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

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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 interplay between state interests, political party strategies and the interests of firms influences the potency for solutions tied to climate and energy problems. The paper therefore contributes to the discourse on the role of politics in sustainability transitions.

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 et al., 1998, p. 185) for immature renewable energy technologies is seen as an important goal for policy, particularly when rapid change is required (Smits et al., 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 and 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 sustainability transitions and the build-up of new renewable energy technologies (Kern, 2015, p. 68; Markard et al., 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 sustainability transitions (Farla et al., 2012; Geels, 2014; Hess, 2014; Meadowcroft, 2011; Smith et al., 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 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) in Norway to

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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 and Smith, 2002). Substantial improvements in technology have been found to come from interaction with the market, emphasising the need for learning feedbacks between different processes (Freeman, 1995). Increased efficiency will often come from learning, experimentation with logistics, and non-technological improvements that are difficult to achieve without practice in markets (Rosenberg, 1972, pp. 12–3). Even though these insights have had considerable impact on policy (Mytelka and 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 technological opportunities. These developments also influence the commitment of policy makers to invest in different solutions such as offshore wind or CCS. Regulations and policies can also provide 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 and Karltorp, 2013). Even though this has benefitted 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 and 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 et al., 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 processes of introducing these policies have until recently been poorly understood (Smith and Raven, 2012). Ulmanen et al. (2009) highlight that niches are not created solely 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 legitimation 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. 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 and 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 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 is closely related to networks of actors (Bergek et al., 2008b; Binz et al., 2012, pp. 165–6). However, the role of networks in facilitating collective action and system building has been less in focus (Musiolik et al., 2012).

2.2. The policy network approach

Based on assumptions about the importance of networks in the sustainability transitions literature, this paper is concerned with how networks are formed and how networks might influence policy outcomes. This assumed link between networks and policy is based on insights from political science, where studies of advocacy coalition framework (Sabatier, 1998) or policy networks (Adam and Kriesi, 2007; Marsh and Smith, 2000) have identified network change as important for major policy change. 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. The policy network approach (PNA) particularly emphasises how the structure of policy networks influences policy outcomes by providing some actors privileged access to the policy process (Daugbjerg and 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. Types of policy networks can be distinguished depending on the degree of integration and cohesiveness (Rhodes and Marsh, 1992). A policy community is typically characterised by restricted access to the network and high degree of consensus among participants. Another characteristic of a cohesive policy community is resource interdependency between network participants (Enroth, 2011). A policy network that lacks such cohesiveness, due to e.g. competition between network members or general lack of collaboration, will resemble an issue network type. Collaboration through coordinated networks matters because policymakers cannot exchange resources for access with every individual interest group (Beyers and Braun, 2014) and network participants need to act jointly to realise shared objectives. 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 and 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 and 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 and state and party actors, and thus access to the policy process.

The relationships within policy networks are structural as they define and constrain the roles that actors can play. Even though available resources at the actor level matters for access to policy makers, policy network participation and the structure of these networks has been found to improve access to both elected and non-elected officials (Beyers and Braun, 2014). The policy network approach can thus 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).

To explain policy outcome as influenced by policy networks, it is necessary to explain network change (Dowding, 1995). Yet, because participants in cohesive policy networks tend to have an interest in maintaining stability (Richardson, 2004), policy networks are often thought of as resistant to change. Policy network change has therefore often been understood as a result of exogenous factors (Rhodes, 2006; Rhodes and Marsh, 1992; Sabatier and Weible, 2007). Important network-external factors can be institutional, economic, technological, and (more recently) climate change. Sometimes, the relationship between networks and exogenous factors can be considered to be two-directional. E.g. technology development related to offshore wind and CCS can shape actors' interest in these technologies, whilst policy networks and actors can themselves shape the conditions for technology development and institutions (Adam and Kriesi, 2007; Marsh and Smith, 2000). Even though events such as the financial crisis or pressure from climate change can affect the resources, interests and relationships of the actors within networks, these network-external changes are interpreted within the structures of the networks (Marsh and Smith, 2000). More recent studies of advocacy coalitions and policy networks have therefore focused on how networks and actors respond to network-external factors.

Even though a policy network 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 and Richards, 2000). Several scholars have therefore emphasised the need to study network change also as a result of interaction between actors and networks in what has been labelled a dialectic model of policy networks (Evans, 2001; Marsh and Smith, 2000).

A common understanding in studies of policy networks is that the interests of actors influence networks. Studies of advocacy coalitions often view interests, and thus participation in coalitions, as conditioned on actors' beliefs and values (Markard et al., 2015). However, that is not to say that actors who hold similar beliefs will act in concert (Sabatier, 1998). A policy network approach considers the interests of actors to be affected by the structures of advantage and disadvantage built into the network (Evans, 2001). Moreover, the broader context within which the network operates affects the interests and actions of network members (Marsh and Smith, 2000). It is therefore necessary to analyse, in addition to the interests of relevant actors, the pattern of interaction within networks (Adam and Kriesi, 2007). The PNA focuses particularly on the alignment between interested groups and state actors (Richardson, 2004) as well as the strategic role of political parties. The policy network approach can therefore be useful for understanding how changing (or stable) relationships between state and non-state actors influence opportunities to participate in the policy process.

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 (Jordan, 1990, pp. 326–7). The outcome of bargaining processes depends on who bargains and the nature of the bargaining process (influenced by policy network structure and strategic actors). The attention to bargaining implies that certain actors can gain privileged access by occupying brokerage positions in the policy network (Beyers and Braun, 2014). Finally, efforts to change policy preferences of important actors can enrol these actors and thus alter the network membership. The analytical framework is visualised in Fig. 1.

The attention to how political parties privilege certain interests over others (Daugbjerg and Marsh, 1998) and the emphasis on state actors' interest in fostering policy networks (Hill, 2013, p. 59) makes the approach useful for analysing transformation processes in contested areas such as 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 constrains network membership and how members act (Marsh and Smith, 2000; Smith, 1993). See Table 1 for a description of how the main concepts have been operationalised.

3. Data and methods

Countries differ in terms of available resources, deployed technologies, industry structure, infrastructure and governing traditions (Ratinen and Lund, 2016). Countries therefore face different opportunities and challenges related to the energy system, and are likely to pursue different strategies in response to pressure on the energy system as a consequence of climate change (Kern and Markard, 2016).

Norway represents a paradoxical context for studying energy transitions (Hanson et al., 2011). On the one hand, nearly all domestic electricity supply comes from hydropower resources and Norway promotes ambitious climate change mitigation internationally. The low and stable electricity prices enabled by hydro resources have supported the development of energy-intensive process industries in Norway (Wicken, 2011). This complex between the hydropower and energy-intensive industries has enjoyed considerable influence on policy processes related to the energy sector (Kasa, 2000, 2011b). On the other hand, Norway is a significant petroleum producer. Oil and gas production and supply to the international offshore oil and gas industry represent the two largest export industries in Norway respectively. Norway thus represents an interesting context to study strategies adopted

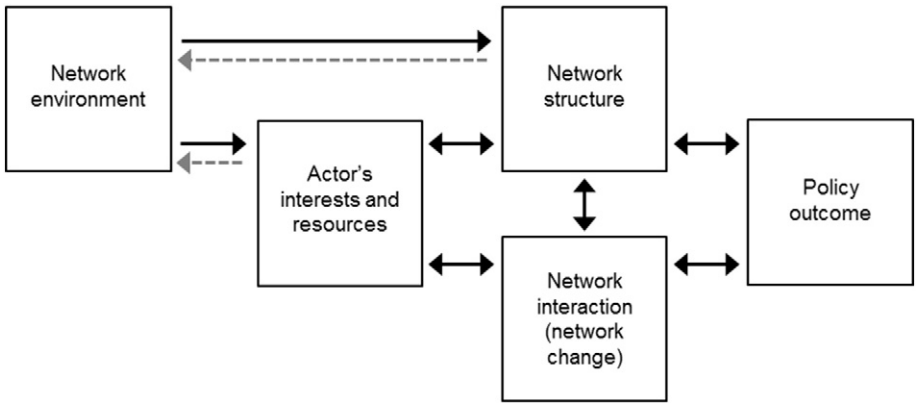

Fig. 1. Policy networks and policy outcomes. Adapted from Marsh and Smith (2000).

Table 1
Operationalisation of main concepts.

Concept	Description	Evidence to look for
Network structure	A policy network continuum ranging from closely integrated policy community to loosely organised issue network (Marsh and Rhodes, 1992).	Issue network characterised by competition or lack of collaboration between actors, no clear state interest, and lack of strategically positioned sympathy within the party-system. Policy community characterised by collaboration, shared interests and mutual goals, participation from state actors, influenced by underlying political party strategies.
Network formation and network change	Policy networks shaped through a dialectic relationship between strategic actors and networks, and from exogenous change (Marsh and Smith, 2000).	Exogenous change: Articulated pressure from climate change, financial markets. Resource exchange (information, threats and promises, political support, financial contributions). Bargaining and compromises. Alliance building. Enrolment of new actors. Efforts to change policy preference of actors.
Influence on policy outcome	Policy networks can facilitate privileged access to policy process, whilst denying others the same privilege (Daugbjerg and Marsh, 1998).	Level of access to policy makers and strategically important political party actors. Policy outcomes in the interest of network members. Niche protection policies through public support towards 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 Kårrstø 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.

in countries with vested interests in fossil fuels (Moe, 2015) combined with articulated climate policy ambitions (Tellmann, 2012).

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 and Strand, 2009; Boasson, 2011, p. 229; Riisnæs, 2011). Further, both OWP and CCS have strong ties to the petroleum industry (Hansen and 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 (Heptonstall et al., 2012; Markusson et al., 2012; Nykvist, 2013). 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,b).

From an energy and climate perspective, the rationale for investing in CCS has been that it could decarbonise natural gas power plants (Langhelle and Meadowcroft, 2009). The rationale for offshore wind has been that it could support the idea of Norway as a "green battery" for Europe (Normann, 2015, p. 186). However, high abatement costs combined with a principle of cost-efficiency in energy and climate policy making (Moe, 2012) have provided weak incentives for large-scale investments from a national climate policy perspective. Yet, CCS is an area where the government has renounced this principle. One suggested explanation for this difference is that even though both technologies fit well with the industrial structure in Norway (Moe, 2015), CCS has been governed with technology development as policy criteria, whilst renewables has been governed with economic policy as criteria (Boasson, 2015).

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.

These differences in public support are further illustrated with Fig. 2, which 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). These similarities and contrasts between offshore wind and CCS in Norway provide an interesting opportunity for studying the creation of niche protection through policies supporting full-scale demonstration.

Following Ratinen and Lund (2016) who suggest that transition processes are influenced by the ties between government and incumbent firms, the positions of the petroleum industry and the hydropower complex in the national economy can in part explain these differences between CCS and OWP. CCS is simply more appealing as it promises to cut emissions without disrupting the existing regime (Scrase and Smith, 2009). However, Kasa (2011a, pp. 62–4) proposes that the different efforts towards CCS and other new renewables in Norway can also be explained with differences in network structures. For instance, Tjernshaugen and Langhelle (2009) show how the nature of the CCS network in Norway has influenced the government commitment to CCS.

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

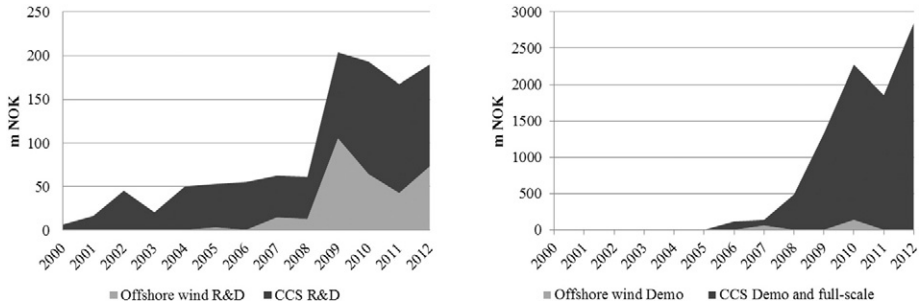

Fig. 2. Public spending on offshore wind and CCS R&D and full-scale demonstration (2000–2012). Funding from the Research Council of Norway (RCN) towards R&D and the Norwegian Ministry of Petroleum and Energy towards CCS full-scale demonstration and state agency Enova towards offshore wind full-scale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

organisations and interest organisations[1]. The politics behind the development of CCS in Norway has been extensively researched[2]. 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 and 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 using binary data[3]. The diagrams show relations between the most important actors during different time periods and how we might interpret groups of actors as part of different policy networks. The diagrams distinguish between three types of relations: Ownership, other formal relation, and informal. I understand formal relations as relations identified through membership of formal networks, government coalitions, and other clearly identifiable relations. I understand informal relations as those identified through different types of resource exchange, membership of informal networks, and collaboration. 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 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 Fig. 3 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 and 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 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

[1] A list of 19 interviewees referred to in the empirical analysis is included in the appendix.

[2] Boasson (2011), Kasa (2011b), Reitan et al. (2008), Tjernshaugen (2007, 2011), Tjernshaugen and Langhelle (2009), Underthun et al. (2011).

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

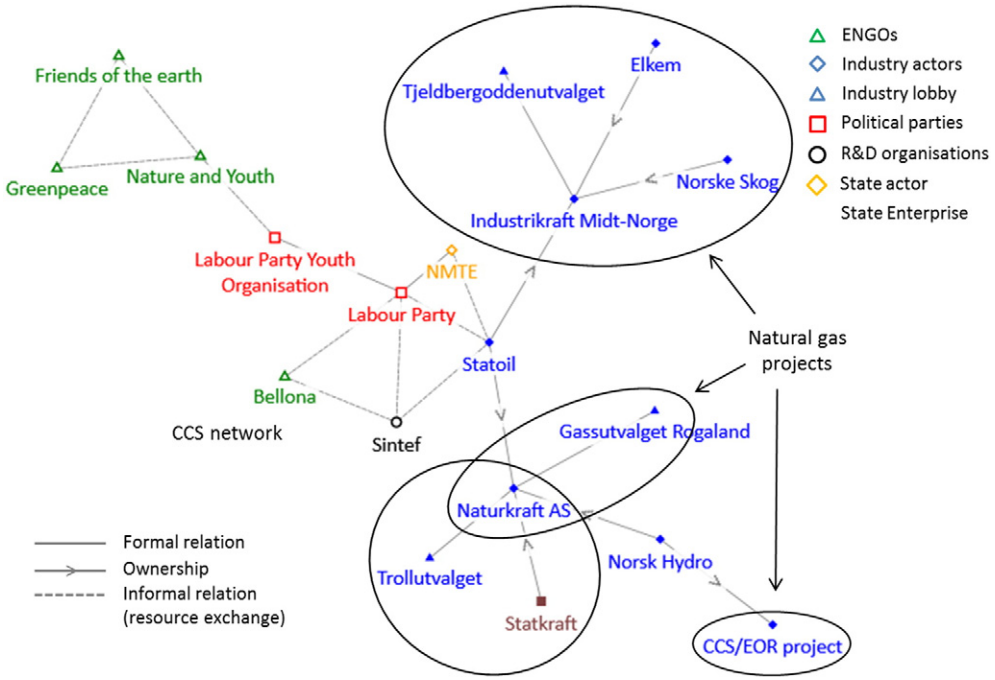

Fig. 3. Mapping of relations between CCS and natural gas proponents and opponents (1986–1998). Shaded area indicates CCS network.

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 and 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.

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 public 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 and 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, which included some of the most prominent proponents and opponents of domestic use of natural gas, ended up proposing to replace inefficient gas-power plants with power from natural gas with CCS and establish a national innovation company for CCS (LO and Ap, 2001). This compromise met resistance from Prime Minister Stoltenberg who favoured policies that followed a least-cost principle (Boasson, 2015, p. 109).

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 and 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 Fig. 4 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 main business organisation, 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

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

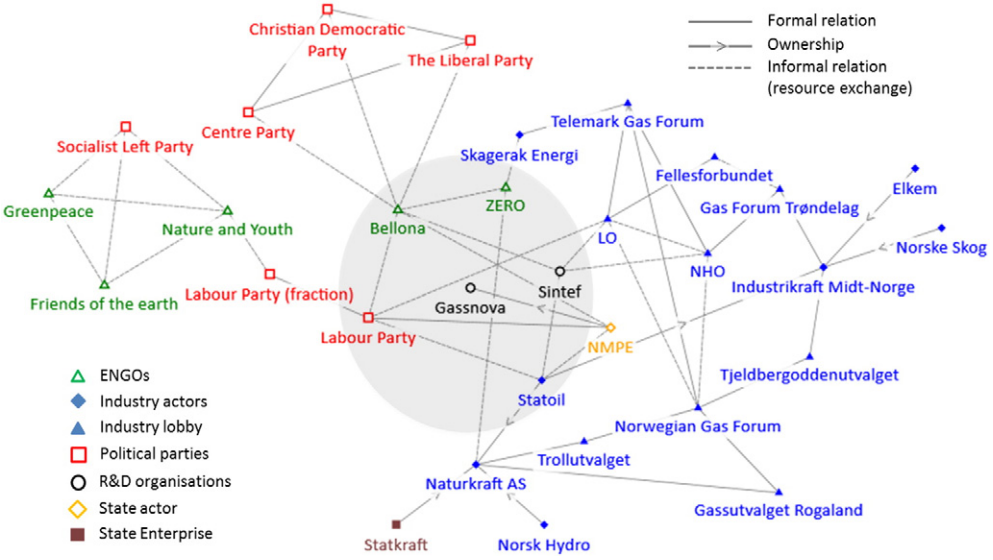

Fig. 4. Mapping of relations between CCS and natural gas proponents and opponents (1998–2004). Shaded area indicates CCS network.

(Ulstein et al., 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, trade unions and 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.

Capturing and storing the CO2 from the natural gas power plants was pivotal for the legitimation 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 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, 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 (see Fig. 5). 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

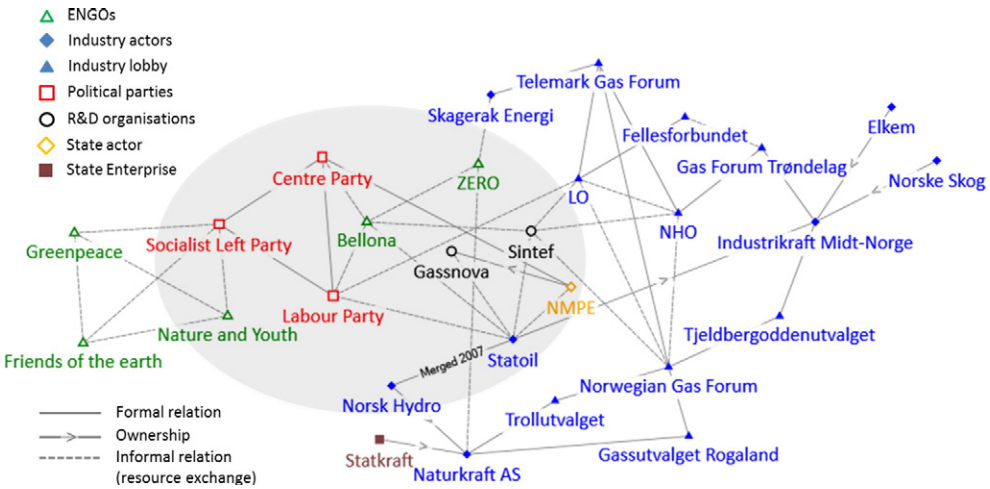

Fig. 5. Mapping of relations between CCS and natural gas proponents and opponents (2004–2007). Shaded area indicates CCS network.

Mongstad, and approx. 5 billion NOK on a technology test centre for CCS at Mongstad (Riksrevisjonen, 2013).

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 and Steen, 2011; Normann, 2015; Steen and 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 financial crisis and reduced offshore petroleum activity motivated firms in the region to pursue offshore wind activities. 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 (Fig. 6).

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].

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 [6], 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]. Moreover, despite the purpose of facilitating industry networking activities [16], there was no collaboration between

[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).

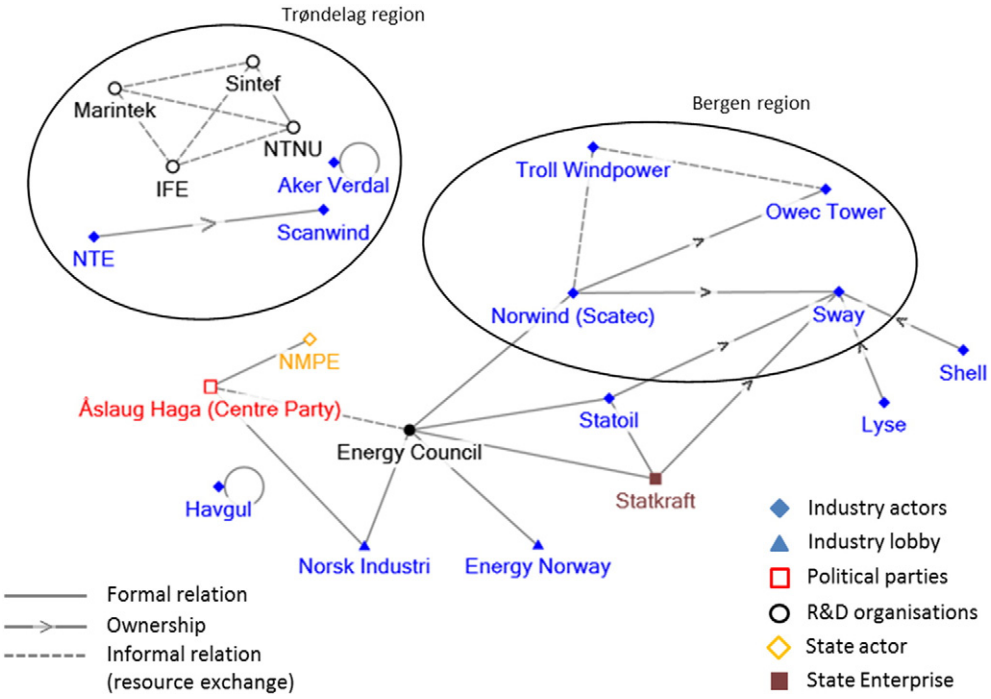

Fig. 6. Mapping of main offshore wind actors and advocates (2000–2008). Circles indicate offshore wind regional clusters.

the two Arena programmes [10]. Thus, even though actor relations were strengthened at a regional level, there was a lack of relations on a national industry level.

As illustrated by Fig. 7, 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 by 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 legitimation 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

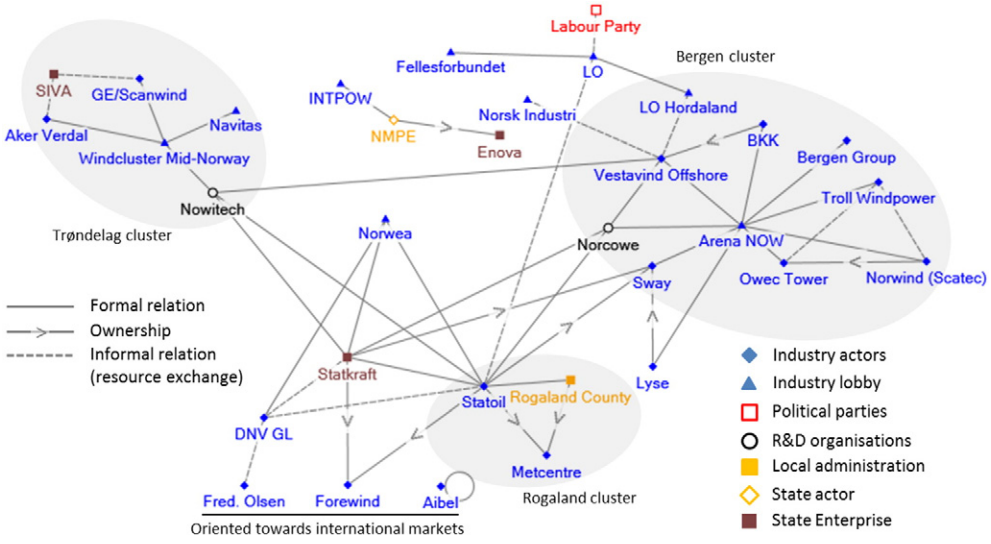

Fig. 7. Mapping of relations between offshore wind actors and advocates (2008–2009). Shaded areas indicate offshore wind regional clusters.

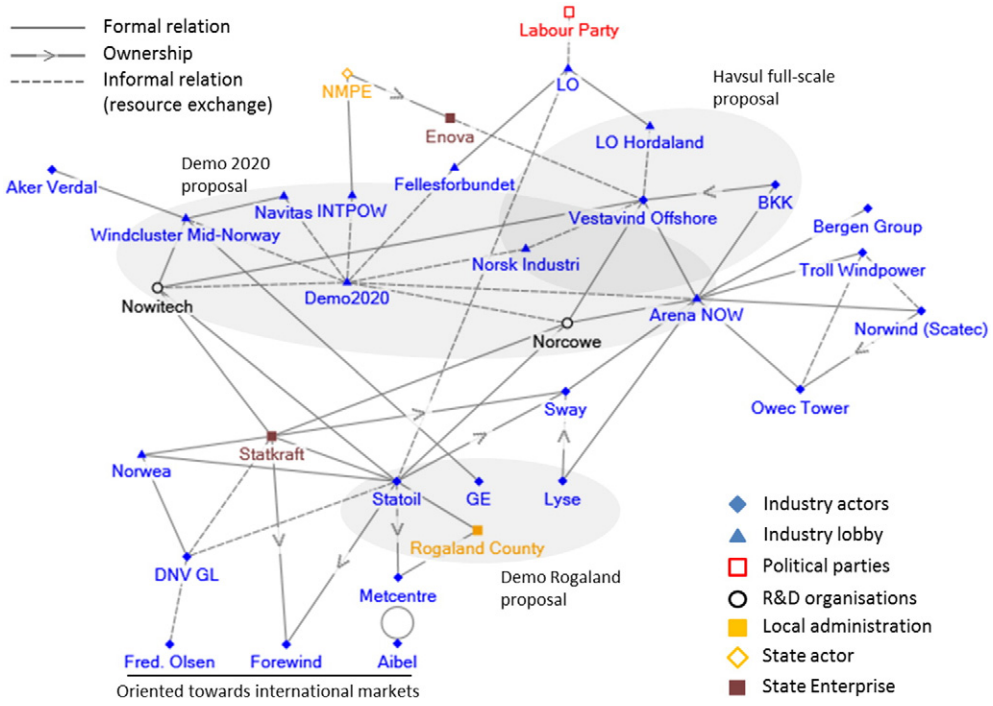

Fig. 8. Mapping of relations between offshore wind actors and proponents (2010–2012). Shaded areas indicate full-scale and demonstration initiatives.

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. This demand was articulated through several lobby efforts by different groups of industry and research organisations (Fig. 8).

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), 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 trade unions and the Labour Party. In particular, local trade unions responded enthusiastically to Havsul. With this local support, Vestavind made numerous attempts in 2010 to engage 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 [3].

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][9][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 [2][4]. 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 [2][4][5][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 [7][13][15][19].

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

In the following, I discuss how the two cases illustrate how policy networks are formed and how network structure influences access to policy processes.

6.1. Network formation and network change

Following Fig. 1 in Section 2, actors as well as exogenous change can influence network change. 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. In both cases, exogenous change put pressure on the socio-technical regime and opened up opportunities for the enrolment of resourceful actors in the networks. In the case of offshore wind, regime pressure led to the formation and initial growth of a network supporting a niche technology. In the case of CCS, however, regime pressure opened up for CCS proponents to enter into the more influential network that included supporters of natural gas. The CCS case is thus an example of how policy networks respond to exogenous pressure by changing the structure of the network.

Attention to exogenous change also helps 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. The size of the network, and the type of resources that it could offer to the government in exchange for access to the policy process, was thus reduced in response to network-external events.

The policy network approach points to alliance building and lobbying as activities that can change network structure. The initial periods in both cases show how actors altered the network structure by strategically forming alliances in regional networks. However, the networks developed differently in terms of enrolment of new actors. In the second period of the CCS case, organisations from the environmental movement, trade unions and business organisations were enrolled as important actors in the network. The network changed further following the election in 2005 with the inclusion of the Socialist Left Party. By comparison, although the Socialist Left Party, trade unions, and environmental movement were positive towards offshore wind, none of these types of actors actively participated in the OWP network. Moreover, the CCS with natural gas proponents recognised in the initial periods a need to consolidate activities at a national level in order to represent a united voice towards national decision makers. Eventually, the CCS policy network united state and government actors, business interests and the environmental movement. This type of alliance building is less evident in the case of offshore wind where despite the Demo2020 initiative different regional projects remained disconnected and competed for attention.

Resource exchange and bargaining are in the PNA recognised as important activities in the formation of closely integrated policy networks. These types of activities are not visible in the case of offshore wind. Conversely, the policy network organising natural gas with CCS interests was shaped in part through resource exchange between the Ministry of Petroleum and Energy, Sintef, Bellona, the Labour Party and Statoil. This resource exchange included threats, promises and political support, which through bargaining led to the compromise that united the Labour Party on the issue and enabled the Socialist Left Party to be enrolled in the network.

One explanation for the difference in resource interdependency in the two cases 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. With reduced exogenous pressure on decision makers in the second OWP period, 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. An implication for research on sustainability transitions is that we should not only analyse the resources available to actors and groups, but also whether other actors need these resources and how resource interdependency is influenced by exogenous change.

6.2. Network structure

An argument in the PNA literature is that cohesive and tightly integrated networks that also include state and political party actors can provide privileged access to decision makers for other network participants. Such cohesive networks are characterised by shared interests, mutual goals, coordination and collaboration. The analysis has therefore investigated these factors.

The first thing to note is that the actors in the offshore wind network had a shared interest in the introduction of various niche protection policies for offshore wind. However, this shared interest did only to a limited extent lead to the articulation of a mutual goal. The joint proposal for a demonstration project in the second period did unite a number of previously disconnected actors. Yet, the goal of achieving public support for Demo2020 was not shared by all actors in what can be characterised as a fragmented policy network. The case of CCS depicts a group of actors that at times had differing interests related to CCS technology development, emissions reductions, natural gas exploitation and mainland industrial growth. In addition, several of the industry initiatives competed for public support in the initial period. However, through strategic alliance building, the network converged on a mutual goal. Thus, whereas the two policy networks where both characterised by some degree of competition between industry initiatives, the structure of the networks in the final periods differ significantly as a broader set of actors were enrolled in the CCS policy network. One lesson for studies of transition processes is that mutual beliefs among a group of actors is not necessarily sufficient for interests to be aligned in policy networks, as sometimes assumed in the advocacy coalition literature. Interests can also become aligned (despite conflicting values) through resource interdependency between actors, which can then have an influence on policy (Smith, 2000, p. 103).

A second noteworthy observation is the strong involvement by state and political party actors in the CCS policy network and the near absence of the same actors in the offshore wind network. This must be understood within the context of Norway as a petroleum-producing country and the resulting state interests in exploiting and securing the future value of natural gas. However, it must also be seen in the context of the strong ties between the Labour Party and trade unions representing the energy intensive industries.

A cohesive policy network is conditioned on a long-term state interest in this network. State interest in natural gas with CCS is evident in the establishment of Gassnova and the Norwegian Gas Forum. At the

same time, public subsidies towards CCS and OWP ran against the policy principles of cost-effectiveness embraced by the Ministry of Finance and the Ministry of Petroleum and Energy. This is particularly evident in the case of offshore wind as there was a distinct lack of interest from these ministries (Normann, 2015). However, this misalignment between established policy principles and need for niche protection is also evident in the case of CCS. Even though the relevant ministries shared the goal of exploiting natural gas with other state and non-state actors, these ministries do not feature as prominently in the analysis of the CCS network.

Immature clean energy technologies require state support (Block, 2011; Mazzucato, 2015). Emphasis on cost-effectiveness can help explain reluctance among some state actors to subsidise offshore wind and CCS. Thus, in both cases an active state required the encouragement from politicians in power. Attention to underlying party strategies in the analysis reveals a significant difference between the structure of the offshore wind and CCS networks.

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. In particular trade unions have enjoyed access through these channels (Reitan et al., 2008). It is also worth noting that the Labour Party has been especially 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 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.

Attention to the changing structure of policy networks and the underlying political party strategies help to explain how it was with the Labour Party in position that policies that supported full-scale demonstration of CCS was introduced. The case of CCS shows how the Labour Party strategically acted upon an interest in the increased use of natural gas throughout the three periods. The Labour Party's close relations to the oil industry also opened up for an interest in CCS for the purpose of EOR. Yet, the Labour Party with Stoltenberg as Prime Minister also showed a reluctance to subsidise CCS on natural gas power plants. With the Socialist Left Party included in the network in the third period, Bellona was able to take a central brokerage position in the network and position CCS as a solution to a political problem. A lesson for transition studies is that the analyses should not neglect the extent to which underlying political party strategies are aligned with major business interests.

6.3. Policy outcome

An assumption in the policy network approach is that the structure of policy networks can influence the degree of access to the policy process, and therefore policy outcomes. Through participation in the natural gas 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 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. However, actor strategies and network structures do not alone explain the different policy outcomes analysed here. The diffusion of new technologies will be constrained by existing investments in fixed assets (Freeman, 1991; Hughes, 1987). The two cases show that CCS was better aligned with established industries and fixed assets. We must therefore also acknowledge how mechanisms of path-dependency and lock-in (Arthur, 1994; Unruh, 2000) explain a preference for full-scale demonstration of CCS, despite an institutionalised preference for policies based on cost-efficiency.

A goal for transition studies has been to understand the conditions for regime stability and change through different forms of niche-regime interaction, 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 and 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) argue 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.

The differences between the two technologies in terms of how they fit with the strategy of a fossil producing country should thus not be downplayed. Nonetheless, the fact that Norway is a fossil producing country does not explain *how* actors and networks translate this particular context into strategies and action, and ultimately policy. Geels and Schot (2007, p. 415) point out that policy stability and change arises from conflicts, power struggles, coalition building and bargaining. Concepts introduced here based on the policy network approach can help to understand more about how such activities unfold, and in particular how state and political party actors actively participate in these activities.

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 sustainability 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 interdependency 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 and 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).

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Appendix A. List of interviewees

[1] Aamodt, Arne, Former CEO, Lyse Produksjon AS, Phone, 20 March 2014.
[2] Alfstad, Haakon, Senior Vice President onshore vind power, Statkraft, Lysaker, 4 November 2014.
[3] Breistein, Dag, Former Head of contracts, Vestavind Offshore, Bergen, 8 March 2013.
[4] Dale, Jørgen, Business developer, Scatec, Oslo, 2 April 2013.
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Appendix B. Supplementary data

Supplementary data to this article includes details about actor relations for different periods and can be found online at http://dx.doi.org/10.1016/j.techfore.2017.02.004.

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