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Original Research Paper

Exploring incumbents' agency: Institutional work by grid operators in decentralized energy innovations

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ABSTRACT

The agency of incumbents has gained increasing attention in the study of transitions. Recent studies show that besides being inert and resistant to change, incumbents can also support transitions. We focus on the agency of a particular type of incumbent, grid operators. In several countries, these actors play an active role in institutional change in the energy domain. At the same time, they are engaging in activities to maintain the regime. This paper examines the actions of grid operators when performing institutional work, i.e. when creating, maintaining and disrupting institutions. We conducted a qualitative content analysis of Dutch media to analyze the actions of grid operators while engaging with decentralized energy innovations. We conclude that grid operators are both subject and object of institutional work as part of a distributed, collective process of institutional change. Furthermore, our analysis reflects on their paradoxical position as embedded actors engaging in institutional change.

1. Introduction

The agency of incumbents have gained increasing attention in the study of transitions (Karltorp and Sandén, 2012; Bakker, 2014; Geels, 2014; Berggren et al., 2015; Geels et al., 2016; van Mossel et al., 2018). Transition theory (most notably the multi-level perspective by Geels, 2002) typically conceptualizes incumbents as inert and resistant to change. This position of incumbents can be explained by their vested interests in the current system. However, recent studies show that incumbents are also engaged in supporting the transition through, for example, their participation in niches (Geels, 2014; Berggren et al., 2015; Geels and Penna, 2015; Smink et al., 2015b; Wesseling et al., 2015a; Wesseling et al., 2015b; Heiskanen et al., 2018; van Mossel et al., 2018; Sump and Yi, 2020). Hence, further understanding of the role and agency of incumbents is critical for the study of transition processes.

Transitions can be viewed as processes of institutional change resulting from the interaction between technology, actors and institutions (Fuenfschilling and Truffer, 2016). With this paper, we aim to contribute to the growing attention to institutional theory in the study of transitions (Geels, 2004; Fuenfschilling and Truffer, 2014, 2016; Lockwood et al., 2017), with a particular focus on the agency of incumbents. Incumbents are defined as those actors that are deeply entrenched in the socio-technical regime. They have accumulated (intangible) resources which provide competitive advantages over newcomers, have a strong network position in a regime, and can influence political processes of agenda-setting (Grin et al., 2011; Geels, 2014; Kungl, 2015).

Abbreviations: GOs, Grid operators; DSOs, Distribution system operators; TSO, Transmission system operator

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In this paper, we focus on a specific type of incumbent, grid operators (GOs) in the Dutch energy system. In several countries, including the Netherlands, GOs play an active role in institutional change in the energy domain. At the same time, they are engaging in activities to *maintain* the regime. This rather paradoxical position of GOs suggests that the institutional work done by GOs deserves a closer look. Institutional work refers to "*the purposive action of individuals and organizations aimed at creating, maintaining and disrupting institutions*" (Lawrence and Suddaby, 2006, p. 215). A focus on institutional work has the potential to offer new understandings of incumbents' agency in transitions.

Three characteristics make it interesting to look more closely at GOs' role in the energy transition. First, GOs are responsible for the physical infrastructure and an essential part of the institutional infrastructure of the system (the energy markets). These infrastructures determine to a high degree where and how actors can transform an energy system. Second, since 2012 GOs have been key actors in the development of decentralized innovations in the Netherlands, in collaboration with relevant actors (Bakker, 2014; Smale et al., 2017). In doing so, GOs are responding to the transition by actively redefining their role in the energy system (Edens, 2018; Zomerman et al., 2018). Third, GOs in the Netherlands and other countries are *public* organizations that constitute a highly regulated monopoly. The public nature of grid operators is reflected by their (legal) mandate to safeguard core public values for the system: affordability, availability, safety and sustainability (Edens, 2017; Edens and Lavrijssen, 2019). Whereas other studies focus on energy suppliers (Kungl, 2015; Heiskanen et al., 2018) or policymakers (Kern and Smith, 2008; Ohlhorst, 2015), GOs are situated between these actors, which potentially influences the power they can apply to their institutional work. Despite their importance, GOs' potential for contributing to the energy transition has been largely overlooked in the literature.

In this paper, we answer the question: *what kind of institutional work is done by GOs around decentralized energy innovations and to what effect?* After we have introduced the empirical focus of this study (GOs in the energy transition in the Netherlands) in Section 2, we present the theoretical lenses used to study institutional work drawing on central concepts of institutional theory (Section 3). In Section 4, we explain the methodology that we used for a qualitative content analysis of Dutch media. We describe the actions of GOs in Section 5 and analyze the institutional work done through those actions in Section 6. Section 7 discusses the implications of GOs' agency for transitions. We wrap up with a conclusion and recommendations for further research.

2. Grid Operators in the energy transition

GOs are tasked with managing the transmission and distribution networks. They host the markets for congestion management and balancing, are the shareholders of the power exchanges on which electricity is traded, provide the data for billing, and determine whether and how actors and technologies are allowed to use the grid. Because grids constitute a natural monopoly, GOs are strongly regulated. Their core activities and role are detailed in legislation, and their economics (tariffs, costs, funds for grid investment, etc.) are decided upon by an independent regulator.

There are two types of GOs: the distribution system operators (DSOs), which manage the low- and medium-voltage grid, and the transmission system operator (TSO), which manages the high-voltage grid. The Netherlands has eight different DSOs: Enexis, Liander and Stedin cover the majority of the country, while Enduris, Rendo, Coteq and Westland Infra service smaller regions. Tennet is the TSO and is also active on the German market. GOs are public utilities, and their shareholders are local governments (DSOs) and the State (TSO). They emerged after the Unbundling Act (2006) required the separation of ownership between network management and commercial energy supply functions. Although some energy companies contested this forced separation, the process was completed in 2017.

The grid plays an essential role in the transition to more decentralized energy systems. Whereas GOs usually operated with predictability and control of supply in a centralized, fossil fuel-based system, the context of their operations looks very different in a decentralized system. They are now faced with the need to strengthen the grids, address chronic congestion and balancing problems, and find ways to incorporate increasingly decentral actors and technologies. GOs are aware of these challenges. A report commissioned by Netbeheer Nederland (the association of GOs) estimated that the infrastructure costs would at least double in different scenarios for 2050; these costs are in line with the Paris agreements (Afman and Rooijers, 2017). The costs of balancing supply and demand (infrastructure, storage and power back-up) amount between 40% up to 250% of the costs of generating renewable energy (Afman and Rooijers, 2017). Moreover, global scenarios, like the International Energy Agency's 450 Scenario, expect that total investments in infrastructure will be as significant as those in renewables (IEA, 2016). Hence, infrastructure is critical to the success of the energy transition, which increases the stakes of GOs in potential system changes.

The transition poses a challenge for the role of GOs in the system, which led them to diversify their actions. For example, GOs have engaged in institutional work through their involvement in experimentation with decentralized energy technologies. Besides technical, this experimentation is also institutional. Current regulations serve as barriers for some innovations to emerge and diffuse (e.g. prosumers cannot trade energy with their neighbours, which may halt peer-to-peer energy trading). GOs are interested in assessing the value of such innovations to tackle their challenges for grid management. They support the development of these experimental spaces as 'institutional niches' (Geels, 2002, 2004), where temporarily some regulations are relaxed. Thus they test, or 'play' with, the limits of what they are allowed to do. Such initiatives, however, generate tensions with the current institutional structures.

The engagement of GOs in experimental activities has been contested. Market parties, such as energy suppliers, advocate for further restrictions on GOs to prevent market distortions and unfair competition. They argue for a market-led energy transition in which decentralized innovations might become their energy services of the future (Energie Nederland, 2016). GOs, however, question the market's potential to power the energy transition and whether it places enough priority to the full societal costs and benefits. They consider themselves better positioned to prioritize such factors due to their public nature and long-term horizon (Enter, 2017). The

lack of clarity on the direction and means of the energy transition fuels the political debate over who should be responsible for the transition and what means actors are allowed to use in it.

3. Theoretical background

3.1. Institutional work as a driver of institutional change

Institutional change is related to "*a difference in form, quality, or state over time in an institution*" (Leeuw and Gössling, 2016, p. 436). In this paper, institutions are "*systems of established and prevalent social rules that structure social interactions*" (Hodgson, 2006, p. 2). They encompass cognitive, regulatory and normative rules (Scott, 2001). DiMaggio (1988) argued that agency is central for enacting institutional change as actors perform *institutional work* for institutional creation, reproduction and deinstitutionalization, the results of these processes depend on the interests and capacities of the actors involved (DiMaggio, 1988; Lawrence and Suddaby, 2006). An instance of institutional work that is widely discussed is the notion of institutional entrepreneurship, which involves "*activities of actors who have an interest in particular institutional arrangements and who leverage resources to create new institutions or to transform existing ones*" (Hardy and Maguire, 2008, p. 198). Institutional entrepreneurship is also understood as a collective process in which the efforts of different actors result in institutional change (Dorado, 2005; Wijen and Ansari, 2007; Jolly and Raven, 2015; Boon et al., 2019).

This collective attribute is not unique to institutional entrepreneurship; the outcome of institutional change is the cumulative effect of the institutional work of different actors, each pulling the field in their preferred direction. The 'vulnerability' of a field to change is related to the existence of uncertainty, tensions and contradictions (Dorado, 2005; Battilana et al., 2009; Leeuw and Gössling, 2016; Hardy and Maguire, 2017). In this context, *institutional fields* are recognized areas of institutional life in which different organizations, such as suppliers, consumers, regulatory agencies and producers, are aggregated (Leeuw and Gössling, 2016). The possibilities for enacting change are associated with how transparent *institutional opportunities* are for actors, which are "*the likelihood that a […] field will permit actors to identify and introduce a novel institutional combination and facilitate the mobilization of the resources required to make it enduring*" (Dorado, 2005, p. 391).

Actors outside or in the margins of a field are usually considered better suited to enact change (See Maguire et al., 2004; Levy and Scully, 2007). Similar expectations are found in the transition literature where change is usually expected from niche actors (see Kemp et al., 1998; Geels, 2002, 2005; Kern and Smith, 2008). From an institutional perspective, this focus on 'outsiders' is supported by the paradox of embedded agency (Holm, 1995; Seo and Creed, 2002; Battilana et al., 2009): "*the challenge of how actors can change the institutional and systemic conditions that are enabling and constraining their very actions in the present*" (Farla et al., 2012, p. 996). Hence, outsiders are expected to be more aware and open to alternatives as they do not have vested interests in existing institutions (Greenwood and Suddaby, 2006). Some central actors, however, are also capable of envisioning and enacting change. Hence, "*a central challenge for institutional theory, therefore, is to show how and why actors shaped by (i.e., embedded within) institutional structures become motivated and enabled to promote change in those structures*" (Greenwood and Suddaby, 2006, p. 27).

3.2. Incumbents' agency: between inertia and strategic action

Incumbents have potential for strong agency (Duygan et al., 2019). However, their agency is usually directed at maintaining existing institutions. The difficulties of incumbents to deal with radical transformation and innovation processes form a central theme in innovation and transition studies. Economic, organizational and sectoral arguments explain these difficulties (Hill and Rothaermel, 2003; Ansari and Krop, 2012; van Mossel et al., 2018). Firstly, incumbents' resources provide a competitive advantage, but also represent sunk costs and infrastructural lock-ins. Incremental innovations add to the existing resources of a firm, while radical changes risk eroding entry barriers and threaten their market position. Secondly, the exploitation of existing resources results in an organizational structure that focuses on predictability and efficiency. This process stimulates the development of routines that inhibit change. Even when change is desired, competition for scarce resources remains, and turf wars can delay or halt attempts for change. Thirdly, the existing relations in a regime or field can contribute to inertia (See Kungl, 2015; Heiskanen et al., 2018). Organizations operate in a web of expectations and institutions that can interfere with their strategic decision-making.

Alternatively, incumbents can also use those same resources, organizational structures and networks in their favour when confronted with transitions (Hill and Rothaermel, 2003; Berchicci and Tucci, 2009; Hockerts and Wüstenhagen, 2010; Wesseling et al., 2015a; Sump and Yi, 2020). They can adopt several behaviours: become first to enter niches, follow into niches, remain inert or delay the transition (van Mossel et al., 2018). Incumbents support transitions for several reasons: develop potential (commercial) opportunities, learn about threats and opportunities, shape their external image, intrinsic drive to innovate, comply with regulations and influence the configuration of the system, both existing and emerging (Markard and Truffer, 2008; Bakker, 2014; Wesseling et al., 2015b; Geels et al., 2016; Sump and Yi, 2020). Berggren et al. (2015) observed that participating in niches while retaining their activities at the regime level seems a likely response of incumbents to emerging opportunities.

Furthermore, Smink (2015a) found evidence of incumbents engaging in all three types of institutional work while contributing to institutional change that is aligned with their preferences. She found five commonalities in incumbents' institutional work activities to influence institutions in their favour. First, incumbents engage closely with governmental decision-making. Second, incumbents always provide alternatives to current or proposed rules. Third, incumbents skilfully frame their interests not only in terms of institutions but also of the technology requiring institutional change. Fourth, incumbents conduct or commission research. Finally, incumbents use the media to influence institutions indirectly. These results suggest that incumbents use their instrumental,

discursive, material and institutional power not only to resist (Geels, 2014) but also to enact institutional change.

3.3. Institutional work as analytical lenses

Studying the institutional work done by incumbents, such as GOs, can provide insights into how they deal with the paradox of embedded agency. This paper follows the three categories of institutional work as defined by Lawrence and Suddaby (2006):

- Actors may engage in actions directed towards the *creation of new institutions*. This type of work is the focus of institutional entrepreneurs. Different sets of practices can be used by actors to achieve such goals, including (i) overtly political work aimed at reconstructing the rules, rights and boundaries defining access to material resources; (ii) normative work aimed at reconfiguring actors' belief systems by attending to the roles, values and norms underpinning institutions; and (iii) cognitive work aimed at altering the boundaries of meaning systems that inform actions, such as beliefs, assumptions and frames. Examples: advocacy and the creation of standards.
- Actors may engage in actions aimed at *maintaining institutions*, or "supporting, repairing or recreating the social mechanisms that ensure compliance" (Greenwood and Suddaby, 2006, p. 230). This includes (i) work aimed at ensuring the compliance to rule systems through mechanisms of rewards and sanctions; and (ii) work aimed at reproducing existing norms and belief systems through routines, patterns and rituals. Examples: auditing and lawsuits to enforce patent rights.
- Actors may engage in actions aimed at *disrupting institutions* or deinstitutionalization. Some actors may undermine existing mechanisms of compliance if related institutional arrangements do not serve their interests. This type of work targets current practices, rules or technologies by (i) disconnecting them from mechanisms of rewards and sanctions; and (ii) disassociating them from their moral foundations in particular contexts. It can be described as 'boundary work', where actors redefine, categorize, reconfigure, abstract, problematize and manipulate the social and symbolic boundaries of existing institutions to decrease their legitimacy or efficiency. Examples: lawsuits to remove biased competitive advantages and weak compliance with standards.

These three types of institutional work will be used as a lens for studying the institutional work by GOs to explore their agency in the Dutch energy transition.

4. Methodology

GOs perform institutional work as part of their regular activities in different areas. In this paper, we focused on exploring the institutional work that GOs perform when engaging with the development of decentralized energy innovations. Although this focus amplified our attention towards institutional creation and disruption, it also allowed us to study the target of institutional maintenance for GOs while pursuing institutional change. Dutch media were used as data source. Hence, our analysis only comprised the work that could be evidenced in the public domain.

Data were extracted from the newspaper database LexisUni. Data were collected from January 2006 (start of the unbundling of energy companies) until December 2018. Media are a suitable data source as they provide coverage of the actions that were considered relevant for the public debate over time. It also provided information about the arguments and institutions that GOs mentioned concerning their institutional work. We included newspapers at both national and regional level to counteract possible biases in the information reported. Our data has limitations regarding the practices and rationales behind actions undertaken that can be identified, particularly for more subtle forms of work, such as lobbying. Hence, we do not claim to be exhaustive in our exploration of GOs' agency.

The search used a combination of keywords related to three terms: Dutch grid operators, experiments and decentralized energy innovations, which were combined to capture the variety of innovation activity of interest for the research (Table 1). These keywords were refined iteratively throughout the search process to identify articles related to the full range of potential innovation-related activities GOs might have been involved in during the period of interest. Individual names of GOs were not used because articles usually referred to these organizations as 'grid operator X', which made the general term sufficient to perform the search.

Table 1
Keywords used in the search and results per search.

Keyword combinations	Results
• NL: netbeheerder* and (experiment or pilot or initiatief or innovatie or living lab or proeftuin or experimenteerruimte) • EN: grid operator* and (experiment or pilot or initiative or innovation or living lab or living lab or experimental space	703
•NL: netbeheerder* and (peer to peer or peer-to-peer or peer2peer or p2p or energiehandel or locale energiemarkt or elektriciteitsmarkt or energie opslag or demand response or vraagrespons or vraagsturing or elektrische auto or EV or smart grid or slimme netten or slim net or buurtbatterij or energieopslag or flexibiliteit) •EN: grid operator* and (peer to peer or peer-to-peer or peer2peer or p2p or energy trade or local energy market or electricity market or energy storage or demand response or demand response or demand-side management or electric car or EV or smart grid or smart grids or smart grid or neighbourhood battery or energy storage or flexibility)	791

Table 2
Categories used for qualitative content analysis

Step	Category	Description
1	Main theme	Central theme(s) that is(are) discussed in the article, e.g. smart grids
	Sub-topic	Particular topic(s) discussed
	GOs involved	Which GOs were mentioned?
	GOs' actions	What did the GOs do? (including their engagement with the media to advance their interests)
	GOs-targeted actions	What do other actors do that directly influences GOs' operations, responsibilities or role in the energy system?
	Other actors' actions	What are the actions of others? How do others respond to GOs' actions?
	Level	To what level of intervention are actions targeted?
		Operational: related to operations, technology or infrastructures.
		Political: related to framing, political decision-making, future vision-building, plans, policy-making or institutions
		Both: Both political and operational
	Related institutions	Which institutions or regulations were referred to in the article?
2	Type of institutional work	*Creating:*
		Advocacy
		Educating actors to support new institutions
		Introducing new frames
		Maintaining (focus on the role of GOs in the system):
		Deterring alternatives
		Creating supportive rules
		Reframing existing institutions
		Disrupting:
		Undermining existing rules based on new standards
		Disputing compliance
		Challenging existing frames
		Both creating & disrupting:
		Constructing networks
		Mobilizing resources
		Changing boundaries for markets and roles

The data were cleaned and translated into English[1] to identify relevant news articles. This process was done iteratively and consisted of four steps. First, we eliminated duplicates found in both search queries. This was done with the help of python code. Second, the data was translated with the help of DeepL, a translating algorithm available online (https://www.deepl.com/translator). As the research is not focused on interpreting the contents of the text but identifying actions, this step is not deemed to compromise the quality of the analysis. The researcher requested proofreading by Dutch native speakers to corroborate the quality of the translation for the job at hand. Third, due to the media's tendency to publish similar stories in several outlets, duplicates and news articles with high levels of overlapping content were eliminated. Among similar stories, the one with the highest level of details in content was selected for analysis. Finally, the articles were scanned for content to eliminate the ones not related to the research focus. This filter was based on two criteria: (a) the article was related to or had implications for decentralized energy innovations, and (b) the article was referring directly or indirectly to the role or actions of GOs in innovative activities. In total, 419 news items were analyzed. Appendix A presents an overview of the articles used per news outlet.

Subsequently, qualitative content analysis was performed to identify and extract the critical information held in the articles. The analysis was done in two steps, and each step was done iteratively following the categories presented in Table 2. In step one, the articles were screened to identify information about the actions by GOs and other actors. The results of this step were used to develop a storyline of the involvement of GOs with decentralized energy innovations (see Section 5). In step two, the theoretical lens of institutional work was applied to the results from the first step. The articles in which institutions were explicitly mentioned, e.g. regarding regulatory arrangements, were the focus of this second-order analysis. The actions of GOs were interpreted as one of the three categories of institutional work (see Section 3.3) by looking at two factors: the intentionality of the action (their intended impact on the institutions or the system) and the system it was influencing (existing or emerging). For example, criticisms of the mechanisms to set tariffs were interpreted as attempts to disrupt this institution to support the emerging system. The iterative empirical analysis of this step served to build our empirical understanding of institutional work.

5. GOs engagement in the development of decentralized energy innovations

This section presents a narrative of how GOs have been involved with decentralized energy innovations. Since their emergence GOs have increasingly diversified the focus of their innovation-related activities (Fig. 1). This narrative serves as a background for the identification of institutional work in Section 6. Appendix B presents an overview of the innovation projects in which GOs were involved.

[1] The main researcher is not a Dutch native speaker.

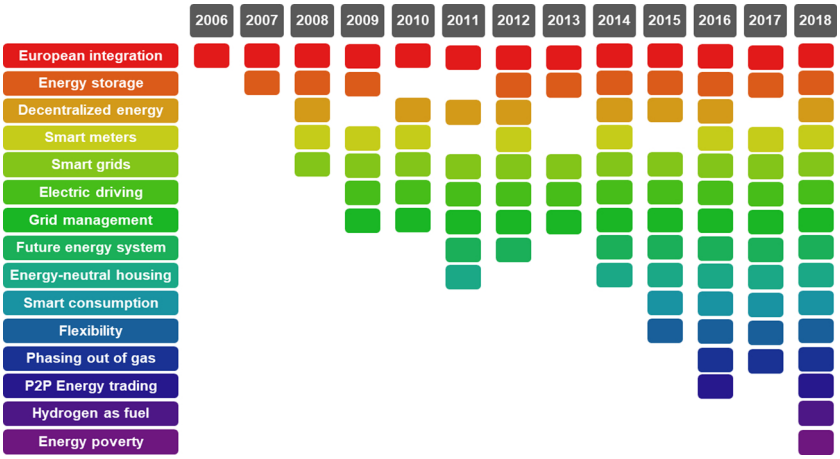

Fig. 1. Areas of focus of the innovation-related activities of GOs since their emergence (based on year of initiation).

5.1. Transmission system operator (TSO)

In 2006, TSO Tennet started its quest for the integration of the Dutch electricity network within the European energy sector. The starting point was the integration of the Dutch, Belgian and French markets enabled by network connections between them (FD, 2006). Projects for (large-scale) energy storage were deemed as unnecessary by Tennet (NRC, 2007). It focused its efforts on reinforcing and expanding the grid to meet the increasing required capacity (FD, 2009a; De Gelderlander, 2011). The next step in integration came with the expansion of its operations to Germany (BD, 2009). Over time, Tennet would expand the number of international connections of the Dutch grid and markets with projects focused on Germany, Denmark, the UK and Norway (FD, 2009b; De Telegraaf, 2010b; FD, 2011a; ANP, 2012; DVHN, 2014; FD, 2016a; de Volkskrant, 2018). This drive was justified by benefits in terms of energy prices and availability, grid balancing and sustainability (de Volkskrant, 2016; NRC, 2018b).

These efforts would be taken to the next level from 2016, when proposals were made for further cooperation to manage the surge in projects for offshore wind production in the North Sea (NRC, 2016; De Telegraaf, 2017). These projects required reconciling national energy policies and 'regional' grid management (FD, 2016b). Furthermore, Tennet also began actions at the national level to increase flexibility with storage (Cobouw, 2018). Experiments were started using electric vehicles (EVs) for grid balancing (NRC, 2018a), which implied bending the rules to allow the participation of these initiatives in balancing markets. In 2017, gas-fired power plants requested a capacity fee to keep operating (FD, 2017). These plants usually provide back-up energy when renewable energy production fails to fulfil its targets, but are closing down due to increasing unprofitability. These companies, therefore, started a debate over the need to create a capacity market in which they are paid even if they do not provide energy, thus keeping fossil fuel plants online. Tennet dismissed proposals for such market as unnecessary.

5.2. Distribution system operators (DSOs)[2]

Since their emergence in 2006, DSOs have perceived the need to make the grid smarter to facilitate their operations. Hence, DSOs became concerned with the technological developments needed to ensure two-way traffic in their grids (ANP, 2008). In 2009, they were assigned responsibility for the installation of smart meters by the Dutch government (FD, 2008), but this process was later halted due to privacy concerns (NRC, 2009a). This situation did not withhold DSOs from starting experiments on the influence of such meters in consumption awareness (ANP, 2010b). They continued advocating for the need for smart meters to enable smart grids due to their benefits for grid management and the transition (NRC, 2009b; de Volkskrant, 2009b). By 2019, over half the households have a smart meter (NU.nl, 2019).

Since 2009 DSOs became highly interested in promoting electric driving. They, firstly, became lead users and experimented with different electric vehicles (EVs) (de Volkskrant, 2009a; De Telegraaf, 2010a). Secondly, they joined forces to create the 'E-laad' foundation to install 10.000 public charging stations in the country by 2012 (RD, 2009). The latter was an attempt to break the 'chicken and egg' problem of EVs, but it was a challenge to the market consensus that the development of charging infrastructure should follow EVs' adoption. Over time, actions were expanded to the development of technical and institutional standards for EVs and their infrastructure (e.g. compatible systems for paying and charging) (DVHN, 2009; ANP, 2010a). After the 'E-laad' project stopped installing public charging stations in 2013 (having achieved approximately 25% of its target), it and DSOs kept advocating for the deployment of public infrastructure and started working with local and provincial governments who took over responsibility for public charging (NRC, 2014a; BD, 2014). 'E- Laad' became an innovation centre working on smart charging solutions (ANP,

[2] Not all DSOs were involved in all the innovation-related activities mentioned in this section. Appendix B presents an overview of the innovation projects associated to individual GOs.

2017). By 2018 public stations increased to 30.000, and the Netherlands had a relatively large penetration of charging infrastructure (NU.nl, 2018).

Since 2010 there was an increased awareness amongst DSOs of the uptake of decentralized energy production by consumers, named prosumers afterwards. This had two main implications for action. First, DSOs recognized how these developments could impact congestion and grid management, particularly in the context of an ageing grid. Smart grids became even more relevant as a cost-effective way to tackle these challenges (RD, 2010; BD, 2011). Hence, experimentation with new technologies increased in business and residential areas. Second, DSOs were faced with difficulties when making investment decisions given an uncertain energy future, especially regarding the energy mix (ANP, 2011a). Therefore, they acknowledged the importance of grid readiness: the need for the grid to be ready to assimilate potential developments (ANP, 2011b). DSOs became interested in knowing more about potential innovative solutions through participation in knowledge generation and experimentation (PZC, 2011; De Gelderlander, 2012; BN, 2012).

DSOs have kept grid readiness as a primary concern of the Dutch energy transition ever since. In 2014, they started expressing their desire for a more active role in the energy transition and had advocated for more room to do so (Cobouw, 2014b; NRC, 2014b). In 2015, flexibility, the capacity to deal with increasing fluctuations in both supply and demand, emerged as the biggest challenge for DSOs to fulfil their role (RD, 2015). Two developments shaped DSOs' actions concerning this. First, the impacts of renewables for grid balancing made DSOs change the focus of control from supply to demand (DVHN, 2016). Besides making consumers aware of their consumption, experiments explored ways to make consumers responsive to variable supply by renewable energy sources, for example, shift demand to noon when solar energy is abundant (BN, 2014). Over time, DSOs advocated for different regulatory changes supporting these developments, such as allowing more suppliers in one connection (FD, 2014). Second, increasing societal calls to stop the country's reliance on natural gas have led to discussions over the need to phase-out gas connections from the housing stock (Tubantia, 2016; AD, 2017). These calls came as a result of several earthquakes in the Province of Groningen, in which Dutch gas production is concentrated (NU.nl, 2017).

The decision to phase-out gas had two potential implications for DSOs (RD, 2016). First, it had the potential of expanding the electricity needs of households if it would also be used for heating, which would increase the load on the grid. Second, any decision would have an impact on their ageing gas networks. DSOs wanted to avoid making sunken investments that would lose value before they could recover it. Faced with this situation, they advocated for changing the law from a 'right to gas' to a 'right to heat' (Cobouw, 2016; GP, 2018). The former implies that every household is legally entitled to a connection to the gas network, and DSOs are obliged to provide such connections. By changing the legislation, DSOs would be exempted of this obligation and could avoid making unnecessary investments.

Moreover, DSOs also started working with municipalities on their goals for energy neutrality, which included agreements to eliminate gas use at the residential level before changes in the law (FD, 2011b; DP, 2018). Experimentation started in collaboration with housing corporations, municipalities, and the construction sector to explore alternatives for heating and housing renovation, for example, by promoting the installation of heat pumps (Cobouw, 2014a). From these actions, it became evident that more impoverished communities and corporations managing social housing would need more financial and technical support for the conversion (ANP, 2018). This sparked further discussions about the distribution of costs and the pace of the change. In 2018, the right to heat was amended in the Energy Transition Progress Act (De Eerste Kamer, 2018).

Finally, it is worth noting that innovation activities by DSOs have been increasingly contested. In 2015, market parties challenged the participation of DSOs in the development and deployment of charging stations (FD, 2015). Even though the regulator justified the DSOs' actions, energy suppliers perceived it as unfair competition and market interference (De Telegraaf, 2016). Moreover, limits to the role of GOs were put on the legislative agenda in 2017 through the Energy Transition Progress Act. Despite the support of some provincial governments (De Gelderlander, 2017), who perceived DSOs' activities as an important driver for the transition, the amendments were made in 2018. The regulated role of DSOs now comprises a list of activities they are allowed to do that are close to the core of managing energy networks. Their participation in innovation and emerging markets is now restricted to spaces permitted by the regulator, such as when new products and services are still in the developmental stage.

6. Institutional work by GOs around decentralized energy innovations

From the developments described in Section 5, it can be observed that GOs performed all three types of institutional work: they *created* institutions, strived to *maintain* institutions and *disrupted* institutions. GOs performed institutional work at two levels: the existing system (shorter-term, focused on their role and responsibilities) and the emerging system (longer-term, focused on innovation for sustainability). This duality is most evident in their institutional maintenance. Furthermore, GOs usually propose alternatives to proposed or existing regulations while performing the three types of work. Therefore, analyzing the intentionality of their actions at the system level becomes critical for exploring their agency. Below we will discuss each of these three types of institutional work in more detail. Table 3 presents a summary of the findings in this section.

6.1. Creating institutions

We have observed two clear examples of GOs' work on creating institutions: smart charging and European integration, where we see three practices: advocacy, educating actors to support new institutions and introducing new frames for problems and solutions. First, GOs advocated for the need to develop public charging infrastructure and mobilized actors to engage in such activities. They did this by forming the 'E-laad' foundation to act on their behalf. The 'E-laad' foundation actively worked on developing networks to

Table 3
Summary of institutional work done by GOs

Institutional work	Related practices	Examples
Creating	• Advocacy • Educating actors to support new institutions • Introducing new frames for problems and solutions • Constructing networks • Mobilizing resources • Changing boundaries for markets and roles	• Promoting need and benefits of interconnection • Educating consumers on electric driving • Experimentation with dynamic pricing
Maintaining	• Deterring alternatives • Creating supportive rules • Reframing existing institutions	• Avoiding the creation of a capacity market • Reframing grid management
Disrupting	• Undermining existing rules based on new standards • Disputing compliance • Challenging existing frames supporting institutions • Constructing networks • Mobilizing resources • Changing boundaries for markets and roles	• Disputing the taxation law • Agreements to stop gas connections before the law changed

establish and promote technical and payment standards, and on educating consumers and other stakeholders with the necessary knowledge to support electric driving. Second, Tennet has been working with other European TSOs to find new ways to solve the flexibility challenge. It actively worked towards the integration of different electricity markets by making new connections with different European countries. These efforts included advocacy work on the need and benefits of interconnection, and mobilizing resources to finance and support the extension of its network. Furthermore, GOs also participated in collective efforts to create institutions in conjunction with their work disrupting institutions. Such instances will be presented in Section 6.3.

6.2. Maintaining institutions

GOs performed work aimed at maintaining the centrality of grid management by linking the existing and emerging systems. They adopted a frame in which grid management was of key importance for the future of the energy system, articulating concerns about the impact of decentralized energy innovations on the grid. This frame legitimized their experimentation and supported their advocacy for strengthening their role. The latter was particularly relevant in the debate surrounding the Energy Transition Progress Act. Moreover, they advocated and created rules to facilitate grid management's adaptation to future developments. Actions in this direction included advocating for regulation for underground planning, and enabling the inclusion of niche actors in the balancing market, e.g. Tennet's experiment with EVs for grid balancing. Thus GOs worked to keep their network position and to prioritize investments in the grid at the core of both systems, and 'the future' was a frame they used to gather support facilitating their current operations.

Besides, GOs worked towards the continued acceptance of sustainability as a norm in the emerging system. They did so in several ways, such as facilitating experimentation, deterring the creation of a new capacity market to restrict dependence on fossil fuel plants, and supporting local governments' efforts to achieve their sustainability goals, such as energy-neutral housing. They also reproduced the sustainability norm in their discourse by providing positive examples of what can be achieved, for example, by relating the transition to the democratization of the energy supply.

6.3. Disrupting institutions

The participation in innovative activities and its associated learning processes have also enabled GOs to identify existing institutions that they considered barriers for their interests and/or the energy transition. Subsequently, they have tried to undermine such institutions by challenging their effectiveness and legitimacy through mostly political work. These actions have been oriented to several areas. First, the rules governing the management of the distribution networks. Currently, only one energy supplier is allowed to control the connection to a household. GOs have advocated against this rule as a barrier for further development of markets, such as local energy trading. Second, the taxation of decentralized energy and storage. Through their experiments and advocacy, GOs have disputed two provisions in the taxation law as barriers for the take-up of decentralized technologies: consumers paying taxes for energy generated by their solar panels outside their property, and the double taxation of storage when used for balancing (tax is paid for both taking energy from the grid and for sending it back). Third, GOs' regulatory space for action. GOs have advocated for further space to lead the transition due to their public mandate. They have challenged rules governing their roles by stating that they restrict their potential contribution. For example, they attempted to undermine the tariff system, through which their regulator sets the price consumers will pay for the transmission of electricity. This system is based on GOs' past performance, i.e. previous costs to manage the grid. GOs, however, dispute its effectiveness in supporting system change as it does not account for the investments needed for the energy transition.

GOs' work on disrupting institutions has assisted collective efforts to create new institutions supporting the growth of niches. There were two instances in which this was observed. First, GOs actively worked and advocated towards the phasing out of gas in

housing. They worked with several actors to stop new gas connections even before their obligation to do so was legally eliminated. Through experimentation, they supported the exploration of alternatives for energy neutrality and heating in different cities. These activities resulted in an increasing amount of municipalities developing gas-free neighbourhoods and the uptake by construction companies of alternatives to increase energy efficiency in their projects. Moreover, they contributed to political efforts to change the law from a 'right to gas' to a 'right to heat' in alignment with other actors' interests.

Second, as GOs focused on finding new ways to cope with grid congestion from decentralized energy generation, the netting scheme, which compensates prosumers for the energy they feed to the grid, was increasingly challenged. In the netting scheme, energy bills are calculated based on the net amount prosumers consume or feed to the grid. However, it is seen as a barrier for smart consumption, energy storage and local trading because it eliminates financial incentives for prosumers to engage in such activities. Thus GOs were first advocating against the netting scheme and later, together with other actors such as energy suppliers and academia, they have been experimenting and advocating for dynamic pricing as a more effective and financially attractive way to manage the impacts of decentralization on the grid.

7. Discussion

Faced with the energy transition, GOs have been quite active to tackle the challenges this poses to both the physical and institutional infrastructure. The institutional work by GOs reflects their paradoxical position. They work simultaneously at maintaining, disrupting and creating institutions. A question that emerges then is how GOs use their agency for institutional change towards decentralized energy systems. Our analysis suggests two answers to that question: the creation of niches and boundary spanning. In both situations, the embedded and public nature of GOs both enabled them to act in ways that newcomers cannot and constrained their institutional work. Our results align with Smink (2015a)'s observations regarding the flexibility of incumbents' agency, i.e. using the same practices for different types of institutional work. Besides identifying the five commonalities previously mentioned in GOs' agency, we can add a sixth one: GOs perform boundary work while engaging a wide variety of actors.

7.1. Creation and growth of niches

GOs facilitated the creation and growth of niches. They were involved in a diverse set of experimentation areas in different functions, like funding them, learning new technical and institutional configurations from them, enabling them through technical or institutional support, and creating expectations around their potential for positive change. In this way, they acted as niche entrepreneurs (Pesch et al., 2017), connecting the needed elements to create a successful niche that allows learning for the transition. In these niche configurations, processes of creating, maintaining and disrupting institutions took place simultaneously.

In the Netherlands, GOs ventured into these niches earlier and more openly than other energy incumbents, notably the large commercial energy suppliers. One explanation is that commercial business models for flexible use and storage of electricity need access to the grid and appropriate markets that value flexibility and allow it to be traded. The publicly-owned GOs are tasked with operating markets and are thus well-positioned to take the lead in setting up new markets. In turn, this requires extensive experimentation with different technologies, roles, market rules, etc. Their public mandate also motivates them to publicly discuss the merits and pitfalls of different institutional and technical arrangements early on without the risk of losing competitive advantage. This attitude comes in stark contrast with the privately-owned, risk-averse GOs in Britain, for example, which need regulatory incentives to innovate (Lockwood, 2016).

The downside of their institutional embeddedness is that GOs are allowed to actively initiate but not to grow these niches, which is a market or government responsibility in the Dutch institutional setup. Therefore, if successful, the niches are to be exploited by commercial market players or others. In the case of 'E-laad' this seems to have been successful: GOs pulled out, and public authorities and companies stepped in to roll out charging stations. In other experiments, however, no other actors stepped in to further implement the results of otherwise successful pilots. Also, the vested grid interests of GOs mean that the Netherlands has seen little experimentation with privately or locally owned microgrids, which are viewed as an important vehicle for the transition in other countries (Burke and Stephens, 2017).

7.2. Boundary spanning

Our findings are in line with previous studies of institutional entrepreneurship by embedded actors (Greenwood and Suddaby, 2006). The presence of contradictions and tensions in the field (Seo and Creed, 2002; Fuenfschilling and Truffer, 2014) can trigger processes that lower actors' embeddedness and enable them to be aware and open to opportunities for change, such as boundary bridging and boundary misalignment (Greenwood and Suddaby, 2006). Actively bridging boundaries took place in three dimensions: networks, framing and levels.

First, GOs worked with organizations in other sectors and at different levels, which exposed them to different institutional logics. In their institutional work, GOs usually do not work alone. GOs have worked with a wide range of actors, including local and provincial governments, technology companies, energy suppliers, energy cooperatives, business parks, housing corporations, automotive companies, construction companies, prosumers and other GOs at national and international level. In such interactions GOs learned from others and used their resources, shared interests and legitimacy to support institutional change (see Greenwood et al., 2002; Sherer and Lee, 2002; Lange, 2019). Hence, GOs were part of a process of collective, distributed institutional change by dispersed actors with different interests, tensions and contradictions (Wijen and Ansari, 2007; Jolly and Raven, 2015). As GOs do not

have a commercial stake in particular solutions, both private and public organizations more easily perceive them as neutral and trusted partners.

Second, GOs flexibly aligned problems, actors and solutions, in a fashion similar to that of the policy entrepreneurs in Kingdon (1995)'s streams model, resulting in new frames. The developments in smart grids offer a clear example of this. It started as a solution looking for a problem, as smart grids were an opportunity. Over time, flexibility emerged as a relevant problem, and smart grids became one of many solutions to solve it. Subsequently, GOs were looking for opportunities to influence decision-making by coupling these streams to the energy transition. This strategy can be identified for all three types of institutional work done by GOs. Their network position enabled them to have a broad perspective of what happens in the sector and how it connects to their evolving role, interests and vision of the energy transition.

Third, GOs went beyond experiments and acted as a bridge between different niches and regimes. Their position enabled them to keep an overview of what was happening in several niches and link that to developments on the regime and landscape level. In this way, GOs were able to perform work creating and disrupting institutions to support the variety of niche developments as well as national policy-making. This observation is in line with other studies that move beyond the 'niche' and 'regime' labels to enhance our understanding of the space for action of the diversity of actors involved (Avelino and Wittmayer, 2016; Wittmayer et al., 2017). The fluidity between the activities at niche and regime level offers further opportunities for action and coordination, particularly in the context of institutional change (Brown et al., 2013; Loorbach et al., 2017).

Boundary misalignment, i.e. a misalignment between the market scope of organizations and the scope of institutional jurisdictions (Greenwood and Suddaby, 2006), also happened. GOs often present themselves as a driver of the energy transition and condemn the fact that they are not given enough space to do so by their regulator (also evidenced by Edens and Lavrijssen, 2019). Greenwood and Suddaby (2006) found that motivation to enact change lies in contradictions between institutional conformity and the limitations this puts on (future) functional efficiency. This boundary misalignment was an important motivation for GOs' agency but, by definition, also constrained them. Both publicly and through their actions, GOs needed to defend their room to experiment and to challenge the boundaries implied by their legal role to be able to create and disrupt institutions. As their association put it: "sometimes we are a bit naughty" (Steringa, 2015, authors' translation).

GOs are ultimately not only subject but also object of institutional work. The role of GOs is regulated by laws, like the Energy Transition Progress Act, and is thus the product of political decisions lobbied on by energy suppliers, GOs and other actors. The role of GOs in the energy transition is, in essence, a legal matter and a topic of ongoing political debate. A debate that is mainly about the role of public versus market parties in realizing the energy transition. The Act, which further reduced the room for institutional experimentation, illustrates that over the timeframe studied GOs' agency has been restricted rather than enlarged.

8. Conclusions and further research

Decentralized energy innovations present both opportunities and challenges for incumbents. This paper aimed at answering the question: *what kind of institutional work is done by GOs around decentralized energy innovations and to what effect?* GOs have performed institutional work often playing with the limits of the regulatory space given to them. Their work has resulted in changes in a variety of areas, such as smart charging and phasing out natural gas. Such work reflects their paradoxical position. As embedded actors, they work on maintaining the institutions supporting grid management and sustainability at the centre of the field. Simultaneously, they also work on disrupting existing institutions by challenging their efficiency and legitimacy in the face of the transition. This work then enables further work on creating new institutions in conjunction with a disperse set of actors. Hence, GOs are part of a distributed, collective process of institutional change. Moreover, actors with diverging interests might perform work to restrict the resources and possibilities of GOs to enact change. Such 'vulnerability' reflects the fact that GOs are not only subject but also object of institutional work.

This contribution offers a different perspective on the role of incumbents in transition research. It highlights the agency of GOs as a particular type of incumbent who manages critical material and institutional resources for the transition. Differently from other incumbents, their agency is motivated by their public mandate, broad access to the grid and markets, and regulatory misalignment. Furthermore, their network position enables them to perceive tensions in the current energy system and assess their impact on a future vision. The transition will require a more fluid view on the roles of actors and their potential for enacting change. This proposition also recognizes the potential for limitations in the extent and direction of the change enacted by embedded actors. Further exploring these limitations offers an avenue for further research by analyzing the impact of the changes achieved through incumbents' agency.

Other avenues of future research can also be identified. First, the paradox of embedded agency does not only manifests itself externally but also within organizations. GOs are complex organizations with separate compliance, regulation and innovation departments. Each of these units may likely have different perceptions on the role of GOs and their aims and opportunities for institutional change. As GOs perform institutional work, it is yet not clear how they manage such practices internally, and what kind of implications this has for the type of work that is done in different areas and niches. In this line, exploring additional data sources, such as interviews and observations, can provide a broader overview of the institutional work done by GOs and their rationales for action. The latter can also contribute to widening the understanding of their institutional work in the context of transitions.

Second, future research could focus on how GOs respond to the duality of being simultaneously subject and object of institutional work in their daily practices. For example, the space for experimentation of GOs was reduced and strictly regulated under the Energy Transition Progress Act in 2017, which raises questions regarding how grid operators adapt their innovation activities to these constraints and what implications this has for the development of new niches. Finally, this work has focused on the Dutch context in

which GOs are subject to particular institutional logics and actor constellations. Future research could expand our understanding of the agency of GOs by making an international comparison of institutional work by GOs and their implications in different institutional contexts.

Declaration of Competing Interest

None.

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Appendix A. Data analyzed per news source

Newspaper	Count
National	*223*
AD/Algemeen Dagblad	1
Algemeen Nederlands Persbureau ANP	27
Cobouw	12
De Telegraaf	27
de Volkskrant	26
FD.nl	24
Het Financieele Dagblad	48
NRC Handelsblad	25
Reformatorisch Dagblad	17
Trouw	16
Regional	*196*
AD/Groene Hart	12
AD/Haagsche Courant	10
AD/Rivierenland	7
AD/Rotterdams Dagblad	3
AD/Utrechts Nieuwsblad	20
Arnhemse Koerier	2
BN/DeStem	23
Brabants Dagblad	19
Dagblad de Limburger	9
Dagblad van het Noorden	19
De Gelderlander	32
De Moer	1
De Nieuwsbode Bunnik	1
De Twentsche Courant Tubantia	10
De Vonk	1
Delftse Post	1
Eindhovens Dagblad	12
Goudse Post	1
Huis aan huis Enschede	1
Leeuwarder Courant	2
Leusden Nu	1
Ons Eiland Goeree-Overflakkee	1
Provinciale Zeeuwse Courant	8
Total	*419*

Appendix B. Overview of innovation projects in which GOs were involved

Area of focus	Innovation projects
Electric driving	2009: Trial with 40 houses in Netherlands with EVs (Enexis) 2010: DSOs create e-laad foundation to install 10.000 public charging stations to push electric driving (10 out of 11 DSOs) 2015: Trial of discount to charge EVs in off-peak hours (Enexis & E-laad) 2017: Large battery at the Jaarbeurs for EV charging in Utrecht (Stedin) 2018: Trial with smart charging at own branch in Duiven (Liander)
Smart grids	2009: Local smart grid in Hemrik business park in Leeuwarden (Enexis) 2011: Smart grid with 70% of an entire street in Hoogkerk (Enexis) 2012: Smart grid in a residential district in Ede (Liander) 2013: Self-generated energy & smart system in two neighbourhoods in Teteringen

	(Enexis) 2013: Smart grid in 250 new homes in the Zwolse Muziekwijk and Easy Street in Breda (Enexis) 2015: Smart energy system in new housing development in Gorcum (Stedin) 2017: Smart electricity grid tested in Merwe-Vierhavens in Rotterdam (Stedin)
Smart meters	2010: 150 households provided with a smart meter in Amsterdam (Liander)
Decentralised energy	2012: Trial in Nijmegen with installing PVs on a foreign roof (Liander)
Energy storage	2012: Buurtbatterij (community storage) in Etten-Leur (Enexis, Alliander) 2014: Vehicle2Home storage trial in Lochem (Alliander) 2014: Power to gas (hydrogen) installation in Rozenburg (Stedin) 2015: Parked EVs for storage in Lombok district in Utrecht (Stedin) 2015: Smart Energy Collective in Hoog Dalen (Stedin) 2015: "City of the Sun" Storing excess energy as hot water in Heerhugowaard (Alliander) 2015: Expansion of vehicle to grid storage trial in Utrecht and 15 municipalities (Stedin) 2017: Virtual power plant in Sloten in Amsterdam (Alliander) 2017: Buurtbatterij in in Rijsenhout near Schiphol (Alliander)
Smart consumption	2015: Smart consumption in De Beitel Business Park in Heerlen (Enexis) 2015: Smart consumption with 300 members of Vereniging Eigen Huis in Amersfoort (Liander) 2016: Pilot in a business park to adjust consumption to renewable energy production in Groningen (Enexis) 2018: Exception to charge dynamic prices to large consumers in the horticulture sector (Westland Infra)
Gas-free housing	2015: Smart energy system in new housing development in Gorcum (Stedin) 2017: All-electric, zero-on-the-meter housing renovation in 8 apartments in Utrecht (Stedin)
Grid flexibility	2016: Trials with EVs for grid balancing in Amsterdam (Tennet) 2018: Use of EVs for balancing the grid (Tennet) 2018: Vehicle to grid compensation for supply with ten cars (Alliander)
Energy trading	2017: Gridflex experiment in Heeten by Cooperative Endona for P2P trading (Enexis)
Energy poverty	2018: Prepaid energy service in Arnhem and Rotterdam (Alliander, Stedin)
Hydrogen as fuel	2018: Test of hydrogen replacing gas for heating in the Rotterdam district of Rozenburg (Stedin)

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