coastal landscapes affected by wind development were differentiated in our study area (Palma, 1997; POT de la Costa Noroeste de Cádiz; POT del Campo de Gibraltar; POT de La Janda; Plan Estratégico Conil 25: Capital Natural, 2015). Through the literature analysis we also detected the sites of planned offshore wind farms.
2. Field observation was performed in these areas. Photographs of onshore wind farms and coastal spaces with different characteristics (cliffs, marshes, beaches, dunes, towns, fishing ports and marinas, coastal roads, etc.) were taken from the areas with highest concentration of population, viewpoints and main roads. The empirical information obtained from the analysis of documents and field observations allowed us to select principle steakholders and issues related to wind energy development to explore in the interviews with them. The steakholders included local politicians (town councillors and mayors), fishermen, tourism entrepreneurs, farmers, environmental protection officers, environmental NGOs, Regional Energy Agencies, and the representatives of Natural Parks, etc. Although there were already large numbers of on-land wind farms (OLWFs) in the area and local people had been living with them for decades, no OWFs had been constructed in the area.
3. In the periods 2012–2015 and 2018–2022, we conducted in-depth interviews in several coastal municipalities

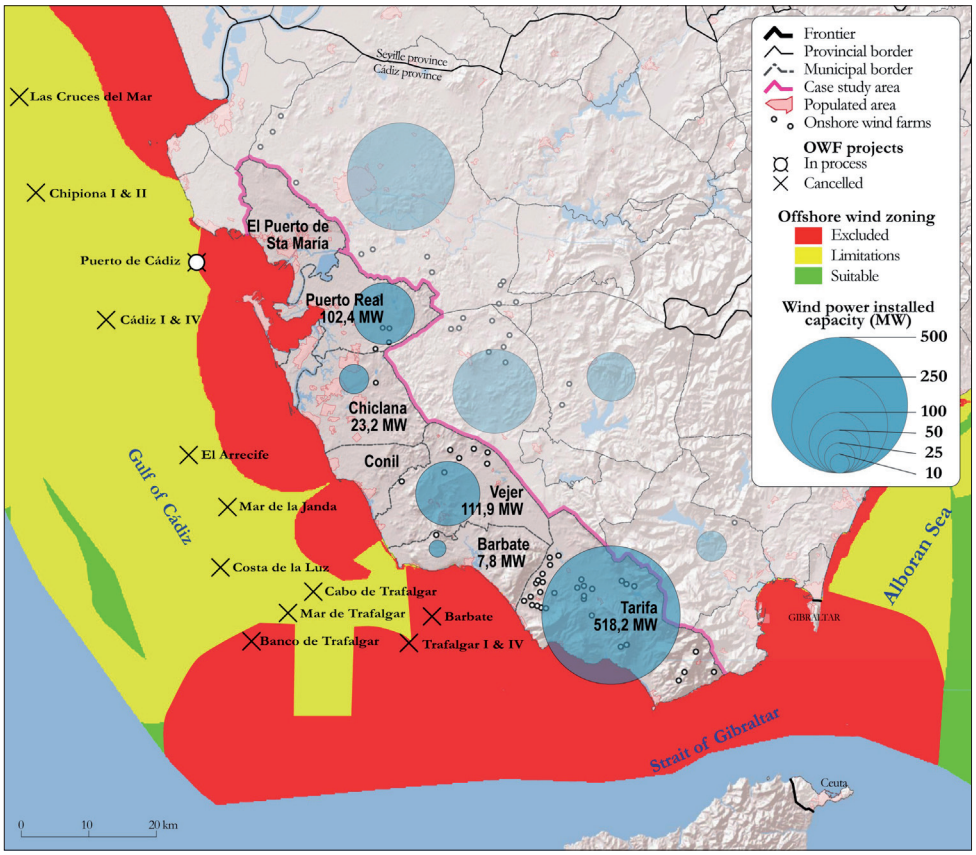

Fig. 3: Pilot OWF projects in the Bay of Cádiz
Source: Elaborated by the authors based on data from the Atlas Eólico IDAE and Global Offshore Wind Farms Database

in the province of Cádiz, adjacent to proposed offshore wind projects (Fig. 4). Some 45 in-depth interviews were held with different local stakeholders affected by the development of wind power projects. We conducted 28 interviews over the period 2012–2015 and 17 over the period 2018–2022. The photographs obtained in the phase 2 were used during the phase 3 to consult the interviewees about the most valued coastal and marine spaces. Although responses on OLWFs were based on real experience, as no OWFs had been constructed in the area, the responses on these projects were largely based on expectations regarding offshore wind development and its possible future impacts, rather than on real experience.

The interviews began with some questions about the personal background of the interviewees, before going on to focus on their values, attitudes, perceptions, beliefs, and experiences about the marine and coastal environment and wind energy projects. In the interviews, we explored their perceptions of the local landscape and seascape, how the resources associated with the sea and the wind are used, and the customs and practices related to different uses of the sea. Interviewees were also asked about the perceived benefits of wind energy projects (both on-land and offshore) and the threats posed by OWFs for other sea uses, such as fishing, tourism, nature protection, etc. All the interviews were intended to be individual, although in one case the interviewee brought two other people with him (Fig. 4). The interviews lasted between 30 minutes and two hours and were all transcribed verbatim.

4. In our analysis of the interviewees' responses, we sought to identify the items that appeared repeatedly in the interviews, and those that appeared in relation to many other elements. These items were also compared with elements considered as important in the literature on the wind farms perception analysed during the phase 1, and our field observations. These items were classified according to the following categories: perceived landscape and seascape impacts, local practices, benefits, and the fairness of the planning process.

5. Results

In this section, we explore local attitudes towards OWFs within the framework of the local resources available to coastal communities and the different elements of their identity. We then compare their perceptions of on-land and offshore facilities, their perceived impact on both the landscape and the seascape, and their opinions regarding their compatibility with local territorial practices and

Fig. 4: Interview with the members of the fisherman association of Barbate. Photo: Y. Prokopenko

socioeconomic values. Finally, we look at questions of fairness in terms of the social, economic, and environmental benefits and the various drawbacks of each kind of windfarm (on-land and offshore) and the public confidence they inspire.

5.1 Seascape, wind, and the construction of local identity

The sea and the wind are both perceived as essential local resources and elements of local identity. "*Many families get by with the help of the sea…*", said the President of a local Fishermen's Association. Another interviewee remarked that "*The sea is an enormous source of resources and part of the identity of all the Levante (eastern) shore…*". While tourism is the biggest economic activity in the area, fishing, varied land- and seascapes, unspoilt beaches and wind all make essential contributions to this important sector. Residents usually associate all these resources with the sea.

Throughout history, the sea has helped sustain the local populations. They do not regard it as an empty space and instead view the sea as full of meaning and symbolism: "*The sea is a full space… a space full of life…*", a natural resource that "*should be treated properly and safely*", since it will be "*inherited by future generations*", according to the President of a local Fishermen's Association. One of the local mayors pointed out that: "*Tarifa and the sea have been an inseparable couple throughout history…*".

The sea is also closely linked to emotional values about the life within it, its aesthetic meaning, and its close ties with wellness and local identity. As one of our respondents said: "*'Mar'" (Spanish for sea) was one of the first words my two-year old ever said. I like it. I'm lucky to live by the sea*". Another respondent added: "*It's a sacred place, the sea gives you something: energy, health…*". The mayor of one of the towns pointed out: "*It is life… It is everything for us*". A member of a local association in Tarifa said: "*The local seascape is very beautiful, and the submarine landscape is very wild. These are part of the success of Tarifa, which lives on tourism and its resources*".

The seascape also has important aesthetic values. Our interviewees distinguished several different seascapes in our study area: the Strait of Gibraltar, the more industrialised northern end of the Gulf of Cádiz and its "pristine" southern side. Place meaning is an integral part of the acceptance of OWFs. The Strait of Gibraltar is perceived as "a unique seascape". As one of the Mayors of Tarifa we interviewed between 2012–2022 made clear: "*In the area of the Strait of Gibraltar, instead of seeing an immense open sea, we see the African continent, just 14 km far away from Tarifa*". Within Spain, which has long northern, eastern, and southern coastlines, the Gulf of Cadiz is quite special in that it faces west and for many years tourists have flocked to this area to watch and applaud the sun as it sets in the ocean (see Fig. 5). The Mayor of Tarifa said: "*It seems a bit silly to us as it happens every single day, but two or three thousand people come to watch …. and they all start clapping …*".

Fishing, and in particular, tuna fishing is a symbol of the Cádiz coast and has been a vital part of the economy for several thousand years, ever since the Phoenician era (1550–300 BC). The Atlantic bluefin tuna has been fished for centuries in the waters of Zahara de los Atunes and Conil using a unique technique called the *almadraba*. In some municipalities, traditional fishing is currently in difficulty and no longer plays an important role in the economy. However, it does remain an important feature of local identity. As the Mayor of Conil pointed out: "*It is still very important socially*". The fish processing industry is still an important economic mainstay in some municipalities. As the Mayor of Barbate explained:

> "Right now the fishing sector is the most important … both culturally and economically because it supports both the fishing itself as well as the canning industry which is currently booming. Eighty per cent of the industrial estate is canning plants, most of which were opened in the last five years".

Fishing has also left its mark on local landscapes with towns like Baelo Claudia – the centre of the fish trade during the Roman era, the Chanca de Conil tuna fish factory, which is now a museum, the Castle of Zahara, the fishing village of Sancti Petri and place names such as Zahara de los Atunes (literally translated as Zahara of the Tuna Fish).

The local westerly and easterly winds (the latter known locally as "our father Levante") are also essential elements of local identity. It is a common belief in this region that the strong winds "protected this area from intensive urban development" and "mass tourism", so saving it from becoming a second "Costa del Sol", the highly developed tourist destination further along the Mediterranean coast to the East. As a result, the Tarifa and La Janda area still boasts unspoilt beaches, dunes, pine woods and wetlands, forming an ideal landscape for many tourists. It offers all the essential ingredients of a "sun and beach" holiday

Fig. 5: Tourists watching the sunset in Tarifa
Photo: S. Briffaud

destination but with a natural landscape that makes it the exact antithesis of the Costa del Sol – so much so that a group of well-known Spanish writers and artists set up residence here in the summer, due to the relatively limited numbers of tourists, the peace and quiet, the harmony with nature and the wild landscape.

In addition, wind, which until the end of the 20th century was viewed as a barrier for local development, has now become an important local resource. According to the Mayor of Barbate: "*the wind was always a problem, … but … now it's become an opportunity for Tarifa with kitesurfing and windfarms*". The Head of an Ornithological Foundation in Tarifa explained: "*The wind has given rise to a wind industry …*". Numerous businesses have been set up on the back of wind-related tourism: "*kitesurfing, windsurfing, surfing, and other water sports have been a huge source of wealth for this area, enabling the town to become economically sustainable …*". These towns are the only wind tourism resorts in southern Spain. They have no competitors. And since the 1990s, windsurfing, kite surfing and other similar sports have become symbols of Tarifa and of the Cadiz coastline, in general. Even in Conil, about 65 km west of Tarifa, the Mayor declared: "*we are promoting nautical activities more and more… taking advantage of the wind to attract this kind of tourism*".

The perception of the wind as a resource that benefits local people comes through the long-established presence and acceptance of OLWFs, which are generally viewed more positively than, for example, urban development in natural landscapes. One of the interviewees from Tarifa remarked that "*land-based wind energy… is an added value for the area because of its ecological and sustainable development values*". Another respondent from Barbate made the following comparisons: "*Some infrastructures are much worse, especially within the towns, buildings, museums, etc., which spoil the area much more … I prefer a windmill to a factory*".

5.2 Factors behind the acceptance/rejection of on-land windfarms and their perceived impacts

5.2.1 Perceived impacts on landscape

In our study area, wind energy has been part of the landscape since 1988, when Tarifa's first on-land commercial wind farms were officially registered as "experimental wind turbines". Since then, several shifts in local perceptions of wind energy have been observed. According to the Mayor of Tarifa, a "laboratory" for wind energy development in Spain, in its initial stages, the local community did not receive any social or economic benefits from windfarm development, which met with widespread opposition. In addition, many of the windfarms were erected along bird migratory routes causing widespread mortality in the avian population. The swift development of wind energy in the Cadiz province led to a heated debate which, among other things, gave rise to the drawing-up of an On-land Wind Resource Organisation Plan in La Janda and nearby areas. This Plan classified the territory into areas that were considered compatible with the deployment of wind turbines, areas that were compatible under certain conditions, and areas considered incompatible. The plan also obliged developers to reach agreement amongst themselves regarding the territorial planning of wind farms in the programming sectors into which these Plans were divided (Baraja et al., 2015). This Plan, however, did not correct the mistakes of previous wind power developments. One of the Mayors clearly regretted this: "*What I think is sad is that it could all have been planned much better without erecting windmills in an apparently random, haphazard fashion*".

From the early 2000s, however, on-land wind energy development has become increasingly normalised in the area and in some municipalities is now the main economic resource. Paradoxically, local acceptance became widespread despite the progressive increase and concentration of on-land wind parks and their strong visual impacts. Many of our interviewees explained that local people had got used to the windmills:

> "20 years on [since the first conflicts], the initial rejection of wind turbines and their impact on the landscape has disappeared" (local Mayor); "In Vejer … they installed seven or eight wind-farms, and nobody minded … Now we have some amazing views, and some windmills and people still take photos and it doesn't mean that the world has suddenly come to an end" (local farmer); "I don't think the windmills are ugly" (local environmental protection officer).

Most residents perceive windmills as a "lesser evil" and "the view of the wind turbine is preferred to that of other infrastructures or urban developments". Another interviewee, an environmental protection officer in the area with the highest concentration of windmills, said:

> "You get used to seeing a seventeen-floor skyscraper on the beach or a building and especially in the Málaga area at six o'clock in the afternoon in the summer, it casts a huge shadow over you as if the sun has already set and I don't know …. I think there are worse things than that, worse things have been done … there are a lot of people who come in to take photos of themselves with the turbines" (Fig. 6).

Some of the interviewees even argued that local people are more concerned about local seascapes than landscapes: "In my opinion, we don't think they have so much impact on the landscape because we spend more time looking at the sea".

5.2.2 Compatibility with local territorial practices and socioeconomic benefits

OLWFs are generally accepted by the local population and wind turbines are considered compatible with local land uses. The Head of a Cereal-Farming Cooperative in Conil pointed out that windfarms bring a whole series of benefits for farmers and have much less impact on land use compared to photovoltaic plants:

> "First they produce money for the Council and then for the owner of the land. I like the energy produced by the windmills more than the photovoltaic plants, because they don't spoil the land so much. All you need is a few tracks and that's it".

The mayor of one of the towns confirms that farmers can continue using the land where wind turbines are sited: "*in the case of wind-farms, the cows continue grazing and farmers continue sowing their seeds …*" (Fig. 7). Other benefits mentioned by livestock farmers included the fact that the construction of wind farms and their associated tracks and paths made it easier for them to reach remote areas.

They also said that their animals enjoyed the shade provided by windmills in the hot summer months and the firm, well-surfaced paths when it was raining. Onshore windfarms are seen as a way not only to increase income for the owners of the land, but also for town councils who often rent out land for windmills. According to many interviewees, the landowners earned up to 6,000 Euros/year for each wind turbine installed on their land over the period 2012–2015.

Fig. 6: Wind farms near the village of Zahara de los Atunes
Photo: M. Frolova

Fig. 7: Grazing cows near wind farms of Zahara de los Atunes
Photo: M. Frolova

And as the Mayor of Tarifa (the town with the most intensive wind energy program) made clear in 2013: "*Windfarms are the primary source of income for Tarifa Town Council… bringing in more than 2 million Euros per year*" in taxes. Wind turbines are also accepted by many tourists and by the tourism sector. Some hotel owners in Tarifa even use windmills in their advertising brochures and the Tarifa business association produced an advertisement in which the mountain ridge was decked with windmills.

5.2.3 Questions of fairness, exclusion of local communities from the planning process and empowerment

Although many of those interviewed regard land-based windfarms as beneficial for their local economies, many complained that the income they generate is not distributed equally between all the different social groups and has no impact on their electricity bills. As one of the mayors emphasised:

> "We get a decent amount of income from these turbines, but the people don't reap the benefits directly … they see them as very distant. The thing that affects them most directly is the electricity bill … that each person must pay at home…".

Another issue raised by local people was that wind farming was not really a solution to the energy problem. A local teacher described wind-farm development as "a makeover operation". She said,

> "we always realised that the windmills spoilt the landscape, and we did not believe that they were solving the energy problem. In fact, we came to the conclusion that they were fairly useless, we saw a lot of windmills that were not moving at all. There was a general sense of dissatisfaction due to the presence of monsters who were examples of the increasing taming of a landscape that we would prefer to keep wild."

Many stakeholders feel excluded from the planning process and see the spatial planning procedure behind wind energy development as top-down and centralised. One of the Mayors said:

> "I would say that the people have not participated in the decision to install windfarms even though we politicians are elected. But I don't consider that to be participation, I understand it in a different way as participative democracy towards where we want to be".

A manager of wind power energy planning from one of the local Town Councils explained it like this: "*This activity is imposed upon us. We just granted a license. It used to be a Council decision but now the Council doesn't decide, it's the job of the Regional Department of the Environment, Industry*

and Regional Development". An environmental protection officer from another town highlighted the weaknesses of the process of spatial planning of OLWFs:

> "Before taking a decision on the siting of a windfarm, environmental impact studies are carried out. I do a study for you and if you don't like it, well you can get somebody else to do another study for you and perhaps they will give you a different opinion".

When members of the different coastal communities were asked about how much power they have in decisions on the use of local resources, significant differences were observed. In Barbate, the respondents felt particularly powerless as regards the use of their territorial resources. A Mayor of Barbate complained that

> "40% of our municipal area is Natural Park and another fortysomething percent is a military area and that is real legal servitude... The result is that this town does not have the same growth potential as any other town with 100% of its municipal area to enable the town to grow or develop its tourism. We feel deceived by the higher tiers of government … because I believe that the Natural Park, as well as being sustainable, should also be a much more important source of income for the town than it is at present. As regards the question of the Army, they tricked a previous Mayor into giving them 5,200 hectares. They promised to build a hospital and a football ground etc., and claimed we were going to be able to live on the Army presence…. They did nothing of what they promised and all they do is bother us with the noise from their planes at one o'clock in the morning, from explosions and firing their guns … And we want to install a fish factory that would provide 150 jobs and they say no… They won't even give us 10 hectares and this is another production sector in Barbate… This explains why there is so much opposition. We don't want to be cheated again".

5.3 Factors behind the acceptance/rejection of OWFs and their perceived impacts

5.3.1 Perceived impacts on the seascape

While public opinion regarding OLWFs is mostly positive, OWFs seem less popular. The idea of using the sea as an energy resource is not new in this area, but our interviewees consider that traditional uses of the sea for energy production were more environmentally friendly in terms of their impact on the sea and the landscape than future OWFs. A local teacher explained:

> "In San Fernando… We've always tried to harness marine energies that were more landscape-friendly because we had watermills that were powered by waves, which have the opposite impact on the landscape in that they are sometimes quite beautiful and are under the water, so they don't produce this impact on the sea …".

In fact, the perceived alteration of local seascapes is an important barrier for the acceptance of OWF. This was particularly evident in the interviews held in 2012–2015, when local people expressed mostly negative opinions about the visual impacts of OWFs: "*A sea- and landscape disaster*"; "*destruction of a seascape*"; – are common assessments of their impact. The local teacher complained: "*If I were to look out to sea and see windmills, I think I'd break down and cry*".

The OWE development projects proposed in this area at the beginning of this century (2003–2009) led a wide variety of stakeholders (Town Councils, local conservationist groups, fishermen's unions, tourism entrepreneurs, etc.) to join forces in opposition to them (Frolova and Pérez, 2011; Todt et al., 2011; Baraja et al., 2015). These groups feared that the vibrations and the noise made by the turbines would affect the fishing grounds and the migration of birds, whales and bluefin tuna; they claimed that the windfarms were incompatible with underwater archaeological heritage, and that the fact that the turbines would be visible from the beach would alter local identity and damage tourism. They also feared that they would upset coastal dynamics and the clarity of the water, etc. One of the local Mayors remembered: "*When the question of building offshore windfarms in the Sea of Trafalgar was first proposed in around 2008, it caused quite a stir*". Another Mayor added:

> "A platform against the offshore windfarms was set up and there was quite a lot of consensuses between all the mayors along this part of the coast [La Janda], mayors from different sides of the political spectrum, we were all agreed" (Mayor Conil, 2013).

The sea off the coast of Cádiz is viewed as an area with many different uses and a fragile equilibrium between them all, on which a new use – renewable energy production –could have drastic effects. A representative of the NGO "Ecologists in Action" explained:

> "In Cádiz this question is difficult because of the large number of constraints due to the presence of military bases and to protect biodiversity, unless they go a long way out to sea, but there they would interfere with shipping lanes."

The meanings we associate with places is another important factor in the acceptance of OWFs. In the Strait of Gibraltar, and southern and central parts of the Gulf of Cádiz, there is more opposition to OWF projects due to the "natural" seascape values attributed to these areas by our interviewees. Those near the Strait of Gibraltar were particularly concerned about the way OWFs might spoil the local seascape with Africa in the background – as one of the Mayors of Tarifa says:

> "I cannot imagine the seascape we have here with wind turbines, perhaps in other places further away from the coast, maybe … where the sea view stretches out to the distant horizon and there's nothing behind it, nothing so characteristic as the Strait".

Another Mayor of Tarifa listed the possible impacts of OWFs on the town:

> "Shipping traffic, birds, whales, seascape, and then the transport of all the energy produced by the turbines and all the infrastructure that this requires on land will also produce a visual impact, plus the impact of the cables … The electromagnetic impact has also been talked about a lot in our town…. They say you won't be able to see them that they're a long way off, but who's going to guarantee that once they've been erected? They would destroy this seascape, which is something innate to us, that we hold in our eyes and in our heart".

Most of the interviewees from the central area of the Gulf of Cádiz also reject OWFs because of their visual impact on the seascape. The President of the Conil Fishermen's Association said: "*The only thing I'm worried about is their visual impact*", while the President of the Conil Business Association made clear:

> "Here the people are completely against offshore wind farms. I don't think they will accept the installation of windmills in the sea, because they will affect the bluefin tuna and the *almadrabas*, in addition to their visual impact… even if they are installed far away from the beach…"

The stakeholders from the Atlantic coast are also concerned about whether people will still want to come and watch the sunset if there are OWFs: "*they are going to ruin the sunset in the sea with the offshore wind turbines*". In the more industrialised northern area, however, various interviewees are more positive about OWFs.

Visibility and distance from the coastline are important factors in the debate on the coast about the benefits of OWF. One of the Mayors had this to say: "*I'm not against them being installed in the sea but we don't want to see them, they should install them further out to sea*". Several local mayors interviewed in 2012–2015 were prepared to accept OWFs providing they were constructed far out to sea, where the visual impact was much less.

Not all the interviewees thought that OWFs would have a substantial visual impact, especially in the most recent interviews conducted in 2021–2022. They also mentioned that fog occurs frequently on the Cádiz coast and that this would drastically reduce the visual impact of the windmills. One interviewee from the Cádiz Port Association, where there are plans to construct a new OWF project said in 2021:

> "They've published pictures in the press with enormous turbines just off the beach of La Caleta, and obviously the visual impact is terrible, but the reality is that if these windfarms are eventually installed they will be so far out from the coast that their visual impact will be inappreciable and they won't bother people so much".

There is also the possibility that local people will gradually get used to seeing OWFs: "*you get used to everything…*", said one interviewee. Another interviewee remarked: "*In the same way as we got used to seeing windfarms on land, we will adapt to seeing them in the sea. It is something that is here to stay*". Even those interviewees who expressed positive views about OWFs, however, would prefer it if they were constructed in industrial areas:

> "They would fit better in industrial areas or close to ports because you can situate the whole value chain there, create jobs in the local area and if this is combined with fish farming plants or green hydrogen, well, even better".

5.3.2 Compatibility with local territorial practices and socioeconomic benefits

Most stakeholders opposed to OWFs are worried about the possible damage they might cause to their businesses and do not believe that these projects will bring any socioeconomic benefits for their town. Many of the interviewees think that OWFs will not have any benefits for local people. One of them complained:

> "The technology would not be local; they would bring it in from outside. And what I am sure about is that they would occupy the space, that's certain. The technical staff who would operate the platforms wouldn't be from here either. I'm sure. Therefore, they would take over our natural space, and we would get nothing in return, because the main source of income in this town is fishing".

The possible negative impact of OWF on fishing lies at the core of many local concerns. These concerns cropped up at all the different stages of our research. One of the Mayors of Barbate remarked:

> "Most people disagree with installing wind turbines in the sea because we are a fishing town and anything that might endanger the already severely battered economy of our fishing sector could affect it and putting that at risk is in no one's interest".

A local businessman pointed out that an essential condition for public acceptance of OWFs would be to demonstrate their positive economic impact on the town: "*putting wind turbines in the sea, without knowing what benefits they are going to bring, well, people's first reaction will be to say 'no'*".

A Mayor of one of coastal municipalities expressed the same idea in more detail:

> "If wind energy is related with job creation, it will be welcomed, but if they present it to us as something that will ruin the *almadraba*, because it's going to ruin the tuna fish, they're going to ruin fishing because they can't even catch squid or octopus. They're going to destroy tourism because the visual impact is tremendous and the first thing you see from our town is the sea and some giant windmills, they're going to be strongly opposed".

We observed that while during the initial research period (2003–2009) the OWF projects were widely rejected by residents, in later surveys conducted between 2012 and 2015, local communities were more receptive to their development as a means of creating wealth and employment.

In this case it is important to bear in mind the economic context in which the second round of interviews took place, with a severe economic crisis in an already vulnerable area. Some respondents argued that local people would be prepared to accept the strong perceived impacts of OWFs, if the projects brought economic and social benefits for the territory. The President of the Conil anti-wind-power platform, which paid a key role in the opposition to OWFs in 2003–2009, was interviewed in 2014:

> "We are not against alternative energy. You just must be a little bit fairer … If they told us they were going to build the windfarms 40 miles out to sea… and that we won't have to pay any electricity bills for the next 40 years and the farms won't cause problems for fishermen, well we could sit down and discuss it".

The same year the President of the Fishermen's Association in one of the towns said:

> "people in our sector think that if someone comes to install offshore wind farms and give us money, then we should accept it… That way there would be different jobs for us to work in … For example, if we had a chance to put fish farms in the open sea, but we didn't have the resources to do so, then OWF would make it possible".

A Mayor of one of the municipalities stated:

> "people's perceptions will be positive if they tell us they're going to set up factories for the assembly of wind turbines and they're going to hire local people or set up fish farms under the windmills …".

In 2021–2022, some respondents were more positive about the possible impacts of OWF on the local economy. "*Offshore windfarms will contribute to the local economy during construction and repair work. Projects of this kind always have a knock-on effect on the local economy*", said the representative of the Cadiz Port Association, which is promoting a new OWF Project in Cádiz in 2021. Moreover, a local Mayor argued that in some cases, these farms will be highly beneficial for coastal communities: "*If you say "no" to offshore windfarms, people get angry, because they need money now*". In 2022, another interviewee, from the NGO "Ecologists in Action" stressed that:

> "We cannot waste this opportunity to create green jobs, as well as decarbonising the economy and reducing

> our dependence on oil, especially given everything that's happening in Ukraine, so if the [OWFs] are well-designed, well-planned and have no environmental problems…".

Although in recent years the coastal communities have tended to be more receptive to OWF, many people still oppose these projects, which are viewed as badly planned, without the participation of the coastal community. For example, the project proposed recently near the Port of Cádiz has been a source of great controversy in local newspapers (Diario de Cádiz, 2022a) and several interviewees rejected it outright. "*It is pure speculation*" – says a representative of the NGO Ecologists in Action:

> "It's absolutely ridiculous to try to take advantage of a loophole in the port regulations to try to slip in a project that is completely unviable, not only because of the damage it will inflict on the landscape, but also because it affects shipping and the migration of critically endangered birds".

5.3.3 Issues of fairness, perceived exclusion of local communities from the planning process and empowerment

Another important issue was how the benefits of OWFs would be distributed within the coastal community. Local stakeholders were concerned about the fairness of the access to local resources and of the distribution of possible benefits from OWFs: "*… This energy serves private interests, not those of citizens*", one of the interviewees complained. A Mayor of one of the towns argued that it is very important for people to know "*whether the benefits go to just a few or whether they are for the entire population*"; another local stakeholder claimed: "*I don't believe all this about financial compensation. It all ends up in foundations or in the hands of politicians*".

According to our interviewees one of the best ways of avoiding unfairness would be to offer compensation to the fishermen, the sector most directly affected by OWFs. The Head of the Tarifa Fishermen's Association claimed that:

> "99% of people agree with what I've just told you. It must have a direct input into the local economy. For fishermen, a wind farm is like a wall that we have to go through. They would have to give us tuna fishing quotas and some financial compensation too".

Many point out that the compensation schemes created by different public administrations, even for OLWFs, are ineffective. An expert emphasised in an interview in 2021:

> "The compensation schemes are no good. In the end, the politicians set up their foundations and the money never actually reach the people. Rather than compensation, what we should be doing is correcting [the imbalances]."

Another common bone of contention amongst local stakeholders was their lack of control over the use of local marine resources. They feel totally excluded from the planning process and their economic interests are ignored. They also think that their access to these resources is being severely restricted and, in some cases, directly blocked. One of the interviewees from Barbate said:

> "The land has its owner, but the sea belongs to the State, … so ordinary people don't really have much to say unless it affects their business … in this case fishing. If they put NATO ships here and windmills there, what can we do? Where can we fish?".

Another common grievance amongst stakeholders in our study area is that the process of planning and operation of wind farms is unfair. They insist that they support renewables in general and wind power projects. The way the energy companies have taken control of their resources with no benefits for local energy consumers, however, is viewed as wrong. As one of local Mayors says:

> "No one could possibly argue that in la Janda we haven't made a strong commitment to renewable energies, especially given the way the companies [mentions the name of one of them] hard sell you the electricity… Because… If not, they cut off the electricity to the school, they cut off electricity to the Town Hall or perhaps to the High School, and if not, they increase the prices or they force you to build a substation and you must pay for it and then assign it to them …"

The power to decide about how to use local marine resources seems to be a key issue in attitudes towards OWFs. This would help empower coastal communities. Another Mayor offered his views on what would be a fair process of OWE planning:

> "Offshore wind power development must be a joint project involving all the towns on the la Janda stretch of coast [including Barbate, Conil and Barbate] … but … everyone should benefit, not just the ones that always do, because we're afraid that … they'll be mortgaging our future".

6. Discussion

Our study on the attitudes of coastal communities in Southern Spain towards wind energy projects gives a good overview of the main factors influencing local people's attitudes towards OWFs and the associated conflicts. These conflicts are closely linked to the perception of the sea and the wind as important local resources and the perceived right of the coastal region to generate wealth for its local community using these resources. Their attitude towards OWFs is also influenced by less tangible aspects of the underlying social, aesthetic, and cultural values that coastal communities attribute to the sea.

For the people who live on this stretch of coastline in the province of Cádiz, the sea is not an empty space. It is full of emotional, aesthetic, socioeconomic and cultural values and is used for a wide array of different purposes which seem threatened by OWF projects.

While OLWFs are generally viewed as compatible with other uses, such as farming, there is much greater resistance to the construction of offshore wind facilities. Our research shows that the fact that coastal communities have come to accept on-land windfarms does not necessarily mean that they will accept OWFs. They are perfectly aware of the need for renewable energy sources for more sustainable development and of the role that can be played by windfarms in general.

Paradoxically, according to most of our interviewees, on-land windfarms in this area are perceived as having less impact on the landscape than OWF projects have on the seascape. In general, they believe that on-land wind power developments are well integrated into the local landscape. The factors behind this positive perception are, for example, the fact that wind power has now been part of the Cádiz landscape for over a generation, that it is compatible with farming and other local practices, as well as the advantages offered directly by on-land wind power or indirectly via its impact on the local economy. As a result, the coastal community has a different relationship with local landscapes than their socioeconomic and cultural links with the seascape.

Here the perceived alteration of the seascape is an important barrier for the acceptance of OWFs, although many of our interviewees stated that they would accept OWFs if they were situated a long way away from the coast.

According to our findings, the main concerns amongst the people of this region regarding the installation of OWFs spring from their doubts as to how much their towns will benefit from OWFs and whether these benefits will be distributed fairly. They are also concerned about the effects they may have on the local economy, energy provision, and social development. Many feel that fishermen (part of the area's most vulnerable economic sector) should receive compensation for loss of income and reduced revenues. In line with other studies on stakeholders' acceptance of OWFs (Chen et al., 2015), however, many interviewees agree that the best strategy is to create new job opportunities to help fishermen, aquaculture farmers and local residents, or to train them in the skills they need to get better jobs.

The different perceptions regarding the economic and social benefits provided by on-land and offshore windfarms was another important issue for most of the stakeholders we interviewed. While most in the local communities appreciate the benefits they receive from on-land wind farms, even though they are not always distributed fairly, they often express completely different views about OWFs, which they believe will do more harm than good for local communities. Others feel that the installation of these facilities could cause control of local marine resources to be wrested away from them. The top-down spatial planning of marine energy systems without the involvement of local actors in the planning process and the fact that their social and cultural values are not considered, makes this feeling of being excluded from energy decision making even more acute amongst local people. There are therefore three key factors to help ensure that local communities are willing to accept OWFs:

i. That they provide economic and social benefits for the area;
ii. That they do not compete with other local uses of sea and wind resources; and
iii. That they have the power to decide over how best to use these resources.

This is the best way to prevent them from feeling disempowered.

Sociocultural and economic relationships between coastal communities and OWF projects vary greatly from one place to another and at different times. As for the spatial variations within the study area, on the one hand, perceptions regarding the visual impact of OWFs varied in line with the different seascapes. The potential impact was considered more negative in attractive seascapes such as the Strait of Gibraltar and the largely unspoilt Atlantic coast of Tarifa, Barbate, Vejer and Conil, while the projects proposed in more industrialised port areas of the coast were viewed more positively. In addition, previous local experience with on-land windfarms, in which the community was more involved in the planning process and the benefits from wind facilities were considered to have been more fairly distributed, meant that some coastal communities in our study area were more predisposed to accept OWFs. Differences between the various towns in the study area in terms of their acceptance of wind projects are also linked to the perception in coastal communities regarding their power to decide on how to use local resources.

As for variations over time, we observed a gradual shift in local perceptions of wind energy installations in general, and especially of OWFs. During the first stage of wind-power development on land, the turbines were rejected by many local stakeholders. From the year 2000 onwards, however, they became increasingly normalised and integrated into local people's image of the landscape. At the same time (2003–2009) there was large-scale rejection of OWFs, in particular, when several OWF projects were proposed in the same area. From 2012 onwards, local communities became more receptive to OWF development as a mean of creating wealth and employment in an area that had been severely hit by the economic crisis, and in 2021–2022 OWFs were considered more acceptable by most of our respondents.

7. Conclusion and policy implications

Our research in the province of Cádiz in southwest Spain over more than ten years provides a valuable lens through which to explore the complex web of changing societal relationships with the sea and OWE. The production of OWE is an issue that goes far beyond the visual impact of the infrastructures. Our analysis of the responses of coastal communities to OWF projects shows that they are inextricably linked with the perception of the sea as an important local resource, over which these communities have less and less control.

Our results have challenged assumptions that coastal communities are more prepared to accept offshore wind-power development than on-land. Differences in local perceptions of the benefits of the former and the latter technologies and their relationship with seascape and marine resources are key to understanding coastal communities' responses to OWFs. While the negative visual impact on the seascape is another important obstacle to public acceptance of OWFs, our interviews show that local stakeholders would be more prepared to accept OWFs if they were situated further away from the coast and provided real benefits for local communities.

Our findings also show that opinions about OWFs can vary greatly from place to place and at different moments in time. These changing perceptions are linked not only to visual impacts and socioeconomic benefits, but also to fewer tangible aspects of our relationship with the sea. These cannot be captured by a purely visual definition of the seascape and instead require a multidimensional view that encompasses practices, emotions, and mindsets. Coastal communities have a very mixed set of values, attitudes, perceptions, beliefs, and experiences about the marine environment, which together form their vision of the seascape. Seascape is a useful tool for understanding local place perspectives and the sociocultural dimensions of renewable energy resources. These values and practices do not fit with the existing approach to MSP in Spain.

One of the greatest challenges is how to reconcile public perceptions of OWFs in coastal communities with the visions of planners and decision makers. This can be achieved through the co-management of marine spaces. It is therefore crucial to plan marine spaces in a way that respects existing sociocultural and economic processes, and the relationships between coastal communities and their seascapes.

The results of our empirical analysis show that the values, perceptions, and practices of coastal communities regarding the sea have a fundamental influence on their opinions on OWFs. If these were accounted for in OWF planning, the

likelihood of conflict and delay would be greatly reduced. Our research indicates that local people are more likely to accept these facilities, if they provide clear, tangible socioeconomic benefits for their communities and if a balanced, shared use of the sea can be guaranteed in which important local economic sectors can continue to thrive.

The implications of our findings for offshore energy planners in Spain is clear. With the recent increase in interest in offshore energy projects in Spain, the current energy crisis, high energy prices and rapidly falling costs of offshore technology, it is likely that OWFs will play an important role in Spain's future energy mix. The results of our study highlight that ignoring local perceptions and practices can result in long delays in offshore wind-power development, so heightening negative perceptions and community opposition.

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Fig. 8: Wind farms near Zahara de los Atunes (Spain) (Photo: Y. Prokopenko)

Fig. 9: Wind farm El Cabrito, implemented in 1993 (Tarifa, Spain), before repowering (Photo: M. Frolova)

Illustrations related to the paper by M. Frolova et al.