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Using Spatial Imaginaries to Understand Contested Senses of Place and Just Transitions in Decarbonising Industrial Regions

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Abstract

The climate crisis and goals for 'green growth' have led governments worldwide to adopt cluster-based approaches to decarbonise carbon-intensive industries (e.g. steel, petrochemicals) and to revive declining industrial regions, a predominant concern for late capitalist societies. Research has begun to investigate the role played by sense of place in sustainability transitions in regions with fossil fuel-intensive industries. However, ways that sense of place may shape just industrial transitions have been underexplored. Adopting a novel analytical approach with the concept of spatial imaginaries, we explore contested senses of place in decarbonising industrial regions and their implications to just transitions. A multi-phase, multi-scalar qualitative methodology was used to investigate 'net zero senses of place' held by government and industry stakeholders and host communities in three emerging UK net zero industrial clusters. Our findings reveal an ontological contrast of industrial places existing between stakeholders and host communities. There was a gulf between the top-down, win-win, and hopeful place visions in policy/industry discourses (e.g. the idea of 'SuperPlaces') and the more ambivalent socio-cultural imaginaries of industrial places held by host communities, comprising bleak lived experiences of extractive place-industry relations alongside positive examples of community-led resilience. The contrasting senses of place underlay local scepticism about proclaimed benefits and visions of industrial decarbonisation, indicating the stakeholders' deficiency in recognising local grievance and struggles, in engaging community in cluster development, and in supporting community wellbeing. We conclude by arguing that stakeholders must go beyond a narrow techno-economic ontology to view industrial decarbonisation as a form of inclusive place-making, working with host communities to address local needs and co-produce shared visions of net zero futures.

Key words: sense of place, industrial decarbonisation, community engagement, left-behind places, just transition, spatial imaginaries

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1. Introduction

Worldwide, industry has become the fastest growing sector of CO_2 emissions (Bashmakov et al., 2022). This has prompted many governments to develop strategies to decarbonise carbon-intensive industries, such as steel (Maier et al., 2024), petrochemicals (Abo-Khalil, 2024), and cement (Obrist et al., 2021), in pursuit of 'green growth' (da Silva Hyldmo et al., 2024). Policymakers have encouraged the co-location and connecting up of industrial facilities in 'clusters' or 'hubs' (e.g. net zero industrial clusters and hydrogen hubs, see Rattle and Taylor, 2023; 2025), with the aim of simultaneously reducing emissions and boosting regional economies through a 'green' industrial revolution (World Economy Forum, 2024). Research and policy have identified the potential of such place-based approaches to produce wider positive outcomes, including reducing regional inequalities and democratising regional industrial policymaking (Bailey et al., 2018; Barca et al., 2012; Flanagan et al., 2023).

However, the predominantly economic perspective adopted by policy and researchers to date on these clusters or hubs—typically at the city or regional scale—has overlooked the meanings and emotions associated with these places by stakeholders and host communities, as well as the local knowledges and lived experiences of residents in industrial places. As a result, several important issues have been neglected, including what senses of place have been invoked in policy and cluster discourses and held by host communities, and how this could inform the delivery of just and inclusive industrial transitions.

This paper argues that sense of place is central to understanding the potential of industrial clusters to achieve broader societal, spatial, and political goals. Sense of place describes the socially constructed, plural, dynamic, and often contested meanings, feelings, and identities associated with particular places in the world (Manzo et al., 2023; Massey, 2004). There is increasing recognition that sense of place is useful for understanding sustainable and just transitions (Biddau et al., 2024; Brown and Spiegel, 2019; Grenni et al., 2020; Horlings et al., 2020; Raymond et al., 2021; Rohse et al., 2020; Stedman and Nilson, 2021). For example, sense of place can function as an analytic lens to understand how place-related meanings affect decarbonisation trajectories (Mohr and Smits, 2022). It can also explain community resistance to the phasing out of fossil fuels (Biddau et al., 2024; Kuchler and Bridge, 2018), and helps the understanding of framings of just transitions from grassroots perspectives (Banerjee and Schuitema, 2023; Biddau et al., 2024; Bohman et al., 2024; Sovacool et al., 2025; Weller, 2019). However, this emerging literature contains significant gaps. Current studies tend to investigate sense of place at a single scale (that of the case study) in relation to specific decarbonisation projects such as coal mine closures (e.g. Mabon et al., 2024). In consequence, little attention has been paid to the role of sense of place in multi-scalar spatialities of regional industrial transitions involving the decarbonisation of interconnected industries and localities (Lai and Devine-Wright, 2024).

This paper develops a novel analytical approach that deepens our understanding of sense of place and how it relates to just transitions by applying the geographical concept of spatial imaginaries. Spatial imaginaries refer to collective ideas about social and spatial relations, which enable shared understanding and collective action (Watkins, 2015). Spatial imaginaries come in three forms: place imaginaries (i.e. that define unique, distinctive spaces in the world and describe their particular characteristics), idealised spaces (i.e. that describe generic types of places, for example 'rural villages' or 'megacities'), and spatial transformations (i.e.

collectively held ideas about how places change over time, for example via 'gentrification' or 'development'). We propose that the conceptual breadth and depth provided by spatial imaginaries, encompassing socially constructed place meanings, types of spaces , and changes to spaces , offer a rich foundation from which to assess sense of place and just transitions in the context of emerging net zero industrial 'clusters' and 'hubs'. Using the three types of spatial imaginaries provides the versatility to encompass matters of space as well as place, viewing them as relationally intertwined (Massey, 2005; Watkins, 2015) and provides an analytical framework to elucidate and extend the place-based agenda for industrial decarbonisation proposed by Devine-Wright (2022). In short, we contend that a deeper understanding of place arises from a perspective that views distinctive places in the world relationally with idealised types of spaces and spatial transformations (see Ryder et al., 2025 for an empirical example of this approach). In addition, we adopt a deliberately broad conceptualisation of place imaginaries to capture heterogeneous aspects of sense of place (Masterson et al., 2017; Raymond et al., 2021) including place-related meanings, attachments, and identities, as well as lived experiences and local knowledges.

Applying this framework empirically, we identify and compare spatial imaginaries invoked by policy and industry stakeholders as well as host communities in three case studies of regional industrial clusters funded by the UK government. Our findings indicate a discrepancy between techno-economic imaginaries of industrial places in policy/industry discourses (e.g. the idea of 'SuperPlaces', referring to prosperous industrial places benefitting from the deployment decarbonisation technologies (HMG, 2020)) and the more ambivalent perceptions of host communities which were primarily defined by a dual place vision comprising bleak lived experiences of extractive place-industry relations alongside positive examples of community-led resilience.

Reflecting on this gap, as well as the dearth of genuine and systematic community engagement across the three clusters, we discuss the implications of contrasting senses of place for just transitions. We conclude by arguing that stakeholders must go beyond a narrow techno-centric ontology to view industrial decarbonisation as a form of inclusive place-making, working with host communities to co-produce shared visions of place-sensitive, net zero futures. In so doing, this paper joins the call for adopting place-based approaches to just industrial transitions, especially in the context of 'left-behind' places (Lai et al., 2025; Moore-Cherry et al., 2025).

The paper proceeds as follows: Section 2 sets the theoretical framework linking sense of place, spatial imaginaries, and just transitions. Section 3 introduces the methodology and case studies. Sections 4 summarises findings in relation to the three forms of spatial imaginaries, held by stakeholders and communities in three industrial clusters. Finally, section 5 discusses implications of the results for conceiving place-based just transitions, followed by suggestions for future research.

2. Theoretical framework

Research adopting a geographical lens on sustainability transitions has long rejected a static 'container' view of place and argued for engaging the relational, multi-scalar, and affective nature of places in understanding the formation of decarbonisation pathways (Binz et al., 2020; Murphy, 2015) and their justice dimensions (Devine-Wright and Ryder, 2024; Eadson et al., 2023; Mabon et al., 2024). Devine-Wright (2022) argued for a place-based research agenda that conceives the creation of net zero industrial 'clusters' or 'hubs' as a process of re-making

industrial places in symbolic, physical, and socio-economic terms, impacting landscapes, livelihoods, and place relations held by host communities, while shaping their reactions toward proposed decarbonisation pathways (Carr-Whitworth et al., 2023; Lewis et al., 2023). Three interrelated pillars were proposed to unpack this process: sense of place (how industrial decarbonisation may affect and be affected by residents' lived experiences and place attachments), ontology (how industrial clusters are collectively imagined), and place-making (how industrial clusters reshape the places where technologies and infrastructures are being deployed) (Devine-Wright, 2022).

2.1 Sense of place and just energy transitions

Sense of place refers to the meanings, attachments, and identities that people associate with a specific place in the world (Manzo, 2005; Masterson et al., 2017; Sebastien, 2020; Stedman, 2003). As people-place relations may differ across individuals, social groups, and localities, sense of place is typically plural and subject to negotiation and contestation (Manzo et al., 2023; Raymond et al., 2021). Social science research on energy has employed the notion of sense of place—and related concepts such as place attachment and place identity—to understand local perceptions of and socio-spatial conflicts over energy infrastructure (Cherry et al., 2022; Devine-Wright and Peacock, 2024; Venables et al., 2012). This scholarship has shed light on how sense of place may guide community interpretations of certain technologies, projects, and associated place changes as 'fitting in' or being 'out of place' (Devine-Wright and Howes, 2010; McLachlan, 2009; Scott and Powells, 2020; Wheeler, 2017).

Sense of place is useful to avoid pejorative 'NIMBY' (Not in My Back Yard) assumptions about community objections that delegitimise local concerns (Devine-Wright, 2009; 2011). It opens up space for recognising the value of local knowledges and lived experiences (Brown and Spiegel, 2019; Feola et al., 2023; Manzo et al., 2023). It can also make explicit the often-neglected "loss of more intangible assets" that accompany the closure of fossil fuel facilities (Banerjee and Schuitema, 2023; Bohman et al., 2024: 435). Biddau et al. (2024) showed how local sense of place hinged upon the coal industry could interact with structural factors in ways that reinforced lock-in mechanisms against energy transition in Italy. With similar observation in Japan, Mabon et al. (2024) contended that just transitions require policy measures to sustain a sense of community and pride in these industrial places.

While these studies provide valuable insights, there remain many gaps in knowledge. There is a tendency in current research to focus on sense of place at a single scale (i.e. the scale of the case study, be it a community, a city, or a region), rather than on the interaction of different imaginaries of place at multiple scales invoked in climate mitigation (for an exception, see Nygaard, 2024), whose spatiality follows a network topology of scale and is constantly evolving with the fluid boundaries of emerging decarbonisation projects (Lai and Devine-Wright, 2024). When multi-scalar dynamics in shaping transition trajectories are examined, the emphasis is often placed on the role of local sense of place in (de)legitimising certain decarbonisation pathways in a place, with little systematic exploration of other senses of place held by actors acting at different scales or senses of place regarding broader spaces in which the place is situated. Relevantly, the geographical and technological focus in the literature often involves a single project and one or a few localities (for an exception, see Crowe and Li, 2020). These studies typically concentrate on new energy infrastructures in rural spaces (e.g. Stedman and Nilson, 2021), highlighting perceived injustices arising from disruption to place attachments (Schlosberg et al., 2017) and place meanings centred on socially constructed ideas

of rurality (Batel and Devine-Wright, 2017; Ryder et al, 2025). Another strand of research has focused on the phase-out of fossil fuel production (especially coal) in struggling industrial areas (e.g. Rohse et al., 2020), emphasising the loss of place identities hinged upon carbon-intensive industry (Banerjee and Schuitema, 2023; Biddau et al., 2024).

However, little research to date has linked these findings about sense of place to industrial transitions, and explored how this can advance a place-based research agenda that exceeds the narrow conceptualisation of just transitions as public acceptance of decarbonisation technologies (Wang and Lo, 2021) or as policy for diversifying workers' employment. We suggest that research on sense of place and just transitions must recognise the distinctive context of industrial decarbonisation, developing a more holistic understanding that can encompass the diversity of actors, spaces, energy-intensive industries, and technologies involved in state or firm-led initiatives to create net zero industrial clusters.

2.2 Using spatial imaginaries to extend geographical research on just transitions

In order to develop an analytical approach that is suitable to address just industrial transitions, we use the concept of *spatial imaginaries*—"stories and ways of talking about places and spaces that transcend language as embodied performances by people in the material world" (Watkins, 2015: 509). This concept is useful for four reasons.

First, spatial imaginaries can be understood as 'performative discourses' that relate the linguistic and the material (Watkins, 2015). Analysis of spatial imaginaries can reveal the ontologies held by stakeholders that is (to be) materialised through embodied practices, articulations, and projects. This is particularly valuable given that most net zero industrial 'clusters' or 'hubs' worldwide are still at the planning stage.

Second, industrial decarbonisation can be understood as a process of 'place-making' (Devine-Wright, 2022) in which collectively held visions for the industrial sector are transformative, designed to change the material, economic, and socio-cultural characteristics of particular places (Chateau et al., 2021; Lai and Devine-Wright, 2024). Scholars in Science and Technology Studies have shown the efficacy of deploying spatial imaginaries to justify or challenge certain socio-technical imaginaries, such as energy transitions (Hess and Sovacool, 2020; Kuchler and Bridge, 2018). We propose advancing this line of research by utilising the three types of spatial imaginaries to investigate different spatial aspects of industrial decarbonisation (see Figure 1).

Third, spatial imaginaries, as an analytical tool, are not confined to the study of collective mobilisation (as in the case of place-framing theories, see Martin, 2003; Murphy, 2015; Pierce et al., 2011) or to the familiarisation of a specific technology through anchoring and objectification processes (as in the case of social representation theories, see Batel and Devine-Wright, 2017; Devine-Wright and Howes, 2010; Stedman and Nilson, 2021). We contend that spatial imaginaries allow a broader investigation of the spatialities of industrial decarbonisation (Lai and Devine-Wright, 2024) as assumed by multiple actors from host communities (Trencher and van der Heijden, 2019) to industry and governments (Arnold et al., 2024; O'Brien, 2010; Valler et al., 2023), and enable a comparison of senses of place in multiple cases and scales.

Fourth, spatial imaginaries take account of asymmetries of power in spatial transformations, which is necessary when considering industrial decarbonisation involving relations between

coalitions of government, corporate, and community actors. Contestation, resistance, and legitimation are expected functions of spatial imaginaries, given that spatial transformation is assumed to involve political struggle (Davoudi et al., 2018).

To devise our analytical framework, we recast (just) industrial transitions, involving the deployment of large infrastructures, as (just) spatial transformations, based on the recognition that technology deployment is a form of place-making. We then deployed and extended the three inter-related types of spatial imaginaries suggested by Watkins (2015) with the three pillars of a place-based research agenda for industrial decarbonisation suggested by Devine-Wright (2022) to unpack the role of place in these processes.

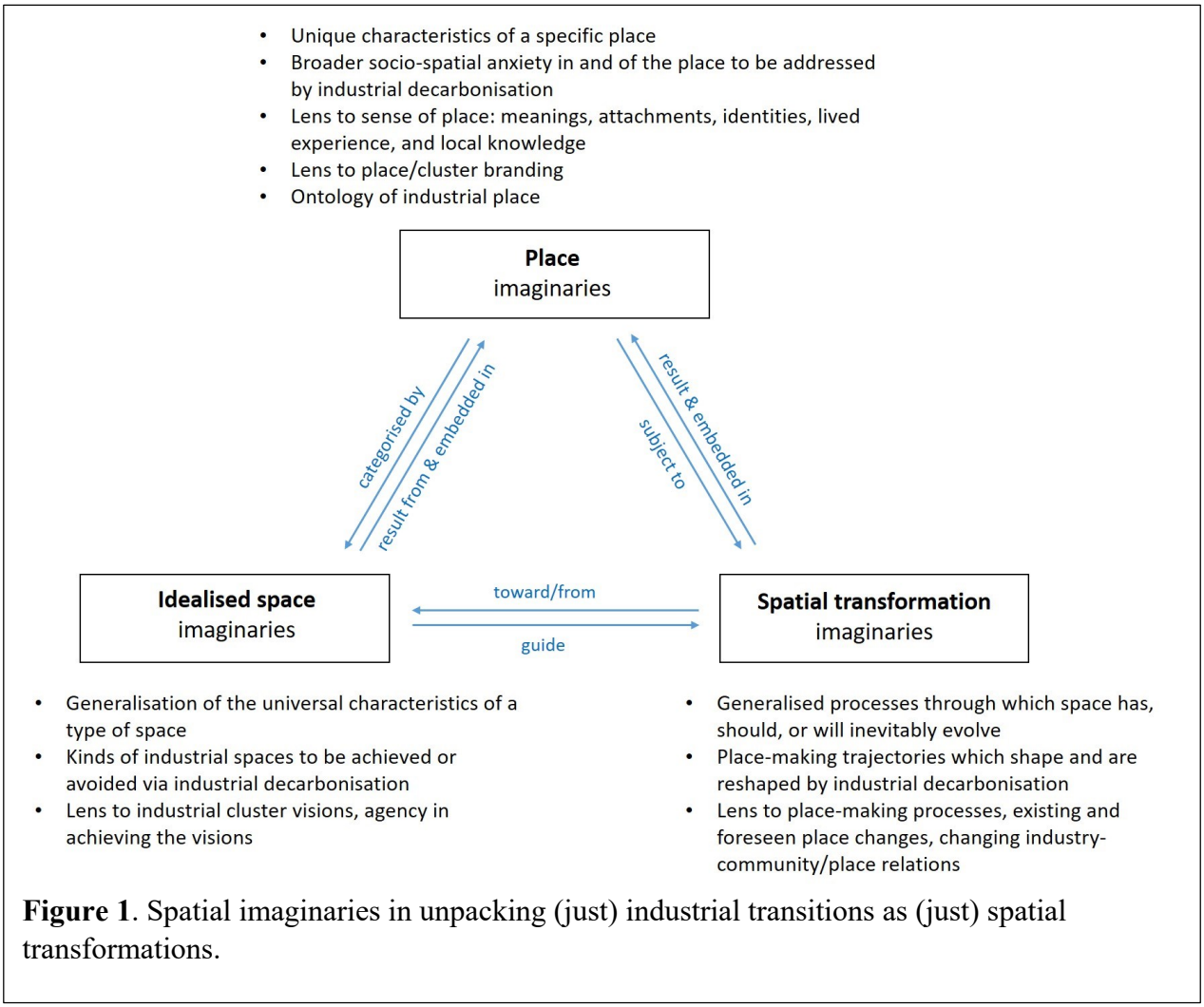

Figure 1. Spatial imaginaries in unpacking (just) industrial transitions as (just) spatial transformations.

(1) *Place imaginaries* describe the purported unique characteristics of a place that can be "at numerous scales" (Watkins, 2015: 510). This type of imaginary is particularly useful for unpacking the senses of place held by different actors; it captures the heterogeneous meanings, feelings, satisfactions, and concerns they associate with a specific place, and can be contested, competing, and evolving over time. Regarding just transitions, using place imaginaries helps reveal how different actors conceive industrial places, while reflecting the broader socio-spatial anxieties about the current status of the place (Millington, 2013) that require solutions and change.

(2) *Idealised space imaginaries* refer to generalised descriptions about certain kinds of places with positive and/or pejorative connotations, such as 'goldilocks zones' and 'left-behind places' (Pike et al., 2024). This type of imaginary categorises certain place characteristics as (un)desirable, and can be linked with certain projects to (de)materialise these characteristics. Regarding just transitions, it can be used to examine types of space that a place could change from/to via industrial decarbonisation (e.g. a declining 'industrial heartland' or an 'ideal net zero place'), and to identify the perceived agents of place-making. In some cases, they can contribute to 'place branding' and 'place-frames' (Trencher and van der Heijden, 2019) to mobilise support for, or opposition to certain projects and associated place changes.

(3) *Spatial transformation imaginaries* indicate the generalised processes through which a place has, will, or should be transformed (for example, globalisation and deindustrialisation). This type of imaginary often entails a sense of inevitability, legitimising a set of associated actions that enable and sustain extensive place change (Watkins, 2015). Regarding just transitions, it helps situate industrial decarbonisation in place-making trajectories—including the historical, ongoing, and foreseen changes to places and to industry-community relations—which it is shaped by and reshapes.

Drawing on these diverse forms of spatial imaginaries provides additional conceptual breadth and depth to understanding how sense of place can inform just transitions, particularly the spatio-cultural politics of low-carbon industrial transitions. Spatial imaginaries are inherently political in that they selectively simplify stories of place, 'other' competing groups, places, and scales, and transmit ideas as performative discourses that have real material and political consequences (Watkins, 2015). Co-constituted with socio-technical imaginaries (Chateau et al., 2021), they can be politically influential in that they help guide policy preferences and investments towards certain technologies (Lai and Devine-Wright, 2024). They could also compete, collaborate with, or resist discourses and visions concerning certain transition pathways, functioning as master frames to support political coalitions and mobilisation for or against certain policies and projects (Benford and Snow, 2000; Maritn, 2003), and strengthen or challenge carbon lock-in to incumbent socio-technical regimes (Buschmann and Oels, 2018; Kuchler and Bridge, 2018).

Based on this approach, we ask three research questions:

1. What imaginaries of specific places, idealised spaces, and spatial transformations elaborate the senses of place involved in the process of decarbonising industrial clusters?
2. How do these imaginaries compare between different actors—policy and industry stakeholders and host communities?
3. What are the implications of these spatial imaginaries for just industrial transitions?

We conducted comparative case studies regarding three UK industrial clusters to investigate the efficacy of this approach.

3. Methodology

Since 2018 the UK government has adopted a cluster-based approach to industrial decarbonisation and linked it to the development of technologies such as carbon capture, utilisation, and storage (CCUS) and hydrogen (Industry Strategy, 2018). The government aims to create the world's first net zero industrial cluster by 2040, and to transform industrial areas into 'SuperPlaces', 'levelling up' declining industrial regions (HMG, 2020; 2021a; 2021b).

Within this context, we designed a qualitative case study methodology to explore and compare the spatial imaginaries envisaged by policymakers, industry stakeholders, and host communities.

3.1 Case study selection

Two layers of comparative case studies (Bartlett and Vavrus, 2017) were conducted. First, we selected three industrial clusters across the UK according to our research focus (Della Porta, 2008)—the North West Cluster (NW), the South Wales Industrial Cluster (SWIC), and the Scottish Cluster (SC). Second, we selected one industrial town within each cluster that was central to cluster building (e.g. hosting or proximal to key emitting sites), namely Milford Haven (MH) in South Wales, Grangemouth (G) in Scotland, and Ellesmere Port (EP) in North West (Figure 2). This strategy enabled an overview of cluster discourses and local responses across different political and spatial contexts, at different geographical scales, and from different sectors (e.g. government, industry, host communities) (for a case overview, see Appendix A).

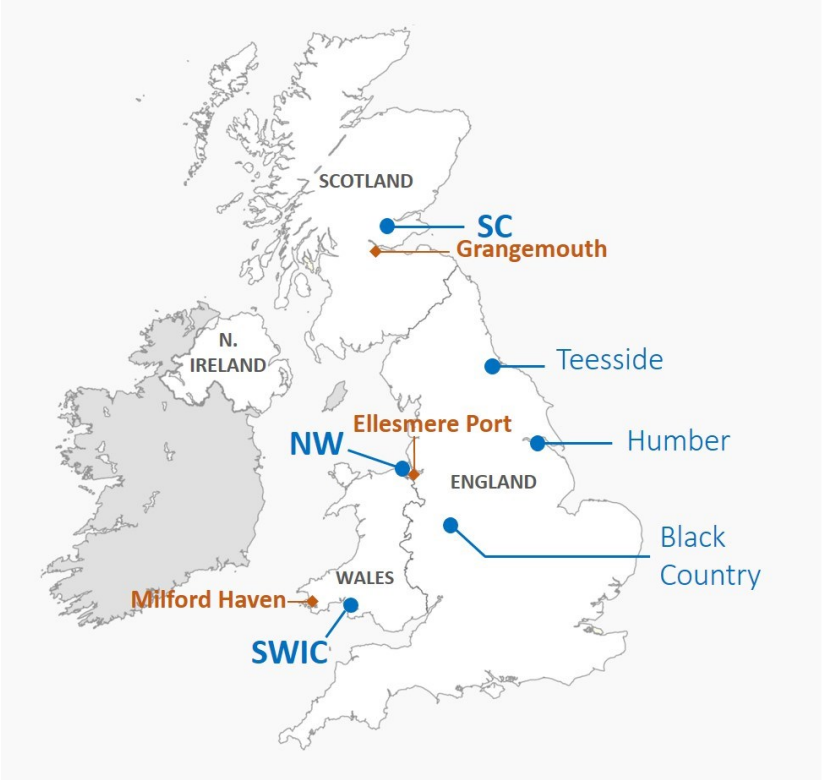

Figure 2. Three industrial clusters (in blue and bold) and the three industrial towns in each of them (in brown) that were selected for this research. The blue dots are only illustrative and do not refer to the absolute locations or centres of the industrial clusters.

The clusters have been instrumentally framed by policymakers and cluster developers as places at a 'regional' level regardless of size difference and dynamic boundaries (Lai and Devine-Wright, 2024). The three local cases are industrial port towns which have witnessed a decline in employment and investment in community building characteristic of the neoliberal shift in the petrochemical industry (Geels, 2022). All had neighbourhoods classified amongst the 20% most deprived areas in the UK, and described as relatively 'left-behind' by some reports (e.g.

Davenport and Zaranko, 2020), leading to several rejuvenation initiatives led by local and port authorities, for example 'Greener Grangemouth' (Falkirk Council, 2024), the 'Origin' branding programme in Ellesmere Port (CWCC, 2023) and 'Sense of Place' branding in Milford Haven (Angharad Wynne, n.d.). These suggest some awareness of ways that sense of place relate to industrial development, aligning with the UK government's policy of 'levelling up' and enabling "our proud industrial heartlands to forge the future once again"(HMG, 2020: 1).

3.2 Data generation, sampling, and analysis

Two phases were used to generate data (Table 1 and 2). Phase one focused on how place is invoked in cluster and policy discourses, and involved three tasks. First, cluster documents were analysed using NVivo software, supplemented by a close reading of UK policy documents (listed in Appendix B). Second, five field trips to the clusters enabled first-hand learning of spatial contexts and key industrial areas. Third, 33 semi-structured interviews with 31 cluster stakeholders (e.g. industry, local/national governments, business organisations, and academia) were conducted. Questions included the authorship, rationale, and strategies involved in cluster branding, perceptions of cluster regions, and imaginaries of an 'ideal net zero industrial place' (see Appendix C). Interviews were recorded, transcribed, and thematically analysed (Braun and Clarke, 2006; Joffe, 2012). We adopted a dual approach that simultaneously looks at "deductive-inductive and latent-manifest set of themes" (Joffe, 2012: 210), paying special attention to themes relevant to existing literature (esp. Devine-Wright, 2022) while remaining open for emerging themes. As the focus is on what and how places are strategically imagined and represented in the policy/cluster documents and discourses, we aligned with the theoretical position of weak constructionism that is adept at unpacking the assumptions, conceptualisations, and ontology underlying the semantic themes (Joffe, 2012). Coding was conducted by the first author with software (NVivo) as well as manually, with the defining and naming of themes and the initial thematic report checked and discussed with the second author.

Phase two captured senses of place and lived experiences of industry amongst host communities in the three industrial towns. Following three preparatory trips to these places, six focus groups with 32 residents were conducted, two in each place (for the focus group questions, see Appendix D). Inclusion criteria for focus groups were adults over the age of 18 who lived or worked in the local place and who would likely have a range of lay knowledges and perspectives about the place. Recruitment information specified that no prior knowledge of industrial decarbonisation plans was needed. Participants were recruited through advertising via known community organisations (e.g. local interest groups, faith organisations), online community networking sites, and posters at locations such as leisure centres, community education hubs, libraries, and supermarkets. We did not specifically invite sectors (e.g. small or medium businesses or trade unions). To accommodate a diversity of participants' needs, an incentive was provided and accessible venues were chosen. Due to some people's lack of availability to attend the focus groups, supplementary interviews were conducted with two residents to enable their participation in the research. In addition, a further six interviews were conducted with local actors in development and decarbonisation projects in Grangemouth and Ellesmere Port.[1]

[1] We found interviewing key local actors in Milford Haven a challenge. This nonetheless was addressed by the participation of a county councilor and a newly-elected town councilor in the two focus groups.

The focus groups successfully captured a range of opinions from a diversity of participants. While the composition of each group differed, we sought to ensure that every participant felt they could contribute to the discussions through a range of discursive and object-based activities. We acknowledge that more extensive data collection could produce more robust findings.

For the thematic analysis of phase two data from host communities, we adjusted the theoretical position to phenomenology, which is compatible with a constructivist paradigm (Joffe, 2012; Pilarska, 2021), to foreground the community participants' lived experiences, perceptions, and emotions regarding the place. The analysis for phase two used a combined deductive and inductive approach similar to phase one. After transcription, initial coding was conducted in NVivo by the third author in discussion with the first author and reviewed by the second author. The focus group design informed the initial deductive analysis, which foregrounded the community participants' lived experiences, perceptions, and emotions regarding:

- Sense of place past and present, which included relations to place, place meanings and attachments, changing experiences of place, relations to industry past and present.
- Perceptions of cluster plans, engagement, and justice dimensions.

Within this overarching framework, inductive coding captured latent differences in a) sense of place and relations to industry experienced in the three cases, and b) differences in intensities of agreement/disagreement to planned industrial decarbonisation within and across the cases.

A final stage of deductive analysis was conducted to enable a comparison between the two-phase data sets using the typology of spatial imaginaries as an analytical framework. These initial deductive analyses for phase one and phase two data were respectively conducted by the first and third authors (for the tables of codes for themes, see Appendix C and D), whose results were then checked between them to produce the first draft of comparison. This draft was refined in discussions with the second author.

Table 1. Research design

Phase	Scale	Focus	Methods
Phase 1 (04/2022-01/2023)	**Cluster** (county/city, regional, national, UK-wide)	**Senses of place of cluster stakeholders** invoked and promoted for cluster branding and promotion	- Document analysis: 69 cluster documents (including 6 websites, 4 webinars, around 40 press releases, and 19 non-technical reports), supplemented with a close reading of 16 policy documents (collected till June 2022) - 5 site visits to three industrial clusters - 33 semi-structured interviews with 31 cluster stakeholders
Phase 2 (02-06/2023)	**Local** (personal, community, township, and surrounding areas)	**Senses of place of host communities** in three industrial towns and how it shapes their views of plans for industrial decarbonisation	- 3 site visits to the three industrial towns (one visit each) prior to the focus groups - 6 focus groups in three industrial towns (2 in each) with 32 community participants in total - 8 supplementary interviews: (1) 2 in-depth interviews with two residents in Milford Haven (one of whom also participated in a focus group) (2) 6 interviews with representatives of local

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	institutions, civic groups and experts relevant to local development and industrial decarbonisation (Grangemouth and Ellesmere Port)

Table 2. Research participants

Phase 1 — **Semi-structured interviews with cluster stakeholders (interviewee n=31)***

Cluster	Total	Cluster leads	Other industry stakeholders	Government actors		Trade organisations	Academia	Other key actors
				local	national			
North West Cluster (NW)	12	2	3	2	-	3	1	1
South Wales Industrial Cluster (SWIC)	13	2	5	1	1	1	1	2
Scottish Cluster (SC)	6	2	2	1	-	-	1	-

Phase 2 — **(1) Focus groups with host communities (n=6)**

Place	Number of participants	Description
Ellesmere Port (EP) in NW	13 total** Group 1: EP1-6 Group 2: EP7-13	• Participant age ranges: between 25-34 and 65 and over, majority between 35-64. • Gender: 9 female (69%), 4 male (31%) • Ethnicity: 12 white British / European (92%), 1 black African (8%) • Direct/family employment in petrochemical and energy industries: 5 (38%)
Milford Haven (MH) in SWIC	10 total Group 1: MH1-4 Group 2: MH5-9	• Participant age ranges: majority between 35-64. • Gender: 7 female (70%), 3 male (30%) • Ethnicity: 8 white British/European (80%), 1 Asian British (10%) • Direct/family employment in petrochemical and energy industries: 5 (50%)
Grangemouth (G) in SC	10 total Group 1: G1-G8 Group 2: G9-10	• Participant age ranges: majority between 45-74 • Gender: 3 female (30%), 7 male (70%) • Ethnicity: 10 white British / European (100%) • Direct/family employment in petrochemical and energy industries: 3 (30%)

(2) Supplementary interviews with community residents and stakeholders (n=8)

Total	Residents	Local civic groups	Government actors	Experts

				local	national	
Ellesmere Port (EP) in NW	3	-	1	-	-	2
Milford Haven (MH) in SWIC	2	2	-	-	-	-
Grangemouth (G) in SC	3	-	-	1	2	-

Notes:

*'Cluster leads' refer to the organizations that led cluster applications for UK government industrial decarbonisation funding programmes. These include two energy consulting firms (NW and SWIC), one decarbonisation development business (SC), one industrial infrastructure and property company (NW), one construction and infrastructure company (SWIC), and one public-private alliance (SC). 'Other key actors' denote organisations outside of the aforementioned categories that play an important role in the formation and development of the clusters, such as a cross-nation organization (NW), a port authority, and a formal non-governmental entity created for the governance of an industrial cluster (SWIC).

**6 focus group participants were members of a local action group opposed to a proposed trial using hydrogen for domestic heating.

4. Findings

Findings are structured according to the three types of spatial imaginaries: place, idealised spaces, and spatial transformations. While recognising differences within and between case studies, we focus on the shared imaginaries in two broad groups—policy/industry stakeholders and host communities—to reveal general, and inevitably simplified, features of their senses of place.

4.1 Imaginaries of place

4.1.1 Techno-economic place imaginaries in industry and policy discourses

The place imaginaries most often invoked in policy and cluster discourses were the self-identified cluster regions and key industrial sites within them. In the Scottish Cluster, these included the whole nation of Scotland, with a special focus on key industrial areas covering "Lothian in the South, through Grangemouth (3.8 million tonnes [of CO_2 emissions]) in the Central Belt to St Fergus (2.3 million tonnes) in the North East of Scotland" (SNZR, 2020: 2) and the carbon storage spaces in the North Sea. The North West cluster was described as a region combining parts of North West England and North Wales, highlighting key sites of industrial emissions like Ellesmere Port and Runcorn, as well as coastal and marine areas for undersea carbon storage such as Liverpool Bay. The South Wales Industrial Cluster was invoked as a region inter-connecting several discrete industrial areas including Milford Haven, Port Talbot, Cardiff, and Newport. These places are often described by cluster developers as configurations of key industrial and energy facilities, and locales for industrial activities that are designed, created, and operated by companies in partnership with governments, trade associations, and academia (e.g. NZNW, n.d.).

These place imaginaries reveal a techno-economic ontology of industrial places that emphasises assets, market competitiveness, and technological innovation, echoing 'place-based' approaches to regional industrial policies that aim to foster a region's potential for economic growth (Alessandrini et al., 2019; Bailey et al., 2018; Weck et al., 2022). Such place imaginaries were tied to place branding and marketing, which represented the clusters as places that were attractive for investment, evidenced by characteristics such as stable public support and resilient energy infrastructures that would ensure high return on investment, social and climate benefits, and reputational gains.

As the industrial clusters cover a wide territorial scope, place imaginaries at multiple scales were invoked. In response to competitive government funding schemes for industrial decarbonisation, industry and policy discourses tended to anchor the clusters at the self-identified 'regional' scale, although individual stakeholders talked more about specific sub-regional places based on their roles and work experiences. Distinctive geographical scales and localities within a cluster were conflated under the same place identity for the purpose of cluster marketing (e.g. "South Wales is a strategically important region for the UKs energy supply, including the UKs largest 'energy' port, Milford Haven" (CR Plus, 2020: 4)). This suggests a fluid and strategic understanding of scale and boundaries by stakeholders, even though in reality competition for resources and recognition may exist between sub-regional places (Lai and Devine-Wright, 2024). Less frequently, (intra-)national scales were referred to in line with government policies (e.g. positioning the UK or Scotland as a world-leader in CCUS technology), as were international scales (e.g. the headquarters and operational sites of industry

stakeholders overseas, competing firms and countries in the global market), reflecting the trans-national, networked nature of the industry, investment, and competition in a global capitalist economy.

Pride in industry was commonly invoked in stakeholder place imaginaries. A proud industrial history was reiterated across cases (e.g. "We were the cradle of the first industrial revolution and must now be the powerhouse of the fourth digital and sustainable industrial revolution" (NZNW, n.d.)). Such place imaginaries often used images of local landscapes and accents in promotional videos, to make "people who live and work within the region […] proud to be part of this [project]" (NW2). Declining industrial regions, if mentioned, were attributed to inequalities in investment such as "the North-South [of England] divide in government funding" (Ennis, 2021) and other external factors such as Covid-19, adding to the call for government support to fulfil the economic potential of these places through industrial decarbonisation.

Underlying these hopeful, optimistic place imaginaries was anxiety in losing out to competition from other clusters for inward investment and government funding, which, some informants feared, could lead to further de-industrialisation with devastating local consequences. The painful closure of steelworks and coalmines in many parts of the UK were recalled by several informants across clusters, who considered industrial decarbonisation not only economically necessary, but also "an important societal thing" (SWIC4). These social concerns indicate that different views about the neoliberal imperative of competition and profit maximisation existed amongst participants, often at individual and national levels (e.g. 'Wellbeing Economy' in Scotland and Wales), and in the UK Government's call for a post-pandemic 'green recovery' (HMG, 2020). Nevertheless, it could be difficult for these alternative framings of industrial decarbonisation to challenge the dominant policy emphasis on economic growth. As one industry informant reflected, "we need a different way of adding value and generating wealth, and it's not necessarily through growth […] I don't think it's gonna be popular amongst, uh, the sort of Tata Sons [the investment holding company of the Tata group who owns Tata Steel in South Wales] to make less steel at the minute" (SWIC5). While the anxieties regarding de-industrialisation suggest some awareness of the social dimensions of decarbonisation, the solution to the potential social crisis was predominantly regarded as techno-economic, namely, boosting regional economic growth by 'greening' its industrial sector.

4.1.2 Socio-cultural place imaginaries of host communities

Community participants tended to adopt a socio-cultural imaginary of place. Grangemouth, Ellesmere Port, and Milford Haven were described in terms of family memories, interpersonal ties, and community activities (e.g. "Everyone in Milford is related to someone." (MH3)). While the focus groups indicated differences arising from life stage and place experience (ranging from having family there for generations to moving into the community over the past few years), underpinning their place imaginaries was a sense of 'home', articulated through emotional, social, and identity connections to family, friends, community, and work, as well as through physical interaction with the environment. Sense of belonging was strong amongst participants (e.g. "With its faults and whatever, I still love it." (MH3)), which was mostly linked to strong community spirit and natural assets (e.g. urban parks) that underpin positive place attachments, place satisfaction, and pride in place.

An ambivalent perception of industry was evident, despite the recognition that it (had) played a strong part in place-making, such as putting towns 'on the map' and bringing people there.

Most participants' lived experiences and memories of place were entangled with industry (e.g. "every time I used to come back on the train, I saw the big Gulf signs and the smell of sulphur, rotten eggs, that always reminds me of Milford." (MH5)). When asked to bring one thing to the focus group that represented the place to them, some showed photographs of family members in previous industries, while others shared a more recent encounter (e.g. a jar representing polluted air). Some residents acknowledged the socio-economic benefits of past industrial development and felt proud of the role their towns had played in the industrial revolution. Others, however, noted the legacy of pollution and reflected on the place's impacts on climate change.

Regardless of industry connections, almost all participants expressed concerns over the ongoing negative environmental impacts and risks associated with local industry. This was often accompanied by discontent with perceived inaction from industry, regulators, and government to address these issues (e.g. "it annoys me that people say 'well you can move out'. If you have family here and connections, industry should be better controlled." (G9)). The secretiveness and lack of transparency regarding industrial operations also fuelled a mistrust of industry and a sense of mistreatment for several community participants (e.g. "I nearly got arrested; I was taking a photo and that [an industrial site] was in the background." (MH2)).

Another recurring anxiety was the eroding townscape and local economy in the face of what Feltrin et al. (2022) called "noxious (employment) deindustrialisation" over the past few decades, in which deindustrialisation of local employment and social lives coexists with continuing industrial production and pollution. This eroding local economy was experienced mostly in terms of the lack of public infrastructure (e.g. the potential closure of local hospitals in Milford Haven), discarded historical buildings that used to be landmarks (e.g. a derelict 19th-century hotel next to the train station in Ellesmere Port), and the decline of once-busy high streets (e.g. the closed banks in Grangemouth). Many participants described the places where they lived using derogatory language (e.g. 'ageing', 'dirty', 'dying', and 'downhill'). This contrasts with memories of the heydays of these places (e.g. "Main street has just gone. It was a lovely town and it's just a wreck now." (MH3)). The declining townscape represents a loss of collective memories (Tomaney et al., 2024) and disruption to positive place attachment (Schlosberg et al., 2017).

Industry was seen as indifferent and unhelpful to this anxiety, and often portrayed paradoxically in place imaginaries, such as a place with an oil refinery yet expensive petrol for local people's cars, or a port with a freight train station but without public access to the sea and train services for local residents. This amplified a sense of frustration and indignation toward industry amongst many residents. It also suggests a spatial injustice (Soja, 2010) in which local people's access to life opportunities and resources were restricted by the development of industry, while bearing a disproportionate burden of environmental costs.

In summary, we found a prevalence of industry-centred, techno-economic place imaginaries in policy and cluster discourses, in contrast to socio-cultural interpretations of place amongst host communities. This suggests contrasting ontologies of industrial places (Devine-Wright, 2022) held by these groups of actors, but also divergent meanings, feelings, sources of pride, and anxieties concerning these places and their futures. The insensitivity of policy and cluster discourses towards the complex place-based experiences and perceptions of industry held by host communities could fuel feelings of recognition injustice among residents.

4.2 Idealised space imaginaries

4.2.1 Imaginaries of 'SuperPlaces' by industry and policy stakeholders

The government objective of turning UK industrial heartlands into "SuperPlaces" (i.e. industrial places revitalised through the deployment of decarbonisation technologies such as CCUS and hydrogen) served as overarching idealised space imaginaries that guided the visions of all three cluster cases. Cluster regions, and places within them, were typically envisioned to be generated by industrial decarbonisation in the form of job retention/creation/upgrade, inward investment, and climate mitigation. These idealised space imaginaries suggest an assumed symbiosis between cluster development and local/regional/national development in the eyes of cluster stakeholders. Through imaginaries such as "a net-zero nation", cluster branding became place branding, and private companies' interests in deploying the decarbonisation projects were equated with—and legitimised by—public interests in pursuing sustainable local/regional/national development. In so doing, industry, with the support of policy, was cast as the key driver of positive place-(re)making and the solution to regional development challenges.

When asked about what 'an ideal net zero industrial place' might look like, most industry and government informants focused on or started with the deployment of decarbonisation technologies in industrial sites. The following quote exemplifies this technology and industry-centred perspective:

> "I would expect that by that time [2050] we would see all of carbon being captured, sequestered […] And I expect that we will see a number of different… low-carbon energy sources become part of the energy mix […] for the manufacturers in the region, and that will include increasing electrification, more hydrogen, umm, probably more emphasis on nuclear technology than we currently have at the minute." (NW11)

In the rare cases when the need for a 'place-based' perspective was invoked, it was often narrowly interpreted in relation to the creation of a green economy (e.g. keeping industry and skills in the region) without placing these effects in specific locations. Only a few informants stressed the importance of embedding decarbonisation infrastructure within local topography to generate "as less impact on the landscape and the local community as possible" (SC6), with the assumption that place change would trigger local resistance.

Local communities were generally absent from industry and policy descriptions of a net zero industrial place. When they were referenced, residents were envisaged as recipients of education, information, and project impacts, or as economic actors (e.g. consumers of decarbonised products and services). They were rarely seen as key actors in the making of a net zero industrial place, which was largely considered a collective responsibility of government and industry. Only one informant considered trust-building to be "more important than actually the technical solution" (SWIC13) and prioritised the task of bringing "prosperity in the widest sense to the local community it operates in". As will be discussed later, this lack of agency attributed to host communities contributed to a sense of power imbalance between industry and community for many community participants across the three industrial towns.

4.2.2 Imaginaries of 'left-behind' places by host communities

Community participants shared three inter-related idealised space imaginaries that depict a complex relation between industry, local development, and community wellbeing, indicative of many 'left-behind' places (Fiorentino et al., 2024a; MacKinnon et al., 2024; Pike et al., 2024).

First, participants described where they lived as 'declining industrial towns' (Feltrin et al., 2022; Mah, 2009; Thomas et al., 2022) characterised by struggling town centres, neighborhoods with poverty and anti-social behavior, dwindling investment in public services, and job losses. This was acutely felt by local people in relation to wealth generated by local industry (e.g. "the difference between public wealth and private wealth is so blatantly obvious around Grangemouth. It's sickening. It's disgusting." (G6)). Consequently, there was a strong sense of distributive unfairness along with discontent toward industry and government bodies.

Echoing this feeling of unfairness was the second idealised space imaginary of a 'sacrifice zone'. As one participant put it, "I feel very strongly that we as Grangemouth citizens are not benefitting [from industry], and we're in grave danger of just becoming the dumping ground" (G9). This imaginary is further strengthened by a sense of spatial injustice, where these places were seen as sacrificed in favour of more prosperous areas, as expressed by a life-long resident in Milford Haven:

> "When I was looking in north Pembrokeshire, and they were sort of saying, 'Oh, let them have it [industry] in Milford.' You know, we're sort of down below. We'll have all the industrial facilities. They just didn't want it up there, but it was alright for us to have it down below." (MH3)

Memories and present day concerns relating to air pollution and industrial accidents featured across all locations (e.g. "When I first moved here I said, 'well what happens when there's an explosion or something?" (MH2)). In this imaginary, industry was seen as a threat to host communities, accompanied by a sense of vulnerability, grievance, and resignation regarding their lack of power over industry practices.

That said, an idealised space imaginary of 'a resilient community' was also shared across the locations, characterised by a strong sense of community often discernible in post-industrial places (Mah, 2009; Pike et al., 2024). Community participants have managed to live with the risks and environmental burdens associated with industrial activities, despite deep concerns over and experiences of previous accidents (e.g. "What do we do? And we just sort of carry on with our day." (MH2)). They expressed pride in the culture of mutual care displayed by local voluntary and civic organisations (e.g. "I look out there and I see amazing creativity of humanity in what has been created, and there is part of me that just wonders at, you know 'look what we can do'." (G2)). This testifies to the power of place attachment in mobilising grassroots initiatives to recreate social infrastructure in 'left-behind' places (Tomaney et al., 2024). In this regard, civic groups and grassroots initiatives were seen as agents of positive place change in response to limited investment from industry and local government.

Aligning with these idealised space imaginaries, the vision of 'ideal net zero industrial places' to several participants hinged upon the principle of distributive justice and fairness in relations between industry and host communities. There was a shared call that industry needs to change to "get the balance back […] instead of [them] taking everything" (G9). Nevertheless, making a 'net zero' place was not always easy for community participants to imagine due to persistent environmental problems and unfamiliarity with the term. Divergent views existed regarding its

feasibility and sufficiency (e.g. "why are we only focussing on carbon emissions. There are emissions of all sorts of things." (EP1). Similarly, there was little consensus concerning the role of industry in the place's future. Some participants wanted polluting industries to shut down, whereas others saw the possibility for a more caring and greener industry co-existing with the communities (e.g. "I want industry to be seen as a blessing rather than a curse." (G2)).

In summary, the divergent place imaginaries between the two groups of actors also resulted in contrasting idealised space imaginaries that illustrated different visions of a net zero industrial places and allocations of agency in positive place-making.

4.3 Spatial transformation imaginaries

4.3.1 Reviving industrial 'heartlands' in industry and policy discourses

A variety of positive, future, and progress-oriented spatial transformations featured in the stakeholder discourses of the three cases, including 'industrial decarbonisation', 'levelling up' (i.e. balancing regional inequalities by providing equal opportunities for development), 'fourth (or green) industrial revolution', and 'Build Back Greener'. Through these imaginaries, industrial restructuring in industrial regions was recast as both desirable and inevitable. Underlying these transformation imaginaries was a 'win-win' assumption that, with the deployment of decarbonisation projects, declining cities, towns, and regions can "thrive into a low carbon future" (Hynet NW, 2022), by turning them into "an attractive place for industry to operate, invest and thrive" (ibid.) and "regain a level of regional autonomy and pride" (Ennis, 2021).

Place rejuvenation via re-industrialisation is imagined as a process of re-embedding industry in the place through ensuring that skills, supply chains, knowledge, and infrastructures are in place, to enable industrial development and boost local economy. In this way, industrial decarbonisation is transformative through a spatial reconfiguration of industry (e.g. reshoring industry and localising supply chains), transforming cluster regions into 'sticky places' for industrial activities (Bailey et al., 2018). This imaginary was further strengthened by notions of 'industrial symbiosis' and 'circular economy' between geographically proximate companies, by a policy imperative of 'just transitions' to protect existing workforces (Lai and Devine-Wright, 2024), and by the ethical claim of taking the UK's responsibility for decarbonisation "in the wider global context" (SIWC13) to avoid offshoring hard-to-abate industry overseas.

Despite an emphasis on 'levelling up' declining industrial regions, little elaboration was given to a fair allocation of benefits in cluster documents and interviews. One informant considered the 'levelling up' policy in general "a bit of a joke" (NW7), insufficient to make up local budget cuts and perceived favouritism towards certain city regions and places in the government's political interests (see also Tomaney and Pike, 2021). For industry-associated informants who held a more hopeful view, 'levelling up' was often narrowly imagined as regional economic growth, skill training and job provision, or avoiding industry shut-down. Concern over the potentially destructive effects of deindustrialisation to workers and communities appeared genuine for some participants, who drew on knowledge of previous examples of deindustrialisation following the closure of coal mines and steelworks in the UK (e.g. "I've worked in Motherwell and seeing the impact of Ravenscraig closure on the local community. [...] And seeing that close is devastating, and I want to avoid that." (SWIC1)). Nevertheless, a neoliberal assumption of economic 'trickle-down' effects (MacKinnon et al., 2022) seemed to

underlie these transformation imaginaries, which focused on capturing added value in cluster regions (Bailey et al., 2018) rather than specific measures to address spatial inequalities (Madanipour et al., 2022; Weck et al., 2022).

4.3.2 Transforming community-industry relations through industrial decarbonisation

Community participants envisaged spatial transformations in a socio-historical manner in relation to past and present waves of industrial development, and provided a more critical perspective on the further neoliberal turn of the petrochemical industry in the UK (Geels, 2022). Since the turn of the millennium, host communities in all three cases witnessed how new companies took over existing oil refinery facilities. These new companies moved away from a paternalist approach towards host communities, as adopted by their predecessors, providing less job opportunities and other economic support for community development alongside broader trends of automation, outsourcing, and cost cutting (Feltrin et al., 2022; Geels, 2022). We found a common perception of an increasingly exploitative relation between host community and industry over recent decades in all cases, and nostalgia for more beneficial industry-community relations in collective memories. This included a stronger community identification with industry in the past (e.g. pride in the work and professional identity), when industry had been the largest local employer and investor in social infrastructure (e.g. leisure and social facilities). As one participant commented,

> "Now it appears to be business will nominate a pot of money to support a community project, and in my view, it's seen as just paying someone to put a label on, 'we have community involvement' […] whereas years ago, they [industry] were the heart, the social clubs of the industry. They brought everyone together, they brought the families together. Now it's lip-service." (EP1)

Instead of being embedded in the community and place, industry was perceived as "totally separate for the community now, to the extent that the community is really struggling to keep all the facilities open, and we're getting no help from the industry" (G6). The socio-economic merits of past industrial development, which were seen by some as an informal social contract to balance the distribution of industrial risks and benefits, had ceased. It was replaced by a growing sense of grievance stemming from "noxious deindustrialisation" (Feltrin et al., 2022), in which host communities ceased to receive meaningful economic benefits from the petrochemical industry (e.g. jobs, tax revenues) but continued to bear its environmental burdens. Echoing Feltrin et al. (2022), the stark contrast between the past booms and current busts of these industrial communities was particularly painful to residents, and could lead to strong feelings of distributive injustice.

This contrast also strengthened concerns of industrial exploitations suggested by the idealised space imaginary of 'sacrifice zones' (see also Biddau et al., 2024) that were not expected to be easily alleviated by hopeful and optimistic visions of decarbonisation:

> "It is a nice lot of words, but it also makes me a little bit angry… if there is that much money in the area, why do we have food banks and child poverty?… billions of pounds worth of investment … Are locals going to see any of that?" (MH2)

In this view, investment in industrial decarbonisation projects became painful reminders of local needs being constantly neglected by policymakers prioritising industry, disguised in the 'win-win' rhetoric. Tackling this sense of unfairness and achieving 'levelling up' agenda entail

restoring community capacities and improving wellbeing by "put[ting] some more money into things that matter to us" (MH1) and by addressing their concerns over past and present environmental harms. In this sense, ideal spatial transformation for community participants involves not only the symbolic and material improvements to place, but also a restoration of more balanced, reciprocal community-industry relations.

Despite a general agreement that decarbonising industry was necessary for tackling climate change, community participants had concerns about technology choice, feasibility, and governance. Some expressed suspicion of greenwashing by fossil fuel industries, and raised questions of the legitimacy of UK-wide and regional plans due to scant public consultation. The presupposition of 'there is no alternative' in policy and cluster discourses exacerbated a feeling of being 'done to' for several participants, as suggested by the following quotes:

> "MH2: We're just the little ants down here, and they're up there making all the decisions and doing what they want to do, without ever asking or consulting because they don't think they need to.
>
> MH1: Or they consult ad infinitum but they take no notice."

This could fuel existing distrust of government and industry not uncommon in these communities (e.g. "I have a deep-seated distrust of those with vast wealth, and I don't really believe that they have our interests at heart. So I don't hold out much hope for all of this" (G1)). It could also delegitimise industrial decarbonisation plans and visions in local eyes:

> "I don't think that our lives are important in this. It's not about us, it's not about how we will benefit. It's about how business will benefit. I don't even think it's so much about how the climate will benefit." (EP3)

Participants with more positive experiences or neutral perceptions of industry, including some former employees or those from younger generations, were more likely to welcome industrial plans, considering them an opportunity for place rejuvenation and restoring positive senses of place (e.g. "at the moment I'm not massively proud of being from Ellesmere Port, but if it did become a world leading location for Green Growth, then I would be." (EP11)). They also tended to have higher confidence in decarbonisation technologies and faith in governance and regulators, and invoked memories of industrial booms.

All participants agreed that the prospects of place rejuvenation via industrial decarbonisation required providing more detailed schemes on aligning employment opportunities, skills training, and other benefits that meet local needs, along with minimising the existing and potential negative environmental and economic impacts of industry. Procedural justice in the form of timely, well-informed, and inclusive dialogue with host communities, followed by tangible actions, is also key to legitimising industrial decarbonisation policies and plans. As a participant in Ellesmere Port stated,

> "Industry needs to realise that we can see through that [PR spin], and for this to actually be viable, they need to actually be honest, and they need to be very specific about what it is that they are trying to achieve." (EP1)

In summary, our analysis of spatial transformation imaginaries suggests contrasting perspectives regarding trajectories of place change between policy/industry stakeholders and host communities. This was linked to differing perceptions of changing relations between industry and host communities, which shaped expectations of industrial decarbonisation as a place regeneration process (Table 3).

Table 3. Spatial imaginaries invoked in policy and cluster discourses and held by host communities

	Policy & cluster stakeholders		**Host communities**	
	Examples	*Characteristics*	*Examples*	*Characteristics*
Place imaginaries	Cluster regions (e.g. Scotland, South Wales) and key sub-regional industrial places (e.g. Manchester), UK, and places outside of the UK Example quote: "North West England and North Wales have always been well known for industrial innovation. The project will build on this proud industrial history, leading the UK's carbon capture and hydrogen economy to support the re-establishment of the region as a global exporter of new technologies, skills and services." (HyNet NW, 2022)	• Ontology: a techno-economic ontology of industrial places: as an investment destination and forerunner of technology deployment, with favorable industrial assets and conditions to showcase the economic potentials of the cluster regions • Scale: anchoring to the regional scale and involving places at the sub-regional level; sometimes invoking the national/UK scale and places overseas • Place pride: pride in place was placed on industrial history and glory • Anxiety: losing the competition for industrial decarbonisation investment and funding; de-industrialisation and associated socio-economic shocks.	Milford Haven, Grangemouth, Ellesmere Port and surrounding areas Example quote: "Well, it's home for me, so it's got plenty of history here. It's just there are things that need to be improved." (EP6)	• Ontology: a socio-cultural ontology of industrial places—as a lived space imbued with histories, family memories, social networks, and community activities • Scale: often referred at town and neighbourhood scales, with a less extent to county and national levels • Place pride: pride in place was often associated with strong community spirits and natural assets, with mixed feelings toward industry • Anxiety: negative evaluation of the place's economic status and living conditions; environmental and health concerns

Idealised space imaginaries	SuperPlaces, Net Zero Industrial Clusters, clean growth hubs, energy transition zone, hydrogen gateway, and a net-zero nation Example quote: "The end goal for the work is that Scotland can offer the next generation a truly sustainable future with good quality jobs created from clean, inclusive, growth across a range of sectors." (NECCUS, 2020)	• Evaluation: positive, technology-driven imaginaries, in which cluster development is conflated with local/regional development • Lens: a technology and industry-centred perspective of place visions • Agency: industry with UK government's leadership and support as key actors to achieve to 'ideal net zero industrial places', with host communities seen as passive recipients of changes	Declining industrial towns, sacrifice zones, a community of resilience Example quote: "And we get everybody eles's rubbish, whether it be waste water and anything […] and we just carry that on shoulders and just deal with it […] if you live here you have to put up with that kind of stuff, or you can go." (G10)	• Evaluation: largely pejorative imaginaries that characterised 'left-behind' places—a strong sense of neglect and unfairness due to the dwindling investment in public services and the enlarging gap between industry wealth and community wellbeing • Lens: fairness-oriented perspectives of place visions that address unbalanced power relations with industry • Agency: community as the key agent in positive place-making in contrast to limited support from industry and government
Spatial transformation imaginaries	Industrial decarbonisation, levelling up, fourth or green industrial revolution, and Build Back Greener Example quote: "Wales has a long and rich industrial heritage, leading the way in the industrial revolution. Now it plans to be a	• Narrative of progress: highlighting progress via industrial decarbonisation, in which decarbonisation technologies like CCUS and hydrogen were seen as desirable and inevitable • Relations: an industry-centred win-win industry-place relation • Re-embedding industry: seeing industrial decarbonisation as reshoring industry in cluster regions through transforming them	Neoliberalisation, cyclic booms and busts Example quote: "Every time there's a shut down or work needs doing on the refineries, they are desperate for people and the skillset is not here. We're not investing in the	• Narrative of decline: highlighting the decades-long downward change of place especially in the neoliberal era • Relations: a growingly exploitative industry-place relation • Dis-embedded industry: seeing industry as increasingly separated from host communities in socio-economic terms, with diverged views of industrial decarbonisation and its impacts on place/communities

	leader of the green revolution." (SWIC, 2021)	into 'sticky places' for industrial activities • Process for place rejuvenation: via reindustrialisation and the neoliberal 'trickle-down' effects across cluster regions	children, in the people who live here." (MH4)	• Process for place rejuvenation: direct, committed investment from industry to address local needs and concerns, rebuilding more balanced community-industry relations

5. Discussion and conclusion

In the context of international efforts to decarbonise carbon-intensive industries, this paper aimed to develop a deeper understanding of how sense of place can inform just transitions. Our approach combined a place-based research agenda (Devine-Wright, 2022) with three types of spatial imaginaries (Watkins, 2015). Through case studies of three UK industrial clusters and associated industrial towns, we demonstrate the analytic power of this approach in exploring and comparing ontologies, senses, anxieties, collective memories, and visions of place held by policy/industry stakeholders and host communities. We also show the limits of the current 'cluster-based' approach to industrial decarbonisation in the UK in recognising and responding to the lived experiences, concerns, and visions of residents in struggling industrial places.

Our findings advance several pathways of research on sense of place and just transitions.

First, existing studies often highlight strong community identities hinged upon carbon-intensive industries (Bohman et al., 2024; Rohse et al., 2020; Norris et al., 2024). It is argued that changes to these industries could disrupt senses of place, triggering resistance against decarbonisation projects (Biddau et al., 2024) if there are no easily adaptable alternatives (Svobodova et al., 2021). The focus is thus placed on restoring sense of place through procedural design and social protection (Banerjee and Schuitema, 2023; Mabon et al., 2024) and harnessing place attachments to support low-carbon transitions (Upham et al., 2018). By contrast, our research revealed complex and ambivalent senses of place in industrial towns that experience "noxious deindustrialisation" (Feltrin et al. 2022). In such cases, industry had ceased to be the primary source of pride in place and job opportunities. Instead, it became an environmental risk and threat in the eyes of many community participants before the introduction of industrial decarbonisation.

For these participants, industrial decarbonisation does not entail a 'transition pain' resulting from the loss of key industry they had identified with (Bogner et al., 2024), but rather the continuity of the industry which they had been estranged from. Decades of neoliberalisation and its articulations—especially in the form of weakening community ties, local employment precarity, decreasing tax revenue from industry, and local budget cuts—have enlarged the separation between the space and interests of host communities and those of industry, accompanied by the dwindling bargaining power of host communities over multinational companies. Community identities anchored on carbon-intensive industries had thus faded to leave bleak senses of place centred on decline, neglect, and reliance on community mutual support. This unbalanced industry-community relation helps explain the limited attraction of stakeholder-led positive cluster visions, which were seen as 'PR spin' or as a bitter reminder of industry's exploitation and indifference to local socio-economic struggles. While the decline in host communities' economic dependence on industry did encourage discussions about the transition to a fossil fuel-free future (Duffy and Whyte, 2017), this does not guarantee local acceptance of government- and industry-led decarbonisation plans. To bring host communities on board for industrial decarbonisation would thus entail recognising and reducing existing negative consequences of industrial development for host communities, and providing clear action plans for benefit allocation in ways that facilitate more reciprocal community-industry relations (distributive justice).

Secondly, our findings suggest that gaps in visions for socio-technical and spatial transformations between national policies, regional cluster plans, and host communities may

not arise from a failure to translate guiding visions across geographical scales (Späth and Rohracher, 2010) or from the insecure structures of feeling surrounding the industry held by local residents (Thomas et al., 2022). More fundamentally, they stem from diverging ontologies of industrial places held by stakeholders and host communities—one anchored in industrial spaces and assets, the other in lived spaces and interpersonal ties. This ontological discrepancy has been intensified by the lack of meaningful and systematic communitive engagement across all cluster case studies. Cluster stakeholders tended to rely on existing, piecemeal, and often one-way engagement mechanisms (e.g. websites, media reports, social media). By excluding host communities from conversations about cluster development, the approach to industrial decarbonisation adopted in the UK to date by government and industry has failed to meet the democratising potential of 'place-based' industrial policies (Barley et al, 2019) and risks intensifying the sense of procedural and recognition injustice amongst host communities.

This analysis indicates that place-based just transitions necessitate respecting ontological differences between actors and recognising socio-cultural place meanings and emotions held by host communities. This requires adopting an inclusive process of co-production that scopes future place visions (e.g. Net Zero by 2050) and facilitates agonistic dialogue (Moore-Cherry et al., 2025), if not consensus, between actors with contrasting senses of place. A mutual learning process can avoid constructing policy and cluster visions on the basis of biased interpretations of the industrial past that neglect marginalised, alternative visions (Feola et al., 2023). Such a collaborative approach (Hindmarsh, 2012) may help prevent the imagined transition space—usually at the regional scale—from diluting, denying, and delegitimising local knowledges and lived experiences with top-down imperatives of industrial transitions (Weller, 2019).

Thirdly, the growing socio-economic and emotional disconnection between industry and host communities supports calls for action to go beyond employment impacts (Garvey et al., 2022) by incorporating the broader social needs of host communities in planning and policy for just transitions (Cha et al., 2020; Farrell, 2012). Grounding the benefits of industrial decarbonisation is vital in under-invested places and communities, where implementing just transitions will be particularly difficult and urgent, given the multifaceted socio-economic challenges they have faced (Banerjee and Schuitema, 2023). In this instance, just transitions involve repairing negative senses of place and accumulated industrial harms (restorative justice) as well as rebuilding community capacities and wellbeing (i.e. the capability approach to justice) (Moore-Cherry et al., 2025). Useful lessons can be learnt from studies on 'left-behind' places. These include addressing the sense of abandonment and affective discontent amongst residents, aiming to restore a more positive sense of place by improving living conditions and place satisfaction (Fiorentino et al., 2024b; Hannemann et al., 2024; MacKinnon et al., 2022). Providing long-term policy support across scales can address a self-reinforcing cycle of poverty, declining public services, and dwindling life opportunities (Fiorentino et al., 2024a; MacKinnon et al., 2024). Finally, it can involve expanding the policy focus from national economic growth, industrial infrastructure, and technological innovations to local economy, social infrastructure, and community capability (MacKinnon et al., 2022; Nordberg, 2020).

Several new research directions follow from these findings. Firstly, our study has shown the efficacy of spatial imaginaries for extending understandings of sense of place for areas earmarked for planned, state-led transformations. Future studies can further develop this approach as industrial decarbonisation shifts towards technology deployment, informing the

understanding of impacts of place change on different social groups and localities. Secondly, a fruitful dialogue can occur between literatures on regional industrial studies and those on 'left-behind' places, such as ways to channel the co-created and captured values of industrial development in a region (Bailey et al., 2018) to restore the foundational economy, social infrastructure, and place satisfaction for deprived communities and areas (MacKinnon et al., 2022).

Finally, we recognise the difficulty of delivering co-production between community and industry stakeholders when mutual trust is absent and the neoliberal imperative for industrial competition remains strong. Institutional constraints and fiscal limitations in local government present another challenge (Bedford et al., 2023). Proactive engagement with host communities in designing industrial decarbonisation plans and visions may also seem structurally challenging for policymakers and industry stakeholders. However, the agency of host communities is likely to unfold in response to associated (potential) place change, especially at the stage of project implementation. Inviting host communities—as key stakeholders in place-making with expertise and knowledge about local socio-physical environments—into discussions about industrial decarbonisation in a timely and genuine manner is key to making the process just and fair in local eyes. Research is needed to support the delivery of place-based just transitions in industrial places and beyond, via sense of place-informed, multi-level collaborative mechanisms that recognise past injustices, and aim for agonistic dialogue (i.e. viewing conflict in a positive light) rather than consensus. Such agonistic dialogue will involve 'interactional expertise' (Collins and Evans, 2002)—to be acquired by policymakers and project/cluster developers or performed by a trusted third party—to combine diverse ontologies, experiences, knowledges of, and visions for industrial places, attending to various trade-offs and tensions emerging alongside the process (Lai et al., 2025), and tapping into 'constructive conflicts' (Cuppen, 2012) that encourage mutual social learnings between governments, cluster stakeholders, and host communities. We believe unpacking contested senses of place with spatial imaginaries could contribute to such dialogues by articulating the diversity, difference, and confrontation between views on industrial decarbonisation held by policy/cluster stakeholders and host communities.

Declaration of competing interest

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Appendices

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