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Public agency and responsibility in energy governance: A Q study on diverse imagined publics in the Dutch heat transition

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ABSTRACT

In Energy Social Science (ESS), the concept of imagined publics is used to describe how energy actors perceive societal groups around new energy technologies and projects. Findings indicate that imagined publics often build upon deficit assumptions; people are (unjustly) considered unknowledgeable, incapable, unwilling and irresponsible agents in governance. While insightful, deficit-based explanations insufficiently capture the *broad diversity of publics imagined around energy system change*.

In this paper, we share the results of a Q-study, designed to systematically identify diverse imagined publics in the Dutch heat transition. We found five imaginaries:

1. "Meaningful participation in a diverse society"
2. "Strong and enthusiastic communities in the lead"
3. "NIMBYs, social contestation and the threat to decarbonisation"
4. "Collectivism & vulnerable groups at risk"
5. "Unburdening individual user-consumers in the transition".

Each imaginary builds upon a different set of epistemic, action and normative assumptions, which construct public agency and responsibility in transitions in distinctive ways. We explore how these constructions come to justify roles and obligations for publics as well of other actors in the heat transition. One of our main contributions is that we explicitly move beyond the analysis of singular imaginaries as we consider imaginaries to be interactive, holistic, and contextual. In comparison, key social, ethical, and political tensions and trade-offs in the heat transition become visible.

1. Imagined publics in the Dutch heat transition

The decarbonisation of heating in the built environment sparks much debate, amongst others because it will have far-reaching impacts on citizens and their ways of living. Some of the measures proposed require people to proactively change their behaviours, renovate and insulate their homes, and invest in alternative heat technologies [1–4]; and whereas fossil fuel-based heat systems have proven to be comfortably reliable, flexible, affordable and almost effortless, alternative heat technologies are often far less familiar, come with higher capital costs, and may not necessarily provide similar thermal comfort levels [4,5]. Therefore, whether people will be supportive of, and willing to

contribute to, decarbonisation of household heating is far from certain.

That is why in many countries, and on the European level, citizen inclusion in innovation, decision-making and implementation is lauded as a way to arrive at more accepted heat decarbonisation measures [6,5,7]. Besides instrumental motivations there is a strong normative-democratic appeal to include citizens [8]. Responsibilities in governance of heat transitions in the built environment are progressively shared by more and diverse actors, such as governments, housing corporations, homeowner associations, energy companies, and grid operators - yet not all of them are publicly answerable for their actions. Granting citizens a seat and say in decision-making on alternative infrastructural, technological, and economic heat solutions could help

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(re)establish a form of democratic legitimacy by enabling trust, transparency, and accountability [8].

While the relevance of including citizens in heat transitions is clear, the notion – both in terms of what it means and how to do it – remains ambiguous. Like in other energy transitions, there are diverging views on the types of roles, responsibilities and mandates that are appropriate for citizens [9–14]. These contesting views are often underlined by vastly different evaluations of people's needs, values, wants, motivations, skills, and capabilities [15,2,3]. In Energy Social Science (ESS), such views on citizens and citizen inclusion are studied by use of the concept of *imagined publics* [16–18]: subjective social representations that build upon all sorts of assumptions and beliefs about the identities, abilities, knowledges, behaviours, and responsibilities of a particular group of people.

The existence of imagined publics in transition governance is not necessarily problematic, or even avoidable. After all, such representations are prerequisite for all technological and societal innovation and change [19,20]. However, imagined publics become problematic when they build upon simplistic and stereotypical biases that result in misrecognition, misrepresentation, and the unequal imposition of barriers to people's access to, and voice in, decision-making [21]. Concerning decision-making on energy, researchers have found that governance actors often imagine publics around renewable energy projects or technologies to be unknowledgeable, ignorant, irrational, incapable, unwilling, unresponsive, or irresponsible agents who are de facto against development, and have concluded that such deficit assumptions can result in closed down public engagement design [22–26]. This is the case, for example, when the primary aim of citizen inclusion becomes to educate 'the public', or, when public meetings are deliberately kept small and exclusive to prevent offering protesting voices a podium to promote their objections [22,23].

So far, ESS research has particularly problematized the existence and performativity of these deficit-based imaginaries. Recently, however, calls for more scrutiny and reflexivity towards diverse sorts of imagined publics have emerged [27,13,14]. Driven by social constructivist and relational notions, the core argument for this is that citizen inclusion and exclusion are never dichotomous or discrete concepts. Instead, each public imaginary co-constructs and enacts technologies, infrastructures, institutions, publics, power, and understandings of inclusive governance in unique ways [13,14]. In that way, an imagined public is always part of a wider technical-institutional arrangement in which (some) publics are recognised, acknowledged, and involved in particular ways and for particular reasons, while others are not [28]. To understand the many ways in which citizen inclusion is defined, justified, and enacted in transitions, new empirical research on imagined publics would necessarily have to engage with the co-constructive workings of diverse imaginaries [13].

In this paper we answer the above call by empirically mapping the diverse and co-existing imagined publics present in governance of the Dutch heat transition.

1.1. The Dutch heat transition

In the Netherlands, residential heat demand is largely met by use of natural gas, not in the least made possible by the country's abundant natural gas reserves in Groningen [29]. After the discovery of these considerable reserves in the late 1950 s, the Dutch government and the natural gas industry (represented by Shell and Exxon) quickly negotiated the terms of natural gas development and distribution – which resulted in a relatively closed-down, technocratic, and top-down gas regime that remained in place for decades. Part of the agreement entailed establishing a relatively large and stable residential demand for Groningen gas; hence, within a matter of years, a nation-wide and fine-grained gas network was rolled out that connected nearly all Dutch households and provided them with affordable, clean, and almost invisibly supplied Groningen gas [29].

Even today, more than 90% of Dutch households still depend on natural gas for space heating, hot water, and cooking. Nowadays, however, this strong dependence – and arguably, lock-in – on natural gas is considered problematic for two reasons. Firstly, climate change considerations have brought about discussions on the desirability of natural gas use for low temperature heating [30,31]. Secondly, after decades of gas extraction in Groningen, the region has been confronted with the frequent occurrence of extraction-induced earthquakes. These have raised concerns around safety and wellbeing, as well as demands for procedural justice, recognition, and fairer compensation by the residents of the area. After years of social unrest, the Dutch government recently decided to gradually shut down production in Groningen towards zero in 2030 [1].

Both trends resulted in the ambition to decarbonise residential heating and replace natural gas in the built environment towards 2050 [32]. The replacement of natural gas by alternative heat sources and infrastructures in the built environment is now referred to as the heat transition [33]. Citizen inclusion is considered prerequisite for support and success of this transition [32], which is one of the key motivations for organising this transition locally and giving municipalities great responsibilities in coordinating, liaising, and executing the incremental phase out of natural gas.

Despite the importance given to citizen inclusion in the heat transition, municipalities have been given very few legal mandates and procedural guidelines to support them in their task [3], and so far, it has proven difficult to get different groups of citizens actively engaged in planning and execution phases of the heat transition [33,34]. A further complication is that it is not only residents, tenants, and homeowners who need to be properly included; the heat transition requires yet untried forms of collaboration with other municipalities, provinces, grid operators, heat suppliers, energy companies, technology developers, home owner associations and housing corporations – who all have different interests and responsibilities, are faced with unique uncertainties, and hold different viewpoints on the best way to engage and approach citizens in it [34]. All in all, what citizen inclusion is, and what forms it should take in the Dutch heat transition, is far from unambiguous.

So far, these different viewpoints on citizens and their role in the transition have received little attention both in research and in governance of the Dutch heat transition. Instead, research has aimed to identify groups of citizens, or segments, that share some values and motivational drivers and should thus be approached in certain ways (see, for example, [33,3,35]). Such research is relevant but does start from the assumption that the main determinants of whether and how inclusion works are essentially found in the characteristics of citizens. It overlooks the ways in which governance actors' subjective imagined publics pre-select and pre-scope participants and procedures in attempts to realise more inclusive governance.

1.2. Societal and scientific contributions

With this research, we highlight the existing subjectivities that colour the ways in which governance actors perceive and approach citizens in the Dutch heat transition. By drawing attention to the present epistemic and normative differences, we contribute to the start of a broader societal debate about what citizen inclusion is, and ought to be, in the context of this transition. This is especially relevant right now, as this is the moment that attempts are made, both locally and nationally, to develop clear procedures and guidelines on how to engage with citizens on phasing out natural gas (see, for example, [36]). This research highlights the need for a debate on the underlying assumptions that are to guide, and potentially close down, such procedures and guidelines.

Our scientific contribution is twofold. Firstly, we move beyond deficit assumptions and dichotomous understandings of inclusion in making sense of the political normativities that characterize imagined publics. Instead, we focus on how each imagined public uniquely

constructs particular roles for publics. With ‘role’ we mean a shared understanding of an actor’s position within a system as characterised by a set of activities, attitudes, and responsibilities (based on the work done by [37] p. 49)). Built on assumptions regarding people’s agentic abilities and responsibilities, public role constructions help understand how publics are positioned in relation to other actors, technology, infrastructure, and system change. The second contribution is that we introduce Q methodology to empirically capture imagined publics. This comes with two advantages: firstly, the methodology allows for the identification of diverse subjectivities in governance, and secondly, it enables a holistic approach [38,39]. The findings of our study – five different imaginaries of publics in the Dutch heat transition – set themselves apart from other studies by their variety (amongst others, we found two yet underexplored imaginaries), their unique embeddedness in the Dutch context, and the ways in which co-constructive relations between publics, institutions, technologies, and infrastructures are holistically captured.

In the remainder of this paper, we define the concept of imagined publics (2.1), review the most common imagined publics (2.2), and propose a reconceptualisation of imagined publics and their underlying assumptions (2.3). In Section 3, we introduce Q-methodology to capture imagined publics and we present the five resultant imaginaries in Section 4. In the discussion, public agency, responsibility, and role constructions in imagined publics are compared, including how these work to establish different understandings of inclusion in energy transition governance (Section 5). In Section 6, we discuss scientific and societal contributions and point towards future research opportunities.

2. Imagined publics: an overview

2.1. What are imagined publics?

Imagined publics are social representations of groups of citizens [40,41] that are shared and enacted by actors in governance networks [17,18]. These are subjective products of social knowledge [40] and as such, build upon all sorts of assumptions and beliefs about the identities, abilities, knowledges, behaviours, and responsibilities of people making up a public.

Imagined publics are produced and productive through linguistic, symbolic, and visual means [42,43]. That is, they are constructed, negotiated, and entrenched via interaction: when publics ‘present’ themselves around energy projects, or in media reports or stories of peers [16], governance actors collectively make sense of these presentations. The act of sensemaking involves drawing upon existing experiences – using knowledge schemata such as categorisations to anchor public presentations to that what is already known. In this process, publics become at least partially re-presented [44]. Imagined publics emerge as somewhat static knowledge schemata that are continuously drawn upon to represent real-life publics.

Once shared and agreed on, imagined publics can be particularly powerful – sometimes even more powerful than the real-life citizens they supposedly represent [16,15]. They help shape actors’ expectations of how decision-making will evolve. Amongst others, imagined publics help anticipate public attitudes and behaviours around a proposed policy or project [16], decide on appropriate actions, strategies, and engagement formats [16], and influence infrastructural and technological requirements and deliverables [19].

Imagined publics become problematic when they build upon and reinforce simplified and stereotypical biases towards certain groups or individuals. Taken-for-granted yet incorrect imagined publics can cause governance actors to misrecognise, misrepresent or even exclude certain groups and individuals from decision-making [21]. While this often stimulates alternative and countering representations to arise, these are not always recognised nor evaluated as equally ‘true’ in governance, especially when imagined publics function to protect and justify incumbent interests [45]. Therefore, exploring diversity of imagined

publics is particularly relevant to understand political and epistemic power dynamics in governance [44,27].

2.2. Commonly studied imagined publics

This section summarizes the most studied imagined publics in technology and energy governance, based on a review of existing literature¹. Imagined publics are primarily studied in three scholarly fields: *Science and Technology Studies* (STS), *Public Understanding of Science* (PUS), and *Energy Social Science* (ESS). Within these fields, ‘the general public’, ‘the local community’, and ‘the individual user-consumer’ are often recognised. More recent and emerging imagined publics, particularly in and around energy, are ‘the prosumer’ and ‘the energy citizen’.

2.2.1. The imagined general public

‘The general public’ is an imagined societal collective consisting of ‘lay people’ or generalized imagined lay persons [40]. Since the 1950s/1960s, three different imaginaries of the general public have prevailed in western technoscientific circles. Firstly, around the 1950s, technoscientific experts considered science an elitist epistemic realm, of which the public had no understanding, nor interest or place in. It was expected to ‘comply passively and gratefully with the policy decision-making of those who know best’ ([18] p. 561). Scientific illiteracy of lay people became problematic when new technologies such as nuclear energy and synthetic biology were met with irrational public resistance [18]. The public had evolved into an ‘incipient threat to the (...) science-led agenda of innovations’ ([18] p. 561) – which could be mitigated, as was the assumption, with better science education and ‘selling science’ more properly [46]. After 9/11, strict surveillance and policing became considered necessary to control a ‘highly politicised’ and dangerous public. No longer was the threat incipient: ‘pre-existing imaginaries of anti-science publics were extended and intensified as publics resisting established technoscience policies were cast as extremist threats to social order’ ([18] p. 561).

Over time, outspoken critique on the deficits-based and blame-infused assumptions underlying these imaginaries arose from within PUS and STS [47]. Wynne scrutinized the deficit model of public understanding of science and problematized how these assumptions allowed governing elites to deny responsibility for flawed and failing science-society relationships [48–50]. Scholarly interest reoriented towards more participatory public engagement with science. It remains contested whether this new focus on participation is indeed based on other than deficit assumptions, or whether it provides a more obscured way of excluding resisting publics from decision-making [49,51].

2.2.2. The imagined (local) community

Around infrastructure development, scholarly attention has gone out to another imagined public, namely ‘the local community’ [25,52,22]. In project development circles, ‘communities’ are considered neighbours with whom one must learn to live together. These neighbours quickly become an implementation barrier when they start to express their discontent with elements of the project. This is particularly true for a small yet outspoken group, labelled NIMBYs [22]. Not-in-my-backyard protestors are seen to lack understanding, information and experience; they are driven primarily by self-interest and are de facto against any development in their direct environment; they have trust issues towards

¹ An open search was conducted in Scopus, Web of Science (core collection) and Google Scholar using search words as “imagined publics”, “Social imaginaries” and “Social representations publics” in combination with “Energy”, “Technology”, and “Governance”. Search results were limited by focusing on publications after 2000 – although publications published before 2000 were included in subsequent snowballing selection if a reading of materials showed these publications to be core to the development of the concept. Close to 100 articles were included in the review.

developers; their behaviour is rooted in emotion and irrationality; and, their actions are harmful for the collective or public interest [25,52,22,24,23]. In short, NIMBYism builds upon a range of deficit assumptions [23]. Despite that research has shown that the NIMBY image of the public is self-enforcing, marginalising and even destructive, it has proven hard to replace in energy governance circles [26,24].

2.2.3. The imagined user-consumer

A third commonly studied imaginary is the user-consumer of a technology or resource [19,53,54]. Even more so than the other imagined publics, the user-consumer is part of a wider socio-technical configuration [55–57]. Historical accounts of energy provision in western societies, for example, describe how for a large part of the twentieth century, energy was considered a public utility. It was produced, distributed, and supplied by state-owned organisations to passive user-consumers who were ‘separated from, and minimally engaged in, energy systems over and above pressing a light switch’ ([56] p. 68). This was justified by all sorts of deficits that pertained to user-consumers, such as a lack of appropriate interest and knowledge, irrationality, and a missing sense of environmental and social responsibility [56]. With notions of liberalisation and institutional reform, a different user-consumer, who was slightly more active, emerged. This user-consumer had a desire for (some) free choice. He or she followed market logics and wanted to choose between energy providers based on price considerations [55].

2.2.4. Emerging imagined publics in energy governance

The relatively recent shift towards decentralised production co-emerges with another, more encouraging user imaginary: that of the ‘prosumer’ [55]. Contrary to its predecessors, the prosumer is an active, tech-savvy, and flexible enabler of decentralised renewable energy provision [58,54,14]. Simultaneously, a more political alternative representation of the public has emerged with the notion of ‘energy citizenship’ [56,59,60]. Like the prosumer, the energy citizen is an active enabler of renewable energy realisation; in addition, energy citizens are considered politically aware, motivated, and concerned and want to realise a system with equitable rights and responsibilities across society [56].

These newer imagined publics are often constituted in and by increasingly fashionable narratives of energy democracy and energy justice [61,62,27]. While it is assumed that these imaginaries are more encouraging for opening up energy governance to citizens and their viewpoints, they also produce and impose particular issues and identities onto publics and can come to perform the inclusion of some citizens at the expense of others [13,60]. In part, this is because these imaginaries also rely on ‘residual realist’ views of citizen inclusion: ‘the who (i.e., public participants) and how (i.e., models of participation and democracy)’ are viewed as ‘being highly specific, pre-given, external, and naturally occurring categories’ ([27] p. 2). The concrete explication of who is to be involved, in what way, and for what sort of outcome results in the automatic exclusion of those who are not necessarily to be involved or are not considered as constructive towards the desired outcome. Hence, even these new imaginaries can result in narrow understanding of citizen inclusion.

In summary, most of the studied imagined publics are based on deficit assumptions. They are problematic for various reasons, not in the least because they are poorly supported by empirical data [26,24]. Despite their inaccuracy, these imaginaries continue to be unreflexively drawn upon and reproduced to justify limiting or excluding the voice of citizen in (energy) technology governance [49,18,17,51]. More recent imaginaries in energy governance seem to rely on more empowering assumptions. However, so far it remains unclear whether these imaginaries will result in more inclusive governance.

2.3. Necessary conceptual developments: from deficit assumptions to role constructions

Although an increasingly diverse number of imagined publics are identified in separate studies around energy projects and technologies, there are but few empirical studies that have followed an explicitly relational and systemic scope (for exceptions see [13,14]). Consequently, there are knowledge gaps concerning how diverse imagined publics are co-constructed with institutions, infrastructures, and technologies in transitions; how diverse imagined publics co-evolve and co-exist in transition governance; and how the ongoing political negotiation and interaction between imaginaries influences how citizen inclusion eventually is performed in various contexts [28].

A more systemic analysis of imagined publics in transitions requires an alternative conceptualisation that does not focus only on deficits, but on how certain assumptions work to construct roles for publics within energy systems [55]. With ‘role’ is meant a shared understanding of an actor’s activities, attitudes and responsibilities within a social structure or system (based on the work done by [37] p. 49)). Reconceptualising imagined publics as particular role constructions for groups of people in transitions enables a more systemic analysis in at least two ways. Firstly, because roles always concern the workings of an object, process, or system. In that sense, roles are relational: they prescribe activities, attitudes, and responsibilities of actors *in relation to* an object, process or system that needs to function, be maintained, or be changed [13]. Secondly, because a role also “always bears a [...] relationship to one or more other roles” – one actor’s role is almost always related to, and constructive of, other actors’ roles. Together, roles form so-called role constellations, or “webs of roles, which interact, interrelate, and co-evolve with one another with regard to a specific issue” ([37] p. PN).

Public role constructions build upon taken for granted assumptions of people’s abilities and willingness to perform the activities and responsibilities that are part of a particular roles. Based on the imagined publics identified in Section 2.2, we distinguish three different types of assumptions that are relevant in the construction of public roles. *Epistemic assumptions* are about a public’s perceived (in)ability to understand, deliberate, and assess issues correctly. Within this category also fall assumptions about the types of knowledge, research and information that people are perceived to have access to, believe in, and rely on, in their assessment of a situation. *Action assumptions* concern a public’s perceived (in)ability to act upon its intentions effectively. Amongst action assumptions are expectations concerning people’s behaviour and responses in particular situations. *Normative assumptions*, then, concern a public’s perceived value drivers and principles. Often, normative assumptions include a moral judgment in that they suppose people’s (un)willingness to care about the ‘right’ things and to be social and moral agent.

Epistemic, action and normative assumptions regard a public’s capacity to ‘critically shape its responsiveness in problematic situations’ ([63] p. 971); that is, its agentic capacity to iterate on past attitudes, actions and practices; to project a variety of alternative future trajectories of action (for the collective); to make practical and normative judgments among these alternatives and to choose the most desirable route for societal change; and to act intentionally in following this desirable route [63,64]. At the heart of public role constructions in transitions is the interwovenness of agency and responsibility. Assumptions on public agency are influential for the sort of activities and the types of responsibilities that are perceived as reasonable, fair, and suitable for publics in transitions; and, at the same time, it is the shared perception of a collective responsibility for societal change that guides the need for and evaluation of public agency [64].

The diverse ways in which public agency and responsibility are defined in and by public role constructions set the requirements for various types of relationships with other actants in energy transitions. Zooming in on the constructed relationships between publics and other actants in imaginaries helps overcome dichotomous understandings of

inclusion and exclusion. Instead of asking, how imagined publics work to include (some) public groups, a focus on role constructions thus allows researchers to ask, how public roles are made by governance actors to justify particular social and technological structures, procedural formats, and forms of inclusion. Of course, such research questions also require holistic methodologies that can help to meaningfully capture the diverse role co-constructions for publics.

3. Methodology

3.1. Q methodology

Q is a methodological procedure for the study of subjectivity [38]. It provides a reproducible measure of individuals' self-referential, holistic viewpoints [39]. In Q, participants assemble their viewpoint on a topic by sorting a set of purposefully selected statements. The result is a unique sorting, or Q-sort, which is further explained by the participant in the sorting interview. Q-sorts can be correlated to identify patterns of shared meaning – or shared perspectives – amongst participants.

A Q-study follows several distinct steps [65]: 1) identification of the concourse; 2) selection of statements; 3) selection of participants; 4) sorting interviews; 5) factor analysis; 6) factor interpretation.

3.1.1. Identification of the concourse

The concourse is an exhaustive set of statements about a domain. It is scoped by the research question, in our case, '*what are the diverse publics imagined in governance of the Dutch heat transition?*'.

For our concourse, statements by governance actors about attributes, behaviours, roles, and responsibilities of citizens in the heat transition were gathered between June 2017 and June 2018. We relied on a wide range of sources, including media outlets, Ministerial letters to Dutch Parliament, interviews with energy professionals, notes from stakeholder meetings and internal strategy sessions of a Dutch gas company. We collected, inductively labelled, and categorised 457 statements.

3.1.2. Q-sample selection

A Q-sample is a selection of statements, which should be balanced and representative for the diversity in the concourse. Each statement in the set should be subjective, clear, and succinct. We moved from our broad concourse to a smaller Q-sample in iterative steps. Firstly, we removed statements with overlapping meaning, and reformulated, merged, and refined statements. Secondly, we designed a sampling grid based on the inductive categories that emerged in concourse identification to ensure our Q-sample was diverse and representative. The Q-sample had to include a balance of unique statements from each of the identified categories. The first selection that was made was discussed within the wider project team to make sure all selected statements were clear, subjective, and uniformly interpretable. We also conducted two pilot interviews to test comprehensiveness and representativeness of the Q-sample. Eventually, we came to a final Q-sample of 38 statements (Appendix A).

3.1.3. Participant selection

Participant selection in Q involves identifying 'persons who are theoretically relevant to the problem under consideration' ([39] p. 192). For our participant selection, we defined governance actors as those actively involved in policy formulation and implementation discussions on phasing out natural gas in the Netherlands.

To identify relevant participants, we made use of two heuristics. At the time of our study, the Dutch government organised multi-actor climate tables to prepare a Dutch Climate Agreement. We made a list of participants who joined tables at which phasing out natural gas in the built environment was discussed. As the climate tables were not fully inclusive, we also relied on media reports to identify underrepresented actors. Amongst others, activist groups protesting continued gas extraction proved not systematically included. We made sure to invite

representatives of these groups in our study. From this longlist, 20 participants were selected whom we believed would diverse positions and perspectives. 15 participants were willing to participate. Through snowball sampling, we added participants to our P set. After 30 interviews, the evolving P set was compared with the initial longlist, and 7 additional participants were invited. 37 participants took part in our study (Appendix B).

3.1.4. Q sorting interviews

Data collection in Q takes the form of interviews, during which participants are asked to sort statements. They first do so in three categories (agree, disagree, neutral) and then specify their sorting on a forced-choice, bell-shaped grid [39]. Interviews result in two forms of data: quantitative Q-sorts and interview transcripts.

Participants were interviewed in December 2018–July 2019. They were asked to rank statements on a 9-point scale (Fig. 1) based on the question: '*To what extent do you agree with the following statements on citizens and publics in the Dutch heat transition?*'. During and after sorting, participants were asked about the statements placed towards the outer sides of the grid, and other statements they felt particularly strong about. Interviews were transcribed and coded manually.

3.1.5. Factor analysis

Factor extraction in Q is an iterative process, in which factor solutions are theoretically and statistically compared to find the most fitting solution. The analysis starts by correlating Q-sorts [39]. Q-sorts that correlate strongly form clusters around a factor. The extent to which a Q-sort is like a factor is given by its factor loading², which ranges between -1 and 1 . We compared solutions with 3, 4, 5, 6 and 7 factors³. Whether a solution was considered fitting depended on the number of unique

| | | | | | | | | |
|--------------------|----|----|----|---------|---|---|---|--------------------|
| Very much disagree | | | | Neutral | | | | Very much disagree |
| -4 | -3 | -2 | -1 | 0 | 1 | 2 | 3 | 4 |
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Fig. 1. Grid used during sorting interviews.

significant factor loadings⁴, the cumulative variance explained⁵, and the

² Brown, 1980, p. 222. A factor loading is considered significant at $p < 0.01$ level, when it exceeds $2.58 \cdot SE$. SE is calculated by $1/\sqrt{n}$, where n is the number of statements in the q-sample. In our study, a loading was significant at $p < 0.01$ level when it was equal or larger than $2.58 \cdot (1/\sqrt{38}) = 0.419$. If a Q-sort had a significant factor loading on more than one factor, a minimum difference of one standard error with the second-highest loading was required.

³ We used the online software package KenQ. KenQ offers Centroid Factor Extraction (CFE) and Principal Component Analysis (PCA), and for each of these options, the choice to apply judgmental or varimax rotation and to flag significant factor loadings automatically or manually.

⁴ Factors were accepted if they had at least two unique significant factor loadings. We preferred solutions in which more than 75% of the participants had a unique significant factor loading.

⁵ In solutions that explained $< 40\%$ of the cumulative variance, factors became less clear and detailed.

interpretability of the factor arrays in relation to the interview data⁶.

Ultimately, we decided on a PCA solution with 5 factors (Appendices A&C). The factors were rotated with varimax first, after which two small manual rotations were undertaken⁷. The solution explains 56% of the variance in the data. 29 of the 37 Q-sorts have a unique significant loading on one of the five factors, and each factor has at least 3 unique significant loadings (Appendix C).

3.1.6. Factor interpretation

In interpretation, the factor arrays are translated into holistic perspectives. The interview data is indispensable at this stage.

Each array is characterised by defining statements: the statements with the highest and lowest z-scores in a factor, that are positioned on +4, +3, -3 and -4 in the arrays. Sometimes, less saliently ranked statements are still theoretically meaningful. These were included in interpretation. Distinguishing and consensus statements help understand differences and similarities between perspectives. Distinguishing statements are sorted significantly different by participants loading on one factor compared to participants that load on other factors. Consensus statements are sorted similar across all factors. In our study, there were no consensus statements. We have provided an overview of defining and distinguishing statements per factor in the results.

Factor interpretation resulted in five imaginaries (see Section 4). In each imaginary, reference is made to statement numbers and their position in the factor array. Distinguishing statements are identifiable by D or D*. Where quotes are used, participant identifiers are referenced.

3.1.7. Methodological limitations

While Q is lauded for its ability to reduce researcher bias by giving participants control over the sorting process, there is still room for researcher subjectivity to influence the study scope and outcomes. This can happen in every step of the methodological procedure but is prevalent in concourse identification and Q-sample selection [66]. In these phases, statements may be overlooked, deemed irrelevant and (wrongly) excluded from the Q-sample. In this study, a missing statement was identified half-way through the interview process – making it impossible to add it to the sample. “The neighbourhood as a social unit in the Dutch heat transition” was considered absent by some participants. Considering the importance currently granted to the neighbourhood in participation design, this statement could have added more depth and detail to the results.

Researcher subjectivity can also influence factor extraction and interpretation of the factor arrays, which is why it is considered desirable to share the preliminary interpretation with participants for verification and reflection. While individual sorting patterns were discussed with participants, and results presented to a wide array of actors involved in heat transition governance in the past few months, participants were not involved in factor interpretation. This is another limitation.

4. Imaginaries in the Dutch heat transition

4.1. Meaningful participation in a diverse society

Eight participants, working for publicly owned organisations such as grid operators (N = 5), not-for-profit organisations (N = 2), and advisory organisations (N = 1) have a unique significant factor loading on factor 1 (See Table 1).

⁶ A factor array is based on the weighted z-scores for each statement in a factor - calculated based on all Q-sorts with a unique significant factor loading on that factor.

⁷ Component 1 and 2 were manually rotated by 10 degrees. Component 2 and 5 were manually rotated by -7 degrees. Both rotations were carried out based on our interview data.

Table 1

Distinguishing and defining statements of factor 1.

| Distinguishing and defining statements factor 1 | | |
|---|----|--|
| Sorted on | # | Statement |
| More positively sorted statements | | |
| +4 D | 24 | “The public” does not exist. There is a large diversity of groups in society who all have different interests and ideas. |
| +3 | 26 | The sooner that people within the environment become involved with plans or projects, the better. |
| +3 D* | 27 | Inhabitants want sufficient and clear information. If you explain what is going to happen, you can prevent resistance. |
| +3 | 33 | Protesting against continued gas extraction is allowed, but you should not spread lies about the risks, or the necessity, of natural gas. |
| +2 | 16 | There are limits to participation – there are some things, on which citizens simply cannot co-decide. |
| 0 | 17 | There are many energetic, participating inhabitants who like to co-decide. |
| More negatively sorted statements | | |
| -1 D* | 34 | Nowadays, a lot of people feel suspicious towards the government and do not trust the decisions it makes for them in relation to energy. |
| -2 | 18 | Provide citizens with control over budgets and let them handle things themselves. |
| -3 | 6 | Consumers want to choose and generate their own energy, and, in time, trade it with their neighbours. |
| -3 | 13 | Ownership of energy sources and infrastructures should lie with citizens. |
| -3 | 35 | There are a lot of people who do not want to take part in a meaningful dialogue – attempts at that only end in a shouting match. |
| -4 | 8 | We ought to close the gas tap for a couple of weeks. That would make for a lot less screaming and shouting for the phase out of natural gas. |
| Number of Unique Significant loadings: 8 | | Explained variance: 14% |

According to this imaginary, there is no such thing as ‘the public’. Society consists of many co-existing groups that all have different interests, ideas, values, and beliefs (24, +4 D). These groups also have diverse wants, needs and abilities (6, -3 & 17, 0). As one participant explains: “We’re too much looking at inhabitants as a group. While there are vastly different people in that group. There are people that do want, people that don’t... some that want to go figure it out by themselves... and some who say: ‘I don’t care. Just show up when it’s ready’. And that variety needs to be accommodated” [P22].

Diversity poses a challenge for governance actors trying to realise the heat transition. There is no one-size-fits-all solution. Therefore, top-down decision-making is impossible. The heat transition takes place on a neighbourhood or municipal level and requires decisions that will directly impact people’s living environment and well-being. If you want such decisions to be accepted, you need to include people in decision-making. Participation can prevent protest: “When people start protesting, they often have a good reason to do so. You should have thought about that beforehand (...) it might slow down the transition a bit, but that is not because of the protesting. That is because you did not have your things in order. You didn’t think well about... well” [P23] (8, -4).

Meaningful participation is fostered by early involvement of interested citizens and provision of clear, honest, and transparent information (26, +3 & 27, +3 D*). The latter is particularly important because there is a lot of misinformation being shared on risks, impacts, and

desirability of certain energy projects (33, +3). With the right information, participation can work to educate:

“That knowledge development of people, which fits their decision-making competences – that just helps you in the discussion. People who now say: ‘it must all be low temperature heating’... and we go and say: ‘but do you know what that means, in terms of costs?’, ‘Yes, that’s cheaper’, they’ll answer. No, it is not cheaper. It is more expensive. So, how are we going to do that? (...) That is the nice thing, if a neighbourhood is involved in tackling her own problems. Then they will go do research. And while in the beginning, they may say: ‘let’s do low temperature’, after a couple of months, they’ll say: let’s not” [P22].

Meaningful participation also requires governance actors to learn and be self-critical towards their procedures and actions. To be able to really listen to, and accommodate, citizens’ perspectives, technical experts and energy professionals need to “deconstruct current silos between professionals and non-professionals” [P22] and let go of some of their pre-existing deficit assumptions about people. In the end, most citizens will be reasonable, willing to listen and open for dialogue (35, –3).

While in this imaginary, citizen inclusion is considered critical for acceptance, participation is also believed to have its limits (16, +2), especially with respect to coordination and ownership of collective infrastructures (13, –3). Energy infrastructure is a collective good and must be guaranteed by grid operators with appropriate technical expertise and a clear statutory responsibility (18, –2). There is an important role for the Dutch government to own, supervise and decide on (national) energy infrastructure. People sufficiently trust the government to decide for them on these collective infrastructures (34, –1 D*).

4.2. Strong and enthusiastic communities in the lead

Six participants have a unique significant loading on factor 2. These participants represent citizen activist groups fighting continued onshore gas extraction (N = 2), environmental NGOs lobbying for minimal extraction and use of fossil fuels in the Netherlands (N = 2), and governmental bodies involved in overseeing the phase out of natural gas in the built environment (N = 2) (See Table 2).

In this imaginary, the transition relies on enthusiasm, agency, and sense of collective pride within communities (31, +4 D*). As one interviewee explains: *“I strongly believe in the power of communities. I think communities are the key. You see, they want to go faster, that is noticeable... and if you compare that with other parties, like the Ministry of Economic Affairs and Climate... there is just a mismatch. Because we see a lot of citizen initiatives and energy cooperatives. My hope is that is we are going to become independent of fossil fuels ourselves. That is how you fix the problem. If there is no demand from your own community... You will see, together we can go much faster than the government” [P3].*

People are considered important and valuable agents in the transition (7, +3). There is a lot of social capital (relationships, networks, shared norms, and values) that can be used to carry out the transition (15, +2 D*). People generally have a lot of energy and motivation to develop, adopt and implement renewable energy alternatives. Indeed, there are many smart, active, and intrinsically driven people who want to get going with the transition (17, +2 D*). They notice that change is needed and are concerned about the earth and quality of life on it, not only now but also for future generations. They feel an urge to preserve and do good within their own spheres of influence.

To reap the benefits of existing social capital and goodwill, it is important to stimulate and financially support citizen collectives in their efforts around renewable energy. With the right support, there are few decisions that cannot be made by people on their own (18, +3 D* & 16, –1 D*).

Not only is the community or local collective considered as key to success in this imaginary, but there is also an explicit contestation of incumbent energy actors. These actors have (too) much to gain from continued production and use of natural gas and other fossil fuels. They

Table 2

Distinguishing and defining statements of factor 2.

| Distinguishing and defining statements factor 2 | | |
|---|----|--|
| Sorted on | # | Statement |
| More positively sorted statements | | |
| +4 D* | 31 | To make the transition a success, you need to stimulate a local sense of collective pride for the own sustainable energy provision. |
| +3 D* | 18 | Provide citizens with control over budgets and let them handle things themselves. |
| +3 | 26 | The sooner that people within the environment become involved with plans or projects, the better. |
| +3 | 7 | The most important stakeholder in the energy transition is the public. |
| +2 D* | 17 | There are many energetic, participating inhabitants who like to co-decide. |
| +2 D* | 15 | There is sufficient social capital amongst Dutch citizens (relationships, networks, norms and values, commitment to the community, et cetera) to make the local heat transition a success. |
| 0 D | 23 | The ‘not-in-my-backyard’ label for involved inhabitants around energy projects is obsolete. |
| More negatively sorted statements | | |
| –1 D* | 16 | There are limits to participation – there are some things, on which citizens simply cannot co-decide. |
| –2 | 32 | People living around energy projects base their opinion of these projects on emotions and mostly irrational arguments. |
| –2 | 38 | It is completely unknown, who the broader public is to whom we ought to listen. She keeps quiet. |
| –3 | 35 | There are a lot of people who do not want to take part in a meaningful dialogue – attempts at that only end in a shouting match. |
| –3 D | 10 | The whole transition becomes potentially delayed by a small group of protestors at the local level. |
| –3 D | 2 | If you want a project to remain unexecuted, add as condition societal support. |
| –4 | 8 | We ought to close the gas tap for a couple of weeks. That would make for a lot less screaming and shouting for the phase out of natural gas. |
| Number of Unique Significant loadings: 6 | | Explained variance: 11% |

are financially incentivised to keep in place, or even expand, current carbon-based and technocratic forms of energy provision.

Traditional energy policy and project development is drenched with marginalising frames of publics, which are strategically used to disempower for societal groups and communities. Instead of listening to people’s concerns, these public and private actors create inappropriate and inaccurate labels such as NIMBY (23, 0 D & 10, –3 D & 32, –2) and the ‘silent majority’ (38, –2). These labels work as cognitive barriers to meaningful participation and help exclude active local community members from formal and legal procedures (35, –3 & 2, –3 D). In other words, these frames allow traditional energy developers to ignore people’s emotions, perceptions, arguments, norms, and values and prevent sector reflexivity (8, –4). This is unacceptable.

4.3. NIMBYs, social contestation and the threat to decarbonisation

Nine participants have a unique significant loading on factor 3. All these participants have a strong background in, or extensive knowledge of production and distribution of natural gas (N = 9). In the context of the energy transition, most of them are currently exploring the role of

alternative gases (N = 7) (See Table 3).

In this imaginary, the main threats to successful decarbonisation are social contestation of critical energy sources, technologies, and projects and distrust towards incumbent gas and energy sector parties.

Not in My Backyard opposition around energy is very real and it is a threat to the energy transition (23, −3 D). Irrespective of the type of project, whether it regards small gas field development or wind energy, “they will just tell you: ‘we don’t want it here, fix it elsewhere’, that is so symptomatic” [P25]. NIMBYs polarise decision-making on the transition, and not only by the extreme viewpoint they represent. They make use of and distribute misinformation (33, +3), base themselves on emotions and irrational arguments (32, +2), misinterpret and misperceive safety risks and impacts (36, +3), and are not open for dialogue. “It might not be lies, but they’re not willing to listen to the facts and enter into a discussion. They’ll immediately say ‘we will continue to litigate because this is unacceptable’” [P27].

Consequently, energy governance has become complex. Often, there is no local social licence, and it is difficult to establish what is acceptable to people. Decision makers feel torn between the short-term demands of local publics and the need for long-term reliable energy supply for

everyone. Unfortunately, most people cannot comprehend this dilemma: they are incapable of grasping the workings of our energy system and the complexity of the transition (9, +2). “The Dutch are incredibly spoiled with an energy system that has such a high level of reliability and security of supply. (...) that is unique in the world. People don’t comprehend the considerable box of activities that is behind it (...) they don’t see the economic and societal costs of security of supply. Those are invisible” [P25]. Hence, people do not realise how reliant they are on natural gas and the gas sector, and instead see ‘security of supply’ as a disguise for public-private interests. How the media report on these issues is not considered helpful; it portrays an extremely negative image of the natural gas sector (25, +1 D*), while paying little attention to everything the sector provides for. Though you should not actually do it, cutting off gas supply for a couple of weeks would help demonstrate how much society still relies on natural gas, now and in the coming decades (8, +2 D*).

People mistakenly believe that the complete phase out of natural gas should be accomplished in but a few years (5, −2 D). They are frightened and wrongly convinced that high transition costs will befall them. At the same time, many do not feel the urgency of climate change mitigation, nor the need for an energy transition (11, −3). The transition seems an unnecessary unfairness to them, especially as it appears, they will have to pay more than industry. Of course, if you know how the economic system works, you realise fairness has little to do with it: in the end, “citizens always pay via taxes or buying products in which CO₂-reductions are discounted in pricing” [P35, similar statement P27 and P25] (21, −3 D*). Nevertheless, because of these perceived fairness issues, people now oppose the energy transition at large. By advocating the swift phase out of natural gas, NIMBYs, environmental NGOs and the media have created resistance against decarbonisation.

The way to de-escalate protest, on a local level and at large, is to ensure that there is some form of financial benefit for people – or at least, to make sure that people do not experience financial loss. In the end, people care most about whether and how the heat transition will affect their wallets and comfort levels (12, +4 & 30, +3). Other measures that will result in more acceptance are “public-friendly information sharing on permits and procedures” [P7] and more involvement of citizens in decision-making. The latter, however, is easier said than done. There are simply limits to what can reasonably be expected from citizens who lack a systems perspective and technological knowledge. Ownership of energy sources and infrastructure for citizens is, for example, not at all desirable (13, −4) and might lead to “heated discussions and fights between neighbours” like in “Kolkhoz in Russia” [P7] or “anarchic Polish collectives” [P25]. In the end, some form of centralised coordination remains necessary. How to ensure societal acceptance for those top-down decisions is a key challenge.

4.4. Collectivism & vulnerable groups at risk

Three participants have a unique significant loading on factor 4. They are all planning the phasing out natural gas in the built environment (N = 3) (See Table 4).

In this imaginary, a collective approach is a prerequisite for an efficient, affordable, and fair transition, even though it may sometimes be at odds with free choice and individual or local group interests (19, +3 D).

“We all realise that you get in together, or you don’t do it. Because it... it is such a big transition of course. And there are big interests involved. And big risks. If you act as a collective... you don’t leave all these risks to be carried alone by the individual... you can also better seize the opportunities that come along (...) And I realise that if it’s not the task itself [decarbonisation] that is central, but the ‘we decide for ourselves’ attitude that may come with decentralisation and local ownership... well, then self-interest might prevail. Then local ownership may become a threat” [P31].

Phasing out natural gas in the built environment comes with a lot of financial risks. There is a large group of people, who cannot carry these

Table 3
Distinguishing and defining statements of factor 3.

| Distinguishing and defining statements factor 3 | | |
|---|----|--|
| Sorted on | # | Statement |
| More positively sorted statements | | |
| +4 | 12 | Societal support for the heat transition is determined by its impact on people’s wallet. |
| +3 | 33 | Protesting against continued gas extraction is allowed, but you should not spread lies about the risks, or the necessity, of natural gas. |
| +3 | 36 | Safety should be dominant in considerations for energy extraction, however, a difference must be made between real safety risks and safety perceptions of local inhabitants. |
| +3 | 30 | People mostly want to be taken care of and be supplied with easy and affordable energy. |
| +2 | 9 | The average person will not be able to understand the complexity of the energy transition. |
| +2 D* | 8 | We ought to close the gas tap for a couple of weeks. That would make for a lot less screaming and shouting for the phase out of natural gas. |
| +2 | 32 | People living around energy projects base their opinion of these projects on emotions and mostly irrational arguments. |
| +2 | 37 | For those living around energy project, financial gain – i.e. have a share in the profits – is important. |
| +1 D* | 25 | People are presented with a considerably distorted and negative image of the fossil industry by the media. |
| More negatively sorted statements | | |
| −2 | 4 | Citizens understand that the costs of phasing out natural gas cannot be borne only by the government, and that they themselves will have to wage in too. |
| −2 D | 5 | Citizens are convinced that natural gas will remain available for a while longer. |
| −3 | 11 | The urgency of the energy transition is broadly felt within society. |
| −3 D* | 21 | It is not fair, that the majority of the transition bill is to be paid by households. |
| −3 D* | 23 | The ‘not-in-my-backyard’ label for involved inhabitants around energy projects is obsolete. |
| −4 | 13 | Ownership of energy sources and infrastructures should lie with citizens. |
| Number of Unique Significant loadings: 9 | | Explained variance: 14% |

Table 4

Distinguishing and defining statements of factor 4.

| Distinguishing and defining statements factor 4 | | |
|---|----|---|
| Sorted on | # | Statement |
| More positively sorted statements | | |
| +4 D* | 14 | There is a large, vulnerable group of people that cannot participate in the heat transition. |
| +3 | 21 | It is not fair, that the majority of the transition bill is to be paid by households. |
| +3 D | 19 | The collective interest of all Dutch citizens is more important than the interests of local groups in the energy transition. |
| +3 | 12 | Societal support for the heat transition is determined by its impact on people's wallet. |
| +2 | 30 | People mostly want to be taken care of and be supplied with easy and affordable energy. |
| +2 D* | 29 | People might not want it, but large-scale energy generation must be developed irrespective of the consequences for our landscape. |
| +2 | 16 | There are limits to participation – there are some things, on which citizens simply cannot co-decide. |
| +1 D* | 10 | The whole transition becomes potentially delayed by a small group of protestors at the local level. |
| More negatively sorted statements | | |
| –1 D* | 7 | The most important stakeholder in the energy transition is the public. |
| –2 D* | 26 | The sooner that people within the environment become involved with plans or projects, the better. |
| –3 | 25 | People are presented with a considerably distorted and negative image of the fossil industry by the media. |
| –3 | 11 | The urgency of the energy transition is broadly felt within society. |
| –3 | 18 | Provide citizens with control over budgets and let them handle things themselves |
| –4 | 13 | Ownership of energy sources and infrastructures should lie with citizens |
| Number of Unique Significant loadings: 3 | | Explained variance: 9% |

risks on their own. These are financially and socially vulnerable households (14, +4, D*) that have little savings or assets (if any) and earn a minimum wage. Often, these people do not have a strong social network to rely on, and they lack applicable knowledge and organisation capacity. As it is, these households have their own short-term concerns, for example, how to pay their rent or mortgage for the coming month. It would be unfair and socially unacceptable to expect these households to pay a high transition bill (21, +3 & 12, +3).

Acceptable decarbonisation involves exploring and preferring the most cost-efficient options. There are two important measurements: firstly, an option is desirable if it comes with the lowest possible societal costs. Secondly, it is desirable if it applies the 'not-more-than-usual' (NMDA) principle, which implies that the individual costs of alternative heat should not exceed the costs a household would have borne, were it using natural gas. Based on these standards, collective solutions like heating grids are often preferable above more expensive individual options: these solutions have the advantage of scale and provide in people's demand for easy and affordable heat (30, +2).

However, such solutions potentially impose limits on citizens' opportunities to choose for energy and heat on their own terms (16, +2): *"We're trying to make a deal for a heating grid for 30,000 to 35,000 households. And a collective approach makes it possible. But that does mean, that if people say... 'but I don't want a heating grid'... well, sorry. It's going to be a heating grid, or else you don't have heat."* [P31].

Collectivism involves coordinated decision-making, with parties in charge that can decide for everyone. Because of the complexity of the

task, it is considered undesirable to give citizens this responsibility (13, –4 & 18, –3). Many of the issues at stake are highly technical and require expert knowledge; there are difficult financial choices and trade-offs to be made; and there are always socio-political tensions as some people will not get what they want, will not be happy about it, and will try to delay the process (10, +1 D*). That is why we need public decision makers with a formal mandate, such as government officials, grid operators, and housing corporations, to make the tough trade-offs on everyone's behalf (29, +2 D*). Their challenge is to find a way to make these decisions acceptable for those whose wants clash with collective needs. This requires proper information sharing and consultation and openness and transparency on why certain trade-offs are made.

4.5. Unburdening individual user-consumers in the transition

Three participants have a unique significant loading on factor 5. Two of them work for a government organisation (N = 2). One participant works for an advisory organisation on citizen participation in the heat transition (N = 1) (See Table 5).

In this imaginary, success of the heat transition depends on the extent to which individual user-consumers are willing to take up certain behaviours, tasks, and responsibilities.

In the past few decades, the State has increasingly retracted and delegated responsibilities to citizens. This has had several economic advantages, such as more individual choice and cost reductions in provision of collective goods. Politically, delegating responsibilities to citizens has helped to address societal suspicion of, and unease with, top-

Table 5

Distinguishing and defining statements of factor 5.

| Distinguishing and defining statements factor 5 | | |
|---|----|--|
| Sorted on | # | Statement |
| More positively sorted statements | | |
| +4 | 7 | The most important stakeholder in the energy transition is the public. |
| +3 | 34 | Nowadays, a lot of people feel suspicious towards the government and do not trust the decisions it makes for them in relation to energy. |
| +3 | 30 | People mostly want to be taken care of and be supplied with easy and affordable energy. |
| +3 | 16 | There are limits to participation – there are some things, on which citizens simply cannot co-decide. |
| +2 D* | 5 | Citizens are convinced that natural gas will remain available for a while longer. |
| +2 D* | 28 | People do not have a strong opinion about natural gas. It is so deeply ingrained in our culture, we are so addicted to it, that it has become taken-for-granted. |
| More negatively sorted statements | | |
| –2 D* | 14 | There is a large, vulnerable group of people that cannot participate in the heat transition. |
| –3 | 25 | People are presented with a considerably distorted and negative image of the fossil industry by the media. |
| –3 | 8 | We ought to close the gas tap for a couple of weeks. That would make for a lot less screaming and shouting for the phase out of natural gas. |
| –3 | 6 | Consumers want to choose and generate their own energy, and, in time, trade it with their neighbours. |
| –4 D* | 20 | It is not the responsibility of citizens to find an alternative for natural gas. If the government closes the gas tap, it should also take care of alternative sources |
| Number of Unique Significant loadings: 3 | | Explained variance: 8% |

down governmental decision-making (34, +3):

“There are a lot of things the government does not just do for you anymore. It no longer takes care of your health insurance, to name an example. While the situation used to be that... we used to have a collective health care funds, and it was really the government who took care of these things. And that was not a big success in all cases. So... there is some responsibility [for citizens]. And I think that you will ultimately also get more social support, this way. If the government is to say: ‘we are taking away natural gas, and you are all going to be connected to a heating grid...’, I think they have something to explain then” [P24].

In the transition too, citizens are made partially responsible for realising decarbonisation, which is appropriate. After all, many of the measures that need to be executed pertain to the private domain. These activities involve individual investments in home isolation, renovation, and renewable energy technology, or require consumer choices for certain energy providers. They *‘take place behind the front door’*, a domain where the government cannot unilaterally enforce its plans and policies (20, −4 D*).

The biggest challenge in the transition is to get people to realise they have a responsibility, and to stimulate them to take appropriate actions. It is most critical that people embrace renewable technologies, products, and services. Without user-consumers enacting the energy transition with their cumulative individual choices, decarbonisation will fail. It is in that respect, that the Dutch public is the most critical actor in the transition (7, +4).

Unfortunately, people are insufficiently incentivised now. Most people feel comfortable continuing using natural gas because it offers a certain standard of living: it is easy, reliable, and invisible (28, +2 D* & 5, +2 D*). It delivers a great level of comfort while being affordable (30, +3). There are very few viable heat alternatives that can compete on these aspects. The State has the responsibility to incentivize business and user-consumers, financially and otherwise, to become more climate-friendly. Part of this is that they should ensure that mature alternatives for natural gas are developed and brought onto the market, and that everyone has free and equal access to these (14, −2 D*).

In addition, individual user-consumers should be unburdened, so that it becomes easier for them to adjust their consumption patterns and energy behaviours. After all, transitioning requires trade-offs for people. They must invest time, energy, and money in figuring out, implementing, and maintaining their own renewable energy provision. There are very few people who are so driven by green motivations that they are willing to go through all that hassle (6, −3). Indeed, for most people, the benefits of being green and autonomous simply do not outweigh the investments. To nudge these people in the right direction, they must be given hassle-free transition options.

5. Synthesis

In Section 4, we described five different imaginaries of publics and their inclusion in governance of the heat transition. Rather than reflecting on each of these imaginaries separately, in this section we compare the ways in which public agency and responsibility are constructed differently, and how this results in different role constellations in the enactment of the Dutch heat transition. We also reflect on how these role constellations relate to different understandings of citizen inclusion.

5.1. Role constructions and public agency & responsibility in transition governance

5.1.1. Empowered or vulnerable? Different forms of agency and the matter of inclusion in, or inclusiveness of, transitions

The five imaginaries highlight the co-existence of diverse and contested assumptions regarding public agency in the Dutch heat transition and provide insights into how such constructions help prioritize forms of citizen inclusion.

To varying extents, imaginary 1 (Meaningful public participation in a diverse society) and 2 (Strong and enthusiastic communities in the lead) present empowered citizens who can (co-)decide on energy matters. The imaginaries differ in how they portray citizens as having access to the right information – where the difference is primarily an epistemic one, namely, what sort of ‘information’ is considered prerequisite for decision-making. In imaginary 1, there is a preference for rationality and science-based information, whereas in imaginary 2, the value of emotions, perceptions and the situated experience is embraced. The imaginaries also differ in the ways in which citizen’s responsibilities around energy grids are envisioned – whereas in imaginary 1, grid management is explicitly considered a more technocratic activity for trained, knowledgeable, and experienced engineers, imaginary 2 does not touch upon matters of distribution, leaving citizens’ roles herein undefined. Either way, both imaginaries are based on more positive epistemic and action assumptions and produce publics as capable and intentional agents in transitions who ought to be given an active role in both decision-making and technology implementation.

This is in contrast with how publics are construed in imaginary 4 (Collectivism & vulnerable groups at risk). Perhaps even more than well-known NIMBY representations recognisable in imaginary 3 (NIMBYs, social contestation and the threat to decarbonisation), imaginary 4 builds upon a range of epistemic and action deficits that work to reduce the agentic capacity of people. While in imaginary 3, the deficits imagined mostly are mostly epistemic and normative in nature, in imaginary 4 the deficits pertain to the public’s ability to act. Some publics are almost considered non-agentic – their assumed financial, social, and educational vulnerabilities are such that active participation in the organisation of the transition is considered nearly impossible. The construction of these publics as passive actors is further reinforced by the characterization of the transition as technical, complex, urgent, sensitive, and high-risk. Consequently, the role foreseen for these vulnerable households is limited: at best, they ought to be transparently informed on decisions made. What is more, more enabled publics who desire more control over their own heat provision may come to pose a challenge for realising collective systems when their individual choices result in the unequal access to, control over, and costs of heat provision. As such, the freedom to choose of these more enabled publics can legitimately be restricted in the name of inclusiveness. In this way, even more agentic publics are granted a limited role in governance.

Hence, in comparing multiple imaginaries, we can observe different public agency constructions that seem to result in different trade-offs being made between inclusion of citizens in realising system change, and inclusiveness of future heat provision.

5.1.2. Virtues or obligations? Different forms of public responsibility in transitions

In the presented imaginaries, forward-looking public responsibility in transitions is constructed in ambivalent and diverse ways. Different interpretations of what it means to be responsible for something are applied – which are mostly underlined by different normative assumptions about publics. This is most clear when comparing imaginary 2 (Strong and enthusiastic communities in the lead) and 5 (Unburdening individual user-consumers in the transition) with each other.

In imaginary 2, citizens are the idealistic and creative initiators of change. They are explicitly positioned as frontrunners who voluntarily take their moral responsibility to contribute to climate change mitigation. These publics are imagined to be particularly virtuous and even praiseworthy [67]. In imaginary 5, an entirely different meaning of responsibility is construed; here, to be responsible does not only refer to the display of appropriate norms, values, and behaviours, it refers “to hav[ing] an obligation to see to it, that a certain state-of-affairs occurs” [68]. Within the more liberal market envisioning underlying this imaginary, citizens are considered free and autonomous in the private domain. It is beyond the government’s mandate to enforce measures here. This explicit autonomy of citizens within the private domain

creates an obligation: citizens are required to change their behaviour and consumption patterns to advance the heat transition. When and where individuals fail to embrace these obligations proactively, facilitation, unburdening and even nudging are justified to steer them in the 'right' direction. This normative "push", of course, is in direct conflict with the genesis notion of freedom.

In that sense, public responsibility may explicitly become at odds with public agency. Even though citizens are granted an important role in the heat transition, the normative qualities and restrictions that are simultaneously imposed on these roles limit the sort of activities and attitudes citizens can take up, and thus remove some of their agentic abilities [60].

5.1.3. Unresolved tensions: Responsibilities of other actors and accountability around mistakes in energy development

Transitions stimulate the collective envisioning of new roles and responsibilities. But collective imagination never starts from scratch: how responsibilities of publics and other parties were lived up to in the past influences how new roles become defined and justified. This is particularly true if there are unresolved issues of recognition and accountability.

This is most evident when comparing imaginaries 2 (Strong and enthusiastic communities in the lead) and 3 (NIMBYs, social contestation and the threat to decarbonisation). These imaginaries propose opposing views on who should *not* oversee the heat transition. In imaginary 3, NIMBY-motivated protestors prioritize their own gains above the collective interest and slow down the transition that energy actors are working hard on achieving. Their influence on governance should be regulated, controlled and perhaps even minimised. In imaginary 2, quite the opposite is visible. There is a strong conviction that incumbent public and private energy developers are self-interested actors, who in the past have prioritized financial gains above safety, well-being, and fairness of local communities. There is also a belief that these parties will try to slow down the transition.

In these imaginaries, there is an almost dichotomous appointment of blame [68]: in both, other parties are envisioned as normatively deficient agents who cannot be trusted to execute critically important activities in the heat transition in a socially responsible manner. At the same time, both imaginaries also contain defensive narratives against being blamed, highlighting the interactive character of imaginaries. The ways in which the NIMBY framing is explicitly rejected and condoned in imaginary 2 is a good example of such a defensive narrative, that builds upon a responsive political awareness or 'meta-knowledge' of the ways in which responsibility in transitions is framed and why [69].

Despite their substantial differences, imaginaries 2 and 3 also have something in common: the belief, that the national government should be more accountable for past mistakes and current struggles around energy development. Imaginary 2 calls for a stronger government acknowledgment of the need to make different value assessments around energy development. Illustrative for many who align with this imaginary is how the Dutch national government has been handling the consequences of extraction-induced earthquakes in Groningen. Imaginary 3 similarly shows that the gas sector operates at the frontline of a crisis of accountability in public administration. In this imaginary, the sector provides a critical collective good in a way that is authorised by the national government and conform existing laws and regulations. As perceived by the participants, the sector's lost social license is at least partially the responsibility of the Dutch government. In both imaginaries, it is considered prerequisite for any future heat system that the government adheres to, prescribes, and enforces more clear societal standards for energy development.

5.2. Relational role constellations and systems of inclusion

The above makes clear that imaginaries contain different constructions of public agency and responsibility and serve to create a variety of

roles for publics in transition governance. What is more, these constructions also serve to legitimize roles for a wide range of other energy actants, such as governments, private parties, technologies, and infrastructures. The simplest way to describe the role relations between publics and other actants is by referencing the activities, attitudes, and responsibilities that actants have towards each other (for example, supporting, facilitating, enabling, protecting, caretaking, challenging, hindering, competing) [37]. Illustrative of this relationality of roles in the found imaginaries is how the government's role and stance towards publics is constructed. In imaginaries where publics are constructed as more agentic, governments are to *facilitate* meaningful participation or to *remove* potential obstacles that prevent citizens to independently develop energy solutions within their homes or communities. In other imaginaries, where publics are either non-agentic or a potential counterforce in the transition, the role of governments is to *decide* on important transition measures in light of societal controversy, to *protect* its citizens, to *enforce* clear rules and regulations, and to make collective value trade-offs that concern the distribution of costs and benefits in the heat transitions.

These role relationships are underlying a variety of institutional and procedural solutions in the heat transition that were also captured in the imaginaries. A good example is the NMDA-principle that is explicitly part of imaginary 4 (Collectivism & vulnerable groups at risk). In essence, the NMDA is a protective measure under the current Heat Law that ensures that households relying on (city) heat grids pay the same price for an amount of heat as households relying on natural gas, put in place to because household-consumers generally do not have the option to choose between different heat alternatives – their role, in that sense, is limited by previously made infrastructural decisions. The NMDA subsequently limits the freedom – and regulates the role – of heat providers to use their own pricing mechanisms.

Interestingly, the new Collective Heat Supply Act (in Dutch: *Collectieve Wet warmtevoorziening*) that is to enter into force on January 1, 2022, will abandon the NMDA-principle as a regulatory pricing mechanism now that natural gas is likely to become scarce in the future and gas prices are expected to rise. Instead of NMDA, cost-based pricing mechanisms are to be adopted [70]. How equal pricing – and thus equal access to heat – is to be guaranteed across regions and infrastructures is still under discussion. In essence, this discussion involves the national government redefining its own role relationship with its public – i.e., what it means to protect household-consumers – in this heat transition in and through institutional change – i.e. the abandonment of the NMDA-principle – while simultaneously developing new roles and responsibilities for publics, grid operators, heat suppliers and municipalities in experimenting with collective heat sources and infrastructures. While such changes in role constellations are beyond the scope of this article, it would be interesting to observe whether and how the envisioned roles of publics in found imaginaries, and particularly in imaginary 4, evolve with the establishment of these new laws and institutions.

A last point we want to draw attention to is how imagined publics as role constellations come to perform different forms of inclusion in and through technologies and infrastructures (see also [13,14]). Centralised heat solutions and gas grids, which are more often considered desirable by actors aligning to imaginaries 3 (NIMBYs, social contestation and the threat to decarbonisation) and 4 (Collectivism & vulnerable groups at risk), come to perform entirely different, long-term role constellations than small-scale technologies and electricity infrastructures – which are more often mentioned in the context of imaginary 5 (Unburdening individual user-consumers in the transition). Currently, this receives insufficient attention in governance discussions even though there is a broad recognition that future heat provision will be increasingly diversified. It would be interesting if follow-up research would aim to uncover whether indeed, (governance actors involved in) adapting gas or heat infrastructures anticipate a more passive role for people within more top-down coordination, while those focused on electricity infrastructures and technologies in the heat transition foresee more

independent and agentic roles for publics in collaborative or even bottom-up coordination structures. The long-term consequences of such infrastructural differences in anticipations on citizen engagement with heat also deserve more consideration.

6. Conclusion

Our Q study showcases the diversity of imagined publics in governance of the Dutch heat transition. We found five distinctive imaginaries. Three of these, “Strong and enthusiastic communities in the lead” (2), “NIMBYs, social contestation and the threat to decarbonisation” (3), and “Unburdening individual user-consumers in the transition” (5) at least partially resonate with imagined publics that have been discussed in the literature (see Section 2). Imaginary 2 presents capable, enthusiastic, and willing community members as key actors in the transition – an image, that relates to the ‘energy citizen’ studied by others (see section 2). Imaginary 3 portrays threatening, irrational, and selfish NIMBYs and a malleable, vulnerable, and unknowledgeable general public. Imaginary 5 assumes individual user-consumers who are insufficiently motivated by environmental values to voluntarily adopt renewable energy technologies.

We also captured two relatively new imaginaries: “Meaningful participation in a diverse society” (1), in which social plurality of publics is embraced and considered a valuable input for decision making, and “Collectivism & vulnerable groups at risk” (4), an imaginary in which large groups of socially and financially vulnerable groups justify a top-down governance approach. We believe it has been the use of Q methodology and our focus on system change that has allowed us to chart out these new imaginaries.

Another advantage of the application of Q in this study is that it has enabled the identification of imagined publics as holistic imaginaries instead of as a set of (deficit) assumptions. The imaginaries uncovered in this study show that publics and their identities, attitudes, capabilities, and responsibilities are always co-constructed with issues, other actors, procedures and institutions, infrastructures, and technologies in heat transitions.

In the synthesis of results, co-construction in imaginaries was explored by use of the concepts of roles and role constellations. We looked at how imaginaries construct different roles for publics in the heat transition based on assumed public agency and responsibility. Contrasting different public role constructions in imaginaries helped to

identify ongoing tensions between citizen inclusion in current governance and inclusiveness of (future) heat provision, and between individual freedom of choice and societal obligation. We also zoomed in on how assumed public agency and responsibility also come to legitimize roles for other actants in transitions, such as governments, private parties, technologies, and infrastructures.

In analysis, imaginaries were found to be interactive – seeing that some role constellations were at least partially created in direct response to other imaginaries encountered. By exploring this interactivity, past yet unresolved issues of recognition and accountability were identified that continue to influence how new (public) roles in the heat transition are defined and justified.

These aspects were discussed merely in an exploratory manner and more research is needed on the long-term performativity of the found imaginaries on citizen inclusion in the Dutch heat transition. Future research could contribute to better understanding the political power dynamics involved in the construction and performance of imagined publics; for example, are there imaginaries that prevail and are taken-for-granted in current policy debates on the heat transition? Such research would also have to include the political activities that actors engage in to promote and counteract imagined publics over time in transition governance. Furthermore, despite the wider recognisability of some imaginaries, each imaginary contains contextual and time-specific meanings and understandings and is only completely true in its spatial and temporal originality. Comparative case research is needed to validate – or contrast – these insights in other settings.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. . Statements & factor arrays

| Statements | Factor 1 | Factor 2 | Factor 3 | Factor 4 | Factor 5 |
|---|----------|----------|----------|----------|----------|
| 1 Acceptance of new energy landscapes comes with time, as soon as people are used to their changed living environment. | 2 | 2 | 0 | 1 | 1 |
| 2 If you want a project to remain unexecuted, add as condition societal support. | 0 | (D) -3 | -1 | -2 | 0 |
| 3 Inhabitants too often expect that the municipality will take responsibility for the heat transition. | 2 | -1 | 0 | 1 | 0 |
| 4 Citizens understand that the costs of phasing out natural gas cannot be borne only by the government, and that they themselves will have to wage in too. | 1 | 0 | -2 | -1 | 1 |
| 5 Citizens are convinced that natural gas will remain available for a while longer. | 0 | 0 | (D) -2 | -1 | (D*) 2 |
| 6 Consumers want to choose and generate their own energy, and, in time, trade it with their neighbours. | -3 | 0 | -2 | 0 | -3 |
| 7 The most important stakeholder in the energy transition is the public. | 1 | 3 | 0 | (D*) -1 | 4 |
| 8 We ought to close the gas tap for a couple of weeks. That would make for a lot less screaming and shouting for the phase out of natural gas. | -4 | -4 | (D*) 2 | -2 | -3 |
| 9 The average person will not be able to understand the complexity of the energy transition. | 0 | -1 | 2 | 0 | 2 |
| 10 The whole transition becomes potentially delayed by a small group of protestors at the local level. | -2 | (D) -3 | -1 | (D*) 1 | -1 |
| 11 The urgency of the energy transition is broadly felt within society. | 0 | -1 | -3 | -3 | 1 |
| 12 Societal support for the heat transition is determined by its impact on people’s wallet. | -1 | 0 | 4 | 3 | 1 |
| 13 Ownership of energy sources and infrastructures should lie with citizens. | -3 | 1 | -4 | -4 | 0 |
| 14 There is a large, vulnerable group of people that cannot participate in the heat transition. | 0 | 2 | 0 | (D*) 4 | (D*) -2 |
| 15 There is sufficient social capital amongst Dutch citizens (relationships, networks, norms and values, commitment to the community, et cetera) to make the local heat transition a success. | 1 | (D*) 2 | -2 | 0 | -1 |
| 16 There are limits to participation – there are some things, on which citizens simply cannot co-decide. | 2 | (D*) -1 | 1 | 2 | 3 |
| 17 There are many energetic, participating inhabitants who like to co-decide. | 0 | (D*) 2 | -1 | -1 | -1 |

(continued on next page)

(continued)

| Statements | Factor 1 | Factor 2 | Factor 3 | Factor 4 | Factor 5 |
|---|----------|----------|----------|----------|----------|
| 18 Provide citizens with control over budgets and let them handle things themselves. | -2 | (D*) 3 | -2 | -3 | -1 |
| 19 The collective interest of all Dutch citizens is more important than the interests of local groups in the energy transition. | 2 | 0 | 0 | (D) 3 | 0 |
| 20 It is not the responsibility of citizens to find an alternative for natural gas. If the government closes the gas tap, it should also take care of alternative sources. | 1 | -2 | 0 | 0 | (D*) -4 |
| 21 It is not fair, that the majority of the transition bill is to be paid by households. | 0 | 2 | (D*) -3 | 3 | 0 |
| 22 The Dutch public does no longer trust and believe the gas sector. And, this cannot be restored anymore. | -1 | 0 | 0 | 0 | -2 |
| 23 The 'not-in-my-backyard' label for involved inhabitants around energy projects is obsolete. | -2 | (D) 0 | (D) -3 | -2 | -2 |
| 24 "The public" does not exist. There is a large diversity of groups in society who all have different interests and ideas. | (D) 4 | 1 | 1 | 2 | 2 |
| 25 People are presented with a considerably distorted and negative image of the fossil industry by the media. | -1 | -2 | (D*) 1 | -3 | -3 |
| 26 The sooner that people within the environment become involved with plans or projects, the better. | 3 | 3 | 1 | (D*) -2 | 0 |
| 27 Inhabitants mainly want sufficient and clear information. If you explain what is going to happen, you can prevent resistance. | (D*) 3 | 1 | 1 | -2 | -1 |
| 28 People do not have a strong opinion about natural gas. It is so deeply ingrained in our culture, we are so addicted to it, that it has become taken-for-granted. | -2 | -1 | -1 | 0 | (D*) 2 |
| 29 People might not want it, but large-scale energy generation must be developed irrespective of the consequences for our landscape. | -2 | -2 | 0 | (D*) 2 | -2 |
| 30 People mostly want to be taken care of and be supplied with easy and affordable energy. | 2 | 1 | 3 | 2 | 3 |
| 31 To make the transition a success, you need to stimulate a local sense of collective pride for the own sustainable energy provision. | 1 | (D*) 4 | 1 | 1 | 1 |
| 32 People living around energy projects base their opinion of these projects on emotions and mostly irrational arguments. | -1 | -2 | 2 | 0 | 0 |
| 33 Protesting against continued gas extraction is allowed, but you should not spread lies about the risks, or the necessity, of natural gas. | 3 | 0 | 3 | -1 | -1 |
| 34 Nowadays, a lot of people feel suspicious towards the government and do not trust the decisions it makes for them in relation to energy. | (D*) -1 | 1 | 2 | 2 | 3 |
| 35 There are a lot of people who do not want to take part in a meaningful dialogue – attempts at that only end in a shouting match. | -3 | -3 | -1 | -1 | -2 |
| 36 Safety should be dominant in considerations for energy extraction, however, a difference must be made between real safety risks and safety perceptions of local inhabitants. | 1 | -1 | 3 | 0 | 2 |
| 37 For those living around energy project, financial gain – i.e. have a share in the profits – is important. | -1 | 1 | 2 | 1 | 0 |
| 38 It is completely unknown, who the broader public is to whom we ought to listen. She keeps quiet. | 0 | -2 | -1 | 1 | 1 |

Appendix B. . Participant list

| Participant | Significant factor loading | Involved in | Organisation type |
|-------------|----------------------------|---------------------------------------|--|
| P1 | 1 | Storage & distribution | Publicly owned grid operator |
| P2 | 1 | End-use in built environment | Private advisory company |
| P3 | 2 | Production (natural gas) | Citizen activist group |
| P4 | 2 | End-use in built environment | Government (municipality) |
| P5 | 2, 5 (no flag) | Storage & distribution | Industry association |
| P6 | 3 | Multiple | Research institute |
| P7 | 3 | Production (natural gas) | Independent advisory board |
| P8 | - | Marketing & sales (natural gas) | Public-private gas trader |
| P9 | 3 | Production (natural gas) | Industry association |
| P10 | 1 | End-use in built environment | Consumer organisation |
| P11 | 3, 5 (no flag) | Storage & distribution | Publicly owned grid operator |
| P12 | 3 | Storage & distribution | Publicly owned grid operator |
| P13 | 4 | End-use in built environment | Private heat alternatives provider |
| P14 | 5 | Multiple | Regulatory body |
| P15 | 2, 4 (no flag) | End-use in built environment | Private advisory company |
| P16 | 5 | End-use in built environment | Environmental not-for-profit organisation |
| P17 | 3 | Multiple | Government (Province) |
| P18 | 1 | Multiple | Industry association |
| P19 | 1, 2 (no flag) | End-use industry & built environment | Industry association |
| P20 | - | Storage & distribution | Publicly owned grid operator |
| P21 | 2 | Multiple | Environmental not-for-profit organisation |
| P22 | 1 | End-use in built environment | Public-private collaboration initiative |
| P23 | 1 | Storage & distribution | Publicly owned grid operator |
| P24 | 5 | Multiple | Government |
| P25 | 3 | Production (natural gas & geothermal) | Gas extractives company |
| P26 | 4, 5 (no flag) | Production (alternative gases) | Public-private collaboration initiative |
| P27 | 3 | Storage & distribution | Industry association |
| P28 | - | End-use in built environment | Government (national) |
| P29 | 1 | Production (natural gas & geothermal) | State-owned extractives company |
| P30 | 1 | Production (heat) | Publicly owned heat producer & distributor |
| P31 | 4 | End-use in built environment | Housing corporation |
| P32 | 3 | Production (natural gas) | Citizen activist group |
| P33 | 3 | End-use in built environment | Government (national) |
| P34 | 4 | End-use in built environment | Government (municipality) |
| P35 | 3 | Multiple (alternative gases) | Research institute |
| P36 | 3 | Multiple | Government (national) |
| P37 | 2 | End-use in built environment | Environmental not-for-profit organisation |

Appendix C. . Factor loadings

| Participant | Factor 1 | Factor 2 | Factor 3 | Factor 4 | Factor 5 |
|----------------------|----------|----------|----------|----------|----------|
| P1 | X 0,6933 | 0,1935 | −0,1457 | 0,0408 | 0,0316 |
| P2 | X 0,5855 | −0,1365 | 0,2266 | 0,2886 | 0,2179 |
| P3 | 0,2015 | X 0,6846 | −0,231 | 0,1212 | −0,0081 |
| P4 | 0,3751 | X 0,6229 | 0,2368 | −0,0284 | 0,173 |
| P5 | −0,1562 | 0,4632 | 0,1366 | −0,2507 | 0,5268 |
| P6 | 0,1841 | 0,2164 | X 0,4553 | 0,1239 | 0,0982 |
| P7 | 0,3952 | 0,1336 | X 0,5331 | 0,2846 | 0,0751 |
| P8 | 0,382 | 0,2822 | 0,2252 | −0,4014 | 0,1222 |
| P9 | 0,4753 | 0,1324 | X 0,5538 | −0,042 | −0,0479 |
| P10 | X 0,7043 | −0,0773 | 0,0879 | 0,1697 | −0,0198 |
| P11 | −0,2558 | 0,2409 | 0,5636 | 0,1131 | 0,4625 |
| P12 | 0,2808 | 0,2348 | X 0,6674 | −0,2339 | −0,0542 |
| P13 | 0,0811 | −0,1741 | 0,0502 | X 0,6079 | 0,3811 |
| P14 | 0,0821 | −0,0459 | 0,0218 | 0,0514 | X 0,6778 |
| P15 | 0,1663 | 0,434 | 0,3177 | 0,4775 | −0,4128 |
| P16 | 0,2244 | 0,4212 | 0,2951 | −0,1365 | X 0,5797 |
| P17 | 0,1112 | −0,2019 | X 0,5747 | 0,296 | −0,2173 |
| P18 | X 0,6753 | 0,2681 | 0,0768 | −0,0633 | 0,1306 |
| P19 | 0,5293 | 0,4618 | 0,1273 | 0,1315 | 0,1758 |
| P20 | 0,2994 | −0,0329 | 0,4065 | 0,3356 | 0,0511 |
| P21 | 0,3742 | X 0,6077 | 0,012 | 0,3552 | −0,1859 |
| P22 | X 0,7025 | −0,0454 | 0,2486 | −0,1391 | 0,0763 |
| P23 | X 0,4306 | 0,0238 | 0,2532 | 0,0332 | −0,0612 |
| P24 | 0,2892 | −0,0673 | 0,0378 | 0,285 | X 0,6567 |
| P25 | 0,0068 | −0,2727 | X 0,8232 | 0,0731 | 0,1497 |
| P26 | 0,2895 | 0,181 | 0,2632 | 0,4306 | 0,4241 |
| P27 | −0,0006 | −0,2078 | X 0,7349 | −0,0256 | −0,0339 |
| P28 | 0,1413 | 0,2821 | 0,3598 | 0,2594 | 0,0289 |
| P29 | X 0,5074 | 0,3116 | 0,1583 | 0,3543 | 0,2388 |
| P30 | X 0,5524 | −0,0835 | 0,2841 | 0,2541 | 0,1754 |
| P31 | 0,0568 | 0,0865 | 0,2489 | X 0,6639 | 0,1405 |
| P32 | 0,0971 | X 0,6449 | −0,0664 | −0,0592 | 0,0867 |
| P33 | 0,3549 | X 0,5576 | −0,0808 | −0,0357 | 0,4107 |
| P34 | 0,0868 | 0,0918 | 0,0875 | X 0,6767 | −0,0776 |
| P35 | 0,1558 | 0,0879 | X 0,6956 | 0,2219 | 0,1602 |
| P36 | 0,3268 | −0,1802 | X 0,5929 | 0,3871 | 0,1882 |
| P37 | 0,2207 | X 0,6814 | 0,1102 | 0,1353 | 0,1892 |
| % explained variance | 14 | 11 | 14 | 9 | 8 |

References

- [1] J. Backhaus. Turning off the Gas Tap: Sustainable Energy Policies, Practices and Prospects in the Netherlands. F. Fahy, G. Goggins, and C. Jensen (Eds.), *Energy Demand Challenges in Europe*, Palgrave Pivot, Cham. (2019), pp. 71–81.
- [2] E. López-Bernabé, S. Foudi, I. Galarraga, Mind the map? Mapping the academic, citizen and professional stakeholder views on buildings and heating behaviour in Spain, *Energy Res. Social Sci.* 69 (2020).
- [3] S.R. Jansma, J.F. Gosselt, M.D. De Jong, Kissing natural gas goodbye? Homeowner versus tenant perceptions of the transition towards sustainable heat in the Netherlands, *Energy Res. Social Sci.* 69 (2020).
- [4] B.K. Sovacool, C. Demski, L. Noel, Beyond climate, culture and comfort in European preferences for low-carbon heat, *Global Environ. Change* 66 (2021).
- [5] B.K. Sovacool, M. Martiskainen, Hot transformations: Governing rapid and deep household heating transitions in China, Denmark, Finland and the United Kingdom, *Energy Policy* 139 (2020).
- [6] A. Morton, A. Reeves, R. Bull, S. Preston, Empowering and engaging European building users for energy efficiency, *Energy Res. Social Sci.* 70 (2020).
- [7] European Commission Directorate-General for Research and Innovation. Final Report of the High-Level Panel of the European Decarbonisation Pathways Initiative. 2018. Brussels: European Commission.
- [8] C.M. Hendriks, On inclusion and network governance: the democratic disconnect of Dutch energy transitions, *Public Admin.* 86 (4) (2008) 1009–1031.
- [9] M. Hodson & S. Marvin. Governing the reconfiguration of energy in Greater London: practical public engagement as “delivery”. [book auth.] P. Devine-Wright. *Renewable Energy and the Public: From NIMBY to Participation*. 2011, pp. 89–100.
- [10] M. Wolsink. Discourses on the implementation of wind power: Stakeholder views on public engagement. [book auth.] P. Devine-Wright. *Renewable energy and the public: From NIMBY to participation*. 2011, pp. 43–56.
- [11] H. Devine-Wright. Envisioning public engagement with renewable energy: an empirical analysis of images within the UK national press 2006/2007. [book auth.] P. Devine-Wright. *Renewable energy and the public: From NIMBY to participation*. 2011, pp. 101–113.
- [12] C.M. Hendriks, Policy design without democracy? Making democratic sense of transition management, *Policy Sci.* 42 (4) (2009) 341–368.
- [13] J. Chilvers, N. Longhurst, Participation in transition (s): reconceiving public engagements in energy transitions as co-produced, emergent and diverse, *J. Environ. Plann. Policy Manage.* 18 (5) (2016) 585–607.
- [14] T.M. Skjølsvold, W. Throndsen, M. Ryghaug, I.F. Fjellsa, G.H. Koksvik, Orchestrating households as collectives of participation in the distributed energy transition: new empirical and conceptual insights, *Energy Res. Social Sci.* 46 (2018) 252–261.
- [15] C. Cherry, C. Hopfe, B. MacGillivray, N. Pidgeon, Homes as machines: exploring expert and public imaginaries of low carbon housing futures in the United Kingdom, *Energy Res. Social Sci.* 23 (2017) 36–45.
- [16] G. Walker, N. Cass, K. Burningham, J. Barnett, Renewable energy and sociotechnical change: imagined subjectivities of ‘the public’ and their implications, *Environ. Planning A* 42 (4) (2010) 931–947.
- [17] C. Marris, The construction of imaginaries of the public as a threat to synthetic biology, *Sci. Culture* 24 (1) (2015) 83–98.
- [18] I. Welsh, B. Wynne, Science, scientism and imaginaries of publics in the UK: Passive objects, incipient threats, *Sci. Culture* 22 (4) (2013) 540–566.
- [19] M. Akrich. User representations: Practices, methods and sociology. In: A. Rip, T.J. Misa & J. Schot (Eds.). *Managing Technology in Society, The Approach of Constructive Technology Assessment*. London: Cassel Publishers Ltd (1995), pp. 167–184.
- [20] S. Jasanoff & S.H. Kim. Containing the atom: Sociotechnical imaginaries and nuclear power in the United States and South Korea. 2009, *Minerva*, 47(2), pp. 119–146.
- [21] C. Howarth, E. Andreouli, & S. Kesi. Social representations and the politics of participation. In: P. Nesbitt-Larking, C. Kinnvall, T. Capelos, & H. Dekker (Eds.). *The Palgrave handbook of global political psychology*. London: Palgrave Macmillan (2014), pp. 19–38.
- [22] J. Barnett, K. Burningham, G. Walker, N. Cass, Imagined publics and engagement around renewable energy technologies in the UK, *Public Understanding Sci.* 21 (1) (2012) 36–50.
- [23] K. Burningham, J. Barnett, G. Walker, An array of deficits: unpacking NIMBY discourses in wind energy developers’ conceptualizations of their local opponents, *Society Natural Resour.* 28 (3) (2015) 246–260.

- [24] P. Devine-Wright, Public engagement with large-scale renewable energy technologies: breaking the cycle of NIMBYism, *Wiley Interdiscip. Rev. Clim. Change* 2 (1) (2011) 19–26.
- [25] N. Cass, G. Walker, Emotion and rationality: the characterisation and evaluation of opposition to renewable energy projects, *Emotion, Space Society* 2 (1) (2009) 62–69.
- [26] M. Wolsink, Invalid theory impedes our understanding: a critique on the persistence of the language of NIMBY, *Trans. Inst. Br. Geogr.* 31 (1) (2006) 85–91.
- [27] J. Chilvers & H. Pallett. Energy democracies and publics in the making: A relational agenda for research and practice. *Frontiers in Communication*, 3 (2018), article 14, pp. 1–14.
- [28] J. Chilvers, H. Pallett, T. Hargreaves, Ecologies of participation in socio-technical change: the case of energy system transitions, *Energy Res. Social Sci.* 42 (2018) 199–210.
- [29] A. Correljé. The Netherlands: resource management and civil society in the natural gas sector. In: I. Overland (Ed.), *Public Brainpower*. Palgrave Macmillan UK, London (2018), pp. 181–199.
- [30] Ministerie van Economische Zaken. Energieagenda: naar een CO₂-arme energievoorziening. 2016. Den Haag: Rijksoverheid.
- [31] Green Deal Aardgasvrije Wijken. www.greendeals.nl. [Online] 2018 16, July. <https://www.greendeals.nl/green-deals/aardgasvrije-wijken>.
- [32] Ministerie van Economische Zaken & Klimaat. Klimaatkoord. 2019. Retrieved from: <https://www.klimaatkoord.nl/documenten/publicaties/2019/06/28/kl-imaatakkkoord>.
- [33] S. Scholte, Y. De Kluienaar, T. De Wilde, A. Steenbekkers, C. Carabain, Op weg naar aardgasvrij wonen: de energietransitie vanuit het burgerperspectief. *The Hague, Sociaal Cultureel Planbureau* (2020).
- [34] S. Buitelaar & A. Heeger. Burgerparticipatie in de warmtetransitie: een handreiking voor beleidsmakers. 2018. Den Haag: Platform31.
- [35] N. De Koning, R. Kooger, L.M. Hermans & C. Tigchelaar. Aardgasvrij wonen: drijfveren en barrières van bewoners (No. TNO 2019 P12006). 2020. Amsterdam: TNO.
- [36] Programma Aardgasvrije Wijken. Handreiking Participatie Wijk aanpak Aardgasvrij. 2020. Available at: <https://aardgasvrijewijken.nl/klp/pc/default.aspx>.
- [37] J.M. Wittmayer, F. Avelino, F. van Steenberg, D. Lorbach, Actor roles in transition: insights from sociological perspectives, *Environ. Innov. Societal Trans.* 24 (2017) 45–56.
- [38] W. Stephenson, Perspectives in Psychology: XXVI Consciousness Out—Subjectivity, *Psychol. Record* 18 (4) (1968) 499–501.
- [39] S.R. Brown. Political subjectivity: Applications of Q methodology in political science. Yale University Press (1980).
- [40] A. Maranta, M. Guggenheim, P. Gisler, C. Pohl, The reality of experts and the imagined lay person, *Acta Sociol.* 46 (2) (2003) 150–165.
- [41] S. Batel, P. Devine-Wright, Towards a better understanding of people's responses to renewable energy technologies: insights from Social Representations Theory, *Public Understanding Sci.* 24 (3) (2015) 311–325.
- [42] A. Arruda. Image, social imaginary and social representations. In: G. Sammut, E. Andreouli, G.E. Gaskell, & J.E. Valsiner (Eds.). *The Cambridge handbook of social representations*. Cambridge, UK: Cambridge University Press, (2015), pp. 128–142.
- [43] S. Moscovici. Social representations and the development of knowledge. In: G. Duveen & B. Lloyd (Eds.). *Social psychology and developmental psychology: Extending the conversation*. Cambridge, UK: Cambridge University Press, (1990), pp. 164–185.
- [44] S. Batel, P. Castro, P. Devine-Wright, C. Howarth, Developing a critical agenda to understand pro-environmental actions: contributions from Social Representations and Social Practices Theories, *Wiley Interdiscip. Rev. Clim. Change* 7 (5) (2016) 727–745.
- [45] A. Stirling, “Opening up” and “closing down” power, participation, and pluralism in the social appraisal of technology, *Sci. Technol. Human Values* 33 (2) (2008) 262–294.
- [46] M.W. Bauer, N. Allum, S. Miller, What can we learn from 25 years of PUS survey research? Liberating and expanding the agenda, *Public Understanding Sci.* 16 (1) (2007) 79–95.
- [47] B. V. Lewenstein. Models of public communication of science and technology. (2003).
- [48] B. Wynne, Public engagement as a means of restoring public trust in science—hitting the notes, but missing the music? *Public Health Genomics* 9 (3) (2006) 211–220.
- [49] B. Wynne, Public participation in science and technology: performing and obscuring a political—conceptual category mistake, *East Asian Sci., Technol. Society* 1 (1) (2007) 99–110.
- [50] B. Wynne, Ghosts of the machine: publics, meanings and social science in a time of expert dogma and denial, in: J. Chilvers, M. Kearnes (Eds.), *Remaking participation: Science, environment and emergent publics*, Routledge, New York, NY, 2016, pp. 177–183.
- [51] S. De Saille, Dis-inviting the unruly public, *Sci. Culture* 24 (1) (2015) 99–107.
- [52] N. Cass, G. Walker, P. Devine-Wright, Good neighbours, public relations and bribes: the politics and perceptions of community benefit provision in renewable energy development in the UK, *J. Environ. Plann. Policy Manage.* 12 (3) (2010) 255–275.
- [53] T.M. Skjølsvold, C. Lindkvist, Ambivalence, designing users and user imaginaries in the European smart grid: insights from an interdisciplinary demonstration project, *Energy Res. Social Sci.* 9 (2015) 43–50.
- [54] M. Ryghaug, M. Toftaker, Creating transitions to electric road transport in Norway: the role of user imaginaries, *Energy Res. Social Sci.* 17 (2016) 119–126.
- [55] G. Walker, N. Cass, Carbon reduction, ‘the public’ and renewable energy: engaging with socio-technical configurations, *Area* 39 (4) (2007) 458–469.
- [56] P. Devine-Wright. Energy citizenship: psychological aspects of evolution in sustainable energy technologies. In: J. Murphy (Ed.). *Governing technology for sustainability*. Routledge (2012), pp. 74–97.
- [57] I. Soutar, C. Mitchell, Towards pragmatic narratives of societal engagement in the UK energy system, *Energy Res. Social Sci.* 35 (2018) 132–139.
- [58] M. Goulden, B. Bedwell, S. Rennick-Egglestone, T. Rodden, A. Spence, Smart grids, smart users? The role of the user in demand side management, *Energy Res. Social Sci.* 2 (2014) 21–29.
- [59] M. Ryghaug, T.M. Skjølsvold, S. Heidenreich, Creating energy citizenship through material participation, *Soc. Stud. Sci.* 48 (2) (2018) 283–303.
- [60] B. Lennon, N. Dunphy, C. Gaffney, A. Revez, G. Mullaly, P. O'Connor, Citizen or consumer? Reconsidering energy citizenship, *J. Environ. Plann. Policy Manage.* 22 (2) (2020) 184–197.
- [61] K. Szulecki, Conceptualizing energy democracy, *Environ. Politics* 27 (1) (2018) 21–41.
- [62] K. Jenkins, D. McCauley, R. Heffron, H. Stephan, R. Rehner, Energy justice: a conceptual review, *Energy Res. Social Sci.* 11 (2016) 174–182.
- [63] M. Emirbayer, A. Mische, What is agency? *Am. J. Sociol.* 103 (4) (1998) 962–1023.
- [64] J. Pelenc, M.K. Lompo, J. Ballet, J.L. Dubois, Sustainable human development and the capability approach: integrating environment, responsibility and collective agency, *J. Hum. Dev. Capabilities* 14 (1) (2013) 77–94.
- [65] E. van de Grift, E. Cuppen, & S. Spruit. Co-creation, control or compliance? How Dutch community engagement professionals view their work. *Energy Research & Social Science*, 60 (2020), p. 101323.
- [66] G. Sneegas, Making the case for critical Q methodology, *Professional Geogr.* 72 (1) (2020) 78–87.
- [67] I. van de Poel, J.N. Fahlquist, N. Doorn, S. Zwart, L. Royakkers, The problem of many hands: climate change as an example, *Sci. Eng. Ethics* 18 (1) (2012) 49–67.
- [68] I. van de Poel, M. Sand, Varieties of responsibility: two problems of responsible innovation, *Synthese* (2018) 1–19.
- [69] S. Batel, P. Devine-Wright, Using NIMBY rhetoric as a political resource to negotiate responses to local energy infrastructure: a power line case study, *Local Environ.* 25 (5) (2020) 338–350.
- [70] Ministerie van Economische Zaken en Klimaat. Kamerbrief over resultaten internetconsultatie Wet Collectieve warmtevoorziening. 2020. Retrieved from: <https://www.rijksoverheid.nl/documenten/kamerstukken/2020/12/14/kamerbrief-over-resultaten-internetconsultatie-wet-collectieve-warmtevoorziening>.