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A personas-based approach to deliberating local decarbonisation scenarios: findings and methodological insights

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Abstract

With the public deeply embedded at the heart of the energy system, it is essential that any transition is shaped by what is socially acceptable/desirable at local levels, taking account of any existing vulnerabilities within the local community. In this paper, we present a detailed description of a novel method for exploring local energy systems change with residents of Port Talbot, an industrial town in south Wales. Our persona-based approach asked small groups of local residents to explore place-based scenarios for energy systems change through the development of local characters or ‘personas’. By situating deliberation within a local context and grounding it in the emotional relationships that matter in residents’ everyday lives, persona-based exploration provides a useful foundation upon which to conduct deliberation of complex socio-technical energy issues that can otherwise be presented and interpreted as quite abstract and technical visions of change. In particular we illustrate how this approach allowed participants to open up about their personal lives, as well as eliciting more sympathetic consideration of the needs of others by better orienting participants to the issues of vulnerability within their communities. Two key processes of persona development enabled this: 1) the incorporation of personal identities, circumstances, or histories (both of themselves or friends/family) within personas, and 2) the embodiment of shared social understandings of local industrial and community decline within personas. As such, we believe that persona-based exploration offers a valuable tool for deepening emotional and context specific public deliberations around energy systems transitions and sociotechnical change more broadly.

Keywords

Social acceptability; energy systems change; deliberative methods; emotion; lived experience; energy vulnerability

1. Introduction

Transforming the UK energy system is necessary to respond to the energy trilemma and tackle climate change. The shift away from fossil fuels towards a system more heavily dependent upon renewable energy will be characterised by intermittency of supply, grid flexibility and at least some degree of decentralisation of energy generation will be necessary [1]. Decarbonised multi-vector energy is increasingly important within visions and, indeed, proposals for how to change the UK's future energy system [2]. Yet such a system brings with it a range of socio-technical challenges, involving interactions between innovative technical developments, the individuals, groups and communities who engage with them, and the business models and governance systems which underpin our energy provision and use. With the public so deeply embedded at the heart of the energy system, it is important that the energy transition is shaped by what is socially acceptable and desirable at both national and local levels.

Previous research regarding public acceptability of energy systems change has tended to be conducted at a national scale [e.g., 3]. However, the success of decarbonised systems will be dependent on the siting of novel infrastructure developments (e.g., new locally based renewable energy sources, smart grids, and local energy storage technologies) within particular local contexts. Such infrastructure can generate considerable controversy, in ways that go beyond NIMBYISM, in part due to perceived threats to community and place identity, as well as distrust of developers, siting processes, and governance structures [4].

The acceptability of whole systems decarbonisation must thus be considered as not only about material interests or discourses, but also the situated experiences and relationships within and through which socio-technical change will unfold [5, 6]. Such experiences may include histories of industrialisation, economic governance and marginalisation, through which local and regional proposals for economic and infrastructural reconfiguration may be interpreted [7, 8]. Some forms of infrastructure change may also imply changes to physical environments and social practices which underpin valued cultural formations and identities [9]. Such identifications are not merely tied to beliefs and the maintenance of routines, the relationships and ways-of-life they sustain also carry emotional value [10]. For example, performances of heating practice or domesticity may be shaped not only by prevailing social norms, but also affectively charged experiences of poverty and vulnerability [11], and biographically patterned relationships of care through which such practices take on meaning [12, 13]. Likewise, new infrastructure may not only alter places of particular religious or normative importance, but also impact emotional links to the past or the feelings of pride and self-worth embedded in socio-material relationships to place in ways which can lead to intolerable feelings of loss [14,

15]. If energy systems transitions are to be successful, it will thus be essential to gather specific, place-based insights to ensure that the significance of meaningful and affective relationships embedded within place are understood and, where possible, taken into account.

In addition, attention has recently turned to questions of energy justice, leading to calls for further exploration of what constitutes not only a low-carbon, but also a just energy transition [16]. Injustices in the distribution of access to energy services and the siting of polluting infrastructure have long been implicated in patterns of political exclusion and misrecognition which privilege some populations and industries over others [17]. Parallel to this, writing on energy poverty has highlighted the emotional and physical toll such conditions may take on those experiencing them, and the ways in which social and economic vulnerabilities may be exacerbated by transitions towards low-carbon energy systems [11, 18, 19]. For example, the rise of demand side management in the form of smart, peer-to-peer energy networks may require diverse forms of financial, knowledge and social capital which are unevenly distributed across society [13, 20]. If such inequities are not recognised and accommodated in advance, the emergence of such systems has the potential to entrench new forms of vulnerability and injustice, with significant implications for social acceptability [21, 22].

While issues of fairness and social justice have been well established in literatures on the social acceptability of energy transitions [23, 24], in practice such principles gain meaning through situated experiences and interactions [25]. Energy systems transitions will not emerge into a vacuum, but *in place*, interacting with socially and emotionally entangled relationships and contexts which shape how the energy system is used and experienced in everyday life [26]. Thus, there is a need to attend carefully to the specific and situated social relations embedded in communities when seeking to understand their significance for just and sustainable energy transitions [27]. While categories such as fairness, vulnerability, and energy justice provide a useful language for deliberating the relational implications of energy systems change, if we are to understand what is at stake for communities facing such transitions, some means are required to make visible the contextualised relationships through which its production and use affects our lives [6, 28].

In this paper, we outline a new method for socio-technical deliberation which aims to give prominence to the situated and emotionally charged relationships through which we make sense of technological change. Specifically, we describe a method for place-based persona development in which small groups of local citizens develop a character through which to explore scenarios of energy systems change. Here we explore the case of Port Talbot, an industrial town in south Wales where the economy relies significantly on the hard-to-decarbonise steel industry and associated businesses. Contributing 16% of Wales' total

carbon emissions [29], the town has become a focal point for the development of a range of in-place or envisaged demonstration projects aiming to decarbonise the area, including smart grid innovations and localised peer-to-peer power networks, power to gas and local district heating systems [30].

We illustrate how persona-based exploration provided a focal point for eliciting sympathetic consideration of the needs of others, and for exploring how personal responses to emergent technologies may translate within the community. We also illustrate how the use of personas provided a valuable avenue for citizens to explore the motivations of project developers, and the ways in which local dynamics of governance and power may evolve in the future. In conclusion, we argue that persona-based exploration offers a means of grounding deliberation over potentially abstract and technical visions of change [31], in the emotional relationships that matter in citizens in everyday lives [32]. We suggest that persona-based exploration offers a valuable tool for considering potential areas of controversy in energy-systems transitions, better orienting us to the aspects of vulnerability and justice which most matter to affected communities.

2. Background literature

Work on social acceptability has argued for some time that it is insufficient to gauge public 'pseudo-opinions' on emergent technologies, about which little is known [33]. In cases where the long-term impacts of socio-technical change are unclear, it is often argued a more deliberative approach is needed to highlight the values and ethical orientations at stake in decisions about the future [34, 35]. Not only do such qualitative methods offer greater flexibility for citizens to frame discussions and proposals in their own terms, they also tend to be better attuned to the experiences, relationships and cultural discourses that give meaning to changes which can often appear unfamiliar, technical, and removed from the knowledge and experiences of affected communities [28, 36]. A range of qualitative methods have been used to explore deeper public understandings and desires surrounding future energy systems change, including: biographical and narrative methods [12, 37]; fictional narratives and storytelling [38, 39]; games and roleplay [40]; deliberative mapping techniques [41]; and public deliberation methods [42]. Qualitative temporal methods attune us to the centrality of change over time in socio-technical transitions, and the use of scenarios within interviews has proven effective in eliciting ethical reflection on the changes to place and everyday life such changes entail [5, 6]. Second-person 'a day in your life' style narratives have also been used as a means of eliciting reflection on a range of different energy related issues [23, 43-46].

However, a key concern is how to facilitate deeper forms of participant engagement and reflection leading to methodological innovation in the way in which scenarios can be portrayed to promote identification [6]. Despite proving effective in eliciting reflection on individual narrative elements (e.g., specific energy technologies or policies), scenario approaches can struggle to access deeper emotional or ethical reflection [47]. Raven and Elahi [48] attribute this to the unusual and disorienting form of narration such scenarios rely upon, dropping the reader in an unfamiliar world with little emotional context to assist sense making. By framing sociotechnical change in terms of second-person encounters with technology, such scenarios may also risk falling into the familiar critique that deliberative methods can operate to reproduce expert evaluations based on technical efficiency and performance, at the expense of values and concerns emerging from more emotionally and culturally complex social milieus [49, 50]. This has been reflected in our own experiences of using second-person narratives where disorientation and the implicit invitation to evaluate performance of technologies described can, at times, displace consideration of what is emotionally and ethically at stake in sociotechnical scenarios. By contrast, studies combining future scenarios with biographical discussion have proved a valuable means of prompting reflection on the ways in which scenarios for socio-technical change may shape or be shaped by lived experience and relationships [51].

Futures-oriented research offers other methods that might help elicit a deeper emotional response in relation to future energy systems change. Character development has long been used as a means of specifying potential users and their needs for new technologies or products. For example, approaches using narrative fiction present rounded characters through which to test assumptions about user needs and behaviour [52]. In such instances, the aim is to develop rounded and sympathetic characters who may behave in ways unanticipated by designers [53]. Nevertheless, without extensive testing and piloting it may prove difficult to develop a range of characters with whom participants may identify. Alternatively, narrative production may be integrated in participatory research itself. Drawing on the concept of worldmaking [54], Vervoort et al. [55] conceptualise these participatory visioning processes as drawing upon the lived experience of participants in order to give depth and social texture to what may otherwise be abstract and dry technical scenarios. While each individual contribution to the worldmaking process necessarily reflects a situated and selective representation, by facilitating a collaborative form of narrative development, worldmaking allows for the emergence of a more pluralistic understanding of how potential futures may emerge and be experienced. Rather than presenting a ready-made future for participants to evaluate, worldmaking implies a degree of freedom and creativity in specifying how sociotechnical trends may be experienced, inviting reflection on the ways shared values and priorities shape

our visions of the future [47]. Drawing on this work, we have sought to develop novel techniques to elicit public discussions of energy futures that can access both top-down responses on public acceptability and deeper emotional and ethical reflections regarding the concrete implications of change for the lives of local residents.

Representing a more limited form of world-making, our approach (set out below) initially presents participants with place-specific future scenarios, before asking them to populate these scenario-worlds with personas: narrative character descriptions through which the emotions, motivations and dispositions of future citizens can be explored and constructed. Rather than casting participants into future scenarios, unmoored from the situated contexts through which they might make emotional and ethical sense of them [56], personas act as proxies, encouraging a more playful and creative engagement with potential futures, providing the space to gradually incorporate situated experiences and relationships into the process of character development. By anchoring [51], these personas in place (the town of Port Talbot), we aimed to minimise the disconnect between abstract and personal responses to energy systems change.

3. Study design

In order to situate social acceptability narratives and, at the same time, experientially embed deliberation and engagement with the energy transition, our approach [57] centred upon four scenarios for energy systems change in Port Talbot. We adopted a multi-modal research strategy [51] combining interview, focus group, map- and character-based methods. Interested in interactions between everyday forms of reliance on energy and potentially complex and upstream changes to energy systems, a key challenge for our study was finding ways of rendering present and potential future infrastructure salient, tangible and hence discussable [5, 14, 58]. By using maps, photographs and place-specific scenarios, we sought to provide a range of interpretive resources to help participants situate themselves in relation to infrastructure change while maintaining a firm grounding in local context [7, 51, 59]. Working with those whose daily lives may be directly affected by place-based energy systems change, our approach allowed us to explore the responses of local people, both as citizens with broader ideas and beliefs about what kinds of socio-technical futures might be socially and ethically desirable, and as emotionally and relationally situated subjects whose wellbeing may be bound up in the local infrastructure and environment [26, 28].

To situate discussion in place and the contexts of participants' daily lives, participants were selected based on shared 'proximal interests' [58], designed to reflect shared points of

experience or ways of relating to life in Port Talbot which might provide shared vernaculars for thinking about energy systems change in the town. *Multi-generational Residents* was a group selected to reflect families with deep roots in the town, extending back at least three generations. *Steel Workers* aimed to reflect local livelihoods shaped by energy intensive industries. In light of the declining share of local employment occupied by the steelworks, *Young Professionals* looked to the prospects for younger residents with technical or social qualifications which may be required in managing transitions and vulnerabilities emerging from energy systems change. *River Users* (regular users of the local River Afan and its towpaths for fishing, boating or walking) were initially recruited to reflect common interests in the outdoor environment in and around Port Talbot. We felt this was an important aspect of local identification to gauge given the town's history of industrial development, and widely publicised controversies over local air quality and particulate fallout from the steelworks. In practice however, the diversity of interests within the River Users group meant that shared interests in the outdoors did not emerge as a strong point of commonality between participants. While we retained the River Users data, we also recruited a fifth group of *Green-fingered Residents* comprising gardeners and allotment holders, which was more successful in eliciting common connections to the local environment. In total, 37 participants took part, with ages ranging from 20-72 and representing a diverse range of geographical areas within the town. All but one of the participants were White British, a statistic that broadly reflects the relatively low levels of ethnic diversity in Port Talbot.

Individual interviews were conducted before participants were brought together for a group-based deliberative workshop. Here, we sought to situate participants within the context of Port Talbot before introducing topics related to future socio-technical change, providing an opportunity to explore participants' contextually situated values, identities and relationships that might otherwise remain invisible in more abstracted approaches to socio-technical evaluation [31, 60]. Structured primarily around a mapping task, participants were asked to discuss their lives in Port Talbot and their day-to-day relationships with energy and the local environment. These insights were then used to structure the first workshop activity, a facilitated discussion of the lived experiences and shared meanings through which participants relate to the area [5]. This framed subsequent socio-technical discussions in a more localised and contextually specific way [59].

The second core activity presented four 'Energy Futures in Port Talbot' scenarios created on the basis of research into expert imaginaries for smart energy demonstrators in the town [61]. Scenarios were developed through documentary research and interviews with representatives from local government, industry and academia involved in research and demonstration of

whole systems decarbonisation in Port Talbot [61]. Draft scenarios were shared with experts and refined in light of an expert workshop and follow-up discussions held in April 2019. These scenarios (*Grid Town*, *Energy Island*, *Industrial Hearth* and *Virtual Marketplace* – see Table 1) were specifically designed and introduced as archetypes to represent a diversity of potential decarbonisation pathways, illustrating different degrees of centralisation and local control. Unusually, two scenarios for hydrogen heating were included in order to differentiate more centralised visions of hydrogen production (*Grid Town*) [1], and visions for a more localised hydrogen economy in Port Talbot (*Energy Island*) which was a key focal point in expert interviews. Each scenario was presented on a large noticeboard in the form of annotated illustrations (Figure 1), accompanied by informational vignettes, a mock-twitter feed and a timeline detailing potential infrastructure transitions to 2050. In line with the multi-method, multi-modal approach to data collection, the purpose of presenting scenarios in this way was to offer a range of interpretive resources from which to make sense of how infrastructural changes may intersect with everyday life in Port Talbot.

The final activity was a persona task, which aimed to encourage reflection on the emotional and cultural implications of each scenario for energy systems change, while avoiding the pitfalls of first-person scenarios discussed above. Each workshop was split into two subgroups and given two scenarios to work with. Choosing from a set of character illustrations provided by the research team (see Figure 2), participants were asked to imagine the name, lifestyle and personality of the person depicted, drawing on as little or as much of their own experience as they desired. Working in small groups, personas were developed through exploration of that character's personal life, work and leisure activities, thoughts and feelings about energy, and hopes and fears for the future, echoing the design of futures-oriented activities sometimes conducted by futurist practitioners [e.g., 62]. Persona development was thus undertaken with a specific scenario in mind. To encourage participants to consider a diversity of perspectives, each sub-group was asked to select a new character illustration for each scenario. Each sub-group thus developed two personas and were then asked to present these in a full-group discussion, enabling participants to compare and reflect on how different persona characters might manage in different scenarios. This allowed participants to explore a broad range of potential scenarios and subjectivities, without the task becoming overly repetitive or time consuming within the confines of a day-long deliberative workshop. The aim of this task was to provide a degree of interpretive distance from the immediate technological changes described in scenarios [47, 63], allowing for a more imaginative and playful engagement with how energy systems change may impact aspects of place that mattered to participants or others in the community with whom they identified or felt sympathy. Our use of the term personas to describe this method thus reflects both a continuity with the terminology of futurist

practitioners from whom we drew inspiration [62], and our overarching aim of encouraging participants to inhabit or form identifications with the persona under construction. While we do at times use the term character to describe the outputs this task generated, a character may be thinly sketched or a caricature, whereas persona implies a greater degree of emotional investment.

Audio recordings of interviews and workshops were transcribed and anonymised. The below analysis is drawn specifically from the personas task, focusing on characters' personal circumstances, financial situations, relationships with the energy system, and health and well-being, which emerged as key themes shaping the concerns of persona characters. Themes were initially identified in discussions of single persona characters, then refined through comparisons between different personas within and across groups [64, 65]. There were two core purposes to this analysis: (1) to assess how the challenges faced by personas shed light on local concerns and how they influenced participants' final evaluations of future infrastructure change, and (2) to consider if and how the process of persona development helped participants reflect on the situated, emotional and ethical implications of complex socio-technical changes. The analysis below thus refers to statements made by participants about the personas they had developed and were selected to illustrate how the personas method contributed to a more locally and emotionally attuned deliberations over potential energy futures. For clarity, when quoting or referring to specific participants we do so using pseudonyms, followed by the name of their workshop group in parentheses, for example: Frank (*Steelworkers*). Personas are introduced in table 2, after which they are referred to solely by numbers (Persona 1, 2, 3).

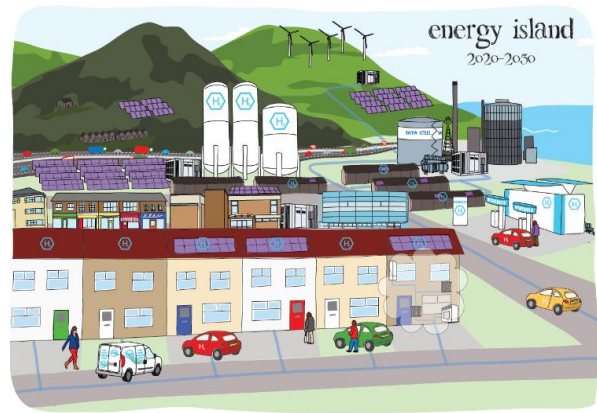


Figure 1. Scenario illustrations for each of the four energy futures in Port Talbot. These were annotated to describe key technical details for each scenario and accompanied by informational vignettes, a mock-twitter feed and a 30-year timeline detailing potential infrastructure transitions to 2050.

Table 1. Key features of the four scenarios for ‘Energy Futures in Port Talbot’ scenarios












Scenario	Description
<p data-bbox="204 371 284 434">Grid Town</p> 	<p>A largely centralised energy system, where electricity is still provided through the national grid. All electricity is from low-carbon sources, such as large-scale wind, tidal, solar and nuclear power plants, with warehouse-sized assemblies of batteries that are used to store this electricity for use during peak times. Hydrogen heating is now used to heat all homes and buildings, which is produced via large-scale and centralised Steam Methane Reforming (SMR) processes and related Carbon Capture and Storage (CCS). Large utility companies still dominate the energy industry and smart meters in every home allow consumers to switch companies easily. However, the best deals (known as Time of Use Tariffs) are only available to those who can adjust their energy use to times of peak wind and solar energy production.</p>
<p data-bbox="204 770 309 833">Energy Island</p> 	<p>A fully decentralised energy system, where Port Talbot is largely separate from the national grid and all electricity for the town produced by local renewables such as solar and wind. Hydrogen heating is now used to heat homes and buildings. Excess electricity is used to make hydrogen locally from water via electrolysis, with hydrogen gas holders around the town used to store this. Electricity and gas bills are still a part of life but people in Port Talbot now buy their energy from one of several local suppliers rather than the national grid.</p>
<p data-bbox="204 1043 341 1106">Industrial Hearth</p> 	<p>A locally governed energy system, where the local council and industry have taken far more control over energy generation in the town. Waste heat from industrial sites (including Tata Steel) is now used to provide heating to homes and businesses through a district heating system. Most electricity is generated locally by solar panels and wind turbines on rooftops and in the surrounding countryside. Heat and power is supplied to consumers via one local energy company, a partnership between industry and the local council. Consumers can select from a range of energy service contracts for ‘warm hours’ and ‘power services’ that come with bundles of ultra-efficient appliance upgrades, new insulation or radiators.</p>
<p data-bbox="204 1384 379 1447">Virtual Marketplace</p> 	<p>A densely networked energy system, where all homes and businesses in Port Talbot now trade surplus electricity with each other and the grid via peer-to-peer energy trading. All homes now rely on electric heating via air source heat pumps, and many homes and buildings in the town also have their own solar panels and batteries. Homes without solar panels can still buy energy from their neighbours. Energy trading is controlled automatically by Home Energy Trading Systems in each home which can learn and adapt to the needs of the household. These AI systems will continually buy and sell energy between buildings and the grid to get the best prices for each home.</p>



Figure 2. Character Illustrations used within the Personas Task, designed to reflect the diversity of residents within Port Talbot.

Table 2. Key details of selected personas, created by participants and illustrated with direct quotes.

	<p>Persona 1: 'John', 55 (Grid Town) A steelworker and normal <i>'Port Talbot bloke'</i>. Suffers from <i>'respiratory problems and back issues due to working in the steelworks for 20 years'</i>. Has an electric car but dislikes technology and <i>'detests his smart meter'</i> that he <i>'thinks it is spying on him'</i>. Feels he doesn't have the skills to adapt to <i>'all this electric stuff and the changing energy [system]'</i>.</p>		<p>Persona 2: 'Sophie Crystal', 28 (Grid Town) An engineer at the steel works expecting her second child. Has a good income and adapted well to the changing energy system. Has all the latest smart technology, but despite the <i>'potential to be technology savvy'</i>, she struggles to find a good work-life balance and is dependent on technology for <i>'organising her life electronically'</i>.</p>
	<p>Persona 3: 'Audrey', 73 (Virtual Marketplace) A retired nurse who received a grant to install the latest in smart low-carbon energy systems that she <i>'would never [have been] able to afford'</i>. <i>'She suffers with her nerves'</i> as she <i>'doesn't understand the technology [she is] reliant on'</i> and worries her <i>'battery might run out'</i> or that <i>'people might tap into her energy supplies'</i>.</p>		<p>Persona 4: 'Lisa Jones', 18 (Virtual Marketplace) Single mum-to-be, <i>'she is unemployed and on benefits, and is struggling to cope on a low income'</i>. She worries about affording the <i>'bare essentials each week'</i> and the variable energy bills that prevent her budgeting easily. She is keenly aware she lives in <i>'the [house] without solar panels'</i> and feels <i>'people are judging her'</i>.</p>
	<p>Persona 5: 'John Travolta', 27 (Virtual Marketplace) Professional dancer with a young child to support. Struggles financially as <i>'his wage is varied'</i> and has <i>'mental health issues'</i>. Has little direct interaction with the energy system and can't afford to <i>'update to the latest technologies, and so can't supplement his 'income from selling [energy] to other neighbours'</i>.</p>		<p>Persona 6: 'Brian', 35 (Industrial Hearth) A smart IT professional, he <i>'heavily into technology and reliant on'</i> smart assistive technologies in his daily life. Approves of local energy provision but feels like <i>'a hostage to the power company'</i>, as he <i>'suffered problems with the infrastructure being set up'</i>. He worries about local energy security if the steel works closes down.</p>
	<p>Persona 7: 'Simon Davies', 37 (Industrial Hearth) CEO of Port Talbot Heat and Power Co. and high-flying career man. Has power and status but is motivated by the desire to produce <i>'recycled, reliable and cleaner'</i> energy than ever before. He is anxious about <i>'being the only [energy] provider'</i> and what would happen if his company (or the steel works) <i>'went bust'</i>.</p>		<p>Persona 8: 'Terry a.k.a. Jet', 33 (Industrial Hearth) A musician dreaming of making it big but <i>'going nowhere'</i>. Good with technology but doesn't own much, claiming he's <i>'not buying into all this, [...] when in actual fact he can't afford it'</i>. He struggles to pay bills on time and worries that the local energy monopoly might put prices up, as <i>'he's got no choice but to go with them'</i>.</p>
	<p>Persona 9: 'Shaniqua-Mae', 26 (Energy Island) A single mum studying to become a nurse. Modern smart appliances <i>'make things easier for her'</i>, but she is <i>'skint'</i> and worried about energy bills. <i>'Because everything is local, she gets cheap deals'</i> from hydrogen energy suppliers and a free hydrogen bus pass but is still worries about power cuts <i>'with winter coming'</i>.</p>		<p>Persona 10: 'Glen', 70 (Energy Island) A retired prison officer who <i>'never really progressed with technology'</i> and just wants a simple life. Gets a good pension but struggles with living costs and high energy prices. He hates <i>'relying on local renewables'</i> and with the energy supply prone to blackouts, he is afraid he'll <i>'be cold in the winter [...] sitting in the dark without a cup of tea'</i>.</p>

4. Analysis

4.1 Vulnerable selves and vulnerable others

One way in which participants' concerns surrounding future energy systems change surfaced was by incorporating elements of their personal identities and vulnerabilities, as well as those of familiar others, within the personas they created. This was particularly prevalent in relation to two forms of vulnerability: economic and digital. Ability to cope with increasing complexity in the energy system was often linked to two persona characteristics, wealth, and technological literacy, with those who lacked one or both of these characteristics thought unlikely to get the best out of the changing infrastructure. The burden of participation was seen as likely being too much for many, such as the elderly or those suffering with ill health, mental illness or learning disabilities:

We all know people in Port Talbot who are doing really well and we all know people who are not doing really well and you've got to think the ones that are doing well are going to survive and it'll be fine but the ones that are not, how on earth are they going to manage to survive in Port Talbot if it's like this and they change everything?

Anne (Multigenerational Residents)

Exploring economic vulnerabilities

The economically vulnerable consumer was a commonly developed persona, often constructed as a young mother (Persona 4 and 9) or an unemployed young male (Persona 5 and 8). While such groups can be treated with scorn in popular discourse [66], the prevalence of such character types in some cases reflected a deliberate attempt to test scenarios by developing a persona who might struggle within them. At the same time, the sympathetic terms in which such characters were elaborated often drew on participant's own experiences of economic hardship. For example, Persona 8 was developed by a subgroup who explicitly wished to explore impacts on low-income and unemployed local residents, drawing direct inspiration from the 'misspent youth' of Frank (Steelworkers), a participant who had worked as a freelance musician as a young man. Drawing on Frank's experiences gave his sub-group a deeper sense of Persona 8's motivations and sympathy for the ways his circumstances may lead to him becoming trapped by rising energy bills:

Because it's Tata and the council combined providing the energy, they have a monopoly on the energy, obviously. They're the sole supplier for the town, so [Persona 8]'s got no choice but to go with them, and if the rate increases every year, he's stuck [...] for example, one year it might be cheap enough,

but then the next year, certain rates and everything rise, your price goes up, you've got no choice but to pay it.

Tina (Steel Workers)

Most concerns relating to economic vulnerability emerged in relation to peer-to-peer energy trading (Virtual Marketplace) and time-of-use energy tariffs (Grid Town), both of which may cause energy prices to become more variable in response to the availability of intermittent renewable energy. In both instances, the inability of economically vulnerable characters to afford smart appliances, heat pumps and digital assistants emerged repeatedly as an issue that participants expected would undermine local residents' capacity to participate in future energy networks. While concerns relating to vulnerability and social justice are not new in energy studies, the personas-based approach offered greater insight than is usually achieved, surfacing personal and relational reflections on variable energy pricing and the detriment it may cause:

I suffer with mental health issues and I worry about the bills. My mother and father, I lived with them all my life, and when you've got responsibilities for bills and you start worrying whether you're going to make ends meet, it does cause a lot of problems. When you've got all these different changes taking place, you hope the best one is going to be financially viable for yourself [...] it's fear of the unknown.

Marcus (Multigenerational Residents)

In developing Persona 5, which depicted severe money worries and depression, Marcus opened up about his own mental health and financial difficulties, exacerbated by the recent loss of both his parents. By seeing an element of himself in this character, he becomes able to both give voice to uncomfortable personal details he hitherto held back from sharing with the group, and to articulate how processes of socio-technical change may impact upon people like himself. By adopting this more personalised and holistic reading of smart tariffs and networks, Marcus' account illustrates the practical difficulties of untangling financial volatility from deeper feelings of ill-health and social vulnerability. While this is a particularly striking instance of a participant identifying with a vulnerable character, it raises wide-ranging questions about the intellectual and emotional toll the management of energy may take on consumers.

These anxieties also manifested in concerns for vulnerable others in society, such as those with caring responsibilities for children or older parents, or those with the financial and emotional difficulties that may accompany mental health problems, bringing the emotional

stakes of systems flexibility more clearly into focus. A concern for the affective impacts of price instability was prominent in several discussions of low-income characters: '*I just think [Persona 4] is just like constantly worrying*' - Emily (Young Professionals).

Concerns also arose over the impact of price instability on household budgeting and financial security. Reflecting on four personas and discussions developing throughout the workshop, the focus of these concerns was articulated by Gordon (Steel Workers):

Yeah... over the period of 12 months, it could cost the same. And that's all well and good for those that can afford it, but for those that can't, those large fluctuations on a monthly basis could mean the difference between putting a meal on the table for the kids [...] that has to be taken into consideration and something done to give some sort of stability so that people can budget.

While Gordon's summarising highlights the wide-ranging nature of the problem price flexibility poses for budgeting, particularly for families with young children (e.g., Persona 2), these concerns mirror more general concerns relating to social justice outlined in energy justice writing on systems flexibility [21, 67].

For these reasons, the proposition of variable energy tariffs, where energy costs are dependent on the shifting balance of supply and demand and thus somewhat unpredictable (Virtual Marketplace and Grid Town) raised serious concerns. Seen as an important skill for managing daily life on a low-income [c.f., 18], the ability to budget household finances and bills emerged as a core skill that personas needed to successfully participate in future energy systems. Utilising these skills, for example through use of price comparison websites and utility switching, some personas were able to effectively navigate future energy systems (e.g., Persona 1's 'money savvy' wife). This strategy was particularly prominent within Grid Town personas, where the ability to switch energy companies was seen as an important defence against the predations of energy suppliers and the rising costs of energy systems change:

She has an option of her suppliers, but in all the others, you've got one supplier or have to rely on your neighbours, where, in Grid Town, she's got an option of looking at comparing the market.

Geoffrey (River users)

Exploring digital vulnerabilities

Tapping into participants' concerns about the shifting relationships with technology that smarter low-carbon energy systems require, the risk of increasing digital vulnerabilities was another topic of discussion. Raised in relation to numerous low-carbon energy technologies (e.g., smart home energy management systems, peer-to-peer energy trading, and time-of-use tariffs), possession of a set of digital skills emerged as a key element of successful participation with future energy systems. Questioning the higher level of mental work required, scenarios such as Virtual Marketplace, and to a slightly lesser extent, Grid Town, were considered too complex for many people to be able to cope with. On a general level, persistent stereotyping arose regarding middle-aged and retired people as 'technophobes' (Personas 1, 3 and 10) with lower abilities to cope with the changing technological infrastructure in the home: *'I don't think somebody like that could assimilate, you know [...] even the concept of peer-to-peer for a lot of people is just way beyond'* Frank (Steel Workers).

However, the extent to which local residents could adapt to a smart, more technological energy system was hotly debated in relation to both the personas and the participants and their families. As the personas were being developed, a sense emerged that most people would likely adapt sufficiently to a smart, low-carbon energy system, in part because people who 'grew up with it' would simply take the new system for granted. Such readings were often informed by unintentional identifications occurring as persona characters slowly evolved to more closely resemble the participants creating them. This was particularly displayed by Frank (Steel Workers) and his group, who after selecting an older woman on the basis she might struggle within Virtual Marketplace (see quote above) gradually endowed her with a desire for data and smart appliances. In contrast, Geoffrey (River Users) and his group's persona, a young mum-to-be, developed an increasingly technophobic attitude, under the assumption that (as in the group's shared view of themselves) she *'is looking for simplicity of life'* and would want to avoid interacting with smart energy technologies, despite growing up with them. Similarly, Persona 2 displayed deep similarities with Tina (Steel Workers), reflecting her perception of herself as a confident career woman in the steel works, with good technical skills that would be an advantage when it came to coping with energy systems change:

Going by her financial situation, I think she'll probably adapt to most of these. Yeah, and she's in that sort of... demographic that would be technology savvy or potential to be technology savvy and adapt to change very well.

In a similar way to ideas around the importance of being financially savvy, being tech-savvy was identified as a competence for negotiating energy systems change. Reflecting on their own abilities, and despite the general sense that people would adapt, many participants felt

that they themselves or other members of their families may struggle. Exemplified by Personas 1 and 3, fears arose that managing smart low-carbon energy technologies in the home might cause or exacerbate stress and anxiety, especially for older residents. Highlighting the varied sources of anxiety possible within a high-tech smart energy system, the evolving discussions around Persona 3 led Monica (Green-fingered Residents) to draw on anxieties her own mother might experience:

That's something that my mum now would worry about... She wouldn't know what to do. She just don't have a clue. And kids putting their fingers in the [air-source heat pump] outside the houses which some little buggers would do and they'd kick them and they'd fill them up with stones and... Again, thinking of my mum and how she would be. She would be like, 'well how much is left in [the battery]? When's it going to run out? How much is a new one? Where do I get a new one from?'

Here we see quite starkly, how the creation of personas operated as a means for thinking through the needs of recognisable others in the community. The resemblance of Persona 3 to Monica's mother reflects the background knowledge and interpretive resources participants brought to the task at hand, the character of worried mother a recognisable figure with whom we would all sympathise. The relatively abstract figure of the vulnerable consumer takes on the characteristics of someone Monica cares deeply about, and in so doing, questions relating to the day-to-day functioning of the system overflow into a series of anxieties about battery longevity, durability, costs and suppliers; practical questions which draw in existing anxieties and blur neat distinctions between economic and social vulnerabilities [20].

Even Tina (Steel Workers) who had previously identified as relatively technologically literate, later went on to describe herself as uninterested in adopting new smart energy technologies:

Tina: I'm not interested in being technologically minded'. I use [my smartphone] purely use for Facebook, WhatsApp and email. I do my banking on there. That's as far as I want to go. I'm not interested in being that sort of...

Luke: Savvy?

Tina: Yeah.

Through this movement between discussion of Persona 2 and Tina's reflection on her own life as a mother and busy professional, we gain deeper insight into concerns participants had around digital skills. Here it is not so much a lack of technical ability; participation in Facebook, WhatsApp and online banking are all relatively complex practices carrying real social and

financial stakes. Rather, it is a perception of smart energy practices as requiring an additional form of being technologically minded, that in the context of a busy professional and family life, may prove difficult or simply uninteresting. In providing a like-minded avatar for Tina, Persona 2 thus operated to decentre the energy system in her thinking about the future, resituating the smart energy future offered by Grid Town within a web of familial and social relationships in which it was seen as potentially burdensome.

4.2 Relationships within a vulnerable town

A second way that participants' concerns surrounding future energy systems change surfaced was through the relationships that emerged as central to their personas' lives and the trust (or more commonly lack of trust) that these engendered. Concerns arose surrounding two core sets of local relationships: trust in governance systems and trust in community. Bringing out feelings of sympathy, vulnerability, and identification, persona-based readings of scenarios thus also provided a resource for considering how energy system changes may co-evolve in relation to the local institutions and communities that shape everyday life.

Trust in local governance

Anxiety over future energy systems change emerged around the configuration of relationships between local government, industry and residents in Port Talbot. Socio-cultural discourses relating to these actors' relationships to the town, as well as the far-reaching impacts of deindustrialisation and economic decline in South Wales, strongly shaped how many participants saw the future of the town:

It's a privately-owned business now. We used to be a national industry, the steelworks, but now Tata own it. If they withdraw [...] if they close that down, Port Talbot could be next. They're talking about moving it to Germany. [...] There's all this fear of the unknown in Port Talbot.

Marcus (Multi-Generational Residents)

With the town's future already viewed as precarious, the risks associated with shifting to localised forms of heating provision, which perhaps relied on only one energy source, dominated participants readings of the scenarios, and emerged within the personas they created. Concern was particularly strong around Industrial Hearth, where reliance on local industry and the steel works to provide heating for most homes was seen as the town putting all its eggs in one basket, but also present in relation to the local hydrogen energy system within Energy Island. In addition, fears surrounding the possible closure of the steel works and

associated industry pervaded discussions [57], with all reflections on future energy systems change considered within this context.

Concerns surrounding the continuity of energy supply were particularly widespread and arose in participant reflections on the effects on residents if something went wrong, i.e., heating loss would affect the whole town, not just a small number of houses or streets. While the insecurity of relying on mistrusted actors for such a vital service was not unique to the personas task, persona development provided an avenue for participants to explore the needs and concerns of those groups they saw as most in need of consideration. This sentiment was emphasised most clearly in the concerns of Persona 6, a disabled resident of the Industrial Hearth scenario. Though described as particularly personally reliant on domestic heating and electronic assistive technologies prominent in the localised energy system, participants' perceptions of the precarity of their town becoming ever more reliant on a single industry meant Persona 6's concerns evolved to be much wider, centred on the potential consequences of industrial reliance on the economic life of the town:

Yeah, [Persona 6 is] worried that if Tata go bust or decide that they're not going to do trading or anything or, you know, if they closed down then all of Port Talbot's going to be left without any heat source. [...] And then that then would have a knock-on effect with the power company – all those people would lose their jobs. All the people in Port Talbot and the surrounding areas would be left without their supplies. It would be a very big mess.

Monica (Green-fingered Residents)

While these concerns were embodied within many of the industrial Hearth based personas, and to a lesser extent Energy Island, they were most prominent in those with existing vulnerabilities, such as pregnant women and the disabled or elderly. Fears of energy shortages and blackouts, especially in the winter, and the impact this may have on vulnerable people emerged repeatedly, with these anxieties most strongly reflected in the development of Persona 10. Specifically designed to personify a future version of an older participant, Geoffrey (River Users), in terms of his personal situation and demeanour, Persona 10 was used to express fears that energy systems change could lead to an expensive, but more importantly unreliable system that would leave residents '*cold in the winter, [...] in the dark and [un]able to boil the kettle*' (Geoffrey, River Users).

In reimagining Energy Island as an expensive and unreliable environment, the personas task operated to decentre the energy system in favour of a focus on the potential for Persona 10 to become subject to detrimental monopolistic power. Drawing on participants own feelings

about place and local discourses relating to the unaccountability of the steelworks and local council, the discussion of Persona 10's plight drew emotional power not only from the technologies and governance arrangements described in scenario materials. It was also informed by the sympathetic figure of Persona 10 as a worried older gentleman, rendered vulnerable by unequal power relationships with which participants felt familiar.

While a degree of distrust in industry was anticipated from prior interviews, personifying shared discourses of distrust and industrial insecurity provided additional nuance. Such distinctions were epitomised in the development of several professional personas who held high-level positions in the future energy system. Through the development of Persona 7, participants displayed both sympathy for industry managers struggling to keep businesses running and a strong dislike for wealthy executives seen as profiting at the expense of local residents:

I don't like this guy [...] He started out like a good guy. [...] I'm against the whole one company running the thing. I think that put me against him straight away by saying he was CEO... and then if he was CEO of Tata even, I'd probably be against him then again because he's got vested interests in making money [...] I think perhaps relying on Tata Steel would be a big worry for him. So, he's relying on them providing the energy. Like, what if Tata Steel went bust?

Emily (Young Professionals)

The personas developed not only shed light on the institutional relations underpinning concerns over the risks of moving towards an energy monopoly, but also on social complexities underpinning relations of trust in infrastructure providers. Persona 7 came to represent neither an exploitative nor benevolent corporate entity, but a conflicted character with complex motivations situated in his local and professional context. Imagining the persona as having 'started out as good guy' acting in the interests of the town and the environment, a combination of vested interests and the need to satisfy Tata Steel as a partner in Industrial Hearth come into conflict with these aims. By presenting the actions of an energy provider in human terms, as a moral dilemma faced by their character, Emily and other participants were able to engage more reflectively about the constraints within which mistrusted corporate entities operate. While this did not eliminate the element of mistrust, Persona 7's presence as a citizen of Port Talbot concerned with the long-term security of local energy provision, points to the cares and characteristics residents might like to see in future energy providers.

Trust in local community

Beyond the focus on local governance and industrial relations, a personas-based approach also allowed participants to explore the changing relationships within the local community that may result from wider energy systems change. Situating the discussions within both a local and an everyday context, the task made it easier to consider the changing relationships with friends, family and the local community that energy systems change may bring. This was most prominent within discussions of Virtual Marketplace, where concerns about direct social conflict emerged readily and in a number of different contexts. One example centred around concerns that local children may interfere with or vandalise external heat pumps or other infrastructure. Another highlighted concerns about energy theft, with participants drawing on local hearsay to express fears that unscrupulous neighbours might steal energy from electric car charging ports:

Monica: Other people charging their cars from your charging point when you're not at home.

Barry: You'd have to put a lock on it. [...] Unless you tap into next doors [laughter]

Monica: Tap into next door's?

Dai: Can be done. Tap into the supply. [Persona 5's] done quite a lot. Lampposts and all sorts of things...

Monica: There's a house on the hill by where I live and every year, they put loads of Christmas decorations up and it's like glowing. The street is glowing from this house. And they'd connected them all up to the lamppost in the street.

(Green-fingered Residents)

Pointing to an underlying sense of mistrust or social tension within the community, the discussion of neighbourly troubles within the personas task provided an avenue for participants to explore how local social relations might shape experiences of energy systems change. While some discussion of crime, drug use and a declining sense of community emerged elsewhere in interviews and workshops, this discussion tended to be in a more abstract sense, possibly indicating a reluctance to personally admit to mistrustful or fractious neighbourly relations. In providing a proxy to explore these concerns, the personas task thus provided a means for participants to discuss underlying concerns about the quality of communal relations in the town, and the vulnerabilities to crime and neighbourly exploitation

which may ensue from more interconnected and public accessible modes of home heating, electricity supply and vehicle refuelling.

Beyond the direct conflict, more subtle fears emerged around various forms of exclusion that may derive from communal energy provision. For example, a personalised interpretation of peer-to-peer energy trading led some to fear that people like Persona 5, might lack the social connections required to access locally produced energy at a reasonable price:

Marcus: [Persona 5] doesn't have much peer-to-peer interactivity, doesn't have much social life in the neighbourhood [...] in the community, therefore can't take advantage of the peer-to-peer system.

Emma: Can't take advantage of the peer-to-peer system because he doesn't know as many people. It's a peer-to-peer energy trading, if you're not from a neighbourhood, you're not going to benefit from that because he's moved around a lot.

(Multi-generational Residents)

Here we see Persona 5, previously narrated as vulnerable due to mental health difficulties, rendered even more so by requirements around community energy trading. At one level, this personalised image of peer-to-peer energy trading may be read as a simple misconception in which algorithmic trading is mistaken for a more personalised form of trading relationship. In this reading, Marcus and Emma's discussion could be read as evidencing the need to take care when introducing peer-to-peer energy and similar systems for more localised trading. However, we would contend that such instances are better read as moments of creative interpretation in which participants explored the broader possibilities of scenarios through their personas. The possibility for peer-to-peer trading to be used to support loved ones or vulnerable sections of the community emerged in several groups as an option, but here Marcus and Emma identify the potential for unintended forms of exclusion to emerge. Given that it is both feasible, and potentially desirable for algorithmic energy exchanges to be programmed to social ends [68], cutting off discussion at this point would have been inappropriate. Moreover, Emma and Marcus' concern over social isolation pointed to a broader concern regarding isolation and feelings of community decline over recent decades. Associated with both the decline of the economic fortunes of the steelworks - and hence the town - as well as broader national trends towards less neighbourly contact, such concerns both pre-dated and shaped feelings towards local energy systems change.

In enabling discussion of rounded characters rather than more generic societal groups, the personas-based approach gave participants the opportunity to explore the emotional

significance of vulnerability. The exclusion of Persona 5 troubled participants not simply because it represented a distributive injustice but because he was recognised as suffering from depression.

The emotional and relational stakes of exclusion also came to the fore in scenarios emphasising use of low-carbon energy technologies in homes (most prominent in Virtual Marketplace). Here concerns emerged that the visibility of novel technologies on homes could become markers of social status, causing new jealousies and exclusions to emerge:

[Some] people will earn more electricity than others just because of where their house is and how much sun their roof gets. People might get jealous and think, you know, falling out with them and you're getting more money for nothing and all this. It could cause problems.

Monica (Green-fingered Residents)

While some participants were concerned with potential feelings of jealousy and social tension, others focused more on fears of the social judgement and isolation that interdependent local energy networks may bring: 'people are judging [you] and social exclusion and all that comes in to play' (Elaine, Young Professionals), which could be problematic for future residents' wellbeing:

Only because it's visible, I feel. I think there's people out there now like [Persona 4]. This is probably a person that could live now but I think by making it visible, it might make her more alienated from society. She might be more lonely.

Emily (Young Professionals)

In focusing on feelings of exclusion, jealousy and loneliness, as well as the financial worries attendant to more flexible, localised energy provision, persona-based exploration allowed a more subtle discussion to emerge of the possible emotional and relational issues arising with energy systems change. In so doing we begin to get a picture not only of the risks and benefits participants saw in scenarios, but the also the ways in which changes to energy systems may interact with local social relations to generate new feelings of risk. Furthermore, in focussing in on the emotional stakes of energy systems change, the personas task enabled us to give a more fulsome account of why such risks matter to people. It was not simply that potential modes of exclusion were seen as breaching principles of distributive or recognition justice (although some certainly were viewed in this way). Such potential injustices took on meaning for participants through the emotional impacts they carried for persona characters, recognisable others resembling Marcus, Monica's mother and others with whom participants

felt sympathy; it was these anxieties, loneliness and suffering which often lay at the heart of concerns over exclusion.

5. Methodological Reflections

By re-situating energy technologies and wider systems changes within the context of everyday life in Port Talbot, our personas approach facilitated more localised and wide-ranging encounters between residents and (what could otherwise be relatively abstract) visions for energy systems change. In trading more generalizable deliberation at the national scale for more place sensitive, emotional reflection, this approach does not negate the need for more nationally representative deliberative exercises. However, it does offer a lens for capturing place based and emotional concerns which may be lost when adopting a wider societal lens. Persona-based exploration enabled deliberation of not only the acceptability of novel energy technologies, but also their myriad connections and interactions with everyday-experience and how these may be impacted by changes to local energy systems. As the above analysis illustrates, participants used personas in a variety of ways. In some instances, the gradual process of elaborating a character and forming identifications with them allowed participants to speak to more personal struggles with mental health; the competing concerns and burdens which might confound expectations that one should be 'technologically minded' in relation to energy; or underlying anxieties about the quality of one's relationships to neighbours and the local community. Parallel to this however, the persistent emergence of vulnerable personas in need of protection also spoke to participants' deliberate use of the task to test scenarios by imagining characters who would struggle with more volatile cost structures or novel forms of technological engagement. In practice we observed both processes operating in tandem, with vulnerable consumers often being seen as analogues for younger or poorer versions of participants, or for elderly parents or other vulnerable relatives.

One key element of our success in engaging local residents with the complex implications of future energy systems change, was the creative and playful element of the activity, something that can be lacking within often dry, technical and prescriptive scenarios-based activities [59]. Participants generally worked collaboratively, leading to the creation of diverse personas that were rich in personal life histories. Sometimes conversations strayed away from the focus on embedding these personas in the local energy futures, and careful facilitation was required to keep the activity embedded within the scenarios. However, on balance, humour acted as a social lubricant, creating a deeper bond between participants, and many took great pleasure in sharing the personas they had created together. Sometimes, this creative process led to uncertainty as to whether they were completing the task correctly, or concerns they were

simply making things up as they went along. A degree of reassurance and support from facilitators was required, both to keep discussions moving, and highlight areas of each scenario for consideration in-light of the characters being developed.

While the capacity to interrogate socio-technical changes from a more situated and experiential perspective was a core strength of the personas approach, at times we observed a more problematic tendency for cultural discourses to give way to cultural stereotyping. Stereotypes emerged in the form of running jokes about a persona's character, usually based on assumptions relating to gender, age or class. Given the reliance of our method on character illustrations as a prompt for persona development, some degree of stereotyping at the outset may have been inevitable. Occasionally, careful moderation was required to keep discussion on an appropriate and on-topic footing. More often however participants themselves recognised the problematic nature of the social discourses at play. At times this was reflected a desire not to use gender or place related stereotypes: *'I feel like I'm judging this lady'* (Emily, Young Professionals). On occasion, these worries led participants to return to certain choices and make changes to a persona's details. To an extent, these reflections illustrate the potential for persona-based exploration to give rise to discomfort among some participants. However, it is also illustrative of the identificatory dynamics at work in persona-based exploration itself; as characters were elaborated, they took on sympathetic traits of participants themselves, their friends or family members. Through this process persona characters became more rounded, resisting initial stereotyped descriptors. Uncertainty or fear of giving 'the wrong answer' is an issue attendant to many forms of qualitative interviewing, and on balance we found the informal and humorous tone of discussion lent itself to focused and creative discussion, while avoiding some of the difficulties others have noted when researching the future [48, 51].

6. Conclusions

In summary, we would argue the personas method described above offers important insights for public and policy deliberations around energy transitions, highlighting the importance of emotional and place-based concerns in addition to traditional normative considerations such as justice or sustainability. Contrasting deliberations framed around specific challenges (decarbonisation, low-carbon technologies or policies), the personas task enabled a more situated mode of reflection, illustrating how local histories and identificatory dynamics give additional layers of emotional and cultural meaning to proposals for energy systems change. By allowing participants to gradually see elements of themselves, relatives or familiar others in the inhabitants of future energy systems, the task allowed for more emotional and sympathetic forms of reflection on how complex socio-technical changes may be experienced in practice.

The recurrent emergence of particular kinds of character such as young or low-income parents and elderly characters who may struggle with new digital technologies, as sympathetic characters supports findings from previous deliberative studies that social justice and the protection of the vulnerable are key values through which citizens evaluate energy systems change [21]. However, by positioning this persona enabled exploration within the familiar context of Port Talbot, we were also able to surface how feelings and relationships rooted in place may impact on perceptions of potential sociotechnical scenarios. Concerns around declining community and anxieties over the reliability and responsiveness of local industry surfaced not only as objections to how scenarios for district heat networks or peer-to-peer trading might function, but also as markers of worry, isolation or loneliness which participants found undesirable in their own right. While in one sense such structures of feeling are independent from scenarios for whole system decarbonisation, blindness to them carries the risk that proposals for low carbon futures become seen as ignoring or exacerbating pre-existing emotional wounds, or simply as addressing the wrong problems in the face of more salient local concerns. In places like Port Talbot, where reliance upon a single industry has peaked in previous decades, significant attention may be required to the social and economic legacies of the past, if those same industries are to be accorded a hearing as a desirable component of low carbon futures.

In eliciting more sympathetic and contextualised evaluations of sociotechnical change, the personas task offers a means of going beyond relatively abstract normative principles such as justice, to examine why it is such principles matter at an emotional level which remains under acknowledged in policy discourses around just transitions. It is one thing for smart, low carbon energy interventions to be designed to distribute costs and benefits fairly, but if such interventions are seen to increase feelings of stress, social isolation, loneliness then they are unlikely to be seen as heralding a future that is either fair or socially desirable. Our findings thus have relevance beyond Port Talbot, calling into question reliance on decontextualised modes of public deliberation and decision-making which often characterise infrastructure planning [31, 50]. While we welcome recent efforts to localise public deliberations around low carbon futures through the use of citizens assemblies, it may be prudent for future efforts in this area to attend not only to context, but to the emotional dimensions through which such changes may be experienced. While personas assisted exploration offers one route to achieving this, we would not be methodologically prescriptive here. Rather this recommendation should be taken as a plea for greater experimentation in eliciting not only ethical reflection of potential technologies and scenarios, but also their emotional dimensions.

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