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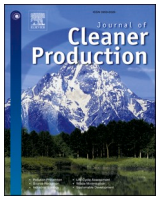

Changing the game: Situating energy citizenship in the Dutch socio-technical landscape

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ABSTRACT

The multilevel perspective (MLP) has made paramount theoretical contributions to transitions studies. However, it has been criticized for weakly considering individual agency. Using the energy transition as a case study, this paper asks how the energy citizenship literature can enhance current understandings of the ways individuals shape socio-technical transitions within the MLP framework. We use extensive interview data to simultaneously examine the cognitive and behavioral dimensions that drive energy citizens' engagement in energy transitions. Our findings indicate that individuals leverage the landscapes and regimes in different ways, which hold implications for socio-technical transitions. As such, individuality is a key and understudied issue within the MLP framework. The contributions of this paper are twofold. First, it contributes to the MLP framework by shedding light on an additional dimension – i.e., individuals – thereby enriching current knowledge of the dynamics of socio-technical transitions. Second, it uses primary data collected in the Netherlands that is sufficiently granular to take the individuality question to the next level.

1. Introduction

The multilevel perspective (MLP) has made paramount theoretical contributions to transition studies (Köhler et al., 2019; Patterson et al., 2017; Sovacool and Hess, 2017), and has critically informed energy transition studies in particular. The key processes of energy transitions are embedded within a larger process of systems transformation, which consumers, users, and communities may exploit to shift the balance of power in their favor (Stephens, 2019). Consequently, individual action comes into focus. An interesting manifestation of individual engagement in energy transitions is energy citizenship. This concept, "recognizes each individual's agency in relation to their sociotechnical and political environment. Beyond being mere users of energy, citizens are seen as actors willing to employ social, material, and political resources in order to influence decision-making concerning energy" (Jansma et al., 2023).

The concept of energy citizenship acknowledges that the public can be "active rather than passive stakeholders in energy system evolution," and that this agency may be underpinned by "notions of equitable rights and responsibilities across society for dealing with the consequences of energy consumption (Devine-Wright, 2007)." In line with this view, we posit that energy citizenship is catalyzed by individuals' material and cognitive interactions with RE technologies during transitions (Renewable Energy and the Public, 2015; Devine-Wright and Batel, 2017). Complex dialogues and exchanges may emerge when individuals act and respond to energy transition discourses that seek to either stimulate or deter energy transitions. These dynamics are embodied in institutions and system infrastructures (Silvast and Valkenburg, 2023).

Despite the social and political complexities involved in the formation and expansion of energy citizenship, the extant literature rarely makes explicit connections between energy citizenship and change processes and dynamics unfolding within systems (Silvast and Valkenburg, 2023). Sociotechnical systems are not normally associated with citizenship studies. In light of this, our goal is to extend current thinking on the democratic possibilities for citizens within energy systems by empirically examining individuals' actions that transfer their relationship with energy from the private to the public sphere (e.g., through community energy or through protests) (Turner, 1990). We leverage the energy citizenship literature to enrich the MLP by incorporating the individual dimension, which until now has been understudied. In so doing, we address an open and often neglected question in MLP scholarship: "How can the energy citizenship literature enhance current understandings on the ways that individuals shape socio-technical

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transitions?"

This paper makes two contributions. First, it makes a theoretical contribution to the MLP, which is a dominant paradigm in transition studies. MLP focuses on three levels: niche innovations, socio-technical regimes, and landscape. This paper adds another dimension that applies to regimes and landscape level, namely individual cognitive and behavioral agency. By adding this component, the new model that this paper proposes is capable of explaining why there are different outcomes (e.g., speed, extent, and spatial) even when the same niche innovations are introduced under systems experiencing the same landscape pressures.

Second, this paper uses interview data collected in the Netherlands by the authors that is sufficiently granular to take the individuality debate to the next level. This is an important contribution because individuality within MLP, although somewhat discussed in the existing literature (Geels, 2019), has largely been a theoretical construct rather than empirically tested. By using extensive interview data, this paper empirically shows the significance of individuality and leaves room for future empirical work.

2. Energy citizenship, MLP, and game theory

a. Where are the individuals in socio-technical transitions?

The three levels making up an MLP system are landscape, regimes, and niche. Most of the system stabilizing dynamics take place in the regime level, where policy, culture, science, markets, industry, and technology respond to stimuli from the landscape level and align to accommodate new technological niches. Changes are slow to come and face resistance from system reinforcing dynamics such as path dependencies, inertia, and lock-in (Geels and Schot, 2007; Sovacool et al., 2022). Under certain conditions, radical innovations can transform a socio-technical system. The social forces promoting such changes are often described in terms of levels of action, landscape, regime, and niche (Geels, 2004; Kanger, 2021). However, the role of individuals as change agents in socio-technical systems is rarely interrogated.

To the extent that individuals' impacts on and exchanges within transitions are neglected, the understandings of socio-technical transitions in MLP remain incomplete. Failures to consider citizen action may lead researchers to mistakenly attribute citizen driven change dynamics to more visible "usual suspects" (e.g., regime level institutions like corporations, universities, and government agencies (Geels, 2004; Thinking Infrastructures, 2019)). We thus complement the current frameworks of MLP by simultaneously examining the cognitive and behavioral dimensions driving energy citizens' interactions with diverse multi-level system components. We use the concept of energy citizenship to enlarge the space that individuals, actors, groups, and agents may occupy in the MLP paradigm.

Energy citizenship and its emphasis on citizens' power and agency helps to address the call for greater consideration of political dynamics and power relations in the MLP literature (Geels, 2019; Avelino and Wittmayer, 2016). Until now, the MLP has privileged policy makers, industries, scientists, and it has relegated to the citizen the role of passive consumer. Moors et al. (2004) criticize the MLP as it describes actors and actor network configurations as mere passive recipients of external forces and the processes that sociotechnical systems entail. Furthermore, Hanss argues that cognitive perspectives may be complementary to MLP in explaining individuality and agency (Hanss, 2021). Individuals' considerable agency in sociotechnical systems can directly influence markets and institutions (Marletto, 2014), and requires scholarly attention. The behavioral manifestations of this agency are networking and strategic gameplaying.

This argument aligns with the idea that bottom up pressures stimulated through citizen action are a necessary facilitating condition to accompany transitions (Edomah et al., 2020). Fig. 1 depicts multi-level system pressures at the landscape level (e.g., climate crisis, war, and tsunamis) that open windows of opportunity to break-free from habits hardwired into the design of dominant technologies and their socio-technical system (Van Bree et al., 2010; Thinking Infrastructures, 2019). It is not given that system actors will seize these opportunities because the oftentimes uncoordinated games steering the market, industry, policy, science, culture, and technology work in symphony to create negative feedback loops that resist system adaptation. However, early adopters and champions of novel technologies leverage this window of opportunity to establish and grow their niche. When a socio-technical transitions gets underway, interactions between niche and regime actors intensify (Geels, 2004; Van Bree et al., 2010; Schot et al., 2016), and emergent knowledge, practices, norms and rules are transferred by niche level actors to regime actors.

Niches are dually defined as "locus of radical innovations" or "protected spaces" that cater to and are supported by users with "special demands (who) are willing to support emerging innovations" (Geels, 2012). Socio-technical transitions are largely shaped by regime level responses to the nature of landscape pressures and niche readiness (Geels and Schot, 2007; Van Bree et al., 2010). The emphasis on niche readiness suggests that change in this system can come from the bottom up (Köhler et al., 2019; Geels, 2004) stimulated by rule breaking behavior by actors in niches, who wish to take advantage of opportunity windows at the regime level (Hatzl et al., 2016). In short, citizenship behavior within niches may hasten and/or protect niche innovations. For instance, citizens' adaptive behavior may help grease the wheels of coordination between actors across system levels or help regime actors

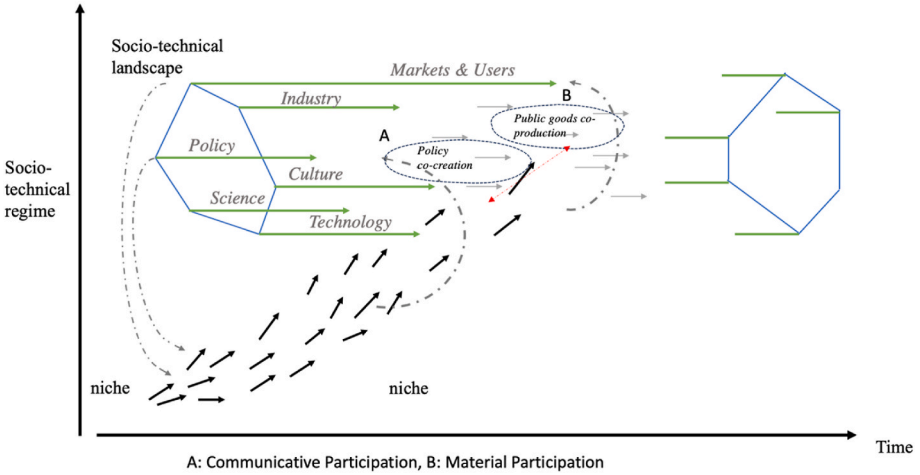

Fig. 1. Energy Citizenship in MLP based on Geels' model.

to break free from entrenched technologies and practices (Jansma et al., 2023). Seen in this light, energy citizenship may be a system disrupting (if not changing) strategy or behavior. Therefore, the dynamics they set into motion at the niche level by energy citizens requires further elucidation.

b. Energy citizenship, a concept in transition

Agency enacts human desires and intentions. Individuals, it is proposed, act in response to rules dominating the social structures in which they are embedded and their own reflexive monitoring (considerations of identity and aspiration). Energy citizenship encompasses a range of practices through which individuals can exercise agency in energy systems.

Many of the actions categorized as energy citizenship fall under the umbrella of the concept "material participation," which was coined by Marres (2012) (Marres, 2012) and later used by Marianne Ryghaug and co-authors to describe "an 'object-oriented' or 'device-centered' perspective that focuses on the role of technologies and material objects for (mundane) participation in political matters of concern" (Ryghaug et al., 2018). Other actions energy citizens can take relates to political communication. For example, Biresselioglu and colleagues (pp 3–4) argue that in addition to material participation, "Energy citizenship also foresees individuals to actively participate in terms of criticizing, stating their ideas, being involved in activist groups or demonstrations" (Biresselioglu et al., 2022). These acts, labeled as communicative participation by Jansma and co-authors, encompass all acts of political communication from protest to voting. This implies that energy citizenship encompasses not only actions supportive of transitions to renewable energy (RE) (e.g., *prosumerism*), but also actions that may slow them down, perhaps to call attention to contradictory aspects of change trajectories and their social equity implications (e.g., implications for communities near so-called "sacrifice zones") (Hernando-Arrese and Rasch, 2022). Regardless of the impact, citizenship is critical for reclaiming and restructuring energy transition dynamics (Stephens, 2019). Material and communicative actions alike play out in distinct regimes or games (see Table 1).

c. Energy citizens, playing the energy game

The situatedness of energy citizens in the context of changing system dynamics can be more fully considered in MLP scholarship by examining individuals' engagement with energy systems through the lens of games (Geels, 2004, 2012). Under this view, group activities are "games" where actors respond to one another's strategies, which can be thought of as other players' "moves" (Geels, 2004). Games normally promote system stability, which – under MLP – is promoted by the rootedness of practices and persons in a system that develops through iterated interactions and positive feedback loops. These reproductive processes ossify over time as actors in systems organize into groups with distinct features.

Group members share common perceptions, understandings, norms, interests, and ways of doing and working (Geels, 2004), which they deploy when pursuing their goals, both personal (e.g., securing access to energy) and collective (e.g., environmental sustainability). These actors are not purely self-referential players. Rather they tend to play within the boundaries of what is permitted and expected by the institutions and infrastructures holding together the regimes (i.e., market, industry, policy, science, culture, and technology) within which they are embedded. The system's structure emerges from linkages between different actors situated in different groups, which result from overlaps between regime activities. In short, behavior in these groupings is heavily influenced by games.

In market games, rules are dictated by market forces such as supply and demand and each player employ strategies to maximize their gains while decreasing costs. The rules regulating behavior differ across consumer categories, from households to industries, with diverse purchasing power and needs. Here, rules regarding the generation, distribution, and taxation of energy come into play, dictating how players move in the game (Kotilainen et al., 2020). It is within this context that energy citizenship can be a game changer, as actors modulate their relationship with energy and one another (Brown et al., 2020; Olkkonen et al., 2017).

Through their material participation, citizens promote energy transitions via their consumption and maintenance practices (Schlindwein and Montalvo, 2023). Everyday energy practices and experimentation are also emphasized (Ringholm, 2022). For instance, energy citizens may turn to material participation to influence the energy market through prosumerism, wherein citizens bend rules that dictate *who can do what, where, when, and how* in an action space (Gardner and Ostrom, 1991; Ostrom, 1990) by being consumers who also generate or co-produce energy. To the extent that consumption and production are key institutions guiding market regimes, material participation may be a game changer shattering normative rules about roles in markets.

Communicative participation harnesses the power generated through collective action, and make a claim on government through mass mobilization. This directly links to polity games, which are coordination games where actors band together to promote their preferred political outcomes. Actors are driven to coordinate by such different factors as shared values, beliefs, and group identities and resource dependencies (Theories of the Policy Process, 2007). Communicative participation is becoming more prevalent across the globe (Sovacool et al., 2022), and it may be supportive of or oppose RE (Ringholm, 2022). It is often leveraged to challenge status quo politics, which support and fortify old energy systems and their power distributions (Stephens, 2019; Hess, 2018; Szulecki, 2018). As such, communicative participation bend both normative rules and expectations about citizens' role in policy making and how governments should relate with citizens, they also may influence regulative rules by encouraging governments to engage citizens in the design of policy. Thus, energy citizens break rules that designate *who is in and who is out* of decision-making processes (Gardner and Ostrom, 1991; Ostrom, 1990).

Engaging in material and communicative participation is an institutionalized choice that reflects and embodies the existing energy infrastructures and discourses. These choices can be thought of as being specific moves players choose to make when playing in collaborative or competitive games. Through the choice of "moves," citizens scale their action to specific games (which we call market and polity games) addressing interactions in specific regimes (the regime of Markets and Users and the regime of Policy). As regimes interact, citizens' localized game playing can have consequences across the system.

Table 1
Participation in energy citizenship.

	Material Participation	Communicative Participation
What it looks like	producing energy, investing in a smart meter, trading energy	protest, petitioning, voting
Where it makes an impact	In market regimes	In policy regimes

3. Propositions

Energy citizenship manifests as "game playing" through which individuals achieve personal (e.g., access to energy) and collective goals (e.g., energy sovereignty) within changing energy systems. To further elucidate how this might unfold, we advance three propositions about individual behavior and cognition in MLP. Unlike hypotheses, these propositions do not correspond to the rule of one independent and one dependent variable with a specific direction that hypotheses require, and as such they can be examined with methods other than (but also including) inferential statistics. Essentially, the propositions help us consider what we can learn by recognizing the complex

interdependencies and multiple dimensions offered by the theoretical frameworks discussed here.

Of interest is the extent to which individuals, embedded in socio-technical systems, can be expected to engage in rule bending or rule changing behavior and the extent to which they respond to landscape pressures or regime level opportunities. Central to this line of argumentation is the idea that rule-following and -bending are strategic behaviors. Therefore, individuals may be sensitive to game elements and to consider them when selecting strategies to bring forward through energy citizenship. Games have four key elements: goals set through pressures at the landscape levels; incumbent and novel rules at regime and niche levels, respectively; challenges generated through windows of opportunities; and interactions between levels which promote and stifle transitions.

MLP expects that system changing pathways are paved through the coupling of (1) landscape pressures, (2) niche innovations, and (3) regime level adaptations or replacements (Geels and Schot, 2007; Geels, 2004; Kanger, 2021). Therefore, the first requirement is the presence of landscape pressures. Individuals may respond to landscape pressures by revising or doubling down on previously envisioned goals, which may motivate them to engage in energy citizenship.

At the landscape level, shifting social values, macroeconomic trends, and environmental conditions signal the need for systems adaptation or transformation (Geels, 2004), and individuals may respond to landscape pressures by shifting goals (or their understanding of a "win"). They may then participate in material and communicative citizenship to reach these new goals. For instance, in current systems the goal may be having reliable access to affordable energy whereas the new goal may be reliable access to affordable and *sustainable* energy. As a result, an individual may opt to install solar panels and batteries on their property. The ability to act on these signals relies on individuals' access to information.

Energy citizens are individuals who receive signals of landscape pressures when they are attune to specific the government agencies, media, or social networks (online and offline) monitoring these specific landscape signals related to energy transitions. Hence, individuals are expected to engage in energy citizenship only if they perceive landscape pressures and make a connection between these pressures with deeply held convictions (i.e., personal or collective goals) that either activate or challenge their understanding of self and belonging in communities (Bosschaart et al., 2020). Based on this, our first proposition is as follows:

Energy citizens will respond to landscape by re-orienting action towards a purpose or goal centered around RE (Proposition 1).

One key assumption driving interactions in games is that all players accept the rules of the game. Following Geels' taxonomy, rules can be regulative (i.e., formal rules like laws and standards), cognitive (i.e., rules of thumb and other heuristics, belief systems and problem definitions), and normative (i.e., behavioral norms, values, and position rules) (Geels and Schot, 2007; Schot et al., 2016). Values, rules, and cognition are often associated with system stability (Geels, 2004; Marx et al., 2015), but they can also be a source of change by normalizing what is radical. In this sense, here, the concept "energy citizen" embeds both, material and communicative energy citizenship, in which the former has been studied in the guise of monetary gains, systems, and regulations, and the latter considered in terms of behavioral norms and values [e.g. (Ryghaug et al., 2018; Lennon et al., 2020)].

Material and communicative participation may interface when individuals and groups engage in the energy transition. At times they align (e.g., co-investing in wind turbines and engaging in an advisory board on siting) at times they do not (e.g., owning solar panels but protesting solar farms). Nevertheless, they are expressions of individuals wish to influence transitions. We place attention on how rules in regimes evolve, emerge, or become obsolete through the emergence of new rules at the niche level (where old rules are not firmly rooted) and their introduction into regime games.

Previous research suggests that actors who normally dominate regimes (e.g., industry leaders and government actors) are slow and hesitant to abandon old rules. This is particularly true for cognitive rules like heuristics, habits, and rules of thumb. Cognitive rules tend to be really difficult to abandon even when they no longer serve the these actors well (Kahneman, 2012). For instance, Kern (2012) finds that despite aspirations to mainstream small scale decentralized technologies into the British energy market and a shift in regulative rules favoring RE technologies, the cognitive rule of continued reliance on centralized fossil fuel-based energy generation persisted among industry and market actors (Kern, 2012). Habit provides an equally powerful explanation for (in)action (Silvast et al., 2024). Habit has a quasi-hegemonic and invisible power (Lukes, 2004): it co-evolves with dominant technologies to blend in with every-day practice and become routine by domesticating users through repetition. However, habits are not fixed – they are formed through cultural and social contexts, and they can change during period of crisis or disruption. In these crucial moments, niche-innovations with enough momentum can draw actors away from the infrastructures and institutions that perpetuate habits (Silvast et al., 2024; Edwards, 2019).

Individuals, especially those situated closer to new and emerging technologies, like RE technologies (Hess, 2005), may have less rigid attachments to old cognitive rules. For example, in Valencia, Spain, individuals demonstrated greater ability to shift cognitive rules favoring agroecology and local food sovereignty compared to political-administrative actors (Sarabia et al., 2021). In the contexts of energy transitions, Rwandans living close to power plants quickly shifted cognitive and normative rules, upon recognizing new economic and social opportunities generated by these technologies" (Brunet et al., 2021). Therefore, we claim that individuals with geographic, economic, or intellectual access to RE technology adopt rules that align with their new RE goals and abandon old rules that no longer fit. This flexibility may help soften lock-ins in current systems (Ringholm, 2022). Thus, we propose that, Citizens will adjust to new personal or collective RE goals by aligning or adapting cognitive and normative rules (Proposition 2).

Upon internalizing landscape pressures through shifting goals and through contexts such as proximity to wind turbines, citizens may change their engagement with rule systems. New goals call for new rules, and subsequent rule bending or breaking behaviors establish new system equilibria by re-aligning relevant human and material actors. Through this process rule breaking behavior become regular part of normal games. The mainstreaming of rules from niche to regime occurs, we argue, when individuals traverse these spaces. Essentially, energy citizens link niche to regime games. These games can be coupled through linkages formed between actors in niches to actors in (or across) regimes. By helping establish new rule-systems through the adaptation or replacement of current rules, individuals may contribute to the evolution of games and instigate changes within socio-technical systems (Gardner and Ostrom, 1991; Ostrom et al., 1994; Kew, 1987). Taking the "game playing" analogy a step further, we propose that citizens follow a game plan made up of rule-sets that combine new and old rules. The extent to which new rules are integrated within rulesets relies largely on citizens' positions within regimes.

Regimes are the meso-level where a wide array of actors interact through rule-based systems. At this level individuals (coupling niches and regimes) can transfer rules between levels. However, they may face resistance. Regime resilience describes dynamics in regimes which limit rule bending or game changing. These can be regulatory, relational, or cultural. Numerous and interdependent institutional arrangements may resist change as was observed by Burin et al. (2022) in Brazil, where continuous litigation and lethargic legislative systems blocked new regulative rules (Burin et al., 2023). Additionally, dominant institutional and legal frameworks can critically shape citizen participation (Marx et al., 2015).

Each regime houses its own type of technology and is guided by common understandings about these technologies (Geels, 2004). Market regime technologies are consumer products around which market

interactions are organized and policy regime technologies are policies which different regime actors support or counter. Through mediation (i.e., interactions) with these technological objects, energy citizens increase their proximity to them (Schot et al., 2016; Hatzl et al., 2016; Chilvers and Longhurst, 2016), and can try to institute rules. Accordingly, material participation seeks to revise rules about who is included in the producing and profiting from energy (Marres, 2012), thereby also altering common understandings about "value," while communicative participation seeks to revise rules about who is included in the design of public policies (Sovacool et al., 2022). Rule bending helps them adjust the ways in which they enroll – gain entry and assert belonging (Chilvers and Longhurst, 2016) - in these regimes and counter regime resilience. Following this discussion, we propose that, Energy citizens use rule bending to change the terms of their enrolment in the production processes of energy market regimes and in governance process in energy policy regimes. (Proposition 3).

We specify that rule bending applies to material and communicative energy citizenship alike. Systematic and market-based rule bending would refer to material energy citizenship whereas communicative citizenship is expressed through other means such as voting and protests.

Our three propositions seek to enhance current understandings on how individuals shape socio-technical transitions. We examine these propositions with content analyses of interview data.

4. Research design

a. Data collection

22 interviews were conducted with subjects residing near wind turbines (<5 km) in 7 different sites across the Netherlands[1] from November 2021 to April 2022 by two senior researchers, both male. Residents living close to wind turbines are more likely to have been exposed to these RE technologies and experienced their implementation. This is why they were selected for study. Furthermore, we also note that proximity to wind turbines may yield different experiences and consciousness of landscape pressures, and are embodied in and gain meaning through everyday practices and social contexts (Chilvers and Longhurst, 2016). In this sense, this study's findings reflect intimate relationships with RE emerging from geographical proximity. Respondents were recruited from a sample of an earlier conducted quantitative survey study.

All but one interviews were conducted via Teams, lasting between 45 and 180 min. An interview scheme was used. Subjects were asked about their personal experiences of living near wind turbines and the technology's implementation process. Then, respondents were asked to share their opinion about the energy transition on a system level, and to reflect upon different sources for RE. They were also asked about the energy policies in the Netherlands. Finally, interviewees shared opinions about various stakeholder types involved in the energy transition, including national and local policy makers, journalists, energy companies, and scientists.

Interviews were categorized in terms of whether interviewees were active energy citizens (i.e., whether they previously or currently engage in material or communicative participation, or both) or not. In this present work, we limit our analysis to interviews with "energy citizens" who were categorized as such if they.

- Told the interviewer that they had purchased or invested in RE technologies and/or in electrification *and* if they associated this expenditure/investment with the energy transition.
- Told the interviewer that they had participated in a deliberative event (e.g. information evening), working group, protest, or petition related to the energy transition.
- Told the interviewer that they were members of an energy community, grassroots organization, or social movement?

We found that 6 respondents practiced material participation only, 4 practiced communicative participation only, and 5 practicing both types of participation. This gave us a dataset of 15 interviews with energy citizens on which we performed content analysis.

b. Content Analysis

Content analysis describes a wide range of different procedures that help specify and structure ideas in the textual records which may reveal new theoretical insights on the individual as a unit of analysis in MLP. We use content analysis to elaborate on MLP theory by exploring individual behavior and cognition during transition. In this process of textual analysis, we are guided by insights from extant literature in exploring our propositions about individuals in MLP.

We conducted our content analysis in four steps. First, we develop a code book based on a survey of the literature on MLP and energy citizenship. Second, the research team read through the interview texts to inductively arrive at a second set of key themes and discussions, and then adapted the original codebooks. In step 3, the interview texts were categorizes based on whether the discussions concern landscapes, regimes, or niches (see column on mother codes in Table 2) in Atlas.ti. In the fourth and final step, text categorized under the mother codes were coded following codebook #2 below.

5. Results

a. Energy citizens adjust goals in response to landscape pressures

The interviewees express an awareness of landscape pressures and connect these pressures to the energy transition. However, they interpret these pressures in different ways, which shapes how they view personal and collective goal(s) related to energy transitions. Most interviewers expressed concern about climate change, describing the energy transition as collective goal emerging from responses to landscape level signals about a changing climate. Seeing climate change as a collective rather than individual problem, Subject #10 places responsibility on

Table 2
Codebook.

	Mother code	Child Code	Applied to
Proposition #1	Landscape	Climate Change	Text linking climate change to energy transitions.
		Ukraine War	Text linking the Ukraine war to energy transitions.
		Phaseout of gas	Text linking natural gas to energy transitions.
		Other	All other landscape pressures
Proposition #2	Rules	Regulative Normative Cognitive	See Geels, 2004
Proposition #3	Regime	Culture	Text linking neighborhood cultures to energy citizenship
		Science & Technology	Text linking scientific developments to energy citizenship
		Industry	Text linking industry to energy citizenship
		Policy	Text linking governments to energy citizenship.
		Market and Users	Text linking market mechanisms to energy citizenship.

[1] A 23rd interview was excluded because the subject did not reside within 5 km of a wind-turbine.

governments to address the problem,

> "Well, yes, politics, of course, they are also with their fingers against the stove and it's getting hot of yes, something has to be done there, little by little." (Subject #10)

Energy citizens see a transition to RE as an important goal that may involve some personal discomfort,

> "I don't think it's (a solar farm) pretty, but I do understand that it's necessary from a sustainability standpoint." (Subject #2)

The phaseout of gas extraction in Groningen is another landscape pressure that interviewees associate with the energy transition as a collective goal. The Dutch economy and energy system have been highly reliant on natural gas extraction in the northern province of Groningen, since 1963 when vast tracts of gas reserves were discovered in the region. However, gas extraction triggered damaging earthquakes, sparking grassroots protest and national controversy. The government eventually conceded and pledged to phase out natural gas use by 2024. Subject #10 refers to the phaseout as an impetus for an energy transition:

> "We have to solve the energy transition in X years, we have to get rid of the gas. And go all make a plan and go all figure out how, and eventually we'll get somewhere." (Subject #10)

Similarly, Subject #14 explains the use of RE technologies in terms of the goal of replacing natural gas,

> "Look if you also want to get rid of gas in the Netherlands and you want to do something for the climate, you can't do that without putting those things (wind turbines) down.." (Subject #14)

There is disagreement about the goal of phasing out natural gas. One interviewee (Subject #11) claims that the government isn't going far enough, arguing that the financial and political incentives it provides are weak. Others question the wisdom of halting gas production, arguing that it is an important transition energy source (Subjects #2,1, and 9). Some pointed to other European countries' (e.g. Subject # 9 mentions "Czechoslovakia[2]" and Subject #13 mentions "Germany") decision to continue investing in gas extraction, and ask if the phase out is a reasonable goal for the Netherlands. For instance, Subject #1 argues,

> "The whole story that we have to get rid of natural gas here, I think that's a farce too. I mean, they're still burning lignite into the air in a lot of places all over Europe. That really doesn't make any sense. And gas is one of the cleanest types of energy we have." (Subject #1)

Another landscape pressure which was on energy citizens' minds was the war in Ukraine (the conflict had begun in February 2022, in the midst of interviewing). Some interviews (Subjects #2, 10) were concerned that it would upend the energy transition, and potentially slow down an already challenging transition. For instance, #10 shared,

> "Unfortunately Ukraine comes in between, which so is an unforeseen project. But to realize it all as quickly as the Netherlands wants to get rid of gas. That's a well-nigh impossible case, it seems to me." (Subject #10)

b. Energy citizens adopt new normative and cognitive rules to pursue transitions

Citizens adapt their relationships to rules to the RE energy transition. In the prevailing fossil fuel reliant energy system, individuals may simply follow rules ascribed to them in their position as "consumers." Instead, energy citizens report adapting normative and cognitive rules about what can be done (position rules) and by whom (aggregation rules).

Normative rules include role expectations (e.g. *who* – governments, companies, or households) should address climate change (Geels, 2004). Given its enormity and complexity, Subjects #13, #9 question if the Netherlands should take so much responsibility for climate change mitigation. They argue that it is a wider, global challenge. For example Subject #13 argues that investments in RE should be spend,

> "where it has the most impact, because we alone are not going to win that war. To put it this way, we are not going to win the climate war here in the Netherlands, within the Dutch borders." (Subject #13)

In contrast, Subject #11 calls for more action from the government, and reframes mistakes that could be made during the RE transition as "learning." This is connected to some extent with how energy citizens relate to regulative rules. Subject 13 sees the need for a change in regulative rules to incentivize investments in RE, arguing:

> "Yes, that anyway look, because in my view if it can't do it without subsidy, it shouldn't have a right to exist, because subsidy is euros and it's about the environment." (Subject #13)

Individuals engage in energy systems because they are frustrated with the slow pace of change. For instance, Subject #14 shares:

> On Facebook there are always these great stories of oh, the Netherlands is so positive and they're doing this and they're doing that. Well, when we came here we were like, "Gee, what a backward country we came back to. … It's just really gone backwards in those 20 years we've been away. (Subject #14)

Another normative rule that some energy citizens who were interviewed adhere to is the idea that individuals and societies to take responsibility for climate change by engaging in material participation. Subject #3 links their energy transition actions (investing in solar panels) to responsibility for the next generation,

> We ourselves keep the thought that something has to be done, because the way we are continuing now with fossil fuels, it is not really possible. We have a number of grandchildren ourselves and … when you get a little older you start to think about it a little differently. How is it going to be for those kids? (Subject #3)

Likewise, Subject #11 associates their own pro-sumerism to responsibility for others,

> I want to move toward a more sustainable world because I think for the sake of the bereaved we should do this. I don't have children, by the way, so that's kind of funny. But I think that the children who are walking around now and who will have children again, I think they should have a good world. (Subject #11)

c. Energy citizens revise their roles from passive to active regime actors

The respondents situated their actions (material or communicative participation) in the *Market* regime and/or the *Policy* regime. In the market regime, energy citizens re-invent themselves as new players in energy production, with the right to profit from this activity in the same way that industry actors do. Subject #21 shares,

> "The residents of the municipality of Dalfsen and immediate surroundings, who have invested in the windmill, simply receive their interest and repayment." (Subject #21)

Moreover, they recognize communicative participation as a legitimate move to take when their new expectations around profit are violated. For instance, when describing a few neighbors' contestation to planned wind turbine development Subject 18 opines,

[2] Czechoslovakia was dissolved in 1992.

> "I don't think they were against the plan, I think they were more against the fact that the compensation was a little lower for them." (Subject #18)

Engaging in the polity regime, energy citizens express a preference for a bottom-up approach to governing energy transitions. With one interviewee saying,

> [referring to local government] think that's a good thing, because then it's closer to the people and people have more say in the matter. Because if that was organized from the government, the national government, it would be very distant and it would be a very cumbersome system that you couldn't get through if you had your way. (Subject #9)

Energy citizens playing policy games also insist on their right to enroll in policy design processes:

> "When the municipality planned to place the windmills next to the residential core, we submitted an opinion, as an objection. We did not want that at all and certainly not such a very high windmill.… Eventually the windmills were shut down and the municipality drew up custom rules …. I must say that we no longer have cast shadow. … Should the municipality still change that due to a change in legislation, of course we have a huge problem as residents and then we have to return to litigation." (Subject #2)

6. Discussion

In this paper, we leverage extensive interview data to simultaneously examine the cognitive and behavioral dimensions of energy citizens' engagement in energy transitions. We deploy insights from energy citizenship scholarship in order to situate individual's emotional and intellectual *connections to* and *actions promoting* energy transitions in multi-level systems. As a result, we demonstrate that individuals shift goals in response to landscape pressures, and that their perceptions thereof influence the cognitive-pragmatic and normative rules that they use, and how they relate to regulative rules. Finally, the energy citizens interviewed try to revise their roles from more passive to active roles in energy regimes. To sum up, we contribute to the literature on systems change in MLP integrating insights from energy citizenship and game theory scholarship.

> Our finding that people perceiving the same landscape pressures may ascribe to different rule-sets (e.g., abandon versus fast-track the phaseout of natural gas) is helpful for understanding the lethargic pace of transitions. Even when actors agree on overall values, they can be differ in terms of ideas about how to solve this issue, causing goal misalignment. This is what Heiges and O Neill found in recycling, where actors are split over competing "zero waste" and "circular economy" ideas (Heiges and O'Neill, 2022). In other words, progress can be impeded by differences in actor goals, strategies and viewpoints.

It bears mentioning that this study's findings may be applied to other institutional contexts. One of the ways to interrogate the limits of MLP and energy citizenship literature is to examine the literature on energy transitions in the developing world. Burin et al.'s paper on energy transitions in Brazil, for instance, describes a highly centralized system focused on cost efficiency and reliability (Burin et al., 2023). In such contexts, the space given to the citizen is rather limited. It may be fruitful to examine our three propositions in alternative socio-political contexts.

Future work could leverage these contributions to more holistically examine transitions over time. The MLP framework views change as a fluid process, which builds up over decades. However, there is a bias in recording only the behavior of powerful actors from governments and industry. As a consequence, individuals are hidden in the transitions literature. Insights gleaned from this paper offer a template to explore the relationship between energy citizenship and sociotechnical transitions, over time. Such data collection can also consider various types of RE technologies while introducing more variation among our interviewees (city versus village dwellers).

7. Conclusion

The findings show that there are cognitive and behavioral dimensions that enrich and refine landscape and regime levels of MLP. We demonstrate that energy citizenship has significant relationships with the four elements of games, namely goals, challenges, rules, and interactions, and that these interactions are situated across levels. In this sense, the individuality and individual cognitive and behavioral agency has always been an integral ingredient of the MLP.

This study's findings have significant policy implications. They indicate that in understanding the technological niches' and the landscape's impact on regimes, individual agency must be considered. To elaborate, to understand the regime changes, such as culture, science, policy, technology, market user preferences, and industry, theories and policies must account for how individual cognitive and behavioral differences may impact new regimes and relevant configurations. Similarly, in understanding landscapes, individuality is a salient factor that can lead to different outcomes. This is shown with regards to energy citizenship and the energy transition, in which differences between individual lead to different speeds and levels of regime change.

We see avenues for two new studies that may further solidify this paper's findings into the existing literature on MLP. First, to make the findings more generalizable, a quantitative study with a larger sample size should be conducted. Qualitative studies are often useful for the current theoretical conjecture, whereas quantitative studies can be used for theory confirmation. Thus, in order to assess how our proposal of individual cognitive and behavioral agency contributes to tangible policies and social actions, quantitative studies are crucial.

Second, we also believe that providing various contexts of empirical sites are important. The Netherlands may be seen as a unique case study because of its desire for RE transition and a high integration among energy communities. In order to see how individuality performs at various levels, different cultural and political contexts may be considered. A comparative study that compares and contrasts levels of individuality depending on political context also would be interesting.

MLP does a wonderful job in linking science and technology studies with environment studies, which has been central in the era where new and emerging technologies show up every other minute. We hope that insights offered here further expand the significance and relevance of MLP within transition studies, while generating greater interest on the phenomenon of energy citizenship.

CRediT authorship contribution statement

Le Anh Nguyen Long: Writing – original draft, Visualization, Supervision, Resources, Project administration, Methodology, Investigation, Formal analysis, Conceptualization. **Sikke R. Jansma:** Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Dasom Lee:** Writing – original draft, Validation, Resources, Methodology, Funding acquisition, Formal analysis, Conceptualization.

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.

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Appendix A. Supplementary data

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Data availability

The data that has been used is confidential.

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