Incumbents' role in sustainability transitions
- From gatekeepers to bridge builders?

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1. Introduction

The aim of this research is to identify the different roles given to incumbents within transition studies, and to explore possibilities to bring new roles. The study is based on an extensive literature review on theoretical and empirical energy transition research, which theorise upon regime incumbents. I sought alternative theorisations on incumbents' role from field theory (Fligstein and MacAdam 2012; Greenwood et al. 2002) and emerging field studies (Van Merkerk and Robinson 2006, Van Wijk et al. 2013, Lounsbury et al. 2003). I draw on empirical examples from energy transition and energy incumbents, but also other empirical studies on incumbents firms from previous studies.

Regime incumbents are one of the key implementers of transition because they hold extensive resources, both financial and institutional, that are needed to enable a shift towards more sustainable systems. However, precisely due to holding resources and corporate power, and due to the historical development paths, it has been argued that regime's industrial incumbents are responsible for the past decades' emissions, they mainly protect their status quo and mainstream businesses, as well as use defensive response strategies, and thus, have little interest in advancing sustainability shift. This gives incumbents rather change preventing role placing incumbent companies in a position of gatekeepers of transition. Several studies also explain that if regime incumbents start to mobilise their resources to more sustainable solutions e.g. energy incumbents entering solar

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and wind energy fields, it is a result of incumbents' tactics to advance their own interests. As a result, incumbents are perceived to water down the sustainability shift (Voss et al. 2009, Smink et al. 2013, Hess 2016). These studies place regime incumbents into a position of hijackers of transition.

I argue that the contemporary theorisations on regime incumbents within transition studies is too narrow and guide the interpretation towards perceiving incumbents and their activities as a hindrance for transition. Several studies undeniably have shown, especially studies on Germany's energy incumbents, that incumbents have used several defensive response strategies to protect their status quo (see e.g. Kungl 2015, Hess 2016). However, there are also examples of other type of activities e.g. from Spain's energy incumbents' role for deploying wind energy (Stenzel and Frenzel 2008) and UK's energy incumbents role in initiating wind power projects (Geels et al. 2016).

To expand the role of regime incumbents, the studies on how incumbent firms are able to "shape" mature and especially emerging fields, might offer useful theorisations. These studies explains how "incumbents shape emerging fields through influencing standards, certificates and value systems, bridging business boundaries and fields, introducing and legitimising contested organisational forms and technologies" (Apajalahti et al. 2017, p.47). When incumbents enter the novel field they bring legitimacy boost for novel solutions albeit might cut off some of the radicalness of the solutions (Van Wijk et al. 2013), create credibility, bring resources, expand field boundaries, which bring space for new actors as well as form new alliances and collaborations (Apajalahti et al. 2017). These studies show that incumbents are capable of more than reactively respond to change pressures, and are crucial in creatively integrating novel solutions with existing knowledge and activities (Bergek et al. 2013). Applying these results to transition studies, a new role for incumbents could be bridge builders of transition.

2. Previous studies on large energy companies

Amongst transition studies, energy transition is one of the most studied sphere of socio-technical systems, and therefore a variety of studies can be found from this research area. I have revised studies on large energy companies mainly in the European context but also few studies from US context. See the extensive summary of revised studies in Appendix A. I have organised these studies according to four main themes based on the content: 1) energy market liberalisation; 2) challenging renewable energy; 3) influence of energy policies and incumbent's political power; and 4) energy incumbents' business strategies. Several themes

overlap and are discussed in parallel, but the separation of the themes captures the major changes in the energy field from the perspective of energy incumbents.

2.1 Energy market liberalisation

Energy market liberalisation has been the most fundamental change that European energy companies have faced during recent decades (Verbong and Geels 2007). Market liberalisation occurred in different phases in Europe, Finland and Sweden being two of the earliest countries. Market liberalisation was actively pushed by many large energy incumbents because it displayed an opportunity for firm growth (van der Vleuten and Högselius 2012). However, for smaller regional energy utilities, growth was not the main motivation (Ratinen and Lund 2014). Liberalisation caused a sense of upheaval and new skills, for example in electricity exchange operations and product development, were needed.

In Finland, large energy companies went through organisational structural changes as the Electricity Market Act obliged the companies to unbundle, i.e. separate electricity distribution from electricity retail and energy production at least at the book level. This also initiated the opening of the electricity retail market for competition, which led to unbundling electricity retail from production. This meant that electricity retail was liberalised to operate in the new electricity markets but, district heating operations remained local monopolies, as did the distribution operations. Second, market liberalisation ended the local electricity monopolies and brought the market logic to companies, which had operated in the past as public utilities, producing energy for local communities and industrial companies. Privatisation of the energy utilities followed liberalisation, although a large share of the ownership of energy utilities remained at least partially with the state or local municipalities. This has enabled the maintenance of strong social ties between companies and the state and thus the unbundling of interests has remained slow (Ratinen and Lund 2014, Ruostetsaari 2009).

In many European countries, market liberalisation has enabled company growth through international mergers and acquisitions. An example is the rise of the 'Big-4' (E.ON, RWE, EnBW and Vattenfall) energy companies in Germany, which was formed through the integration of eight vertically integrated energy utilities and international expansion (Kungl 2015).

Market liberalisation boosted the development of new contract models, but energy incumbents faced challenges due to their new profit-seeking role. Incumbents had credibility challenges with their 'environmental claim' in developing and launching green electricity

contract models (Wüstenhagen, Markard and Truffer 2003) and even more so, when developing energy saving business concepts (Didden and D'Haeseleer 2003). Didden and D'Haeseleer (2003) argued that energy companies had lost their natural role of promoting energy saving in the liberalised energy market context. In spite of these challenges, Markard and Truffer (2006) found that market liberalisation has increased energy companies' innovation activities, stimulated diverse strategies and new test platforms (e.g. fuel cells). Incumbents have also started to follow each other's activities and imitate successful strategies (Markard and Truffer 2006).

2.2 Challenged by renewable energy

The second research focus area addresses the challenges that large energy companies have encountered when renewable energy has penetrated the markets. Several studies show that large energy companies were initially uninterested, sympathetic but sceptical, or perceived the deployment of renewable energy technologies as a threat (Markard and Truffer 2006, Richter 2011, 2013, Verbong and Geels 2007, Jacobsson and Lauber 2006, Wassermann, Reeg, and Nienhaus 2015, Hess 2016). Many of the studies have a German focus and have been used as an example of energy incumbents' shock and outsiderness to renewable energy markets and small-scale off-grid energy solutions. Mario Richter (2011, 2013) found that initially incumbents did not perceive the solar PV technology and changing customer-user profiles as either a threat or an opportunity. Incumbents were simply more focused on large-scale renewable energy programmes; their high profit expectations, expected return on investment, and their renewable energy portfolio did not match with small-scale renewable energy projects. Furthermore, German energy incumbents believed that distributed energy technologies would stay in niches and a centralised structure would remain dominant: thus the focus was on conventional energy production and distribution (Wassermann, Reeg, and Nienhaus 2015).

Whether renewable energy is perceived as a threat or not is very dependent on the type of renewable energy. Wind energy was initially largely opposed by electricity utilities for being too small, costly and unreliable. Subsequently, however, when the size of wind turbines grew and efficiency improved, it became more attractive to large energy utilities (Markard and Truffer 2006). Large-scale wind farms suited energy utilities' logic and they started to invest in wind. In particular, Spanish and Dutch examples show how regional utilities were engaged in windpower test projects early on (Verbong and Geels 2007), whereas German energy companies initiated wind projects rather late, after several years of both resisting and

lobbying against a feed-in-tariff for wind and early negative experiences of wind technologies (Stenzel and Frenzel 2008). The UK's windpower projects were also initiated rather late but have been largely driven by large utilities (Geels, Kern, Fuchs, Hinderer, Kungl, Mylan, Neukirch, and Wassermann 2016).

While renewable energy might have been perceived as a threat for incumbents, this is not necessarily unique for renewable energy technologies. Markard and Truffer (2006) remind us that combined cycle gas turbines were also once seen as unreliable and not cost efficient enough, and thus a threat to the profitability of coal and nuclear energy. In addition, nuclear power technology was seen as alien to energy utilities for two reasons: the familiarity of fossil-based production and also its substantially high capital costs. Common to the diffusion of new energy technologies has been that governments' support has been fundamental in the deployment of such technologies (Markard and Truffer 2006). Renewable energy technologies are no exception. Several of the reviewed studies on large energy companies combine an analysis of the challenge of renewable energy with an investigation of policy incentives for renewable energy deployment. This is discussed in the next research focus area.

2.3 Influence of energy policies and incumbents' political power

Several studies focus on the linkage between political governance and large energy companies. Large and old corporate actors often have close linkages to political actors, the energy (or industrial) elite and institutions, which have enabled the growth of corporate power and tend to sustain the stability and status quo of large corporations (Kungl 2015, Ruostetsaari 2009). On the one hand, energy policies and incentives such as feed-in-tariffs (FITs) have shown to be quite effective for improving the deployment of renewable energy, creating political pressure for change, and reducing the asymmetry of power between large energy companies and smaller energy market entrants, at least temporarily (Kungl 2015, Jacobsson and Lauber 2006, Geels et al. 2016, Stenzel and Frenzel 2008). Germany is a great example of how the implementation of FITs in 1990 began to slowly whittle away at energy incumbents' entry into renewable and distributed energy markets by restricting the benefits energy incumbents received through demarcating incumbents' ownership of renewables (under FITs) up to 25% (Jacobsson and Lauber 2006, Stenzel and Frenzel 2008, Geels et al. 2016).

On the other hand, due to incumbents' privilege in institutional settings and governance, large energy companies have political power. Thus they are able to influence policy initiatives

through direct lobbying and indirectly influence policy processes, for example through engaging in political working groups or even raising lawsuits (Jacobsson and Lauber 2006, Hess 2013, 2016, van der Vleuten and Högselius 2012, Wassermann, Reeg, and Nienhaus 2015, Kern and Smith 2008, Bosman, Loorbach, Frantzeskaki and Pistorius 2014). As a continuation of Germany's FIT case above, energy incumbents realised the FITs' effects only after wind turbines became competitive and started to be diffused. Several energy incumbents protested against the FITs, refused to pay FITs or purchase wind farms' electricity for their grid, which were later resolved in court cases (Stenzel and Frenzel 2008). Another example of corporate political power is found in David Hess's (2013, 2016) study on the spread of the distributed generation of solar power, which took off in the US alongside the introduction of net metering, and soon after third-party ownership took a market lead. Incumbents perceived a money flow out of the energy sector and began to test a range of strategies to slow down the growth of distributed solar generation, for example by initiating campaigns and influencing regional energy policies in order to gain favourable regulations but also by launching their own solar energy development programmes (Hess 2016). Sandra Wassermann, Matthias Reeg and Kristina Nienhaus (2015) found that energy incumbents were pushing to integrate the renewable energy trade with mainstream markets, whereas new entrants tried to promote direct marketing. To integrate the renewable energy trade with conventional markets would have required skills in trading practices, which new entrants did not have. Another example of incumbents' political power is Florian Kern's and Adrian Smith's (2008) study on a Dutch energy transition project, in which the Ministry's focus was on business opportunities. Energy incumbents were able to hijack the open platform, which was developed to enhance the energy transition.

As the above studies show, the influence of policy on large energy companies and incumbents' use of political power have similarities across different studies. Often, first, a new policy initiative (to direct activities, change or reduce the power of incumbents, for example FITs) is introduced, second, the incumbents employ resisting tactics as a countermove and third, the policy initiative is modified to fit better with energy incumbents' operations, and thus the policy gets watered down (Hess 2013). However, implementing policy initiatives also often generates contradictions that cause cracks in dominant coalitions, and space for new coalitions is formed. An example of this is found in the study by Rick Bosman, Derk Loorbach, Niki Frantzeskaki and Till Pistorius (2014) on the discussion on a coal tax in the Netherlands. A new coalition to promote the tax was formed by energy incumbents who use natural gas, and by environmental NGOs. Indeed, previous studies show that if powerful energy utilities become strategically motivated in promoting new technologies it creates a legitimacy boost for renewable energy. An example is Spanish Iberdola, whose subsidiary began to develop wind turbine components and managed to

create a strong market share and develop national wind markets (Stenzel and Frenzel 2008). In the following, the focus is turned to energy incumbents' new business strategies.

2.4 Energy incumbents' business strategies

The fourth research area focuses on how incumbent energy companies have entered the renewable energy market, and developed new business models and growth strategies. Energy market liberalisation set energy incumbents to compete in electricity markets. Many of the incumbents transformed from local monopolies into multinational energy corporations (Ratinen and Lund 2014), resulting in business development and R&D becoming one of the major development areas for energy incumbents. Directly after market liberalisation, competition was centred on price competition, which diminished the profit margins. The first new business models had several pricing options, for example spot-priced contract models, but soon after 'green contract models' were introduced and energy utilities began to diversify their product portfolios. Energy companies developed environmentally friendly concepts such as contract models, based on earmarked renewable electricity purchased from the electricity exchange, or hybrid solutions consisting of integrated contract models that included, for example biomass, wind, solar and hydro power (Bird, Wüstenhagen and Aabakken 2002). However, the slow opening of the market and the partial nature of liberalisation, as well as high entry barriers in some regions, slowed down the development of green products (Bird et al. 2002).

Thus, the first contract models did not necessarily influence the energy production of energy incumbents. Increasing the use of biomass and forming collaborative wind parks were the first business strategies to increase the use of renewables, and they fit well with the energy incumbents' production logic, i.e. large-scale efficiency and compatibility with burning fossil fuels (Vergbong and Geels 2007, Geels et al. 2016). The distributed generation of solar energy turned out to carry a different logic.

Van den Buuse (2009) studied the business strategies of large globally operating European energy companies, both oil and gas as well as electricity and heat companies. Energy companies used different strategies depending on their core field of business (Van den Buuse 2009). For example electricity utilities entered the solar PV business (2005-2007) when solar energy showed signs of becoming economical in electricity production, whereas oil and gas companies were already involved in the mid-1980s in developing and commercialising solar technology (Van den Buuse 2009). Whereas oil and gas companies had established subsidiaries specialised in solar technologies, electricity providers could vertically integrate renewable energy production into their value chain. Boscherini, Chiaroni, Chiesa, and

Frattini (2012) (2012) found several business strategies of Italian energy incumbents to integrate renewable energy into their business. The strategies to integrate renewable energy varied from strategic involvement that positioned solar energy as strategic, but outside the core business, to developing renewable energy as a core business (Boscherini et al. 2012). They found that, typically, if renewables had a complementary role, energy incumbents established new business units, formed collaborative projects with research institutes and acquired or constructed renewable power plants. If renewables, for example solar energy, were seen as a core (future) business, incumbents established new spinoffs or integrated renewable energy into older spinoffs through which new external partnerships were sought and solar energy solutions were developed, monitored and assessed (Boscherini et al. 2012).

However, strategies to integrate renewable energy into incumbents' business strategies have exhibited great regional differences. For example German energy incumbents initially ignored business opportunities (Richter 2011, 2013) and then worked to resist renewables (Kungl 2015). Thus, several studies show contradictory results on incumbents' activities. This is partly due to historical, societal and geographical differences (Ratinen and Lund 2014) but also because during market transformation, companies might act in a self-contradictory manner. Hess (2016) suggests that energy incumbents acted inconsistently by simultaneously resisting distributed generation of solar energy, which allowed new actors (third-party ownership agreements) to enter the field, and by simultaneously trying to gain a competitive position in solar energy by purchasing smaller solar energy providers and setting up corporate-internal divisions. In addition to the variety of contexts and external conditions shaping incumbents' responses to renewable energy, firm-internal factors such as resources, capabilities and priorities might also lead to different strategies. Energy incumbents have a strong position in developing new energy solutions as Meadowcroft (2009) notes, they "enjoy huge advantages including pre-established infrastructure, relative ease in obtaining finance and insurance, developed networks of suppliers, familiarity to customers, embedded technical standards and training routines, and a tight 'fit' with existing regulatory approaches" (p. 329).

2.5 Summary

Many of the revised studies have a regional focus on one country or draw comparisons between a few countries. There are a few reasons for this: energy systems and energy policies vary to a large extent between countries, there are differences between energy histories and different countries' natural resources; for example coal was considered Germany's national

resource (Pahle 2010). Most strikingly, energy incumbents' activities and strategies have varied significantly, even after market liberalisation and integration attempts by the EU.

The business development of energy incumbents in the field of renewable energy has two aspects. On the one hand, energy incumbents' engagement in renewable energy gives the signal that the technology in which they invest has developed and became so cost-efficient that even market leaders who control the mainstream markets, which the new technology might disrupt, are becoming involved. This gives a credibility push to novel solutions. On the other hand, as many energy researchers have noticed, "the dominant organizations in an industrial field tend to absorb the challenging technological models, but in the process they also transform the designs to make them more compatible with the existing technologies and products favoured by the incumbents" (Hess 2013, p. 849). Therefore market transformation is more likely to be influenced by large market actors than communities and niche innovators due to incumbents' countervailing corporate power (Hess 2013, Smink et al. 2013).

The involvement of energy incumbents is often framed as 'hijacking' the energy transition. Due to incumbents' political power and their ability to mobilise their resources to modify markets and protect their benefits and the status quo, incumbents are perceived as watering down the energy transition. This is especially evidenced through the German example of the decline of the 'Big-4' energy companies and their multiple attempts to resist, for example feed-in-tariffs (Kungl 2015). Indeed, the German case is a special one and interesting as the incumbents' decline is particularly severe. It seems that the studies from Germany have coloured the interpretation of the role of incumbents in energy transition. There are, however, more positive examples of energy incumbents' involvement. For example Spain's example of wind power (Stenzel and Frenzel 2008) shows how energy companies were forerunners of the deployment of wind power. Also in UK, energy incumbents have played an important role in wind power deployment (Geels et al. 2016). Several European energy incumbents have now begun to develop new business models on renewable energy, finding solutions that bridge mainstream markets and more sustainable ways of producing energy. The diversity of incumbent responses suggests the need for more studies on energy incumbents' organisational structures, which keep these large players attached to mainstream ways of producing energy.

3. Incumbents within transition studies

While I acknowledge that there are several theoretical perspectives within transition studies, I analyse two most widespread theoretical apparatuses from the industrial incumbents' perspective. I focus on how industrial incumbents are expected to behave during transition, and especially how their scope of action i.e. how they main stability of regime and how they engage in the change of regime. These two apparatuses or frameworks are 1) multi-level perspective (MLP) and MLP based transition pathways developed by Frank Geels and Johan Schot (2007), and more recent framework of industry destabilisation called triple-embeddedness framework (TEF) developed by Bruno Turnheim and Frank Geels (2012, 2013).

Within socio-technical transition studies, incumbent organisations are mainly seen as stable, large and dominant actors who control, maintain and reproduce the socio-technical regime. Therefore incumbents are core regime actors that maintain the stability of a regime and industry hegemony because the current configuration of the markets, industries, institutions and activities benefit them. However, as there are many different kind of transitions, which can unfold different transition pathways, also industrial regime actors have different scope of action. In Table 1, I summarize the five different pathways developed by Geels and Schot 2007 (see also other typologies for transformation e.g. Smith, Stirling and Berkhout 2005).

3.1 MLP and pathway typologies

Table 1. Five transition pathways (Geels and Schot 2007) and envisaged incumbents' actions.

Pathway typologies	Description	Incumbents' role/ activities
"zero-proposition" on stability and reproduction	No external landscape pressures. Niche-innovations are not visible. → Regime is dynamically stable and only reproduction occurs	Socio-technical landscape reinforces and stabilises the regime activities. Incumbents in the regime have normal competition, development projects and incremental improvements within stable rule-sets. Type of incumbents' actions: "business-as-usual"
Transformation	Moderate landscape pressures. Niche-innovations exist but are not developed enough. → Regime is modified	Landscape exerts pressures on regime activities. First incumbents respond by neglecting pressures and then reorienting their activities. Incumbents use adaptive capacity, incorporate some external knowledge and the

		symbiotic character of niche-innovations adds to the regime and does not disrupt the basic architecture. Type of incumbents' actions: "organisational reorientation".
De-alignment and re-alignment	Divergent, large and sudden landscape changes. Multiple niche-innovations co-exist and compete. → Regime destabilises	Landscape exerts much pressure, regime rules destabilise and increasing regime problems cause incumbents to lose faith, resulting in regime de-alignment and erosion. Incumbents are unable to reorient for they do not see how to respond to pressures and thus, do not defend the regime. Type of incumbents' actions: "organisational decline".
Technological substitution	Much landscape pressure. Niche-innovations are radical and well developed. → Regime is replaced, niche-innovations breakthrough	Landscape pressures are strong but the regime is stable. First, regime actors think that problems can be solved and neglect niche-innovations. Then, landscape pressures intensify (possible shock) and create a sudden disruption; niche-innovations fill the rupture and replace the old technology. Type of incumbents' actions: "organisational disruption".
Reconfiguration	Landscape changes gradually. Niche-innovations are symbiotic. → New regime grows out of old one. Regime changes gradually.	Regime actors adopt niche-innovations, which leads to gradual change in regime. New technical solutions are further explored and combined with existing solutions by incumbents. Changes by incumbents influence the landscape, which starts to generate more pressure for further changes. Type of incumbents' actions: "organisational turnaround".
Combination of above five pathways	Examples of combinations: 1) moderate landscape pressure and regime adjustment (transformational), 2) landscape pressures increase, symbiotic niche-innovations, further regime adjustments (reconfiguration), 3) landscape pressures become critical, regime adjustment is insufficient. Niche-innovations are well developed and radical (technological substitution), OR 4) several 'weaker' niche-innovations co-exist	First, incumbents neglect landscape pressures or modestly adjust their activities. Second, if the adjustments are not sufficient and landscape pressures intensify, incumbents start to adopt symbiotic niche-innovations as add-ons. Third, if landscape pressures intensify, the regime starts to change, incumbents run into serious problems and "lose faith" in their response possibilities. If niche-innovations are simultaneously well developed and disruptive, incumbents' technologies are substituted and incumbent organisations experience drastic decline. If multiple 'weaker' niche-innovations occur and compete, incumbents might have time to re-align and diversify their activities in a rapid turnaround process. Type of incumbents' actions "organisational disruption" or "organisational turnaround"

	and compete (De-alignment and re-alignment)	

The five transition pathways provide incumbents and their activities different types of agency. The scope of actions available for incumbents within the pathways depends on the type of relationships between the regime and landscape levels as well as the regime and niche levels. Depending on the congruence of landscape pressures and the degree of development of niche-innovations, transition pathways are different. Therefore, the landscape and niche levels are seen as forces that govern and influence the regime incumbents' actions. It is either changes in the landscape or/and the maturity of the niche-innovations, which drive incumbents activities. This does give a rather passive flavor for incumbents' activities.

3.2 Industry destabilisation

Since development of MLP framework, more recent transition studies has shifted their attention to delving deeper into the regime level. Geels (2011) responded to the criticism addressed towards the three levels' hierarchical character and lack of agency by defining landscape and niche levels as 'derived concepts' that forms the scene of action and change for regime actors.

Based on three case studies by Turnheim and Geels (2012, 2013) and Penna and Geels (2012) the authors developed a new framework for the 'destabilisation of the industrial regime' in order to analyse the potential decline of existing industrial regimes, how a regime changes and how dominant actors in the regime gradually diminish their grip. Turnheim and Geels (2012) describe the destabilisation as a longitudinal process in which both external pressures, especially institutional and economic pressures, and endogenous enactment of regime actors shape the regime, and thus the reproduction of core regime elements is weakened (see Figure 1).

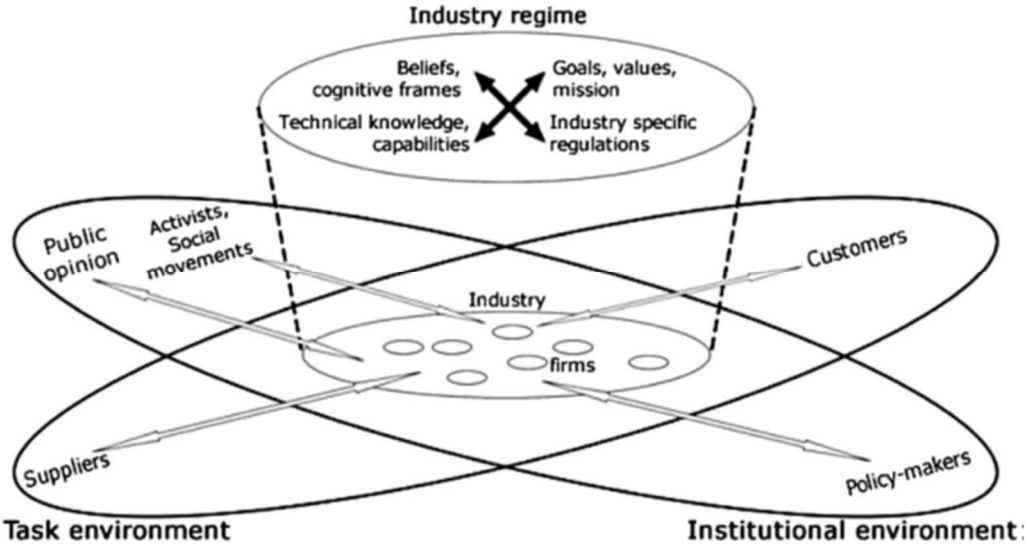

Figure 1. Triple embeddedness framework (TEF) of industries (Penna and Geels 2012, p. 1002).

The TEF framework place incumbents into a more constructivist position where incumbents have also their own development processes that can initiate change and also influence the two environments where incumbents are embedded. In the above figure, the arrows connecting exogenous environments and the industrial regime are bidirectional, which means that regime actors respond strategically to the external pressure.

The industry destabilisation occurs when "increasing external pressures weaken the performance of industries... sustained performance problems lead actors to question the regime's viability, ultimately leading to weakening commitment and destabilisation" (Turnheim and Geels 2012, p. 38). The authors describe the destabilisation process as an evolving iterative process of increasing mismatch between external environment pressures and endogenous enactment, which in the end leads to a situation in which industrial actors gradually lose faith in the existing regime.

In the TEF framework, regime incumbents are seen as respondents to changes in the external environment. Although regime actors are given the possibility of shaping the external environment, the change occurs only when the organisational response is not sufficient for tackling pressures. This gives the regime incumbents rather reactive role. However, the TEF framework is a fruitful theorisation to develop more plural picture on the role of incumbents within transition. To develop more active role for regime incumbents and follow the "shaping" aspect that the TEF framework hints to, I will next turn to field literature and more recent innovations studies on incumbents that already have the potential to contribute to more active role of incumbents.

4. Search for new theoretical perspectives from field literature and recent innovation studies

4.1 Incumbents in field studies

The transition literature was not developed to focus on power and agency as an outset, and thus, field theory helps to incorporate these elements. I broadly label this stream of literature as field theory, which is an established research paradigm in American sociology, but I also draw on related studies from institutional theory that address organisational fields and their relationship with large established actors, as well as studies on emerging fields. Fligstein and MacAdam (2011) built on the notion of fields as arenas of conflict that comprise actors with different power and resource balances. In mature fields, actors mobilise their resources strategically but are bound to the stabilised set of field rules, and field membership is an advantage recognised by other field members (Fligstein 2013). Fligstein's and MacAdam (2013, p. 41-42) define incumbent actors as "powerful organizations or groups which have the necessary political or material resources to enforce an advantageous view of appropriate field behavior and definition of field memberships on other groups".

In a mature field, incumbent organisations use their power to defend their position and during market transformations, invaders are more likely to introduce novel field conditions and rules. Fligstein's theorization carries the similar relational aspect on incumbents vs. market entrants as does the transition studies on incumbents vs. niche actors. What new can the field theorization bring to transition studies is that it makes the power differences between various sorts of actors, more explicit. It reduces the (analytical) hierarchical levels of MLP (landscape, regime, niche), thus making the relationships between various actors more explicit.

Fligstein and MacAdam (2012) conceptualise fields as strategic action fields, whereby skillful actors try to strategically influence other field members by mobilising their power and various resources. Strategic action fields (SAFs) are linked to other strategic action fields, in a layered manner, which Fligstein (2013, p. 41) describe as the 'Russian doll' metaphor. Fligstein and MacAdam's theorisation includes hierarchical elements between different strategic action fields, whereby more powerful actors exercise power over less powerful ones.

The benefit of using the field literature is the explicit focus on field rules and conditions that are shared by field members. Field members are able to modify and shape field rules even

within mature fields (see e.g. Royston Greenwood's, Roy Suddaby's and Bob Hinings's (2002) study on five large accounting firms), but especially when a field is going through transformation. The field rules and conditions are constantly negotiated and due to power differences and the benefits gained by incumbents from contemporary institutions, the large actors have a better position in negotiating conditions that favour them. Moreover, when a new field is emerging, the field rules are in flux and susceptible to the influence of powerful actors, who can easily mobilise their resources. Fligstein and MacAdam called these "powerful outside actors" (2012, p. 99). Powerful outside actors can modify the resources available to new emerging fields and shape new fields' rules and conditions. Whereas for example many innovation studies see incumbents, when confronted with radical innovations, as those who lose the game, in Fligstein's strategic action fields, incumbents rarely lose their position.

It is worth noting that in Fligstein's theorisation, fields are constantly in motion, even the mature and stable fields: "fields are socially constructed arenas within which individuals or groups with differing resource endowments vie for advantage" (Bourdieu and Wacquant 1992, in Fligstein 2013, p. 41). For incumbents this means a constant struggle for a dominant position, interpretation of other actors' moves within a field and reproduction of the rules that benefit the value of the incumbents' resources.

The normal, everyday jockeying of field activities such as incremental strategic adjustments and changes in field members' relationships is the source for subtle change. Often, small adjustments within a field are difficult to observe and it is even impossible to predict the direction of change. But it is precisely in the invisible, subtle and often creeping character of these steps where the power of endogenous change is located. The small adjustments might generate, in time, large-scale changes that can be more durable than that which an exogenous crisis might bring. Fligstein and MacAdam also acknowledge the possibility of drastic "external" shock but those are rare occasions.

Greenwood et al.'s (2002) case example on five big accounting firms mibolising change within organizational field showed how these incumbents introduced a contested novel organisational form. These firms had central position within a field and solid linkages to other organizational fields, which they used to bridge field boundaries. Moreover, because of their vision over various fields, they were first to observe the emerging opportunities stemming from their big clients' needs, but also having close linkages to industry association, which they used as political resource, allowing these five firms to shape field's boundaries and common standards (Greenwood et al. 2002).

Few other case examples on incumbents in mobilising change is Van Wijk et al. (2013) study on development of sustainable tourism certificate, Lounsbury et al. (2003) study on emergence of US recycling field and Van Merkerks and Robinson's (2006) case on how lab-on-chip technology became legitimate technology. In Van Wijk et al. (2013) study incumbent tour operators shaped sustainable tourism movements' discourses and certifications for the field, which strengthened the movement but as a downside incumbents brought into discussion a concern over commercial feasibility and the lack of consumer demand, which diluted the radicalness of the certificate. In Lounsbury et al. (2003) study it was only after large solid waste conglomerates commercialized a new recycling business, that recycling materials became a valued material, which was built upon non-profit associations' lengthy education efforts for sorting waste within households. In Van Merkerk and Robinson's (2006) study new Lab-on-a-chip technology gained a legitimacy boost only after a group of traditional microreactor actors took it in their technology development program. "In summary, incumbents shape emerging fields[but also mature fields] through influencing standards, certificates and value systems, bridging business boundaries, introducing and legitimising contested organisational forms and technologies" (Apajalahti et al. 2017, p. 47). Apajalahti et al. define field shaping as "an ongoing interactive process of mobilising organisational business and discursive activities directed at influencing field definitions, boundaries and conditions". Furthermore, as the case studies introduced above show, when incumbents start to become involved and shape the emerging field, it gains a boost – but as a trade-off may lose some of the radicalness of the novelty in the process.

To conclude, field theory places incumbents in a dominant position within a mature field. Actors within a field have different resources and a power imbalance. However, actors' positions are not stable, but incumbents as well as other actors within a field need to constantly adjust their activities in response to other actors' activities. These adjustments are not just the source of reproducing field rules but also of field change. Although positions are renegotiated, due to resource and power dominance, incumbents rarely lose their position. Incumbents also often have close relationships with the state field, which is a mutually beneficial relationship. Another source of field change is changes in state or proximate fields. Due to their position, incumbents often have good prospects in other fields and, thus, are prepared for changes.

4.2 Incumbents in innovation studies

Innovation studies have a long tradition of being interested in the relationship between firm type and innovations activities. Innovation studies on incumbents, which are often referred to as well-established, large and old or monopolistic corporations, were originally concerned about how incumbents survive when facing radical innovations. The traditional juxtaposition between incumbents and challengers/market entrants/pioneering entrepreneurs, which is often dated back to Schumpeter, is especially prevalent within innovation studies. Whereas early innovation studies on incumbents focused on the survival of incumbent firms, the later studies focused on the changes in incumbents' performance during technological transformation and their role in different phases of the technological development cycle (Anderson and Tushman 1990).

The focus also shifted towards explaining the performance of incumbent firms and the influence of incumbents' assets and capabilities (see e.g. Rothaermel and Hill 2005, Hill and Rothaermel 2003) as well as value networks (Christensen 1997, Christensen and Rosenbloom 1995). However, question of whether incumbents survive radical or disruptive innovations is still persistent. For example, Clayton Christensen's (1997) famous book "The innovator's dilemma", as well as Christensen's and Rosenbloom's (1995) article on attacker's advantage, argue that incumbents are more likely to introduce disruptive innovations and retain their dominance within industries as long as the innovations are compatible with the value networks where the incumbents operate.

More recent innovation studies on incumbents are inclined to demonstrate that incumbents do have a more pluralistic role in the introduction of novelties within specific market contexts (see e.g. Bergek et al. 2013, Fuentelsaz et al. 2014, Dyerson and Pilkington 2005). These studies show an increasing amount of evidence on the ability of incumbent organisations to maintain their market position and build new business around novel, even radical technologies (Hill and Rothaermel 2003, Bergek et al. 2013, Fuentelsaz et al. 2014, Sood and Tellis 2011). Incumbent's success has been largely explained by their strong complementary resources, which generally refers to services, customer relationships, networks and contracts in the value chain. The value of complementary assets for incumbents depends on the market context (Fuentelsaz, Garrido, and Maicas 2014), and complementary assets are often mobilised in areas close to the incumbent's current expertise and continue to be developed during technological shifts (Dyerson and Pilkington 2005). The ability to use their long-developed complementary assets and constantly improve and reaim these resources gives incumbents a strong basis to act during technological shifts. In addition, incumbents' strong financial resources enable incumbents to endure long

development periods and invest in R&D to gather new knowledge and experience on the novel technology, which helps them to perform better during technological shifts (Hill and Rothaermel 2003, Jiang, Tan, and Thursby 2010). Typically, new market entrants have little access to this type of complementary and financial resources (Dyerson and Pilkington 2005).

Bergek, Berggren, Magnusson and Hobday (2013) challenge the traditional explanations and underlying assumptions on why incumbent firms are observed to have difficulties in responding to competence-destroying and competence-enhancing discontinuous technological change. They argue that previous literature on discontinuous technological change and radical innovations over-assumes the power of new entrants to disrupt the existing system and under-values the power of large incumbents to integrate new innovations and technologies into their existing operations. Using the concept of 'creative accumulation' Bergek et al. (2013) try to capture the innovating capacity of large incumbent organisations and especially argue that incumbents are important integrators of old and new technologies. Berkeg et al. (2013) show in their cases how new entrants were not successful and how large incumbent firms still struggled with organisational continuity. Bergek et al. (2013) observed intense competition among incumbents prior to discontinuous technological change, which leads to intense 'shakeout' in the industrial field whereby some incumbent firms absorbed and integrated new knowledge and technology into their 'existing capacity'. To conclude, these more recent innovation studies on incumbents bring more pluralistic role for the large industrial actors during technological change.

5. Discussion

5.1 Summary of the literatures

In this section, I reflect on what conceptual and theoretical insights these literatures offer in understanding incumbents' activities within transition. I then identify three different (but closely linked) roles on incumbents based on the theoretical insights especially on what kind of action is expected from incumbents. But first, Table 4 provides a summary of the introduced theoretical perspectives, with a focus on how incumbents are perceived to maintain stability and contribute to change.

Table 4. Summary of the literatures with respect to incumbents' roles in stability and change.

Literature stream	Approach on incumbent actors	How incumbents maintain stability and engage in changes
Socio-technical transition	Incumbents are regime actors who reproduce the regime.	Stability: Incumbents dominate the regime, maintain regime rules, are path dependent and protect their advantages. Change: Incumbents adjust/change their activities by responding to landscape pressures and niche activities. Reorientation/regime destabilisation occurs if landscape pressures and niche-innovations are well developed simultaneously, threaten incumbents' activities and earlier incumbent responses have been insufficient. There are different type of organisational change involved: business-as-usual, reorientation, decline, disruption and turnaround but change is initiated through external pressures either form landscape or niche. Therefore, incumbents are more reactive and do not initiate change. There is a possibility of displacing incumbents in radical change.
Field theory	Incumbents are dominant field actors who engage in constant jockeying to maintain their position and restore their valuable resources.	Stability: Incumbents protect their status quo and only rarely lose their position. Incumbents have superior power and resources as well as close relationships to other fields, which enable the maintenance of stability. Change: Incumbents' change rise through subtle, everyday jockeying in the field through, e.g. adopting best practices from other field members/other fields. Incumbents can form a powerful outside group that invades a novel field. In turbulent field changes, incumbents rarely lose their position because they have close relationships with proximate field around them. However, change is proximate fields might cause exogenous change. There is also a possibility for rare macro crisis occur. Therefore, incumbents change constantly through endogenous processes. They have close relationships with other fields

		and state. Incumbents rarely lose their position.
Innovation studies on incumbents	Incumbents adopt small piecemeal changes through incremental and competence-enhancing innovations. Incumbents protect their market share.	Stability: Incumbents maintain their market share by constantly improving their technologies, products or processes through incremental innovations. Change: The literature offers two approaches to change. A) Incumbents' market share is threatened by competence-destroying innovations (or disruptive innovations) that are normally introduced by new market entrants. Thus, change is introduced by market entrants and incumbents are assumed to lose market share. B) Incumbents are capable of creatively integrating even competence-destroying innovations with their existing activities. Incumbents are more likely to develop new dominant designs than market entrants. While market entrants might bring novelties to markets, incumbents are able to introduce wider-scale change. The possibility of A follows the traditional perspective on incumbents facing radical innovations. These are however rare occasions. The possibility of B follows more recent studies and gives incumbents more multiform role in change.

I argue that many of the theoretical perspectives I have brought together overemphasise incumbents' resistance to change and undervalue incumbents' ability to actually integrate even radically novel technologies with their existing activities, and, moreover, undervalue the wider 'positive spillovers' for the field development. It is perhaps the case that much of the discussion has focused on the early stages of introducing radical or disruptive innovations, and because of this, the potential for involvement by incumbents has gained less attention. Therefore, as much as incumbents have power and resources to resist change, they could mobilise exactly these to change the field.

Dynamics of transition, the underlying assumptions concerning agency in the literature, and more specifically concerning the role assigned to incumbents needs further qualification. Many of the transition studies see regime actors as responsive by their very nature. In

conceptualising transitions, much emphasis has been placed upon political and other 'landscape' forces that are expected to put pressure for change on regime actors. Another source of pressure is expected to come from specific niche actors in the form of introducing niche innovations that are expected to put pressure on regime actors by competing with mature technologies, processes and/or products. Although the above description is a highly simplified version of regime dynamics, it illustrates what kind of agency has been given to regime actors.

More recently, Turnheim and Geels (2012) raise the issue that in the process of destabilisation, regime actors do influence, for example policies, customers and public opinion (see Turnheim and Geels 2012). Additionally, Penna and Geels (2012) explicitly focus on dialectical interactions between endogenous and exogenous processes, and the related framing struggles. In spite of the above mentioned interaction dynamics, regime incumbents are seen principally as responding to the economic and institutional environment. This view makes visible only the tip of the iceberg of regime actors' activities and does not adequately show how incumbents not only influence but also shape the 'environments' in which they are embedded by mobilising their power and resources. This shaping aspect might offer a fruitful path to follow in future research.

5.2 Incumbents roles – gatekeepers, hijackers or bridge builders

Based on the theoretical perspectives, I have constructed three roles for incumbents that are currently persistent or emerging in the above introduced literatures. These are gatekeepers, hijackers and bridge builders. These specific roles can vary in different cases and incumbents might adopt different roles in different issues that the organization is facing. These roles are more as an illustrative roles, which hopefully evoke discussion on how we, as transition scholars, perceive regime incumbents and what kind of roles and spheres of action we give to incumbents, and whether there is room to expand or widen our perspectives.

Gatekeepers

Gatekeepers role is based on the idea that incumbents have so much power and resources that they get to regulate what kind of change occur, who implements the change and letting through only those ideas and actors who does not threat incumbents' activities. Therefore, gatekeepers hold the gate by defining who is allowed to go through, on what premises and turning down the potential threats of challengers. This refers to incumbents' highly protective behaviour and

lobbying activities. The German example fits well to this role (see e.g. Jacobsson and Lauber 2006, Stenzel and Frenzel 2008, Wassermann et al. 2015, Kungl 2015, Geels et al. 2016).

Hijackers

Hijackers' role refers to incumbents who takes in to develop even new and radical technologies but simultaneously blocks other actors from markets and purchase smaller challenging competitors only to slow down the change. Hijackers also might enter new business areas to use their power to water down the most drastic change that potentially would occur unless incumbents interfere the situation. Thus, hijackers simultaneous develop their own activities and slow or water down other developers activities. This role is implicit in several sustainability oriented studies where incumbents are seen the main problem in both terms, in social justice and environmental sustainability. However, the description given to hijackers' role is an extreme and rarely as fierce. There are few studies that have these elements (see e.g. Kern and Smith 2008, Voss et al. 2009, Smink et al. 2013, Van Wijk et al. 2013, Hess 2013, 2016).

Bridge builders

Bridge builders' role is actually closely linked with the hijackers' role but it is about "reading" incumbents activities differently, and realising the shaping potential that incumbents can offer. Bridge builders are incumbents who actively seek links between their contemporary/mainstream activities and new business opportunities. Bridge builders are well aware the direction of change and want to be included because of seeing the potential of new solutions and the ways in which incumbents can contribute to it. Bridge builders literally build bridge between mainstream infrastructure, resources and contemporary ways to operate with new technologies, solutions and novel ways to operate. Field studies and more recent innovations studies give insights for this role (see e.g. Greenwood et al. 2002, Lounsbury et al. 2003, Dyerson and Pilkington 2005, Van Merkerk and Robinson 2006, Sood and Tellis 2011, Van Wijk et al. 2013, Fuentelsaz et al. 2014, Apajalahti et al. 2017 and most importantly Bergek et al 2013 on 'creative accumulation' of incumbents).

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APPENDIX A Summary of previous studies on large energy companies organised under four different themes: 1) energy market liberalisation; 2) challenging renewable energy; 3) influence of energy policies and incumbent's political power; and 4) energy incumbents' business strategies.

Reference	Relevant research focus	Main findings relevant for studying large energy companies
Energy market liberalisation		
Gregor Kungl (2015) Stewards or sticklers for change? Incumbent energy providers and the politics of the German energy transition. Energy Research & Social Science, Volume 8, Pages 13–23	Loss of market share of Germany's Big-4 incumbent energy providers (Big-4): E.ON, RWE, EnBW and Vattenfall. Field of electricity supply Historical 1998-2013 Energy market liberalisation Challenging renewable energy Energy policy incentives & Energiewende	Germany's big-4 decline has four sources. 1) Energy market liberalisation (EnWG) in 1998 set into motion a wave of mergers and acquisitions (Big-4 was born out of 8 utilities). 2) Early feed-in-tariff in 1990 favored small electricity producers and obliged utilities to purchase produced electricity to the grid at market price. 3) Renewable Energy Sources Act (EEG) in 2002 re-obliged utilities to attach small-scale renewable electricity to grid and to pay minimum fee for next 20 years. 4) Nuclear Energy Act in 2002 set restriction to build more nuclear power plants and to phase out nuclear, new Nuclear Fuel Tax Law in 2011 and decision to phase out nuclear after Fukushima caused significant profit loses for Big-4.
Erik van der Vleuten and Per Högselius (2012) Resisting change? The transnational dynamics of European energy regimes in: Geert Verbong & Derk Loorback (eds), Governing the energy transition: Reality, Illusion, or Necessity? London: Routledge: London, 75-100.	Events that enhanced European incumbents to maintain the stability but also engage in changes. Field of electricity provision Historical 1950-2010 Energy market liberalisation Political influence of energy incumbents	European energy incumbents were actively pushing the energy market liberalisation, which was mainly seen as an opportunity to firm expansion (especially mid-European incumbents). The environmental legislation was proactively shaped by Spanish and British electricity incumbents, former for gaining business opportunities and latter for preventing the entrance of small competitors. The study challenges the early notion that incumbent regime resists the change but that they also neutralize the pressures for radical change and even "actively pushed liberalization or environmental policies to support ongoing regime developments" (p. 98). As a result, the most important dominant regime structures remained stable during major reconfiguration of the markets.

Jochen Markard and Bernhard Truffer (2006) Innovation processes in large technical systems: market liberalization as a driver for radical change? Research Policy 35, 609–625.	Development of electricity system through technological innovations of nuclear, CCGT, wind and solar PV technologies prior and after market liberalisation Historical 1950-1990s Field of electricity provision Challenging renewable energy Incumbents' business strategies	The historical take on to nuclear, CCGT and wind power show that in the context of energy monopolies, incumbent electricity utilities were initially opposing each of the new technologies. Nuclear power technology was seen alien for utilities who were familiar with fossil based production and substantially high capital costs. Later on CCGT (combined cycle gas turbines) technology caused fear of losing the profitability of coal and nuclear energy and general expert opinion was that it will not be cost efficient in large-scale. Wind power was opposed by electricity utilities for being too small, costly and unreliable. Each of the technologies became accepted later on as the technologies became more reliable, efficient (e.g. size of wind turbines), cheaper. Especially nuclear and CCGT gained acceptance for fitting well with centralised electricity system. Governments' support was fundamental in the deployment of each of the three technologies. In the context of energy market liberalisation, energy utilities have developed more diverse strategies than expected. In the case of a fuel cells development, incumbent utilities has had various projects and test platforms, they were actively developing markets and even became first movers with the emerging field. Thus, market liberalisation has boosted overall innovation activities of incumbents because past ignoring strategy would be too risky and going along improve competitive advantages. This all enhance learning. Incumbents has also started to follow each other's activities and imitate successful strategies.
Lori Bird, Rolf Wüstenhagen, and Jorn Aabakken (2002) A review of international green power markets: recent experience, trends, and market drivers. Renewable and Sustainable Energy Reviews 6, 513–536.	Energy market liberalization and development of new electricity contract models Field of electricity provision Energy market liberalisation Incumbents' business strategies	Energy market liberalisation accelerated incumbents to develop green energy products to respond the increasing competition. Most of the developed products were hybrid solutions consisting of integrated contract models including biomass, wind, solar and hydropower. However, the slowdown of market opening or partial liberalisation, as well as high entry barriers in some regions slowed down the development of green products, which in many cases were sold out.

Mari Ratinen and Peter Lund (2014) Growth strategies of incumbent utilities as contextually embedded: Examples from Denmark, Germany, Finland and Spain. Technology in Society 38, 81-92.	Country comparison (Denmark, Germany, Finland, Spain) of the growth strategies of European large energy incumbents and the influence of the context Field of energy provision Historical 1990-2013 Energy market liberalisation Incumbents' business strategies	In spite of market liberalization, unbundling of interests between governments and energy utilities has remained slow due to state-ownerships and governments favouring certain energy forms. Findings suggest that strong social ties (between incumbent and government bodies/legislation) seem to slow down the changes i.e. shift towards renewable energy or scale and fuel use. If the ties are weaker, policies are more likely to introduce changes in markets and policies over utilities' activities. Energy incumbents strategies' vary geographically and historically (e.g. Finland's focus on biomass and political lean towards nuclear energy), Spanish wind conditions (and strongly regional energy systems) and Denmark's' low own resources (wind is favoured but also a lot of gas power), as well as the type of energy users such as large industrial electricity users (heavy industry). Large utilities were keener on internationalisation strategies than smaller utilities, who has domestic market focus.
Marcel Didden and William D'haeseleer (2003) Demand Side Management in a competitive European market: Who should be responsible for its implementation. Energy Policy 31, 1307-1314.	Enhancing energy saving at the post-liberalised era Energy market liberalisation	Traditionally energy saving measures were tightly linked with IRP schemes (integrated resource planning) where utilities would provide energy service for minimum societal costs and treat the energy efficiency investments similarly as energy production capacity investments. The authors conclude that market liberalisation and profit seeking focus distorted the natural role of energy incumbents and only "artificial" measures have remained, meaning that incentives are required for increasing energy efficiency or obligation schemas or third party actor agreement are required.
The challenge of renewable energy deployment		
Mario Richter (2011) Utilities' Business Models for Renewable Energy: Evidence from Germany. World Renewable Energy	German energy incumbents' perspectives towards renewable energy	Detached energy sources and changing customer-user profiles was not perceived as a threat, because large energy companies were more focused on large scale renewable energy programs, the profit expectations, return

Congress 2011 –Sweden 8-13 May 201, Linköping, Sweden.	Challenging renewable energy Incumbents business strategies	on interest and renewable energy portfolio standards did not match with renewable energy projects at customer sites.
Mario Richter (2013) German utilities and distributed PV: How to overcome barriers to business model innovation. Renewable Energy 55, 456-466.	German energy incumbents' perspectives towards renewable energy Challenging renewable energy Incumbents business strategies	German utilities did not perceive solar PV as a threat, neither business opportunity, but as a competing form of electricity generation. Main reasons for this were the small size and dispersed locations of consumer-PV. Consumer-PV was also perceived weak, dependent on feed-in-tariff and relatively expensive.
Sandra Wassermann, Matthias Reeg and Kristina Nienhaus (2015) Current challenges of Germany's energy transition project and competing strategies of challengers and incumbents: The case of direct marketing of electricity from renewable energy sources. Energy Policy 76, 66–75.	Emerging field of renewable electricity markets, integrated marketing vs. direct marketing Field of electricity exchange Challenging renewable energy Political influence of energy incumbents	Increasing renewable energy and political target setting as well as nuclear phase-out, shocked German energy incumbents, who until 2010-2011, had mainly ignored the field of national renewables and business opportunities (except hydro and wind power). Incumbents had believed that distributed energy technologies will stay in niches and centralised structure remains with the focus on conventional energy production and distribution. Energy incumbents started to push for integrating renewable energy to electricity exchange. Small renewable energy providers promoted an alternative way that of direct marketing where they could sell electricity directly. The study show that integrating RES to existing electricity exchange structures requires financial resources and experience on trading practices, which favours large and medium-sized electricity providers. The actors promoting for the alternative direct marketing model was not able to form political linkages that would have supported their model. The study concludes that in addition of developing innovative business solutions, market actors are able to influence on the regulative frameworks, which could enhance the market transformation.
Verbong, G., Geels, F., 2007. The ongoing energy transition: lessons from a socio-technical, multilevel	Development of Dutch electricity regime and	The major shifts in the Dutch energy system has been 1) shift from coal to natural gas (and nuclear energy) since 1960s, in which government took central role in the energy field (also in banning natural gas use during oil

analysis of the Dutch electricity system (1960–2004). Energy Policy 35 (2), 1025–1037.	development paths for wind, biomass and solar PV Field of electricity provision Historical 1960-2004 Political influence of energy incumbents	crisis), 2) the important role of industrial actors in developing CHP technology and producing electricity, which formed a decentralised actor group as opposed to centralised utility energy production, and 3) market liberalisation and privatisation. In the three emerging development paths of wind, biomass and solar until mid-1990s, energy incumbents were strongly involved with the early wind development projects (1976) being "sceptical but sympathetic." Focus was on large wind parks and turbines but most experiments with large-scale turbines were not successful. Biomass, and especially co-firing with coal has been easier change for incumbents due to its compatibility with the existing production modes. However, solar PV was considered to be too small and costly to attract incumbents' attention (excluding few small solar PV installations for green marketing purposes).
Energy policy incentives and political influence of incumbents		
Staffan Jacobsson and Volkmar Lauber (2006) The politics and policy of energy system transformation—explaining the German diffusion of renewable energy technology. Energy Policy 34, 256–276	Political conditions that led to the strong deployment of solar and wind energy in Germany Field of electricity production Historical 1974-2003 Energy policy incentives Challenging renewable energy Political influence of energy incumbents	One of Germany's success behind the significant amount of renewable energy, is the regulatory continuity FIT from 1986 – 2002. Study show that incumbent utilities and their coalition as well as political parties, were not prepared for the strong take-off for renewable energy when the early policy instruments, which favoured the small providers, were implemented. It was until the wind turbines started to diffuse, become efficient and generate revenue from the FIT, when energy incumbents realised the growth of renewable energy and started to resist changes. It seems that by then, it was too late for incumbents to protest and slow down the development and some incumbents even favoured the development.
David Hess (2016) The politics of niche-regime conflicts: Distributed solar energy in the	Conflicts between incumbents and entrants in the deployment	Distributed generation (DG) of solar started to generate momentum during 2000s due to introduction of netmetering and sped up along with decreasing costs of solar, rising electricity retail prices and financial

United States. Environmental Innovation and Societal Transitions 19, 42-50.	of distributed solar and netmetering in US Field of electricity provision Energy policy incentives Challenging renewable energy Political influence of energy incumbents	programs for residential payback periods for DG solar. A third-party ownership (e.g. rooftop installations) solutions increased, which caused new investment flow "outside" the energy sector. Incumbents saw the development as a threat and as a response, incumbents began to test a range of strategies to slow the DG solar growth phase down e.g. initiating campaigns and influencing regional energy policies to gain favourable rules but also purchased smaller solar providers and set-up corporate-internal divisions for solar. Incumbents favoured utility-sized solar farms and centralised distribution.
Frank Geels, Florian Kern, Gerhard Fuchs, Nele Hinderer, Gregor Kungl, Josephine Mylan, Mario Neukirch and Sandra Wassermann (2016) The enactment of socio-technical transition pathways: A reformulated typology and a comparative multi-level analysis of the German and UK low-carbon electricity transitions (1990–2014). Research Policy 45, 896–913.	Comparison of the German and UK low-carbon electricity transition. Field of electricity supply Historical 1990-2014 Energy policy incentives	Germany's electricity transition is driven by new market entrants due to historical political encouragement of market entrance of small renewable energy producers (first feed-in-tariff in 1990 restricted the larger producers to gain benefits). UK's electricity transition has been largely market driven and slow. UK's market based Renewables Obligation (RO) was set in 2002 requiring energy utilities to reach annual renewable electricity targets. Amendments to RO and several other policy initiatives to increase renewable energy, including first feed-in-tariff in 2010, increased the policy pressure. In UK, large energy utilities has been implementing electricity transformation by converting towards biomass and constructing large-scale wind power.
Till Stenzel and Alexander Frenzel (2008) Regulating technological change – the strategic reactions of utility companies towards subsidy policies in the German, Spanish and UK electricity markets. Energy Policy 36 (7), 2645–2657	Wind power deployment and investments in Germany, Spain and UK Field of electricity provision Energy policy incentives Incumbents business strategies	Although incumbent energy operators have been seen to hinder the deployment of renewable energy technologies (RETs), empirical evidence suggests a wider picture. Some European energy incumbent are leading investors on RETS [especially wind power], while others actively block the development. UK: Energy incumbents have been leading, even "hijacking" the wind power investments when Renewable Obligation (RO), which obliged incumbents to provide certain amount of renewable energy and RETS became strategic for incumbents. Renewable Obligation Certificates (ROCs), a tradable

		instrument that were given for every kWh of renewable electricity, was set to facilitate the development. This favoured incumbents who had strong financial base and trading skills to trade ROC's, which new entrants often did not have. Moreover, new entrant's had financial troubles due to uncertain policy support (by 2005, 81,45% of wind capacity was owned by big utilities in UK). Germany: Early FIT in 1990 favoured small market entrants and households. Large utilities did not believe the market opportunities of wind energy nor small-scale installations, but later on incumbents displayed strong resistant and lobbying strategies against FIT. Energy incumbents had had negative experiences on early wind power R&D but later on when wind power plants grew in size and profitability increased, German big energy utilities slowly entered wind power markets (by 2005, 1,16% of wind capacity was owned by big utilities in Germany). Spain: First FIT implemented in 1994, which was modified in 1998 to include two options: direct feed-in-tariff payed for each kWh produced or a possibility to sell the electricity to wholesale pool with market price and additional premium. While the second option were taken slowly at first, it created wind power boost when government announced a target to install 13.000 MW by 2010 (later on the target was raised to 20.000MW). Four largest regional Spanish energy utilities, began to construct wind farms, develop regional wind power and invest on development and manufacturing of wind turbine components (Iberdrola in forefront). Wind power became strategic in 2004, when the second option of FIT was revised and new benefits were given to those who installed forecasting system and provided additional grid services. (by 2005, 58% of wind capacity was owned by big utilities in Spain)
Michael Pahle (2010)	Drivers of Germany's investments to coal.	Hard coal and lignite are historically domestic fuel sources for Germany. After market liberalisation in 1998 investments in natural gas increased and

Germany's dash for coal: Exploring drivers and factors. Energy Policy 38, 3431–3442.	Field of electricity production Historical 1960-2008 Energy market liberalisation	it was given some tax reliefs. However, along with nuclear phase-out decision, natural close down of older power plants and the need to replace capacity losses, coal has been re-established as an important energy source and new coal power plants have been constructed in Germany. Natural gas would be favoured for its lower emissions and threat of increasing CO_2 prices but its fuel price development is uncertain and construction expenses higher than coal plants, which are enjoying also political support. Coal power has had smaller construction expenses and coal and lignite are fuels that are more familiar for German's companies. Moreover, investors mistrust towards future renewable energy deployment and public protests against coal power have had only moderate effects.
David Hess (2013) Industrial fields and countervailing power: The transformation of distributed solar energy in the United States. Global Environmental Change 23, 847–855.	Incumbents power, resistance and ability to transform the markets Field of electricity provision Political influence of energy incumbents	Incumbent energy companies often first forms a blockage and when countervailing power increases, moves towards incorporation and transformation. The incorporation can include mergers and acquisitions where incumbent purchase smaller firms. The transformation might include some challengers to grow to large companies. Challengers rarely remain the same in these processes. "The dominant organizations in an industrial field tend to absorb the challenging technological models, but in the process they also transform the designs to make them more compatible with the existing technologies and products favoured by the incumbents. (p. 849)". The study concludes that the transformation is more likely to be influenced by large market actors than communities and niche innovators due to incumbents countervailing corporate power.
Rick Bosman, Derk Loorbach, Niki Frantzeskaki and Till Pistorius (2014) Discursive regime dynamics in the Dutch energy transition.	Discursive turns/contradictions in the discussions of Netherlands' national energy transformation Field of national energy policy	The authors found fundamental contradictions and disruptions between new emerging narratives and the dominant storyline of "decarbonization in a European market, while keeping the energy supply secure and affordable" and the authors. Main contradictory discourses: 1) at the same time energy system should operate market-based but to operate well it require support and 2) government should create favourable investment conditions but

Environmental Innovation and Societal Transitions 13, 45–59.	Political influence of energy incumbents	should not disturb the markets. The ruptures in storylines weakened the dominant regime coalition and generated surprises, such as debate over coal tax created a coalition between incumbents who used natural gas and NGO's who advocated the introduction of coal tax. Another example relates to the shift towards decentralised, local energy system, which contrasted sharply the idea of common European energy markets and caused doubt on the role of centralised system and existence of energy incumbent.
Florian Kern and Adrian Smith (2008) Restructuring energy systems for sustainability? Energy transition policy in the Netherlands. Energy Policy 36, 4093–410.	Dutch energy transition and incumbent's dominance at the common transition platform Field of national energy policy	Dutch energy transition process was carried through by creating a self-organised platform. Evidence show that incumbent actors dominated or 'hijacked' the discussion and participation of smaller actors and government bodies was low. This was partially due to Ministry's emphasis on new business opportunities, leaving the structural changes to background. While this type of platforms might tie incumbents to transition by helping them to find interest and think for long-term development, there were two consequences for incumbents' over-representation in the platform. First, the attention was directed towards experiments, pathways and practices, which does not adequately open-up space for development of systems innovations, 2) this does not allow adequate development of niches and simultaneous creation of political pressure to be strong enough for more fundamental changes within regime.
James Meadowcroft (2009) What about the politics? Sustainable development, transition management, and long term energy transitions. Policy Sci 42:323–340.	Considering energy incumbent's power in energy system change Field of energy policy Political influence of energy incumbents	There are political tensions in transition, which needs to be taken into consideration and which makes the transition a messy process. Powerful energy incumbents tend to focus on incremental improvements and "enjoy huge advantages including pre-established infrastructure, relative ease in obtaining finance and insurance, developed networks of suppliers, familiarity to customers, embedded technical standards and training routines, and a tight 'fit' with existing regulatory approaches." (p. 329).
Incumbents' business strategies		

Rolf Wüstenhagen, Jochen Markard and Bernhard Truffer (2003) Diffusion of green power products in Switzerland. Energy Policy 31, 621–632.	Development of Swiss green electricity markets and the role of utilities Field of electricity provision/products Historical 1980s-early 2000s	Traces of green contract can be traced into introduction of distributed solar by private persons and early medium-sized utilities during 1980s. During 1990s green contract models on PV, wind and hydro, which were mainly developed by municipal utilities, started to become more common but took-off in early 2000s. The green contract models were developed by municipal utilities and towards the early 2000s, also by larger utilities. Most challenging aspect of the production of these contract were the credibility of the "environmental claim" made by incumbent energy utilities but was eased-up through collaboration with environmental NGOs and the development of specific eco-label. The credibility challenges were especially challenging in hydropower. Utilities that developed the eco-label standard benefitted their position of being forerunner and gained their position when competitors brought several new green products with varying quality into the markets.
Lorenzo Boscherini, Davide Chiaroni, Vittorio Chiesa and Federico Frattini (2012) Escaping the incumbent's curse: how utilities respond to the emergence of renewable energy technologies. ISPIM Conference Proceedings; Manchester: 1-20. Manchester: The International Society for Professional Innovation Management (ISPIM).	Italian energy incumbents options, means and motivations to integrate renewable energy into their business Field of energy provision Incumbents' business strategies	Italian energy incumbents (both, oil and gas companies AND electricity and natural gas providers) has a range of different options for integrating renewable energy into their businesses. These were establishing new business units to work with collaborative projects or acquiring/constructing renewable power plants. In these cases, renewables play a complementary role for core business. Establishing new spin-offs or integrating renewable energy to older spin-offs where e.g. new external partnerships were sought and solar solutions were developed, monitored and assessed. In these cases, renewables were already seen as a part of the core (or future) business. Motivations to integrate renewables rang from strategic involvement by positioning solar as strategic but outside core business, into developing renewable energy as core business and building renewable energy plants in collaboration.

D.J.H.M. van den Buuse (2009) The development and commercialization of solar photovoltaic technology in the energy industries: An incumbent firm perspective. Master's Thesis. University of Amsterdam Business School.	Energy incumbents' (oil/gas and electricity/heat) engagement to solar photovoltaic Field of energy industry Incumbents business strategies	Depending on the energy incumbent's core field e.g. gas and oil companies, electricity and heat companies, there are differences in the integration of solar PV. Whereas oil and gas companies has been establishing subsidiaries for developing renewable energy solutions, electricity and heat companies can vertically integrate produced solar energy to its value chain in several parts. Electricity utilities entered the solar PV business (2005-2007) when solar showed signals of becoming economical in electricity production, whereas oil and gas companies were involved already in mid-1980s to develop and commercialise solar technology.