A multilevel analysis of climate change inaction: case study of an Australian electricity company

To cite this article: Kirti Mishra, Cristina Neesham, Ken Coghill & Wendy Stubbs (2020): A multilevel analysis of climate change inaction: case study of an Australian electricity company, Australasian Journal of Environmental Management

To link to this article: https://doi.org/10.1080/14486563.2020.1758806

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ABSTRACT

Climate change is a key societal and economic challenge. Despite widespread recognition of the need for urgent action on climate change, transformation to a zero carbon economy is still elusive. While there are detailed accounts of organisational responses to climate change impacts, little is known about climate change *inaction*. We adopt the theoretical framework of resilience in social-ecological systems to explore the change processes needed to overcome climate change inaction. Through an in-depth case study of an Australian energy company, we identify the impediments to climate change action due to rigidity and scarcity traps at three levels: micro (organisation), meso (industry), and macro (government). These traps inhibit transformation from a fossil fuel regime to a renewable energy regime. Our study contributes to a multi-level theory of organisational inaction on climate change by identifying specific causal factors that erode systemic adaptive capacity, increasing the probability of rigidity and scarcity traps. We find that different inaction occurs at all three levels, and is closely interconnected across levels within a social-ecological system, due to dynamic antecedents (e.g., changing individual attitudes, business practices, and government policies). Competencies, resources, and cultural changes can help organisations traverse rigidity and scarcity traps to overcome climate change inaction.

Keywords: adaptive cycle; business model transformation; climate change; resilience; energy sector; social-ecological systems; transformation.

Introduction

Despite widespread recognition that urgent action on climate change is needed, transformation to a zero-carbon economy is still elusive. There is consensus among scientists that anthropogenic climate change will have catastrophic negative consequences such as collapse of global food production, mass species extinction, acidification of the oceans, dramatic sea level rises, and extreme storms and droughts (Dunlop and Spratt, 2019; Tollefson, 2018; Wright and Nyberg, 2017). Recent research has warned that humankind has only a decade until feedback and cumulative effects threaten a point of no return and the eventual collapse of the biosphere (e.g., Aengenheyster, Feng, Van Der Ploeg and Dijkstra, 2018; IPCC, 2018). Burning fossil fuels for electricity generation is the human activity contributing most to climate change (IPCC, 2018). Rising electricity demand was one of the key reasons why global CO2 emissions from the power sector reached a record high in 2018 (IEA, 2019). Consequently, it is increasingly acknowledged that meaningful action on climate change entails transformation from a carbon intensive fossil fuel driven economy to a zero carbon renewable energy based economy (Deegan, 2010; Linnenluecke and Griffiths, 2012; Slawinski, Pinkse, Busch and Banerjee, 2017). This transformation requires drastic cuts in greenhouse gas (GHG) emissions (IEA, 2019; IPCC, 2018), and radical shifts in socio-political structures, technological and economic systems, organisational business models and modes of organising (Böhm, Misoczky, and Moog, 2012; den Elzen, Höhne and van Vliet, 2009). However, ever-increasing greenhouse gas emissions and atmospheric concentrations of CO2 re-emphasize the climate crisis and point to climate change inaction (De Cock, Nyberg and Wright, 2019). The atmosphere has

already warmed by 1.1°C above pre-industrial levels and climate forcing from current emissions means that, with at least another 0.6°C of warming in the pipeline, we are already close to exceeding the Paris Agreement target of 1.5°C (Mann, 2014). Avoiding the globally accepted 'dangerous' limit of 2°C increase thus looks less and less likely (Anderson, 2015). Scholars have therefore criticised current global, national and organisational efforts to reduce GHG emissions, arguing that these responses have been unable to effect a shift away from a coal driven economy and have called for investigation of system-level impediments to effective response to the climate change crisis (Adler, 2019; McKibben, 2013; Slawinski, Pinkse, Busch and Banerjee, 2017).

These calls for investigation reflect a lack of theorising to improve understanding of the inadequate organisational transformative action in response to climate change challenges. Research on the environment in management and organisation science has long focused on change within individual companies and in individual behaviour. But with the acceleration of the climate crisis, it is imperative to expand research focus from the firm and individual toward the system level, and to explore options for transformation at the system level. Meaningful response to climate change requires simultaneous transformation at the different structural levels of the social-ecological system (SES) such as changes in the economic, political and social orders at the macro level and changes in business models at the micro level (Wittneben, Okereke, Banerjee and Levy, 2012; Wright, Nyberg, De Cock and Whiteman, 2013). Scholars have investigated climate change inaction at the macro or micro levels but ignored the interactions between levels (Okereke and Küng, 2013; Wade, Dargusch and Griffiths. 2014.) Furthermore, this literature has mostly focused on the difficulty of implementing specific climate change responses such as internal governance practices and emissions reporting (e.g. Bumpus, Tansey, Pérez Henríquez, and C. Okerek, 2014)

and has overlooked systemic underpinnings of organisational imprinting or inertia, which reinforce existing models of management and organisation. Consequently, scholars highlight the need for multi-level social-ecological system (SES) research, to elucidate the system-level mechanisms that are impeding adequate responses to the climate emergency and to advance theorizing on climate change inaction (Adler, 2019; Kolk and Tsang, 2017; Levy and Spicer, 2013).

Adopting the lens of resilience as viewed in the social-ecological systems literature, this article addresses these knowledge gaps by posing the research questions: what causes climate change inaction, and how can climate inaction be averted? Following Carpenter, Westley and Turner (2005), we conceptualise resilience as the ability of a SES to persist, transform and adapt to threats and challenges of climate change by traversing through different stages of the adaptive cycle (growth/exploitation, conservation, creative destruction/collapse, and reorganisation). We assert that organisational climate change inaction is a result of the presence of 'rigidity' and 'scarcity' traps in the adaptive cycle. Through an in-depth analysis of interviews and documents of an Australian energy company (GENTAILER), this article identifies rigidity and scarcity traps at organisation, industry and government levels within the Australian energy system. The article extends current theorising on sustainability transformations by uncovering impediments at multiple levels within the SES, and by identifying strategies for traversing these traps. Scholars have highlighted the need to look outside traditional disciplinary boundaries, and towards the natural sciences in particular (Starik and Kanashiro, 2013), to bring relevant concepts, perspectives, and biophysical foundation models to the study of the organisation–natural environment relationship (Winn and Pogutz, 2013). Thus, by using the resilience framework to identify the presence of rigidity and scarcity traps that impede climate change action,

we draw upon the natural sciences to study sustainability transformations – answering calls for conceptual integration within social and behavioural sciences (Mysterud and Penn, 2007). However, we acknowledge the inherent challenges of applying theory from the natural sciences to study organisational adaptation, since adaptation may occur as a natural process, without any conscious intent on the part of the species. In adopting the resilience framework, we follow scholars who have used it to study social sciences and social systems (e.g. Amundsen, 2012; Boonstra, 2016; Strunz, 2014). We also extend the literature on intentional corporate actions in response to climate change (e.g. Wright and Nyberg, 2015; Okereke and Küng, 2013; Porter and Reinhardt, 2007).

This article is organised as follows. The next section presents the resilience framework. We then discuss the methodological approach, followed by the research findings and implications of these findings. We conclude with a discussion of how competencies, resources, and cultural changes and adaptive governance can help organisations traverse rigidity and scarcity traps to overcome climate change inaction.

Resilience: a framework for understanding sustainability transformations

In the interdisciplinary field of social-ecological systems, resilience is defined as 'the capacity of a system to absorb and re-organise while undergoing change' (Folke, 2006, p. 259). This definition encompasses three different but complementary features. The first is persistence, i.e. the capacity to absorb or buffer shocks while maintaining structure and function. The second, transformability, is the system's potential to recombine structures and processes in order to undergo change. Resilience is an organisation or system's capacity for dynamic development and ability to engage in transformative activities. Examples of such transformative activities could be investing in social and human capital and changing property rights (Folke, Carpenter, Walker, Scheffer, Chapin and Rockström, 2010; Walker, Holling, Carpenter and Kinzig. 2004).

The third feature, adaptability, is the ability to combine experience and knowledge to adjust responses to changing external drivers and internal processes, while maintaining current processes (Carpenter and Brock, 2008).

Resilience is an appropriate framework for this study, as effective responses to climate change require transformation at the macro level, for example, changes in economic, political and social orders; at the meso level, for example changes in demand, production, and the short term measures of industry success; and at the micro level, for example, changes in business models and organisational identities (Wright, Nyberg, De Cock and Whiteman, 2013). Organisations operate in an SES, and their climate change actions are embedded in a multi-level and multi-actor governance framework (Hoffman and Bansal, 2012; Espinosa and Porter, 2011; Okereke, Wittneben and Bowen, 2012). Scholars have called for adoption of multi-level theoretical frameworks, such as resilience, to study sustainability transformations and to investigate antecendents to climate change inaction across the different levels of the SES (Levy and Spicer, 2013; Slawinski, Pinkse, Busch and Banerjee, 2017). When applied in sustainability research, resilience is operationalised as an SES's ability to transform from an unsustainable regime, which promotes resource exploitation and leads to depletion of ecosystem services, to a regime that supports sustainable use of resources and ecosystem conservation (Folke, Carpenter, Walker, Scheffer, Chapin and Rockström, 2010; Westley, Tjornbo, Schultz, Olsson, Folke, Crona and Bodin, 2013).

Literature has suggested that climate change transformations require systemic shifts in institutional underpinnings such as mental models, management routines, and resource flows (Westley, Antadze, Riddell, Robinson and Geobey, 2014; Westley Tjornbo, Schultz, Olsson, Folke, Crona and Bodin, 2013; Westley and Antadze 2010, Olsson and Galaz 2012). Corporate actors and actions occur within a wider multi-level

and multi-actor governance system comprising a vast and disparate infrastructure of institutions, markets, rules, norms and discursive formations (Berkhout, 2011; Levy, 2013; Pinkse and Kolk, 2012; Valente, 2010; Wright, Nyberg, De Cock and Whiteman, 2013), which should be incorporated into investigations of organisational climate change actions.

Meaningful response to climate change requires a regime shift, to allow for changes in economic, political and social orders at the macro level, and in an organisation's business model at the micro level (Lefsrud and Meyer, 2012; Wright, Nyberg, De Cock and Whiteman, 2013). At the organisational level, progress towards transformation of organisational business models has been incremental. Traditional business models exacerbate the problems of climate change (Ryan, 2008; Stubbs and Cocklin, 2008a) and foster business as usual responses to impacts of climate change, by encouraging organisations to externalise the social and environmental costs of their activities and internalise the economic benefits (Sharma and Starik, 2004). Fundamental change to traditional business models is needed, in order to transition to a low carbon future (Foxon, 2011; Fry and Slocum Jr. 2008; Stubbs and Cocklin, 2008). This transformation in business models requires systemic shifts in institutional underpinnings, such as mental models, management routines, and resource flows (Westley, Antadze, Riddell, Robinson and Geobey, 2014; Westley, Tjornbo, Schultz, Olsson, Folke, Crona and Bodin, 2013).

Adaptive cycle and traps: an explanation for climate change inaction

Central to debates on resilience is the notion of adaptive cycles, which is a framework to visualise and organise ideas around resilience of SES (Holling and Gunderson, 2002). According to this framework, SES maintain their resilience by continuing to replicate the four phases of the adaptive cycle: growth/exploitation (r), conservation (K), creative

destruction/collapse (Ω), and reorganisation (α) (see Figure 1) (Gunderson and Light 2006). Resource accumulation and increasing connectivity occur during the growth phase. These are preserved during the conservation phase (e.g. for a social system, the accumulating potential develops from skills, networks of human relationships, and mutual trust). Abundant resources and entrepreneurial leadership often mark this r-stage in social systems. During the growth stage, the system is characterised by untapped and uncommitted potentiality (Boonstra, 2016). An organisation has either just survived or learned from a crisis (MacGill, 2011, p. 528), or is in its infancy and able to grow substantially, for example due to a first mover advantage. Once kick-started along a growth trajectory, many resource flows are available for experimentation. In the r-phase, network connections are established, and trust and dependencies are built. As the organisation matures in the K-phase, a 'business as usual' mindset starts to prevail. The organisation becomes overly dependent on, and confident of, its current state of being (Vonck and Notteboom, 2016; Lovallo and Kahneman, 2003), thus growing into 'an accident waiting to happen' (Vonck and Notteboom, 2016, p. 314). When connectedness and human and social capital reach maximum potential, the creative destruction phase is triggered, followed by reorganisation. For an economic or social system, the accumulating potential could result from the skills, networks of human relationships, and mutual trust that are incrementally developed and tested during the progression from r to K.

INSERT FIGURE 1 ABOUT HERE

It is during the Ω-phase that extreme disturbance and disorderly collapse occurs, and the 'accident' manifests itself through triggers by 'agents of disturbance'

(Holling, 2001, p. 394). An important aspect of the transition to this phase is the leaders' realisation that their organisation is indeed facing turbulence caused by impacts of climate change. Thus, a so-called gestalt switch should occur, in which leaders become aware of deficient operations (Abcouwer and Parson, 2011). Leaders who are able to manoeuvre the organisation through chaos are vital throughout this phase (Fath, Dean and Katzmair, 2015, p. 3). Finally, during the transition from the Ω to the α-phase (the period of reorientation and future development), crisis gradually makes way for opportunity as the organisation searches for new ways to thrive by means of innovation. This marks the initiation of the new cycle or regime shift (Dryzek, Norgaard and Schlosberg, 2011). A resilient social system thus uses crisis as an opportunity to transform into a more desired state characterised by new structure, function and feedback pathways. The system undergoes renewal and reorganisation due to self-organisation of teams and actor groups that draw on various knowledge systems and experiences in order to develop a common understanding and policies for adaptive co-management efforts (Folke, Hahn, Olsson and Norberg. 2005).

The occurrence of rigidity and scarcity (poverty) traps provides an explanation for climate change inaction. Traps prevent regime shifts by halting the adaptive cycle and reducing the transformational capability of the SES (Patton, 2011). Holling and Gunderson (2002) coined the concept of rigidity trap to define constraints that occur when a system's resilience is high, i.e. when it has great ability to resist external disturbance and to persist 'beyond the point where it is adaptive and creative' (Holling and Gunderson, 2002, p.96). During the conservation phase (K), this occurs when the dominant system resists change in the face of new conditions and clamps down to maintain existing conditions. In social systems, a rigidity trap is created when members of organisations and their institutions become highly interdependent, interconnected,

and inflexible such that there is a concentration of influence and reduction in organisational creativity and ability to self-organise (Fath, Dean and Katzmair, 2015). Scheffer, Westley and Brock (2003) propose that rigidity traps can be created if there is too much stability in an institutionalised regime, through either uncritical consensus or suppression of alternatives. The presence of strong, self-reinforcing controls in rigidity traps inhibits transformability and prolongs the persistence of the status quo (Westley et al., 2006). A rigidity trap is characterised by a concentration of power, a few very tightly connected system constituents, and lack of diversity (both functional and response diversity), so there is no space for novelty or innovation to emerge (Nielsen and Ulanowicz, 2011). For example, the absence of early adopters creates a rigidity trap against organisational innovations by delegitimising and reducing the desirability of new products, and by preventing the release of organisational resources for product development (Moore and Westley, 2011).

A poverty or scarcity trap (Gunderson and Holling, 2002) occurs when a system cannot access enough activation energy during the reorganisation phase (α) to reach a state where positive feedbacks drive growth internally. The system is unable to release enough resources to support creative exploration of new possibilities (Allison and Hobbs, 2004; Gunderson and Holling, 2002; Westley, Zimmerman and Patton, 2006). For example, highly creative teams may generate prototype after prototype, but in the absence of mechanisms to select one option and move it into production, the team will be stuck in a poverty trap (Westley, Zimmerman and Patton, 2006). In a poverty trap, transformability of the social system is limited, because mobilisation of ideas and resources to enter the 'front loop', where growth and productivity are possible, is resisted. Some examples of scarcity traps are: lack of focused leadership (Gunderson and Holling, 2002); decrease in social capital (Barrett and Swallow, 2006); and loose

connections among members or agents in the organisational system (Limnios Mmouni, Mazzarol, Ghadouani and Schilizzi, 2014). From the preceding discussion it is concluded that resilient SESs are ones that successfully navigate all stages of growth, development, collapse, and reorientation of the adaptive cycle. Any impediment in the form of scarcity and rigidity traps leads to perpetuation of status quo and eventual decline of the SES. We propose that climate change inaction can be explained by the presence of rigidity and scarcity traps which prevent transformation to a zero-carbon future and reinforce the current fossil driven economic system.

We note that the adaptive cycle concept may appear to be deterministic, i.e. it may be perceived as an inevitable sequence of exploitation, conservation, collapse or release, and renewal and reorganisation. Furthermore, in natural systems, intentional adaptation in species may not always occur. However, organisations are different from ecosystems in that their actors can generally draw on a set of mechanisms that are not available to ecosystems, such as formulating strategies and responses based on knowledge, sense-making, and experience of organisational members; and therefore have potential for change and adaptability (Holling and Gunderson, 2002; Linnenleuke and Griffiths, 2010). While our conceptualisation of intended adaptation may not align with the natural adaptive cycle used in ecosystems research, we draw from applications and developments of the resilience framework in social sciences and social systems (e.g. Linnenleuke and Griffiths, 2010; Strunz, 2014; Tidball, Frantzeskaki and Elmqvist, 2016) to use the adaptive cycle concept to investigate organisational exposure and responses to impacts from climate change, such as damage to physical assets, increase in price of raw materials, disruption of supply chains, and regulatory changes. Concepts of resilience and adaptive capacity can be applied to socio-economic organisations and management decision situations because they provide a deeper understanding of a broad

range of systems, including social and business organisations, by emphasising the role of multi-level interactions and system transformability (Folke, Carpenter, Walker, Scheffer, Chapin and Rockström, 2010). Furthermore, human agency adds a less understood and therefore less predictable component, but also adds potential responsive dynamic preparedness and management abilities not normally found in ecological systems (Boonstra, 2016; Fath, Dean and Katzmair, 2015).

The resilience framework can help shed light on two important aspects of climate change inaction: first, the traps preventing business model transformation in response to climate change impacts; and, second, the traps present at multiple levels within the SES that are impeding the regime shift. Therefore, we propose that these traps are antecedents to climate change inaction and are preventing the transition of SES towards a zero-carbon future.

Methodological approach

We conducted a single in-depth qualitative case study of an Australian energy company (GENTAILER) to investigate factors associated with climate change inaction and to identify rigidity and scarcity traps. A single case study is suitable in research such as this one, where the research intent is to extend theory in topic areas about which little is known (Creswell, 2007; Eisenhardt and Graebner, 2007). Furthermore, a single case study approach is also recommended for studying a phenomenon in its natural or 'real-life' setting, where contextual elements have to be taken into account (Flick, 2014; Yin, 2014). Qualitative business research methods are suitable for capturing the plurality and multiple levels of the social world (Flick, 2014). In-depth case studies are appropriate for exploring organisational phenomena, when little is known about the phenomenon under investigation, and for extending current theorising (Eisenhardt and Graebner, 2007). Case study methods are useful for developing idiographic and in-depth descriptions of how

rigidity and scarcity traps are created and lead to climate change inaction – as illustrated by Morrow and Smith (2000) in their discussion of the role of qualitative case study inquiry in psychology research.

Single Case study design

We used an instrumental case study of GENTAILER, one of the largest Australian energy companies with generation assets and retail functions, and the associated energy sector. An instrumental case is selected for the purpose of building and extending knowledge that may be applied outside the boundaries of the specific case being explored. It is conducted to provide insight into an issue (e.g., climate change) to '[help] us pursue [an] external interest' (Stake, 2005, p. 445) such as the regulatory and industry forces influencing climate change responses.

Selection of Australian energy sector and GENTAILER

A case study should be selected purposefully (Patton, 1990) and not haphazardly (Yin, 2014). The validity, meaningfulness and insights generated from qualitative inquiry are associated with the information-richness of the case selected (Patton, 1990). Within the resilience literature, it is imperative for empirical studies adopting the adaptive cycle framework to demonstrate the presence of qualitatively different regimes within the social-ecological framework under investigation (Walker, Holling, Carpenter and Kinzig. 2004; Fath, Dean and Katzmair, 2015). Existing research has already established the presence of two distinct regimes in the energy sector: the fossil fuel regime, and the renewable energy regime (Markard, Raven and Truffer, 2012; Strunz, 2015). The fossil fuel regime is characterised by large-scale production and transmission technology, a concentrated ownership structure and a set of policies that support this arrangement. The renewable energy regime is characterised by a more

decentralized technological and economic structure and an alternative, sustainability-oriented set of policies (Strunz, 2015). Key features of these two regimes are summarised in Table 1. Sustainability transformation requires a shift from a fossil fuel regime to a renewable energy regime (Pinkse and Kolk, 2012; Sousa, Martins and Jorge, 2013).

INSERT TABLE 1 ABOUT HERE

We selected the Australian energy sector as it represents a fossil fuel regime, due to its dependence on coal. The energy sector is the largest source of emissions in the Australian National GHG inventory, accounting for 35% of emissions in the year to December 2015 (DEE, 2016). Coal fired generation is the dominant energy supply technology in the National Energy Market, supplying 73% of output in 2017–18 (AER, 2018).

GENTAILER was one of the highest GHG emitters in Australia at the time of the study. The Australian energy sector and GENTAILER are representative of a fossil fuel regime (see Table 2), and therefore appropriate for studying climate change inaction and rigidity and scarcity traps.

INSERT TABLE 2 ABOUT HERE

Data Collection

In this research article we draw upon primary (interviews) and secondary (documents) as sources of data. In total, twenty in-depth semi-structured interviews were conducted: eight interviews at the GENTAILER (GEN1-GEN8), four interviews

with Australian Energy Policy Experts (POLICY1-POLICY4), and eight interviews with representatives of Australian Energy Industry Institutions (ENERGY1-ENERGY8). Nineteen interviews took 60-65 minutes; one interview with a member of the corporate affairs team took two hours. The first author transcribed all the interviews verbatim. Table 3 provides examples of Australian energy industry institutions.

INSERT TABLE 3 ABOUT HERE

Data analysis

Data analysis in qualitative research consisted of preparing and organising the data for analysis, then reducing the data into themes through a process of coding, condensing the codes, and finally representing the data. We constructed a detailed description of climate change responses of the Australian energy sector at organisation, industry and government levels, highlighting key actions taken, major players and institutions involved, and their roles and key networks, interactions/relationships, and actions (Creswell, 2007). We followed the template analysis method for categorical aggregation of data (Crabtree and Miller, 1999). We developed an a priori coding structure from a mixture of a priori interests and initial engagement with the data, and application to the full data set (Crabtree and Miller, 1999), and a coding manual of a priori codes corresponding to organisation, industry and government levels. The coding manual consisted of rigidity traps and scarcity traps as first order codes, followed by 13 second order codes and 26 third-order codes (see Table 4, including sample quotes). This served as a data management tool to organise segments of similar or related text for corroborating evidence. The codes were refined and modified during the analysis process (King, 2004). During this step we also looked for overlap and redundant codes before categorising them into themes. Primary and secondary data were uploaded to

Nvivo to facilitate 'chunking' of data into codes ('nodes'), to make connections, and to subsequently corroborate and legitimise the data, following a strategy recommended by Crabtree and Miller (1999).

INSERT TABLE 4 ABOUT HERE

Research findings

Our data analysis reveals the presence of pathologies in the form of rigidity and scarcity traps within the Australian energy system at organisational, industry and government levels. We found that GENTAILER and the Australian energy sector's transformability – that is, the potential to recombine structures and processes for moving towards the renewable energy regime – has been reduced due to rigidity and scarcity traps at all levels in the adaptive cycle (see Figure 2), leading to climate change inaction. The presence of rigidity traps in the K phase and scarcity traps in the α phase at the organisation, industry and government levels reinforces the structure, functions and feedbacks of the fossil fuel regime in GENTAILER and the Australian energy sector.

INSERT FIGURE 2 ABOUT HERE

Rigidity traps in the adaptive cycle

Rigidity traps have prevented GENTAILER and the Australian energy sector from moving beyond the conservation phase (K), such that the dominant fossil fuel regime has resisted change in the face of demand for transformation towards the renewable energy regime and clamped down to maintain existing structures, functions and feedbacks. GENTAILER's coal-driven revenue model, application of the energy

reliability criterion and low-cost wholesale prices for organisational decision-making, together with the emergence of a generator utility business model, created a rigidity trap at organisation level.

All GENTAILER participants reported that the asset portfolio had become increasingly carbon intensive due to acquiring coal generation assets, which, according to two participants GEN4 (Corporate Affairs Team Member), and GEN7 (Marketing Team Member), were the cheapest source of reliable energy in the National Energy Market.

> *So yes, we introduced into the portfolio officially a coal fired power station and a coal mine. It's the biggest generator, and it's reliable generation. So, this is reliable generation and the cheapest in the NEM. In the end this industry runs on a reliability test. It doesn't run on a climate change or price test, so in terms of leading the industry it's a great decision. [GEN7]*

Further, GEN5 (Corporate Affairs Team Member), noted that coal assets created a commercial advantage in the wholesale energy market, since coal generation was at the time *a low*-cost, reliable energy source. Strunz (2014) argues that energy reliability is a measure of performance within a fossil fuel regime and its role in driving organisational decision making is detrimental to developing renewable energy technologies and sustainability transformations.

The emergence of a generator utility model at GENTAILER is also indicative of a rigidity trap. GEN3 (Corporate Affairs Team Member) explained this shift in the business model and strategic focus:

> *And now we've become certainly the biggest generator, but we want to become the best. We're going to work to become the best generator. Best meaning high reliability, low cost, we are at the forefront of that!*

According to GEN1 (a Board of Director) and GEN6 (Marketing Team Associate Manager), GENTAILER's new generation focused business model shifted the strategic importance away from climate change responses to operational efficiency and low-cost wholesale energy generation.

Richter (2013) asserts that a generator utility model is reflective of a traditional fossil fuel-based business model, and proposes that decentralised business models with a focus on energy services are necessary for moving to a renewable energy regime. GENTAILER's then-current model was a rigidity trap, inhibiting the model's transition to a renewable energy regime.

The energy sector in Australia is made up of four structural institutions: 1) NEM-the National Electricity Market, (2) AEMO: Australian Energy Market Operator, 3) AER: Australian Energy Regulator, and (4) AEMC: Australian Energy Market Commission (see Table 4). The National Electricity Market (NEM) is the interconnected power system operating across Queensland (Qld), New South Wales (NSW) and its Snowy Mountains (Hydro) region, Victoria (Vic), South Australia (SA) and Tasmania (Tas). AEMO plays an important role in supporting the industry to deliver a more integrated, secure, and cost-effective national energy supply. Its roles include maintaining reserve requirements, coordinating dispatch of generation, and determining the spot price and financial settlement of the market. AER regulates energy markets and networks under national energy market legislation and rules. AEMC is the rule maker for Australian electricity and gas markets. It makes and amends the National Electricity Rules, National Gas Rules and National Energy Retail Rules. It also provides market development advice to governments. Together, AER, AEMO and AEMC provide the regulatory framework within which the NEM operates. Our findings and analysis revealed that these institutions, however, have no role in climate change actions

of the energy sector. This is because climate change action is not made a part of their roles and responsibilities. Their strategic focus is in sustaining a competitive energy market in Australia, without accounting for climate change. From our data analysis we conclude that AEMC, AEMO and AER's objective is to pursue the long-term interest of customers in respect of security, supply, safety and reliability, and price, but does not incorporate an environmental sustainability role. This limited role of industry institutions in implementing national climate change policy in the energy industry indicates the presence of a rigidity trap at industry level. Industry institutions focus entirely on economic reform. ENERGY1 (Market Analyst) explained:

> *No role for AEMO, AER in transformation, they have to be involved. One of their objectives is to protect the long-term interests of consumers. They still don't even see that as being about climate change. It's like somehow, we can have a competitive electricity market in a world of runaway climate change. There's still clearly a big disconnect.*

Furthermore, the energy sector institutions continue to focus on energy security, affordability and efficiency, not climate change. AER's key functional objective is to monitor the spot market and transmission network in order to 'keep the lights on' (AER, 2017). ENERGY4 (Market Analyst) argued that:

> *Essentially the AEMC has a very clearly defined role and a clearly defined objective, which is the National Electricity Objective. Which is to pursue the long-term interest of customers in respect of security, supply, safety and reliability, and price. This role does not encompass an environmental sustainability role, doesn't encompass the social sustainability model, it's purely to work to develop an efficient energy market.*

According to resilience scholars, the loss of functional diversity (decrease in the number of functional groups such as species or business units) and of response diversity

(decrease in the range of responses such as new product offerings and diversification of assets in response to climate change) are reflective of rigidity traps (Elmqvist, Folke, Nyström, Peterson, Bengtsson, Walker and Norberg, 2003). The absence of industry electricity generators association involvement in climate change action suggests the presence of a rigidity trap since there is limited or no response to climate change from the industry associations and this depletes the system's diversity and capacity to self-organise, given the potential influence of industry associations and their coordination role. Since energy sector institutions continue to focus on energy security, affordability and efficiency there is consolidation of coal-driven large-scale production and transmission utilities in the Australian energy sector - a fossil fuel regime.

At government level, we found evidence of a rigidity trap due to the lack of integration of climate change, national energy and economic policies. This is a result of inconsistencies between energy and climate change policies (POLICY1, POLICY3 Senior Government Advisors). POLICY2 further argued:

> *We still talk about climate policy and energy policy as though they're separate spaces. People say, well of course they're related to each other, but they're separate, which seems pretty odd when you think that the energy sector is 60% of Australia's emissions. How can you talk climate change and not talk energy?*

After the July 2016 federal election, the Government attempted to integrate climate change policy and national energy policy through the Council of Australian Governments (COAG) – the intergovernmental body through which national, state, territory and local governments negotiate, coordinate and harmonise the application of their respective powers. In October 2016, the COAG Energy Council commissioned the Independent Review into the Future Security of the National Electricity Market (Commonwealth of Australia, 2016). The review identified the need for an integrated

energy and climate policy and proposed a Clean Energy Target (CET). The CET would have mandated a certain percentage of power be generated from gas and renewable energy to enable Australia to meet its Paris emissions reduction commitments. Furthermore, as part of the orderly transition to a renewable energy regime, CET mandated three years' notice of the intention to close generators. However, CET faced intense criticism within the ruling Coalition party, led by the former prime minister Tony Abbott, for containing new subsidies for renewable energy (Murphy, 2017). Consequently, Prime Minister Turnbull proposed the National Energy Guarantee as an alternative (COAG Energy Council, 2017) that would force retailers to guarantee a certain amount of dispatchable power that can be switched on and off on demand, to avoid outages while also ending subsidies for renewable energy generation after 2020, to bring down electricity prices (Wordsworth, Borrello, and Gribbin, 2017).

Since climate change responses were not integrated with either the national economic policy or the national energy policy, the number of alternative paths for transformation towards a renewable energy regime was reduced. This resulted in a decline in the response diversity at government level, which is characteristic of a rigidity trap.

All these rigidity traps – coal-driven revenue model, application of the energy reliability criterion, low-cost wholesale prices for organisational decision-making (at organisation level), the limited role of industry institutions in implementing national climate change policy (at industry level) and the lack of integration of climate change policy with the national energy and economic policies (at government level) – reinforced the fossil fuel regime through suppression of alternative business models and policies that would favour a shift to a renewable energy regime. The coal-driven revenue model reinforced business-as-usual organisational operations by shifting the

strategic importance away from climate change responses to operational efficiency and low-cost wholesale energy generation, a characteristic of the fossil fuel regime. The separation of climate change policy and energy policy at the macro level and emphasis on energy reliability at the meso level further strengthened the fossil fuel regime.

Scarcity traps in the adaptive cycle

Along with the rigidity traps, research findings also revealed the presence of scarcity traps in the Australian energy sector, preventing its transition to a renewable energy regime. GENTAILER's suspension of investments in renewable energy, reduction in resource allocation for developing new renewable energy technologies, and organisational sense breaking provide evidence of scarcity traps at organisation level.

GEN4 (Corporate Affairs Team Member and GEN6 (Marketing Team Associate Manager) both asserted GENTAILER was struggling to secure capital for large-scale solar development and therefore had decided to halt investments in renewable energy technologies and services.

Furthermore, GEN8 (Company Secretary) reported that there was a significant reduction in human resources in the emerging technologies team and many projects were put on hold due to budgetary restrictions owing to a lack of capital funds available for the development of alternative energy sources and services.

GEN4 (Corporate Affairs Team Member) commented that, since the energy technologies team did not generate any revenue, the business had forgotten them, 'as they were now just the poor cousins of the coal assets'.

Organisational climate change literature reinforces the importance of organisations committing resources such as dedicated personnel, staff training, monitoring and management systems, and funding for innovative projects, research and development, in achieving meaningful responses to climate change (Dahlmann and Brammer, 2011;

Haigh and Griffiths, 2012). The suspension of GENTAILER's renewable energy investments due to the financial allure and claimed reliability of coal generators and reduction in resource allocation for developing new renewable energy technologies are scarcity traps that inhibit GENTAILER's transition to a renewable energy regime.

We also found evidence of organisational sense breaking, i.e. 'the destruction or breaking down of meaning' (Pratt, 2000, p. 464). The addition of major coal generators and renewables to the asset portfolio had led to dissonance within GENTAILER about the nature and identity of the organisation, since it is now a large generator of fossil fuel energy:

> *But internally I guess for many of us it is difficult to justify. We have the solar and hydros, but now we have the really big coal, the largest actually. So, there is that talk about what does this mean? We have now become [one of the largest] coal generation operator across the NEM. Are we a coal generator or a renewable retailer? I am not sure a lot of us are clear on that. [GEN3]*

GEN4 (Corporate Affairs Team Member) commented that internal organisational dynamics had changed due to contradictory targets across different business units:

> *So yeah but there is really a natural and awkward tension, particularly around the solar. We do the solar business and their mandate is to grow, and the impact on the traditional business is reducing consumption. With the solar division who every time they install something is clipping the load from our coal-based generator. Every time we go out and install solar on a customer it is in direct harm to our merchant industry business. It's very tense sometimes because one of the biggest drivers to the bottom line profitability for us is the amount of electricity and gas that our customers use.*

GENTAILER's inconsistent strategic goals (such as providing energy products based on renewable energy and acquisition of coal generators) and changes in the organisational model have led to organisational sense breaking. Westley, Olsson, Folke, Homer-Dixon, Vredenburg, Loorbach, Thompson, Nilsson, Lambin and Sendzimir (2011) assert that organisational sense breaking impedes the transition to a renewable energy model by inhibiting the sharing of resources and networks among organisational members. GENTAILER lacks the resources (capital investment) and trust (among organisational members to self-organise and collaborate) required for business model transformation (scarcity trap). Transformation is driven by social networks of teams and actor groups who draw on various knowledge systems, leadership styles, trust, vision, meanings and experiences to develop a common understanding and governance policies leading to adaptive co-management efforts. Due to organisational sense breaking and intra-organisational tensions the cost of collaboration and conflict resolution is increased, thereby reducing the system's potential for renewal and reorganisation. Richter (2013) and Strunz (2014) highlighted the critical role of industry investments in developing a renewable energy regime. An oversupplied market reduces resources available for investing in renewable energy technologies. This constitutes an industry-level scarcity trap. According to AEMO, there were between 7.5 and 9 gigawatts of surplus capacity in the national electricity market (AEMO, 2017). ENERGY1 noted that, as a result of the oversupplied market, the energy industry struggled to invest in new sources of renewable energy and carbon capture technologies. Warburton (2014), who chaired a review of the Renewable Energy Target, remarked:

> *In a market environment where capacity is already oversupplied and demand may continue to decline it is quite reasonable (and efficient) for no new investment in renewable capacity to occur.*

Furthermore, policy uncertainty and the lack of bipartisan support for national climate change policy represents a scarcity trap at government level, since these factors limit resources for renewable energy development. Scholars have noted and criticised the uncertain and turbulent development of Australian national climate change policy (Curran, 2015; Macintosh, 2015). The uncertain regulatory environment creates investment uncertainty thereby limiting capital flow for development of renewable energy sources. According to ENERGY5 (Market Analyst):

> *… the government attempts to aid in energy transformations have actually made it worse, because of a lack of policy certainty. We had spent years talking about a carbon price and suddenly we had the carbon price. Then we had a really high carbon price, then we had no carbon price. All of that is governments trying to drive through the fence in the energy market and all … all of that has actually, probably made it worse.*

The ensuing uncertainty led to weak investment signals for the renewable energy industry, as GEN1 (a Board of Director) noted:

> *The governments just continue to flip-flop around what are the right policy settings to deal with climate change. The politics of carbon have become so toxic and it's been chopped and changed so many times. I'm told by bankers in this space that no one is interested in lending anymore. That they won't finance projects in this sector anymore.*

GENTAILER also highlighted the negative impact of policy uncertainty in one of its blog posts:

> *We believe the piecemeal introduction of carbon reduction and renewables policies without a long-term commitment has produced unintended consequences for*

wholesale energy markets, as incentives for development and price signals have shifted over time.

Transforming the energy sector requires both long-term planning and a stable and certain policy platform (Kolk and Tsang, 2015). This should ensure that investment decisions do not lock in an unnecessarily high emissions profile, and that the transition takes place in a timely manner (Strunz, 2014). Policy uncertainty and lack of bipartisanship represent a scarcity trap, since they inhibit investment in renewable energy. Due to the resulting lack of investments, the energy sector cannot access enough activation energy during the reorganisation phase (α) to reach a state where positive feedbacks can drive transition to a renewable energy regime. Consequently, GENTAILER and the Australian energy sector are unable to release enough resources to support the creative exploration of new renewable energy products and services.

Discussion

In summary, micro, meso and macro level rigidity traps reinforce the status quo of the existing fossil fuel regime, inhibiting technical, structural and economic changes. The resilience literature notes that rigidity traps create strong self-reinforcing controls, which inhibit the flexibility needed for transformation (Carpenter and Brock, 2008). GENTAILER's use of energy reliability and low-cost wholesale prices as criteria in its decision-making, coupled with the emergence of the generator utility business model, serve as self-reinforcing controls. As a result, GENTAILER has been heavily dependent on using coal and was unable to transform its business model and adopt renewable energy technologies and services. Dependence on reliability standards is an impediment to energy sector transformation since it acts as a cognitive barrier and prevents managers from investing in innovative technologies (Richter, 2013). According to O'Reilly and Tushman (2004), a cognitive barrier is the mental inability of humans to

use information objectively, and it impedes the ability of executives and senior staff to understand the needs of very different businesses. The results of this study suggest that dependence on reliability standards is a cognitive barrier preventing development of new renewable energy products and services, since it leads to continued application of the old measures of success (i.e. economies of scale or production costs per unit) to the new field of renewable energy regime.

At the meso level, lack of industry involvement creates a rigidity trap that represses innovation (Scheffer and Westley, 2007). Transformative technological solutions need the support of structural institutions (Grubb, 2004). Due to the lack of integration of climate change related targets (such as emission reductions under the Paris Commitments) into national energy and economic policies, the incumbent fossil fuel based system is reinforced, since there is no challenge to existing structures of legitimation (e.g. the NEM laws) and market domination (e.g. fossil fuel based generators contribute 45 per cent of NEM generation (AER, 2018)). These rigidity traps prevent transformation (Moore and Westley, 2011) by suppressing a key feature of resilience, namely dynamic interactions. This limits the ability of actors within the system to reorganise their interactions, even when a reorganisation would benefit the provision of ecosystem services to society overall (Gunderson and Holling, 2002). For example, the continued use of the reliability criterion at organisation level prevents the emergence of a new business model.

Scarcity traps at micro, meso and macro levels limit the resources required for developing new renewable technologies to facilitate transition to a renewable energy future. Scarcity traps at GENTAILER created intra-organisational conflict and sense breaking, which can lead to loss of cultural cohesion, social disruption and diminished

adaptive abilities (Limnios Mmouni, Mazzarol, Ghadouani and Schilizzi; 2014). Research findings show that within GENTAILER different business units had contradicting policy positions, were competing internally by vying for the same customer groups, and working towards conflicting short-term and long-term strategic goals.

Evidence of an oversupplied market at the meso level facilitates exploitation of existing operations and processes to maintain the current market share, which leads to repression of new waves of change. Due to policy uncertainty and lack of bipartisan support for a national climate change policy, the weak investment signals for renewable energy created a scarcity trap at government level. This uncertainty deters investment in transformative actions and processes (Kolk and Tsang, 2017). The macro level rigidity traps suppressed the development of renewable sources of energy, leading to reinforcement of coal-based generation. Due to the dominant use of coal for energy production, emissions increased across the National Energy Market in Australia during the study period. More specifically, rigidity traps reduce strategic sensitivity (Doz and Kosonen, 2010) to climate change as they reduce awareness of climate change impacts. In addition, due to intra-organisational conflict, oversupplied market and policy uncertainty, scarcity traps prevent the mobilisation of ideas and resources required for a renewable energy future. At the organisational level, intra-organisational conflict leads to social disruption and loss of cultural cohesion (reduction in ties and connections among organisational members) and adaptive abilities, precipitating a scarcity trap. Organisational members compete over limited resources instead of focusing resources and their energy on developing new renewable technologies and transforming the organisation. The oversupplied market at the meso-level facilitates exploitation of existing operations and processes to maintain the current market share, and leads to

repression of change towards renewable technologies. At the macro-level, policy uncertainty deters investment in new renewable energy generation. Together, these traps at multiple levels reduce resource fluidity, i.e. the ability to reconfigure capabilities and redeploy resources rapidly (Doz and Kosonen, 2010).

Resilience scholars propose that competencies, resources and cultural changes can traverse rigidity and scarcity traps in the adaptive cycle. SES may overcome the rigidity trap through an increase in functional diversity and response diversity, through small-scale differences (experimental policy), and by building buffer capacity through stored capital and redundancies within the system (Fath, Dean and Katzmair , 2015; Winn and Pogutz, 2013). Resilience literature also suggests that SES may escape the scarcity trap through an increase in positive feedbacks i.e. a change or changes in a particular variable, process, or signal that reinforce subsequent changes of the same type. This is facilitated through bilateral (both top-down and bottom-up) information flows throughout the system. Collaboration within and between old and new organisational forms can help to build adaptive capacity by building on learning experiences and using these opportunities to adjust organisational actions and practices (Fath, Dean and Katzmair, 2015).

It is important to stress that transparent and inclusive decision-making processes viewed as legitimate by stakeholders are a precondition for adaptive governance systems to effectively overcome rigidity and scarcity traps (Westley, Tjornbo, Schultz, Olsson, Folke, Crona and Bodin, 2013). Furthermore, the ability to coordinate experiments that contribute to system innovation is of crucial importance in releasing lock-ins and traps, and in enabling transformations to new regimes (Grin et al., 2010). Such ‘systemic experiments’ should broaden the diversity of options, ideas,

organisational settings, and practices (see, e.g., Bormann and Kiester, 2004; Rudd, 2004).

Resilience scholars (Olsson, Gunderson, Carpenter, Ryan, Lebel, Folke, and Holling. 2006; Brown and Westaway, 2011; Westley, Olsson, Folke, Homer-Dixon, Vredenburg, Loorbach, Thompson, Nilsson, Lambin and Sendzimir. 2011; Westley, Tjornbo, Schultz, Olsson, Folke, Crona and Bodin, 2013) highlight the important role of policy or institutional entrepreneurship, and of transformational leadership, for GENTAILER and the Australian energy system to traverse traps by coordinating collaboration, staking out new pathways, identifying leverage points, developing strategies for overcoming barriers, and linking strategies to the specific opportunity context for gaining momentum for change (Westley, Tjornbo, Schultz, Olsson, Folke, Crona and Bodin, 2013).

Conclusion

More than 20 years after climate change was recognised as a critical problem, the energy sector has failed to address it. Indeed, as McKibben (2012, p.8) points out, 'the rule is ever more carbon'. This study sheds light on this very paradox: the fact that climate change, if neglected, would turn into a climate emergency was already clear 40 years ago, yet so very little was done to avert it. Our study addresses the critically important disjuncture between the spectrum of corporate sustainability efforts and the deteriorating state of the planet (Slawinski, Pinkse, Busch and Banerjee, 2017) by exploring climate change inaction. We demonstrate that traps at three levels – organisation (micro), industry (meso), and government (macro) – are antecedents to climate change inaction, preventing the transformation of social-ecological systems for a zero-carbon future.

Scholars have raised concerns that the bulk of current organisation and management scholarship on climate change responses is too narrow, limited by its focus on changes in firm-level and individual-level behaviour (Jermier, Forbes, Benn, and Orsato, 2006; Banerjee 2011, 2012; Wittneben, Okereke, Banerjee and Levy, 2012). They have called for research to focus on the SES within which firms and individuals operate, and on how this system can be mobilised to respond to the environmental challenge. In adopting the framework of resilience and adaptive capacity, this article has analysed the systemic nature and origins of climate change inaction. In explicating the systemic impediments and origins of climate change inaction, the findings of this study may be used to help chart a path forward.

By identifying antecedents to climate change action in the form of rigidity and scarcity traps, we answer recent calls in the literature for multi-level theorising on climate change inertia (e.g. Slawinski, Pinkse, Busch and Banerjee, 2017). The study applies the resilience framework to a dynamic, socially constructed system. In sustainability literature, the occurrence of traps has so far primarily been explained by a lack of adaptive capacity or 'adaptability' (Moore, Olsson, Nilsson, Rose and Westley, 2018; Westley, McGowan and Tjörnbo. 2017). The literature does not explain what entails a loss of adaptive capacity (Boonstra, 2016). This article identifies specific causal factors that erode adaptive capacity, increasing the probability of rigidity and scarcity traps.

It is unlikely that firm-focused actions in corporate sustainability will be able, on their own, to resolve the systemic challenges of climate change (Ehrenfeld, 2005). By using the lens of resilience, this article highlights the systemic and dynamic nature of climate change responses and follows appeals for more systemic empirical research on corporate sustainability (Bansal, Hoffman, Levy and Lichtenstein, 2012; Slawinski, Pinkse, Busch and Banerjee, 2017; Valente, 2010).

The extant literature explains shortcomings in climate change response actions using static external institutional barriers such as the lack of a strong policy framework, policy uncertainty, managerial perceptions of climate change as an opportunity or threat, and managerial preferences (Galbreath, 2011; Okereke and Küng, 2013). Our study identifies meso-level emergent institutions (e.g. the oversupplied market) as an antecedent of climate change inaction.

Our study also responds to the lack of a comprehensive multi-level theory of organisational inaction on climate change that would bring together the antecedents at each level as well as interactions across levels. Dynamic antecedents (e.g., changing or emergent individual attitudes, business practices, and government policies) could explain that inactions operate at different levels, and are also closely interconnected across levels (Hulme, 2009).

The research was limited to one case study subject to one national regulatory regime and investigated over a limited period. Further research could investigate changes affecting SES rigidity and scarcity traps, including changes to firm operation, other energy sector firms and government policy and regulation. Longer periods could be studied.

Future research could also extend our findings by examining how the rigidity and scarcity traps at different levels interact with each other, using a co-evolutionary lens (McKelvey, 1999). An explanation of these interactions can enrich existing literature on climate change inaction and inertia, and inform public policies and regulation.

Furthermore, since the research context represents a shifting landscape due to dynamic changes in the physical environment, national policy framework and market forces, future research could track the evolution of the traps identified in our study.

These findings have significant implications for policy and practice. They serve as an impetus for energy industry organisations and policy makers to work outside their traditional boundaries in order to respond to climate change. They also suggest the need for countervailing public policy that can shape an appropriate environment for mitigating the potential vulnerability of industry actors to rigidity and scarcity traps. This serves the interests of both energy industry actors and the wider community affected by the existential risks of climate change.

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