TIK WORKING PAPERS

on

Innovation Studies

No. 20161026

<http://ideas.repec.org/s/tik/inowpp.html>

Policy networks in energy transitions: The cases of carbon capture and storage and offshore wind in Norway

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[This version: October 2016]

Abstract

This paper employs the concept of policy networks to study how interest groups and actors compete over the influence of energy and climate policy. It is argued that the creation of learning arenas is critical for the development of immature technologies. The paper then analyses two large efforts to secure state funding of large-scale demonstration projects for offshore wind and carbon capture and storage technology in Norway. The paper describes a range of similarities between these two technologies in terms of scale, maturity, and costs, and in the way they represent possible solutions to the problem of climate change. However, the paper also describes enormous differences in government support towards full-scale demonstration. These differences are then explained in the analysis, which shows how different network structures facilitate different levels of access to the policy making process. The paper provides insights into how the interests of political parties influence the potency for solutions tied to climate and energy problems. The paper therefore contributes to the discourse on the role of politics in sustainable transitions.

Keywords: Sustainable transitions, Protective space, Policy networks, Carbon capture and storage, Offshore wind energy

1 Introduction

A critical role for policies related to new renewable energy technologies has been to reduce the costs associated with making these technologies competitive with incumbent technologies. It is therefore important to understand how new technologies can improve and become more cost-effective. Much of this improvement is considered to occur through the experimentation and participation in markets (Hanson 2013). However, new and immature technologies are often excluded from market participation due to high costs and financial risks that private firms are either not able or willing to shoulder. For this reason, the creation of temporary protected spaces (Kemp, Schot, & Hoogma 1998, p. 185) for immature renewable energy technologies is seen as an important goal for policy, particularly when rapid change is required (Smits, Kuhlmann, & Teubal 2010, p. 420). These spaces can function as learning arenas where technologies can improve shielded from mainstream market selection (Geels 2005, p. 684). Such learning arenas are unlikely to develop for immature technologies without state support (Mazzucato 2013). Thus, the ability to influence institutions is important for the improvement of new renewable energy technologies. Such influence will often be exerted through so-called advocacy coalitions or policy networks that share certain common beliefs and visions for a given technology (Jacobsson & Lauber 2006). How different actors are able to shape the selection environment in which they operate through lobbying and coalition building is however still under explored in much research on sustainable transitions and the build-up of new renewable energy technologies (Kern 2015, p. 68; Markard, Suter, & Ingold 2015). Coalition building involves not only firms but also state actors as well as political parties and individuals. Thus, to better understand the political conditions for certain policies, the analysis needs to include the interests and participation of state and political actors.

The purpose of this paper is to specifically investigate how policy networks are formed and how these policy networks influence the possibility for actors to participate in the policy process. This can help us understand how relations and negotiations between different types of both state and non-state actors influence the governance of science and technology. The paper thus contributes to recent and important debates concerning the role of politics in the formation of policies for sustainable transitions (Farla et al. 2012; Geels 2014; Hess 2014; Meadowcroft 2011; Smith, Voß, & Grin 2010).

In the following section, I argue that learning arenas are important for the successful development of new energy technologies and that networks play an important role in influencing policies that support the formation of such arenas. I then present the policy network approach that I use as an analytical framework, followed by a section on data and methods. In sections four and five, I use the cases of carbon capture and storage (CCS) and offshore wind power (OWP) to analyse policy network formation and policy change. The final sections discuss the findings and suggest some implications for further research.

2 Niche protection and policy networks

2.1 Why niche protection policies matter

An essential insight from the field of innovation studies is that R&D investments do not necessarily lead to innovation (Mytelka & Smith 2002). Substantial improvements in technology has been found to come from interaction with the market, emphasising the need for learning feedbacks between different processes (Freeman 1995; Rosenberg 1972). In addition to intra-firm relationships such as those between users and producers of technology, systemic aspects of innovation have been increasingly recognised as important for the improvement and diffusion of technology. Rosenberg also pointed out that not all improvements in efficiency are attributable to technological change (1972, pp. 12-3). Rather, improvements may come through learning, experimentation with logistics, and non-technological improvements that are difficult to achieve without practice in markets. Even though these insights have had considerable impact on policy (Mytelka & Smith 2002), innovation policy is often designed based on an emphasis on R&D (Mazzucato 2013, p. 44).

Expectations for a future market for OWP and CCS, and the possibility for industrial actors to benefit from such markets, influence the decisions by firms to invest in a particular technology. Hekkert et al. (2007) refer to this as a process of guiding search routines in the direction of particular solutions. Developments exogenous to the system are important for this guidance, such as the growth of an industry in other countries and actors' assessments of the present and future technological opportunities. These developments also influence the commitment of policy makers to invest in different solutions such as offshore wind or CCS. At the same time, regulations and policies can provide important guidance for firms' interests in investing in different technologies. In the UK and Germany, policies promoting offshore wind power have had a positive influence on the direction of search towards offshore wind in Europe (Jacobsson & Karltorp 2013). Even though this has benefitted the industries in the UK and Germany primarily, these commitments towards offshore wind have also created expectations for the participation of Norwegian suppliers in a European market (Hansen & Steen 2011; Normann 2015).

The processes of knowledge development and guidance of search depend on the creation, or expectations, of a market. A major policy issue is to complement existing R&D policies with policy measures leading to the formation of protected market spaces (Bergek, Jacobsson, & Sanden 2008b). These protected spaces are often referred to as socio-technical niches (Kemp et al. 1998). Niches are important for learning and the development of networks, and the creation of these niches often rely on government policies. However, the process of creating these policies have until recently been poorly understood (Smith & Raven 2012). Ulmanen, Verbong, and Raven (2009) highlight that niches are not created only by public authorities, but through negotiations between a variety of actors and frequently involve strategic lobbying. Similarly, Bergek et al. (2008b) argue that to create legitimization for the

development of niche protection policies “*new technology and its proponents need to be considered appropriate and desirable by relevant actors in order for resources to be mobilized, for demand to form and for actors in the new [technological innovation system] to acquire political strength*”. This implies that to understand how actors can acquire political strength, we need to identify the relevant actors that participate in negotiations. Additionally, Bergek et al. (2008a) add that “*legitimacy is not given, however, but is formed through conscious actions by various organizations and individuals in a dynamic process of legitimation*”. Thus, legitimacy is not something that is created by chance, but through purposeful strategies.

A blocking mechanism for new clean energy technologies can be that advocates of a particular technology may be too weakly organized to influence policy (Bergek et al. 2008a). Such an understanding may also be related to the concepts of socio-technical niches and regimes (Geels 2011). Regimes and niches are communities of interacting groups, where regimes are considered to be large and stable whereas niches are small and unstable (Geels & Schot 2007, p. 402). New renewable energy technologies are disadvantaged, as they are not aligned with the selection environment shaped by the dominant regime (Hanson 2013). A solution to this, often found in the innovation systems literature, is to address this weakness in the system by supporting advocacy coalitions or networks (Bergek et al. 2008a, pp. 423-5). It is therefore necessary to also understand *how* networks are formed (Bergek et al. 2008b).

Networks have received much attention in the innovation literature as they facilitate knowledge development and diffusion. In the technological innovation systems literature, the guidance of search and legitimation processes are closely related to networks of actors (Bergek et al. 2008b; Binz, Truffer, & Coenen 2014; Binz et al. 2012, pp. 165-6). However, the role of networks in facilitating collective action and system building has been less in focus (Musioli, Markard, & Hekkert 2012).

Kasa (2011a, pp. 62-4) proposes that differences in the network structures could be an explanatory factor for the different efforts towards CCS and other new renewables in Norway. For instance, Tjernshaugen and Langhelle (2009) show how the nature of the CCS network in Norway has influenced the government commitment to CCS. Finally, the difficult task of exploring how networks are affected by, but also how they can influence, the institutional context is still in need of further empirical investigation (Binz et al. 2014).

Following this, to analyse how differences in networks can lead to different levels of policy support towards clean energy system building we need to understand how networks are formed, how network participation and structure influences policy, and the relationship between networks and the institutional context.

2.2 The policy network approach

The policy network approach (PNA) is a heuristic device that can be employed to suggest something about actors and relations that is understood to exist within the policy process (Evans 2001). To Smith (1993, p. 56), policy networks occur “when there is an exchange of information between groups and government (or between different groups or parts of the government) and this exchange of information leads to the recognition that a group has an interest in a certain policy area”. Such a definition goes beyond the mere structure of the network, but focuses particularly on resource exchange between actors. Further, it highlights the role of government actors in policy networks. Finally, Smith points out that one of the drivers of the formation of a policy network is a common interest in a particular policy area. This latter point is given prominence in Hay’s (1998) definition of policy networks as “strategic alliances forged around a common agenda of mutual advantage through collective action” (p. 38).

The PNA can illustrate how the structure of policy networks influences policy outcomes by providing some actors privileged access to the policy process (Daugbjerg & Marsh 1998; Smith 2000). If PNA is to have any explanatory power, we need some way of distinguishing between different types of network structures and a way to characterise policy network change over time. To do so, Marsh and Rhodes (1992) proposed a continuum between what they referred to as issue networks and policy communities at opposite ends. Policy communities often consist of a limited set of actors. Access to the community is therefore highly restricted, and there will be a high degree of consensus among the members. Another characteristic of a policy community is that the members have resources that other members of the community seek. Following this, policy networks can be distinguished according to their degree of integration and cohesiveness (Rhodes and Marsh 1992). A policy network that lacks such cohesiveness, due to e.g. competition between network members or general lack of collaboration, is closer to an issue network. Finally, an important variable in all policy networks is the interests and resources of state actors. Closely integrated policy communities tend to develop in areas where state actors have particular goals (Smith 1993, p. 225). Moreover, such policy communities are often the result of underlying party strategies (Daugbjerg & Marsh 1998). Conversely, a less cohesive and loosely organised issue network is often characterised by no clear state-led view on policy goals and a lack of a strategically positioned sympathy within the party-system (Daugbjerg & Marsh 1998).

The structure of most policy networks will exist somewhere in between these two ideal types. In this paper, I use policy networks as a general term to refer to structures with different characteristics. Distinguishing between whether a policy network resembles an issue network or a policy community can however be analytically useful to understand how certain structures facilitate relations between interest groups, state and party political actors, and thus the ability to influence policy.

To explain policy outcome as influenced by policy networks, it is necessary to explain network change (Dowding 1995). Rhodes and Marsh (1992) pointed to changes in the environment of the networks as the primary driver for network change. They defined four broad categories of exogenous or network-environment change: economic, ideological, technology, and institutional. Changes in technology and institutions might of course be influenced by policy networks and actors (Adam & Kriesi 2007; Marsh & Smith 2000). Thus, technology development related to offshore wind and CCS may not only be influenced by the nature of policy networks, but may also in itself contribute to changes in these networks. Economic change as result of events such as financial crises however can more easily be regarded as exogenous change. With relevance to the topic of this paper, I will add climate change as an additional exogenous change.

The relationships within policy networks are structural as they define and constrain the roles that actors can play. The approach can illustrate how some actors are restricted from access to the policy process not only from the lack of resources but also because of a particular structure (Compston 2009). In a cohesive policy network with characteristics of a policy community, network members will have an interest in maintaining stability (Richardson 2004). Policy networks are therefore often thought of as resistant to change. In a stable policy network with long-term relationships and shared norms that transcend particular policy issues, policies are likely to be shaped from bargaining (Jordan 1990, pp. 326-7). Thus, policies may be introduced as a result of a compromise to ensure stability for the community as a whole.

Even though a policy networks approach tends to privilege structural factors and exogenous change, policy networks consists of actors and are therefore also inherently dynamic. It is not only the policy network structure, but activities in networks, that influence policy (Hay & Richards 2000). Several scholars have therefore emphasised the need to study interaction between multiple levels to understand the causes of network change (Evans 2001; Marsh 1998; Marsh & Smith 2000). Strategic actors can make decisions within the boundaries set by the policy network. Policy networks can therefore also change through alliance building, bargaining and compromises. The outcome of bargaining processes depends on who bargains and the nature of the bargaining process (influenced by policy network structure and strategic actors). Moreover, efforts to change policy preferences of important actors can enrol these actors and thus alter the network membership. The analytical framework is visualised in Figure 1.

Figure 1 Policy networks and policy outcomes. Adapted from Marsh and Smith (2000).

The policy network approach can be useful for analysing the “battle over institutions” (Jacobsson & Lauber 2006). Moreover, the particular attention to government actors opens up for studying how political parties privilege certain interests over others (Daugbjerg & Marsh 1998). Thus, the PNA can contribute to our understanding of how certain actors enjoy privileged access to decision-making processes in the domains of energy and climate. While actors form (strategic) alliances in an attempt to influence policy and institutions, a dialectic approach to policy networks draws attention to how the structure of policy networks constrain network membership and how members act (Marsh & Smith 2000; Smith 1993). See table 1 for a description of how the main factors have been operationalised.

Table 1
Operationalisation of main factors

Factor	Description	Evidence to look for
Policy network types	A policy network continuum ranging from closely integrated policy community to loosely organised issue network (Marsh & Rhodes 1992).	<p>Competition or collaboration between actors in policy network.</p> <p>Shared interests and mutual goals.</p> <p>Interests of the state and political party actors in policy area.</p>
Network formation and network change	Policy networks shaped through a dialectic relationship between strategic actors and networks, and from exogenous change (Marsh & Smith 2000).	<p>Exogenous change: Articulated pressure from climate change, financial markets.</p> <p>Resource exchange (information, threats and promises, political support, financial contributions).</p> <p>Bargaining and compromises.</p> <p>Alliance building.</p> <p>Enrolment of new actors.</p> <p>Efforts to change policy preference of actors.</p>

Influence on policy outcome	Policy networks can facilitate privileged access to policy process, whilst denying others the same privilege (Daugbjerg & Marsh 1998).	Policy outcomes in the interest of network members. Level of access to policy makers and strategically important political party actors.
Niche protection	New technologies often need protection from mainstream selection environment (Smith & Raven 2012). Often policy driven.	Public support towards full-scale demonstration.

3 Data and methods

The paper makes use of two cases. Carbon capture and storage (CCS) and offshore wind power (OWP) represent two technologies that exhibit interesting similarities. First, great expectations for cost reductions through research and development (R&D) efforts have been attached to both technologies. However, it has been challenging to meet these expectations (though recent developments in offshore wind are promising). Both technologies have in Norway been associated with political prestige (Andersson & Strand 2009; Boasson 2011, p. 229; Riisnæs 2011). Further, both OWP and CCS have strong ties to the petroleum industry (Hansen & Steen 2011; Tjernshaugen 2011). Both technologies have in offshore petroleum producing countries been legitimized by claims of competitive advantages with regards to technology base, natural resources, and clean energy potential. Finally, even though there are no direct technological barriers to implementing commercial projects, both technologies have been challenged by high costs. It has been more difficult and expensive to develop CCS at a commercial scale than what was initially expected due to problems with funding, legal risks, and storage uncertainty (Markusson et al. 2012; Nykvist 2013). Offshore wind also faced difficulties in the mid-2000s due to a near monopoly on turbines, underestimation of the difficulties related to marine operations and the effect of corrosion, and steel prices (Heptonstall et al. 2012). Consequently, the costs have been above initial expectations of policy-makers. The creation of learning arenas through full-scale demonstration has therefore been identified as critical for realizing necessary cost-reductions in both CCS and OWP (Kern et al. 2015a; Kern et al. 2015b).

One important difference, however, can be observed in the political willingness to promote and develop these two technologies in Norway. One of the potential explanations for the lack of willingness to support offshore wind is that there are certain institutional barriers to the development of immature technologies in Norway. A principle of cost-effectiveness has been influential on energy and climate policies, resulting in a reluctance to support particular technologies (Moe 2012). Yet, CCS is an area where the government has renounced this principle. Figure 2 shows that whereas the state has invested limited resources in offshore wind beyond R&D funding, nearly 1 billion EUR was invested in CCS between 2007 and 2012 (Riksrevisjonen 2013). In this paper, I propose that an

analysis of the policy networks forged around CCS and offshore wind in Norway help to explain these different levels of state funding towards full-scale demonstration.

Figure 2 Public spending on offshore wind and CCS R&D and full-scale demonstration (2000-2012). Funding from the Research Council of Norway (RCN) towards R&D and the Norwegian Ministry of Petroleum and Energy towards CCS full-scale demonstration and state agency Enova towards offshore wind full-scale demonstration. Source: Annual accounts from RCN, Norwegian Ministry of Petroleum and Energy and Enova.

In studies of the performance of technological innovation systems in countries most committed to offshore wind and CCS, knowledge development has been found to be among the strongest features with sufficient quantity and quality of R&D (Jacobsson & Karltorp 2013; van Alphen 2011, pp. 254-6; Wiecek et al. 2013). Similar observations have been made in studies of offshore wind and CCS in Norway (Hansen & Steen 2011; van Alphen et al. 2009). Figure 3 shows that government funded R&D towards new clean energy technologies, including CCS, through The Research Council of Norway has increased significantly in recent years.

Figure 3 R&D funding from Research Council Norway (RCN) towards clean energy technologies (incl. CCS), 2001-2012. Source: RCN annual budget reports. Data compiled by author.

The formation of a market for offshore wind has however been found to be a key area to improve in order to strengthen the systems both in Europe (Jacobsson & Karltorp 2013; Wiecek et al. 2013)

and in Norway (Hansen & Steen 2011). Similarly, a lack of market formation has been identified as a weakness in the system for CCS in Norway (van Alphen et al. 2009). The cases of offshore wind and CCS in Norway are therefore suitable for studying the creation of niche protection through policies supporting full-scale demonstration.

Data for the analysis consists primarily of existing empirical studies and 42 semi-structured interviews conducted between 2013 and 2015 with politicians, civil servants, industry representatives, research organisations and interest organisations¹. The politics behind the development of CCS in Norway has been extensively researched². This part of the analysis therefore builds substantially on this body of research in addition to interview data. By comparison, the development of political support for offshore wind in Norway has received less attention. This part of the analysis therefore draws mostly on interview data. In addition, the analysis makes use of data from public hearings, parliamentary debates and newspaper archives.

The analysis is based on an iterative qualitative approach, using the method of process tracing to describe the developments of policies, policy networks, and the relation between the networks and the actors within these networks. Process tracing is well suited for explaining particular outcomes (George & Bennett 2005, pp. 205-32) and for recognizing the relationship between agency and structure (Pettigrew 1997, p. 341). First a narrative was created for CCS and offshore wind, based on initial interviews, existing research and newspaper archives. These narratives were used to identify key events, the most relevant actors and potential relations between these actors. Based on the construction of these narratives, most of the interview respondents were identified. Each interview was tailored to suit the expertise and role of the respondent. However, in all interviews I was interested in indicators of collaboration (or lack of), conflicts and the resolution of such conflicts through bargaining, interests of lobby groups and their efforts to influence processes of decision-making, the interests of decision makers such as politicians and high-level civil servants. Interviews were transcribed, and all data material was coded according to indicators of actor interest and political agency, network structures, and influences on network change (see table 1). The initial narrative was then adjusted based on the coded material in an effort to draw out the most essential insights relevant to the purpose of the paper, as outlined above.

Finally, the networks were illustrated for the different time periods described in the narrative. Diagrams were made with the NodeXL software extension to Excel. Based on qualitative interpretation of the data material, relations between actors were identified and coded in the software

¹ A list of 20 interviewees referred to in the empirical analysis is included in the appendix.

² Boasson (2011); Kasa (2011b); Reitan, Syrstad, and Underthun (2008); Tjernshaugen (2007, 2011); Tjernshaugen and Langhelle (2009); Underthun, Kasa, and Reitan (2011).

using binary data³. The diagrams show the most important actors identified in the two cases, the types of relations between these actors during different time periods, and how we might interpret groups of actors as part of different policy networks. Note that distances between nodes (actors) in the diagrams are not reflections of the strength of relations. Although the diagrams were made for illustrative purposes, they can clarify how the policy networks evolved over time and how this might be related to policy outcomes.

4 The development of CCS in Norway

Norway has been a large exporter of natural gas since the early 80s. The development of CCS in Norway therefore has to be understood in relation to on-going efforts since the late 80s to increase the domestic use of natural gas. These efforts have been motivated by ambitions to increase regional development and industrial growth by providing a reliable supply of cheap electricity through the development of natural gas power plants. However, as nearly all electricity on the domestic grid is generated from hydropower, the construction of new gas fired power plants would lead to large increases in national CO₂ emissions. Thus, natural gas in Norway has been a complex issue of industrial development, energy and climate concerns.

4.1 1986-1998: Competing interests in a loosely integrated policy network

The conflict between natural gas proponents and the environmental movement can be traced back to 1994, when the three major industrial actors Statkraft, Statoil and Norsk Hydro established Naturkraft AS. The purpose of Naturkraft was to develop two natural gas fired power stations. In 1997, another three industrial actors established the company Industrikraft Midt-Norge. Once again, Statoil was one of the investors, this time together with Elkem (material production) and Norske Skog (pulp and paper). A year later, Norsk Hydro announced plans to test a gas power plant using carbon cleaning technology. As figure 4 illustrates, these projects were supported by regional lobby activities. Simultaneously, there were conflicting interests amongst the project owners (Tjernshaugen 2007, pp. 20-1) and the different projects competed for resources and political support at the national level (Alstadheim & Grande 2000) in a structure resembling that of a loosely organised issue network, weakening the potential to influence policy.

The push for increased domestic use of natural gas was driven in particular by key members of the Labour Party and the Norwegian Confederation of Trade Unions (LO) who shared a common interest in establishing natural gas power plants (Underthun et al. 2011). There was considerable local support for these projects, but they also met resistance at a regional level from local politicians and at a national level from environmental organisations and political parties concerned with climate change (Tjernshaugen 2011). This exogenous pressure from climate change opened up for the promotion of

³ Background data on actor relations available from the journal website or from the author.

CCS in Norway (Kasa 2011b, p. 163), which was exploited by actors that were able to position themselves centrally in the CCS network.

In this period, a group of actors shared a mutual interest in promoting CCS (albeit for different reasons), which led to the formation of important relations between these actors. Researchers at the SINTEF institute had together with Statoil collaborated on CCS combined with enhanced oil recovery (EOR)⁴ since 1986, and the opportunities for both emission reductions and increased oil recovery that the technology represented had attracted interest from the Labour Party (Tjernshaugen 2007, p. 118). Motivated by an offshore CO₂ tax, Statoil introduced full-scale CCS at the Sleipner natural gas field in 1996 (Tjernshaugen & Langhelle 2009), which created an initial learning arena demonstrating the feasibility of the technology. The same year, SINTEF published a report on the potential for carbon sequestration from natural gas power plants offshore, commissioned by the environmental organisation Bellona, and financed by the Labour led Ministry of Trade and Energy (Tjernshaugen 2007, p. 123). By suggesting CCS as a solution to a political problem, Bellona gained access to the Labour Party (Kasa 2011b, p. 163) and both Bellona and SINTEF became attached to the developing natural gas network, thus altering the network structure.

Figure 4 Mapping of relations between CCS and natural gas proponents and opponents (1986-1998). Shaded area indicates CCS network.

⁴ I thank two anonymous reviewers for pointing to the role of EOR.

4.2 1998-2004: Towards a cohesive policy network

As a response to the challenge presented by conflicting interests between industrial actors, the Norwegian Gas Forum was established in 1998 with an aim to unite the regional initiatives at a national level. In its early stages, the network was concerned with ‘educating’ Norwegian politicians about the benefits of natural gas (Underthun et al. 2011) in an attempt to change actors’ policy preferences and consequently the policy network structure.

In 2000, Jens Stoltenberg was elected as the leader of the Labour Party and following a resignation of the centre-right coalition minority government (Bondevik I) over the natural gas issue, Stoltenberg was appointed Prime Minister in March 2000. Stoltenberg was known to be a supporter of increased use of natural gas and had important relations with the Norwegian oil block, and in particular Statoil (Mjøset & Cappelen 2011). In November 2000, the collaborative committee between the trade unions and the Labour Party appointed the Henriksen Committee to work on a “strategy to increase the use of natural gas in Norway”. The committee included some of the most prominent proponents and opponents of domestic use of natural gas, and resulted in a recommendation to significantly increase the production and domestic use of natural gas (LO & Ap 2001). One of the instruments that was recommended to realise this goal was to establish a national innovation company for CCS (Kasa 2011b, p. 164).

In 2001, the Labour Party lost the general elections and Bondevik was again appointed Prime Minister. The Bondevik II government was only willing to support natural gas on the condition that the power plants had zero CO₂-emissions. The Bondevik II government was therefore more interested in subsidizing CCS R&D than the infrastructure for natural gas (Syrstad & Reitan 2007). A consequence of this was that between half and two-thirds of the budgets in the main research programs aimed towards developing clean energy technologies was allocated to CCS (Moe 2012). One of the recommendations from the Henriksen-committee was then followed up as an innovation company for CCS, Gassnova, was established in 2004.

As figure 5 illustrates, there was in this period also strong opposition towards the development of natural gas power plants both within the Labour Party and in Parliament (Tjernshaugen 2007, pp. 145-50). Significant lobby efforts were therefore made at both a regional and national level. In 2000, an informal network that included the industry business organisation, the trade unions, the Trøndelag municipality and local businesses was formed with the purpose of influencing leading politicians in the Labour Party that were opposed to natural gas power plants (Granviken 2000). In 2001, the trade union Fellesforbundet then instigated the establishment of Gas Forum Trøndelag, whose primary purpose was to mobilise support towards use of natural gas amongst local businesses. These initiatives, motivated by a common interest in the development of natural gas further strengthened the relations between a large group of both state and non-state actors.

Bellona had in the early stages been the main advocate of CCS. However, in 2002 a group of former Bellona employees started up a new NGO called ZERO. ZERO had from the outset CCS as one of their main issues [12] and played together with Bellona a role in influencing the debate about natural gas with CCS in Norway (Tjernshaugen 2007, pp. 165-6).

The Labour Party's informal oil network was also mobilised in an effort to influence policy preferences and strengthen the case for natural gas in Parliament. The network, which was unknown to the environmental fraction of the Labour Party until 2004, consisted of central Labour Party politicians and business leaders from the petroleum sector (Ulstein, Krossli, & Bore 2004). This gave companies with significant financial interests in the domestic use of natural gas with CCS such as Skagerak Energi, Statoil, Statkraft, and Aker special access to the internal energy policy discussions in the Labour Party (Dagsavisen 2004).

In 2003, The Federation of Norwegian Industries (NHO) and regional business organisations became members of Gas Forum Trøndelag (Reitan et al. 2008). The relations between the Norwegian Gas Forum, the trade unions and the business organisations were then formalized through the establishment of the Gas Alliance in 2004. The Gas Alliance was important for the organisation of research on gas-based industrialization, but perhaps more importantly, the political impact of the policy network was strengthened (Kasa 2011b, p. 167). This was most evident in the role the network played in a parliamentary decision to invest in natural gas infrastructure in 2005 (Reitan et al. 2008). Thus, in this period a loosely organised network changed through strategic alliances and collective action to a more cohesive policy network with a greater potential to influence policy.

Figure 5 Mapping of relations between CCS and natural gas proponents and opponents (1998-2004). Shaded area indicates CCS network.

Capturing and storing the CO₂ from the natural gas power plants was pivotal for the legitimization of natural gas power plants, and strengthened relations between actors across the policy domains of energy, industry and climate. Influenced by the energy intensive industries, the primary goal for the trade unions was to secure reliable supply of electricity [14]. Kasa and Malvik (2000) show how the networks connecting the energy intensive industries with the Labour Party were so close and permanent that they provided privileged access to the formation of the Labour Party's politics. Bellona had long pursued increased support for the development of CCS in Norway as a response to climate change, and saw gas power plants as an opportunity to bring CCS further up on the political agenda (Tjernshaugen 2007, pp. 122-6). The network was reinforced by the inclusion of Statoil, who had an interest in a license to construct one or more natural gas power plants. However, Statoil (and the state) also recognised that the development of CCS technology on gas power plants would be necessary to secure the value of future natural gas exports given the anticipation of stronger international climate policies [8][17].

The natural gas with CCS lobby had secured important political support for the funding of infrastructure for natural gas and large R&D programs for both CCS and various uses of natural gas that could improve energy efficiency in the energy intensive industries. However, due to periods of low electricity prices and high natural gas prices, gas fired power plants had been difficult to make competitive even without carbon capture technology. With CCS, natural gas would certainly not become cost-efficient and the industry was not prepared to cover the cost of developing full-scale CCS on commercial power plants (Boasson 2011, p. 117). Continued development of CCS therefore required the creation of a protected space that shielded from these selection criteria.

Throughout this period, the hope to combine CCS with EOR caused companies and government agencies to take proposals for CCS more seriously than they otherwise would have. Bellona and others argued for public investments in CO₂ transportation because most of the extra revenues from EOR would accrue to the state. However, at this time a number of reports also found a lack of feasibility in projects that combined CCS with EOR. The energy agencies and the petroleum industry therefore remained sceptical regarding the profitability of EOR (Tjernshaugen 2011).

4.3 2004-2007: Strengthening the policy network

Leading up the elections in 2005, the Labour Party, Centre Party and the Socialist Left Party proposed the formation of a new majority government, and the CCS issue was looking to become the source of a major conflict between and within all three parties. However, influenced by a broad set of actors including Bellona, Nature and Youth and the Federation of Norwegian Industries, both the Centre Party and the Labour Party voted for resolutions in favour of natural gas with CCS in 2004 (Tjernshaugen 2007, pp. 170-1). For the Socialist Left Party, it was more of a difficult issue.

The new coalition won the election in 2005. With the formation of a majority government, the issue of gas fired power and CCS was moved from Parliament to government negotiations. Both Bellona and Statoil actively sought to influence these negotiations. Statoil applied pressure by threatening to close down the refinery at Mongstad [17], and also used the energy crisis during the winter of 2006/2007 to lobby for the gas fired power plant at Mongstad (Tjernshaugen 2007, p. 187). Bellona, who had over the past decade gained privileged access to the Labour Party, influenced the negotiations by lobbying for CCS as a solution that could satisfy the environmental movement and the Socialist Left Party, whilst at the same time clear the way for the development of a gas fired power plant at Mongstad. The latter was important to the Labour Party, the trade unions and heavy industry business organisations. In the end, there was a need to maintain the stability of a policy network that now also included political parties and environmental organisations that had been opposed to CCS. A political compromise was reached that included an ambitious plan for deployment of CCS at gas-fired plants with government subsidies as the main instrument (Tjernshaugen 2011). As a result, in the period 2007-2012, the state spent 1,9 billion NOK on the planning of full-scale CCS at Kårstø and Mongstad, and approx. 5 billion NOK on a technology test centre for CCS at Mongstad (Riksrevisjonen 2013).

Figure 6 Mapping of relations between CCS and natural gas proponents and opponents (2004-2007). Shaded area indicates CCS network.

5 The development of offshore wind in Norway

Most of the offshore wind entrepreneurial activity in Norway can be traced to the offshore oil and gas industry. With expectations of a growing European market for offshore wind from around the mid-2000s Norwegian firms started to explore opportunities by developing solutions for the offshore wind industry that exploited technology, resources and competences from the oil and gas industry (Hansen & Steen 2011; Normann 2015; Steen & Karlsen 2014).

5.1 2000-2009: The emergence of two offshore wind clusters

In Trøndelag, there had been significant R&D activities on onshore wind since the early 2000s and by 2005 these activities were increasingly transferred to offshore wind [18]. In the same period, the company Scanwind developed a turbine that was particularly well suited for use offshore. Even though Scanwind was located in Trøndelag, there was little collaboration between the turbine developer and the R&D network in the region [10]. In addition to substantial activity on the topside of offshore wind, the Trøndelag region also harboured large oil and gas suppliers such as Aker Verdal, with significant competence and resources related to the construction of offshore foundations relevant for the offshore wind industry.

In 2007, a number of firms in the Bergen region organised with the aim to create a regional offshore wind cluster [16].⁵ Exogenous pressure from the finance crisis and reduced offshore petroleum activity motivated firms in the region to pursue offshore wind activities. Figure 7 shows that by the end of 2008, two regional offshore wind clusters in and around Bergen on the west coast and Trøndelag in Mid-Norway had emerged, largely based on existing industry and research infrastructure related to oil and gas.

There were, however, not only small and medium sized specialist suppliers and research organisations that developed an interest for offshore wind in the 2000s. In 2007, Statoil and Statkraft, Europe's largest generator of renewable energy, opened discussions on a possible offshore wind collaboration [8], which led to investments in two large projects in the UK (Sheringham Shoal and Dungeon) and later the establishment of the Forewind consortium together with two international energy companies, in response to Round 3 for UK offshore wind farms. Statoil's offshore wind initiatives also included a floating concept, Hywind, which resulted in the world's first full-scale demonstration of a floating turbine in 2009. However, the involvement of Norwegian suppliers in the project was limited [16] and the Hywind demonstration did not provide an important learning arena where other suppliers could test technology [8].

⁵ A cluster is a geographically concentrated group of firms and organisations in a particular field, linked by commonalities and complementarities (Porter 1998, p. 199). Clusters are different from policy networks. Policy networks can for instance extend beyond the geographical boundaries of a cluster. Moreover, cluster membership might not lead to network membership as companies in one cluster may not necessarily collaborate towards a mutual goal. Nevertheless, cluster participants will often share common interests (Porter 1998, p. 205).

Figure 7 Mapping of main offshore wind actors and advocates (2000-2008). Circles indicate offshore wind regional clusters.

Following these early initiatives, offshore wind rose on the political agenda in Norway between 2007 and 2009 (Normann 2015). An important step in this period was the publication of a report on offshore wind by the Energy Council, commissioned by the Minister of Petroleum and Energy, Åslaug Haga. Haga was a vocal advocate of offshore wind, and the report can be interpreted as an attempt to influence policy preferences of actors. The group behind the report consisted of representatives from the most important energy companies in Norway. Even though the ministry toned down the most optimistic conclusions [5], the report recommended large government investments in both infrastructure and full-scale demonstration of offshore wind (Energirådet 2008). Another important step that was taken was the adoption in Parliament of a law for the production of offshore renewable energy in 2009. The government also launched the new organisation INTPOW that would help bridge access for Norwegian firms in the renewable energy industries to international markets. However, the main instrument introduced for the development of offshore wind technology in Norway came through the establishment of two state funded research centres dedicated to offshore wind, located in Bergen (NORCOWE) and Trondheim (NOWITECH). With this, significant funding of R&D activities was secured and the offshore wind research communities in Bergen and Trøndelag were strengthened. However, with the establishment of two centres, a degree of competition over resources between the two clusters was maintained [2][8].

In 2009, the industry networks in Bergen and Trøndelag were further strengthened as they were formally recognised as Innovation Norway Arena programmes called Arena NOW in Bergen and Arena Mid-Norway in Trøndelag. The Trøndelag network was also strengthened with the acquisition of Scanwind by General Electric and the promise of resources from the state owned Industrial Development Corporation of Norway (SIVA) towards infrastructure for offshore wind in the region. Even though the Arena programmes offered the existing clusters better visibility in the public sphere, they were explicit about not participating in any lobby activities [10][9]. Rather, their purpose was to facilitate industry networking activities [16]. However, one of the respondents noted that there was no collaboration between the two Arena programmes in Bergen and Trøndelag [10][9]. Thus, even though actor relations were strengthened at a regional level, there was a lack of relations on a national industry level.

Figure 8 Mapping of relations between offshore wind actors and advocates (2008-2009). Shaded areas indicate offshore wind regional clusters.

As illustrated by figure 8, by the time the Stoltenberg II government was re-elected in 2009, a significant momentum had developed around offshore wind in Norway, primarily driven by recognition of the industrial potential rather than from the production of kilowatts [9]. Offshore wind was singled out, together with CCS (and to a lesser extent solar PV), as a technology that was to be prioritized through major R&D allocations, and as a technology that could represent a significant share of the future value creation in Norway.

In this period, we can observe that network formation was influenced by actors with mutual interests in offshore wind as well as from exogenous change. The emergence of two clusters around Bergen and Trøndelag had initially contributed to placing offshore wind on the political agenda. With exogenous

developments in the oil and gas industry and the financial markets, these networks were further strengthened as more resourceful actors were enrolled and legitimization for favourable policies increased. Yet, it was also evident that offshore wind was due to high costs in need of protection, through policies, from competition with both incumbent technologies and more mature new energy technologies.

5.2 2010-2012: Competing interests in an incohesive policy network

By the end of 2009, it was evident that the existing support mechanisms for new renewable energy were insufficient to realize large-scale offshore wind in Norway (Normann 2015). Thus, similarly to the case of CCS a few years earlier, there was a need for public support of large demonstration programs and full-scale demonstration parks that could provide a learning arena shielded from the mainstream selection environment. As shown in figure 9, this demand was articulated through several lobby efforts by different groups of industry and research organisations.

Shortly after NOWITECH and NORCOWE had been established in 2009, plans for a demonstration park for offshore wind were developed inspired by the Alpha Ventus park in Germany [18][17]. A group consisting of the two research centres, as well as the Arena clusters in Bergen and Trøndelag then sent a formal proposal to the Ministry of Petroleum and Energy in February 2010 requesting significant state funding towards a demonstration project labelled Demo 2020. Thus, new relations were established between actors with a mutual interest in policy support towards offshore wind. The proposal was formally supported by NORWEA, Navitas (a supply network for oil and gas), the trade unions and the Federation of Norwegian Industries.

In April 2010, Statoil, GE and Lyse Energi announced plans for their own demonstration project called Demo Rogaland. Having made the investments in the Scanwind turbine, GE needed to develop industrial partnerships and to pre-qualify technology to compete in Round 3 in the UK (Vik 2010). Unlike Demo 2020, this project did not require state funding.

Around the same time as the offshore wind research network lobbied for Demo 2020, the energy consortium Vestavind Offshore also lobbied for government funding to realize a full-scale offshore wind project called Havsul. Vestavind Offshore had relations to both the Arena network in Bergen and NORCOWE, but had no direct involvement in the Demo 2020 proposal. In 2008, Vestavind Offshore had opened a dialogue with local representatives from the trade unions and the Labour Party. In particular, the local trade unions responded enthusiastically to Havsul. With this local support, Vestavind made numerous attempts in 2010 to engage the trade unions centrally and members of Parliament. They also had meetings with representatives from the Ministry of Petroleum and Energy and the Ministry of Trade and Industry. However, Vestavind struggled to gain access to the political

leadership in the two ministries, and was unable to bring the issue sufficiently high on the trade unions' agenda [2].

Figure 9 Mapping of relations between offshore wind actors and proponents (2010-2012). Shaded areas indicate full-scale and demonstration initiatives.

Network formation in this period can be characterised by increased network membership but also by a lack of collaboration between actors. The three separate demonstration projects involving different groups of actors led to competition over resources and political attention (Normann 2015). The Demo 2020 proposal suffered from a lack of support from the large industrial actors involved in offshore wind [8][11]. Lyse Energi put resources towards Demo Rogaland [1], and it was difficult to unite all the offshore wind actors behind one proposal [18]. Statoil and Statkraft were also by this point investing in the Sheringham Shoal project in the UK, which fulfilled their need to develop experience and competence [1][3]. Statoil and Statkraft had only had limited involvement in the regional offshore wind clusters, and the Norwegian supply industry found it difficult to become attached to the activities of Statoil and Statkraft [1][3][4][11][16].

The Demo 2020 proposal was followed up in 2010 with efforts to influence policy preferences through meetings with the Ministry of Petroleum and Energy and conversations with members of Parliament, mainly from the political opposition [16]. Although the need for support mechanisms for offshore wind had been formally proposed in Parliament as early as 2007 (Normann 2015), the Demo 2020

initiative led to new discussions in Parliament on the issue in 2010. Interestingly, there seems to have been a broad consensus in the Standing Committee on Energy and the Environment in support of the initiative as committee members from both government and opposition parties argued in Parliament for large state funding of both the Demo 2020 and Havsul projects in March 2010 (Stortinget 2010a).

Unlike in the case of CCS where powerful state actors and strategically important political players shared an interest in increased use of natural gas with CCS, interviews point to a lack of interest in offshore wind in the Labour Party, the Ministry of Finance, the Ministry of Petroleum and Energy and the Ministry of Trade and Industry [1][8][14][16].

In June 2010, a united opposition submitted a proposal for government support towards Demo 2020 (Stortinget 2010b). The response from the Minister of Petroleum and Energy was that public investments in larger domestic offshore wind projects would be introduced once the costs of offshore wind had been reduced. In the meantime, existing policy instruments available through Enova and the Research Council would remain as the main tools for supporting offshore wind. In the same debate, the minister also referred to possibilities to engage in international markets aided by the newly established organisation INTPOW. In the end, the lobby efforts for Demo 2020 were insufficient as the proposal was rejected in Parliament in June 2010.

Vestavind Offshore reconfigured the Havsul project from a commercial full-scale wind farm to a demonstration project and continued dialogue with the authorities throughout 2011 and 2012. However, following work on a white paper on climate policies that finished in 2012, it became clear that there would be no room for the state to co-finance full-scale demonstration of offshore wind in Norway (Gillesvik 2012), and the project was subsequently terminated later the same year.

6 Discussion

The objective of this paper has been to investigate how network structures can explain differences in government support towards the development of new clean energy technologies. I have done so through an analysis of the formation and structure of policy networks supporting the development of offshore wind and carbon capture and storage in Norway. In the following, I discuss how the two cases presented in this paper illustrate how policy networks are formed and how network participation and structure influences the formation of niche protection policies.

6.1 Policy network formation

In the previous two sections, I have described how groups of actors organized in different regions with ambitions to develop industrial activity connected to offshore wind and CCS. These policy networks expanded as individual actors exploited windows of opportunity (Kingdon 2011) that emerged from exogenous change. In this way, the two cases illustrate how network change is influenced by developments at both macro and micro level. The strengthening of the policy networks was necessary

to build sufficient political support needed to realise niche protection policies through public investments in full-scale demonstration projects. In the case of offshore wind, it was particularly changes in the financial markets, decline in the petroleum industry, and growing international markets for offshore wind that gave industry representatives temporary access to decision makers, whereas pressure from climate change created the opportunities for CCS advocates.

The cases also reveal how policy networks are shaped through internal dynamics influenced by the interests and resources of both state and non-state actors. Previous studies have illustrated how formal networks are important for the build-up of technological innovation systems (Musiolik & Markard 2011; Musiolik et al. 2012). In the case of CCS, a formal network such as the Norwegian Gas Forum played an important role in uniting competing interests and strengthened the broader CCS policy network. However, in the case of offshore wind the formal industry and R&D networks that were established had little impact on the formation of a cohesive offshore wind policy network.

A cohesive policy network is conditioned on a long-term state interest in this network. Section 4 describes how there has been a long-lasting policy goal of increasing the domestic use of natural gas in Norway, with the trade unions, the business organisations, and the main fraction of the Labour Party as the most prominent advocates together with regional interest groups. However, natural gas was met with forceful opposition from environmental groups and in Parliament. This is in contrast to the case of offshore wind, which was much less contested. Yet, although section 5 reveals little opposition towards offshore wind, there was a distinct lack of interest within the Labour Party, the Ministry of Finance and the Ministry of Petroleum and Energy (Normann 2015).

One insight from the cases presented in this paper is that informal relations between state and non-state actors and relations between business interests and political parties matter for the formation of cohesive policy networks and increases the potential to influence policy. The establishment of such relations relies on actors that have resources that other actors in the policy network need. This is evident in the case of CCS where different actors such as Bellona, Statoil, the Labour Party, the Socialist Left Party, and the Ministry of Petroleum and Energy formed a policy network through the exchange of resources and bargaining. The case of offshore wind shows that the resources available to many of the policy network members were not needed by centrally placed politicians or important state actors such as the Ministry of Trade and Industry or the Ministry of Petroleum and Energy. One possible explanation for this difference is that whereas advocates of CCS were able to present multiple rationales for public investments in CCS, offshore wind actors were unable to present offshore wind as a solution to pressing problems for key state and government actors. An implication for research on sustainable transitions is that we should not only analyse the resources available to actors and groups, but also whether other actors need these resources.

6.2 Policy outcomes

An assumption in the policy network approach is that the structure of policy networks influences the degree of access to the policy process, and therefore policy outcomes. Table 2 shows the main policy events relevant for the development of CCS and offshore wind in Norway. From this, we can see that both technologies were supported by increased funding of R&D and infrastructure, and regulatory policies. The difference, however, is evident in policies for full-scale demonstration.

Table 2

Main policy events relevant for CCS (1997-2006) and offshore wind (2007-2012) in Norway

CCS policy outcomes	
1997	Christian Democrats-led government made CCS part of formal requirements in Naturkraft's permit.
2000	Labour-led government increased CCS R&D funding from NOK 9 million in 1997 to NOK 20 million in 2001.
2002	Annual funding of CCS R&D through Klimatek programme increased from approx. €2 m to just below €6 m.
2005	Parliament voted in favour of investing in natural gas infrastructure. Gassnova established (state-owned innovation company for gas technology) with €250 m fund. Climit research programme on CCS established with annual funding of approx. €19 m. Declaration that the government should retrofit the Naturkraft power plant at Kårstø with CCS at the government's expense. The state spent €240 m on full-scale CCS at Kårstø and Mongstad between 2007 and 2012.
2006	Agreement between Ministry of Petroleum and Energy and Statoil to establish capture technology test centre at Mongstad (TCM). The state spent €625 m between 2007 and 2012 on TCM. Statoil granted license for natural gas power at Kårstø with CCS.
Offshore wind policy outcomes	
2007	Enova funding of €7.5 m towards Statoil's Hywind.
2009	Adoption of law for production of offshore renewable energy. NORCOWE and NOWITECH established with combined annual funding of approx. €4.5 m. Arena NOW and Arena Mid-Norway established. SIVA received €23 m from government for investments in infrastructure for offshore wind in Verdal.
2010	Proposal to publicly finance offshore wind demonstration project rejected in Parliament.
2012	White paper confirmed that the state would not co-finance full-scale demonstration of offshore wind.

Both cases show how actors can alter the network structure by strategically forming alliances and enrolling new actors in the policy network. In the case of CCS, strategic actors made successful efforts to influence the policy preferences of centrally placed actors, which strengthened the policy network and improved access to the policy process. The policy network advocating CCS thus developed from one resembling a loose issue network to one with characteristics of a stable policy community.

Eventually, the CCS policy network united key state and government actors, business interests and the environmental movement. Through participation in this policy network, CCS advocates gained privileged access to the policy process that in the end contributed to the government decision to fund large-scale demonstration of CCS. The organisation of advocates of offshore wind, however, can be seen as an example of a less cohesive policy network with little impact on the policy process. The offshore wind case illustrates how the opportunities for actors also can be constrained by the structure of the policy networks as members of the offshore wind policy network struggled to gain access to key political players and state actors, and therefore also the policy process.

Gullberg (2011) points out that Norway has a parliamentary system with strong corporatist traditions, with more regulated access to participation in policy-making processes. The importance of corporatist channels increased with the formation of a majority government in the period 2005-2013. Reitan et al. (2008) show how in particular the trade unions have enjoyed access through these channels. It is also worth noting that the Labour Party has been particularly concerned with keeping with the interests of the energy intensive industries in Norway (Kasa 2000). The most cost-effective way of ensuring this was through the development of natural gas power plants. The strong relationship between the trade unions and the Labour Party, and their mutual interest in developing favourable policies for the energy-intensive industries thus had an important impact on the political support towards full-scale CCS in Norway (Kasa 2011b). This is then an example of how the institutional context influences network formation. Moreover, this shows how the influence of policy networks increases when business and state interests are aligned.

Mazzucato (2013, p. 161) argues that a successful energy transition relies on the commitment from large energy companies, and evidence from the two cases shows that a policy network needs participation from the larger industrial actors to achieve political breakthrough. Even though new technological inventions can originate from small and agile companies, it is the financial muscle of the big enterprises that can breach the so-called “valley of death” between R&D subsidies and market-based instruments. Many of the respondents highlighted the lack of major industrial actors in the offshore wind networks.

The absence of influential actors in the offshore wind network can in part be explained by its fragmented structure, which resulted in a lack of a united and strategic effort to influence key decision makers. However, two additional factors help to explain the lack of participation of large firms in the offshore wind network. First, the growth of an international market for offshore wind reduced the incentive for larger firms to participate in a domestic policy network for offshore wind (and as section 5 shows also influenced the political debate about the need for niche protection policies in Norway). Second, increased investment levels in offshore oil and gas pulled industrial actors out of the network. Not only did this reduce the size and influence of the network, but it also reduced the type of resources

that it could offer to the government in exchange for ambitious policies supporting full-scale offshore wind in Norway. This underlines how policy network structures are influenced by exogenous change.

Finally, the cases reveal important differences between how CCS and offshore wind have been aligned with established industries. These differences are not so easily explained through the lens of the policy network approach. An important goal for transition studies has been to understand the conditions for regime stability and change through different forms of interaction between the niche and regime, influenced by exogenous change. Such interaction can be understood to follow different pathways, depending on the degree of competition or mutual enhancement between niches and regimes (Geels & Schot 2007). The CCS case can be interpreted as an example of niche-regime interaction where the niche was adopted by the fossil-based regime in response to exogenous change. Torvanger and Meadowcroft (2011, p. 309) point out that the high government research expenditure on CCS allows Norway to pursue oil and gas extraction while maintaining claims to an ambitious climate policy. Thus, niche protection policies for CCS could also strengthen the existing trajectory of the regime. This is in contrast to offshore wind where similar support towards full-scale demonstration would facilitate a reorientation by regime actors rather than a strengthening of incumbent activities. Thus, the multilevel perspective can help us understand how policy networks can also be shaped by the way in which niches and regimes are aligned.

7 Conclusions

In this paper, I have offered an approach to analyse how interests, networks and relations influence political negotiations and how negotiations lead to particular policy outcomes. I have used this approach in a comparison between the development of political support towards carbon capture and storage and offshore wind in Norway. The analysis shows that policy network structure matters and that in order to understand how niche protection policies are formed, we need to also understand the interests of political parties and their relations with both state and non-state actors. In this way, the paper has responded to calls for an improved appreciation of how actors forge political networks and how these impact policy (Bergek et al. 2015, p. 11). In this concluding section, I highlight three particular insights that I see as relevant for research on policy formation and sustainable transitions.

First, informal relations formed through the exchange of resources are critical for policy network formation. Privileged access to policy makers is thus provided to those actors that have exchangeable resources. One way to better understand how some actors influence policy outcomes might therefore be to analyse the strength of resource dependency between actors.

Second, the cases in this paper illustrate how state and government actors have interests in particular policy areas. Transition studies should pay closer attention to the interests of state actors and political parties and individuals, and how these are aligned with business interests.

Third, focusing on policy networks is not sufficient to explain policy outcomes as such networks are but one component of an explanation (Rhodes & Marsh 1992, p. 196). A conceptualisation of niche-regime alignment can help to explain how policy networks are influenced by the institutional context, and thus further explain why some policies are favoured by centrally placed actors.

An intriguing area for further research that has not been explored in this paper would be to investigate causal relations between the development of new renewable energy technologies and carbon capture and storage. An analysis of policy networks could provide interesting opportunities to explore how actors with interests in competing clean energy technologies collaborate and compete over access to the policy process. Such insights would contribute to a more general understanding of how technological innovation systems interact with other systems (Bergek et al. 2015, pp. 5-6).

Acknowledgements

I gratefully acknowledge constructive comments on earlier drafts from Laura Diaz Anadon, Anne Therese Gullberg, Charlene Zietsma and three anonymous reviewers. I also wish to thank all interviewees who took time to talk to me despite their tight schedules. Research for this paper has been funded by Centre for Sustainable Energy Studies (CenSES).

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