The Politics of Low Carbon Transitions – Protected niches, actor networks, narratives and changing contexts

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Understanding how to move towards more sustainable societies is a key challenge for analysts, civil society organisations and policy makers alike. The literature on sustainability transitions indicates an important role for niche activities which have the potential to overturn or green incumbent socio-technical regimes. In the context of climate change, many advocates and policy makers put a lot of hope in renewable energy technologies like solar photovoltaics and offshore wind. These technologies are not (yet) competitive under 'normal' selection environments and therefore require 'protective space' to improve their performance, reduce costs, enable the growth of supportive actor networks, etc. Which niches receive this kind of protection, why and through which processes, is an interesting field of study for scholars interested in the politics of low carbon transitions. The paper argues that these processes can be usefully analysed by looking at actor networks, the discourses they mobilise and the way in which they strategically engage with changing energy and climate policy contexts. The paper reflects on empirical work on PV and offshore wind niche developments in the UK and the Netherlands and thereby makes a contribution to the emerging literature on the governance of low carbon transitions.

Key words: politics, governance, low carbon transition, innovation policy, protective space, offshore wind, PV

1. Introduction

Understanding how to move towards more sustainable societies is a key challenge for analysts, civil society organisations and policy makers alike. In many areas of modern society it has become clear that substantive changes are required to address environmental (such as pollution and climate change), social (growing inequalities; access to affordable energy services) and economic problems (e.g. volatility in oil prices; dependency on fossil fuel imports). The literature on sustainability transitions which has emerged over the last decade is analysing such systemic changes in societal subsystems fulfilling needs such as transport, energy or food provision (see e.g. Schot and Geels 2008; Smith, Voß et al. 2010; Markard, Raven et al. 2012). Building on insights from innovation studies, history and sociology of technology as well as evolutionary economics, the literature on sustainability transitions indicates an important role for niches (Geels 2002; Hoogma, Kemp et al. 2002). Niches are defined as alternative socio-technical configurations which fulfil needs in a different way compared to the incumbent arrangements (e.g. small-scale, household PV systems producing electricity rather than large-scale, centralised fossil fuel power plants). Historical evidence shows that such novel configurations can eventually overturn and replace incumbent systems if they reduce costs and improve performance and if incumbent systems of provision are destabilised (e.g. through external shocks, macro-economic or macro-political factors).

For example in the context of climate change, many advocates and policy makers put hope in renewable energy technologies like solar photovoltaics (PV) and offshore wind to make existing electricity systems more sustainable and replace fossil fuel based generation. These technologies are not (yet) competitive under ‘normal’ selection environments embodied within dominant socio-technical regimes and therefore require ‘protective space’ to improve their performance, reduce costs, enable the growth of supportive actor networks, etc (Smith and Raven 2012). Within these ‘protective spaces’ real world experimentation with technologies can take place and supportive constituencies can be built around them (Kemp, Schot et al. 1998; Jacobsson and Lauber 2006). Often such protective space is provided by targeted policy instruments but it also includes specialised niche markets where a technology is already competitive (e.g. space satellite application of PV cells or remote telecommunication installations) or cultural niches where lead-users have different preferences (e.g. green movements valuing the independence from the grid and utilities rather than cheap electricity).

However, much of the existing literature on the development of sustainable niches takes these spaces for granted rather than empirically investigating through which processes such protective space is created. Smith and Raven (2012) have recently suggested a framework for looking at these processes in order to address this gap in the literature. We argue that asking questions around which niches receive protection, why and through which processes, is an interesting field of study for scholars interested in the politics of low carbon transitions

(Scrase and Smith 2009; Kern 2012; Meadowcroft 2011). This paper suggests that these processes can be usefully analysed by looking at actors and the networks they build, the discourses they mobilise and the way in which they strategically engage with changing energy and climate policy contexts. The article aims to answer the following research question:

Which mechanisms explain why some sustainable energy advocates are more successful than others in creating a protective space for their respective niches?

By answering this question, the paper is aiming to contribute to the emerging literature on the governance of socio-technical transitions. Several authors have argued that the politics of transitions is an important field of study which needs more explicit analytical attention (Meadowcroft 2011; Shove and Walker 2009; Kern 2012; Scrase and Smith 2009). Existing studies of sustainable energy niches often exclusively focus on the effects of supportive policy instruments on the development and deployment of the technology, but fail to engage with the political processes through which such protective space is created. Smith et al (2010) have identified a "need to explain how and why individual agents are able to reform the rules in desirable directions, in the context of regimes and niches, thus dealing with the politics essential to transitions" (p. 445). By focussing on the agency for sustainable energy alternatives, this paper aims to contribute to an emerging theory of niche protection.[1]

2. Analytical Framework and Methodology

Protective space

Over the last decade a substantive literature has emerged on transitions towards more sustainable socio-technical systems. Building on a variety of strands within innovation studies, this literature has analysed the processes which lead to change of socio-technical systems providing services such as energy, transport or food (Geels 2002; Elzen, Geels et al. 2004; Smith, Stirling et al. 2005; Jacobsson and Lauber 2006; Kern and Smith 2008; Smith, Voß et al. 2010). One of the key arguments of this literature is that sustainable technologies often do not fit well with established selection environments of incumbent socio-technical regimes (e.g. in terms of price, performance or consumer expectations) and have difficulties breaking out of niches into mainstream markets (Smith 2007). Therefore a lot of emphasis

[1] This paper is based on a three year bilateral research project funded by the ESRC in the UK and the NOW in the Netherlands. This financial support is gratefully acknowledged. For more information on the project 'The politics of low carbon innovation: towards a theory of niche protection', please see: www.lowcarbonpolitics.org.

has been put on the provision of temporary 'protective spaces' for niche technologies to improve their performance and reduce costs in order to become competitive (Kemp, Schot et al. 1998). Niches are conceived of as containing diverse (experimental) socio-technical configurations around a core technological artefact.

Nurturing, shielding and empowering as processes of socio-technical configuring

Given that the existing literature often takes protected spaces for granted, Smith and Raven (2012) have suggested a framework for looking at the processes of how protective space is created in more detail. They argued that positively affecting the development of niches requires three processes: nurturing, shielding and empowering. ***Shielding*** relates to the work that innovation advocates do towards alleviating the niche innovation space for developing a sustainable technology from mainstream selection pressures such as price, efficiency, infrastructure requirements, and consumer expectations which, absent shielding, would 'select against' the sustainable technology. Shielding thus enables the second key process, ***nurturing***, which is about the work that actors do to improve the shielded innovation's performance. Nurturing work is described in the strategic niche management literature (Kemp, Schot et al. 1998; Verbong, Geels et al. 2008) and has been shown to consist of organizing learning processes, articulating shared and specific expectations, and building heterogeneous and resourceful networks. Finally, ***empowering*** relates to work aimed at achieving institutional changes that are favourable for the niche technology, such as sustainability criteria becoming a part of the selection environment.

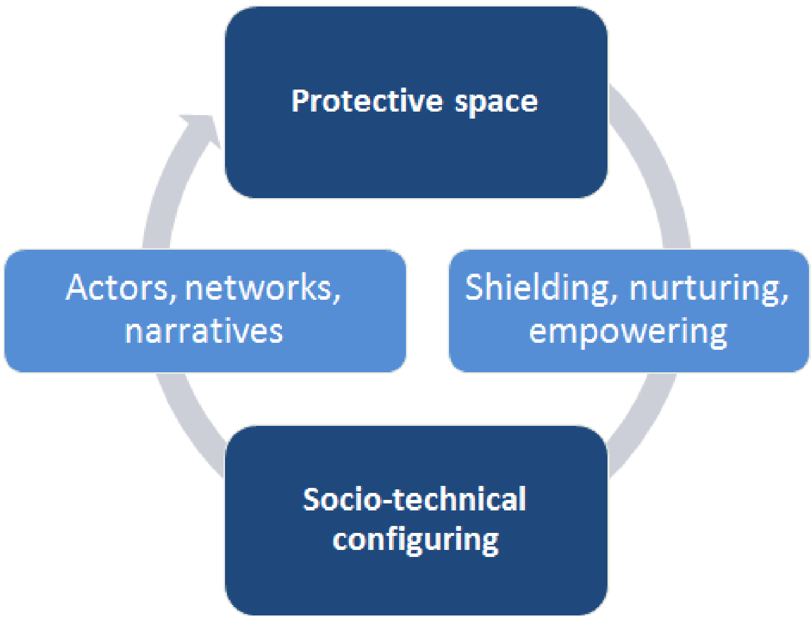
Creating protective space

Building on the recent literatures on institutional change and network governance, Smith and Raven argue that in order to analyse the creation of protective space as a collective social process, it is important to shed light on the involved actors, their networks as well as the narratives used to promote the technology. Narratives are important as they are used by actors to help creating positive expectations about the niche, make claims for niche friendly reforms and critique existing regimes (Smith and Raven 2012). The policy studies literature more widely attributes an important role to narratives, discourses or ideas in processes of policy or institutional change (Hajer 1995; Laird 2001; Kern 2011). In these studies narratives are shown to be important in attempts to re-shape perspectives in order to change patterns of behavior and achieve institutional reforms.

Actors and their networks are important in studying the creation of protective space as it is actors who individually or collectively mobilise resources, learn, lobby policy makers etc. Transitions are necessarily multi-actor processes as no single actor unilaterally has the power or resources to bring about transitions. Therefore network governance (Kooiman 1993; Rhodes 1997) is central. Smith and Raven hypothesise that the sense-making of advocates is influenced by their uneven access to resources as well as the challenge to influence powerful actors in institutional positions who often understand sustainability very differently (p. 1031) which makes processes of creating protective space highly political.

In summary, the suggested framework tries to capture the recursive relationship between the processes of niche actors trying to create a protective space for their respective technology through forming networks and drawing on narratives as well as the impact this activity has on the socio-technical configuring of the niche through processes of shielding, nurturing and empowering (see Figure 1). This framework has already been usefully applied to explaining solar PV developments in the Netherlands (Verhees, Raven et al. 2013) and the UK (Smith, Kern et al. in press) and papers on the offshore wind developments in both countries are under development.

Figure 1: Recursive relationship between protective space and socio-technical configuring



Methodology

The paper is based on four in-depth case studies. Case studies are a good methodology to use in situations when aiming to understand complex and contemporary social phenomena which cannot easily be attributed to a single cause (Yin 1994). The analysis used a process tracing approach. Process tracing is an analytical approach to reconstruct a process and identify causal mechanisms in a complex phenomenon (George and Bennett 2005: 6). The case studies are based on a systematic review of the academic literature, policy and stakeholder documents, relevant trade press, complemented with data on R&D funding as well as deployment. This data was used to first construct a timeline of important developments. Subsequently a number of semi-structured interviews with stakeholders directly involved in these developments were conducted for each case. These included technology developers, policy makers, academics, firms and trade bodies, etc. The interview transcripts as well as the other data were then subjected to an analysis on the basis of the categories specified in the analytical framework in order to trace key processes shaping the studied niche developments.

3. Case Studies: PV and Offshore Wind in the UK and the Netherlands

This paper draws on four case studies, each focussing on a particular niche technology in a given context: PV in the UK and in the Netherlands as well as offshore wind in the UK and in the Netherlands. Given space limitations, we will only be able to very briefly summarise some of the key developments in each of these cases here before we turn to the discussion of important findings regarding the actors, networks and narratives involved in the creation of protective space (section 4). Since interest in both of these renewable energy technologies intensified after the 1973 oil crises, this period is taken as the starting point of the analysis.

PV in the UK[2]

Whilst the research, development and use of PV electricity can be traced back to space satellite programmes, exploration for its terrestrial potential began in earnest after the oil crises. The new Department of Energy launched a UK renewable energy programme in 1974 and PV was one of the options being investigated. Its advisory agency, the Energy Technology Support Unit (ETSU), undertook desk studies to assess the viability of different renewable energy technologies. They concluded PV was not relevant to the UK. Nevertheless, government R&D budgets funded "a small programme of work on solar cells because it recognised that they had major export potential" (Flood 1996). Over a dozen universities began investigating solar PV. Funds soon stopped, and PV research had to proceed indirectly through materials science research grants and university funds. PV

[2] The description of this case closely follows Smith et al, in press.

advocates were undeterred. A UK section of the International Solar Energy Society (UK ISES) was founded in 1974 and had over 300 members within a year. A Solar Trade Association was set up in 1978 and there was some commercial interest in PV modules for low-power applications in remote, off-grid locations where the economics were viable. Some environmentalists experimented with very small, off-grid PV systems with batteries and PV development remained part of the environmentalist narrative.

Any space for arguing energy alternatives narrowed considerably with the discovery and opening of North Sea oil and gas. This removed energy security from the political and economic agenda, as the UK became an energy exporter in the 1980s. In addition, the Thatcher governments were hostile to public support for industries and technologies generally. Funding for renewable energy R&D was cut. Falling and relatively low oil and gas prices diminished interest in PV further.

In the 1990s developments became a bit more favourable. The EC/EU THERMIE programmes [3] in particular supported a number of demonstration projects for building integrated, grid-connected PV systems. Several UK partnerships bid successfully to these funds. Demonstration moved PV assessment from laboratories and desk-studies into real UK situations. Towards the end of the 1990s, the increasing political prominence of climate science provided a change in context with renewed impetus for renewable energy. For example in May 1997 the Chief Executive of BP America, Lord Brown, accepted the possibility of climate change and saw solar PV as having a bright future: "I am convinced that we can make solar competitive in supplying peak electricity demand within the next ten years" (NATTA RENEW newsletter July-August 1997). Lord Brown pledged to increase investment in solar from $100 million to $ 1 billion a year (Pinkse and Buuse 2012).

During the 2000s the Labour government launched a number of renewable energy policy initiatives, culminating in the Energy White Paper 2003. However, the main policy instrument for renewables deployment (Renewables Obligation, RO) did not help PV, because the RO price ceiling was too low to encourage investment in PV. However, a series of grant programmes designed to help PV and other smaller-scale renewables deployment were introduced (see Table 1). All these schemes were over-subscribed and the funds

[3] The Programme for the promotion of energy technology in Europe (Thermie) ran from 1990 to 1994 and had funding of €350m. It was followed by Thermie 2 which ran from 1995-1998.

available depleted rapidly. Installers and PV suppliers complained that a glut of time-limited grants did not help their business planning and cast uncertainty over sector growth. Some limited replenishment of funds did not really address a stop-start dynamic in PV deployment.

Table 1: Overview of UK government PV demonstration and deployment programmes

Name	Years	Funding provided	Total capacity installed under the scheme
SCOLAR Programme	1998-2000	£1m	100 small PV areas for schools and colleges (2-3kW each)
PV Field Trials Programme	2000-2006	£9.4 million	1.5MW
Major Photovoltaics Demonstration Programme	2002-2006	£31 million	8MW
Low Carbon Buildings Programme	2006-2010	£13.4 (for PV)	4,549 projects

After signing up to the EU 20-20-20 targets in 2008, the UK government was under pressure to do more to support the deployment of renewable energy. Civil servants within DECC were concerned that while they were working on a renewable energy strategy, the 2008 energy bill "didn't have anything new for renewables ... and we knew more was needed to meet European renewables targets" (interviewee evidence). Large offshore wind farms were seen as a major component in meeting the target, but as with nuclear, additional legislative measures would be needed to underpin this policy commitment. Support from Parliament was needed for this legislation, and this provided MPs favourable to micro-generation and feed-in tariffs (FIT) with a bargaining opportunity. Instead of suggesting to replace the RO with a German style FIT, lobbyists changed their tactics and argued for FIT to complement the RO by focusing on micro-generation technologies. A new FIT instrument would be dedicated to small scale generation below 5MW capacity, and the RO would continue for generation above that scale. Government resistance to dismantling the RO could be side-stepped. Eventually, a political deal was struck: the backbenchers supported the government bill for nuclear and offshore wind reforms, in return for the inclusion of FIT in the legislation. In April 2010 the government introduced a FIT for small-scale renewable energy technologies.

The new policy support for PV led to an unprecedented level of deployment of PV: In its first year the FIT led to 28,608 new PV installations (77 MW installed capacity). However, in February 2011, less than a year after the start of the FIT scheme, the Energy Secretary of the new Coalition government, Chris Huhne, announced an unplanned review of the scheme. He said the government was concerned about larger scale, 'solar farm' projects cashing in on generous FIT price for PV. Despite significant political protest and legal challenges, cuts to the FIT were delayed but could not be prevented altogether. Rates were more than halved and the FIT budget was capped. As a result, PV deployment slowed down and led to a bust of several solar installers and a loss of faith in government support for PV.

PV in the Netherlands[4]

In The Netherlands, the history of solar PV started somewhat earlier. PV emerged as a subject of interest for physicists and chemists already in the 1920s as a possible solution for the depletion of natural resources in the context of rapid industrialization. Early research in the photovoltaic phenomenon took for example place in the Philips lab but was terminated in the 1930s due to problems with the efficiency and handling problems. In the context of the oil crisis in the 1970s and the emerging opposition to nuclear power, advocates tried to revive the fortunes of PV and lobbied for large scale PV application as an alternative solution to the energy problem. However, the Ministry of Economic Affairs which is responsible for Dutch energy policy deemed the technology to have been 'developed for space' and 'unacceptably expensive' (Verhees et al 2013). The subsequently established National Research Programme Solar Energy (NOZ-I) therefore focussed on solar thermal technologies which were seen as more commercially viable in the short- to medium term and contained relatively limited funding for solar PV. ISES, the Dutch chapter of the academic research network 'International Solar Energy Society', lobbied for more funding for PV but to no avail.

NOZ-II in the early 1980s had the same focus and continued to consider PV a long term option at best. Nevertheless, advocates established the Holland Solar trade organisation in 1983 to represent its members, including manufacturers, research institutes, consultants and (solar boiler) installers. Shell entered the solar PV market in 1984. By the mid-1980s academic solar PV supporters now held professorial University posts with good connections to civil servants and some PV projects abroad were seen as promising so that the Ministry of Economic Affairs changed its views on PV. A dedicated PV research programme was

[4] The description of this case closely follows Verhees et al 2013.

established (NOZ PV) which ran from 1986-1990. Its objective was for the Netherlands to keep up with international developments and to investigate possible applications in developing countries and potentially later in the Netherlands. A second, follow up programme (NOZ PV II, 1990-1994) with an increased budget was set up and reflected hopes that in the long-term PV could become a competitive energy technology. It also reflected growing concern about climate change and the importance of renewable energy technologies. The focus of the programme shifted from basic cell research to development and deployment of PV. This was even more clearly the case in NOZ PV-III (1997-2000) which “sought to create conditions and remove barriers for large-scale implementation of solar cells in the Dutch electricity system” (Verhees 2013: 279).

Off-grid small scale PV installations were commercially viable in a number of niche markets since the 1990s. These included recreational vessels and houseboats, lights on buoys and beacons, and more recently also street lighting, remote measuring stations and parking meters. However, this was a relatively small market and while growth was steady, its combined installed capacity was overtaken by grid-connected PV systems in the late 1990s. This followed as a consequence from a number of public demonstration and market creation initiatives. These were funded by the NOZ PV programme mentioned above in which grid-connected, decentralised, building-integrated PV systems in new housing developments were seen as the most promising route to market in the Netherlands (see Verhees et al 2013 for an explanation of a variety of the reasons for this shift). In the late 1990s a number of projects were funded, including the Amersfoort 1MW project which installed PV on some 500 houses. These projects were mainly aimed at technical learning. A voluntary agreement was made between PV solar industry players, energy companies and the Ministry of Economic Affairs with the aim to increase Dutch installed PV capacity to 10MWp by 2000 to create a substantial domestic market for PV.

The liberalisation agenda during the 2000s offered an opportunity for PV in the Netherlands as the ‘green electricity’ market was liberalised ahead of other market segments and utility companies used ‘green electricity’ for marketing purposes to retain and win new customers. Green groups like WWF campaigned for renewable energy as a means of combatting climate change. A tax exemption for electricity produced from renewable sources also improved its economic competitiveness. However, most of the Dutch ‘green electricity’ demand was met by imports at the time.

In the beginning of the 2000s a subsidy scheme was established (Implementation Scheme Energy Subsidies EPR) which supported PV deployment and led to a rapid increase in installations. However, the scheme was dropped in 2003 by the new centre-right coalition government which perceived PV as a too expensive option not suitable for the Dutch climate. After the next election a new centre-left government came into power in 2006 new measures to support PV were announced. The government put in place a production subsidy for PV (as part of the SDE) which paid an above market price for green electricity fed into the grid and which was differentiated according to technology. This scheme proved very popular and the budget was soon depleted. Another government and PV policy change in 2010 abolished the technology specific rates and thereby drastically cut support for solar PV and completely abolished for smaller systems (<15kWp). By 2010 PV deployment in the Netherlands was around 80MWp of installed capacity (Netherlands Statistics) but without production or purchase subsidies being available installations have stagnated since. A Solar Industry Platform was set up in 2011 to bring together many of the small and medium players involved in PV-related manufacturing and to lobby government on behalf of its members.

Offshore wind in the UK

As in many countries around the world, the oil crisis in the 1970s triggered a search for alternative energy sources in the UK, and using wind turbines to generate electricity was one of the options considered. There was some academic interest in wind technology and a British Wind Energy Association (BWEA) was set up in 1978. The government initiated a R&D programme for the development of vertical axis turbines which led to a prototype being built in 1986. The UK government's as well as the Central Electricity Generating Board's (CEGB)[5] interest in wind included desk-studies into developing turbines for offshore wind. However, drops in the price of oil meant ministers lost interest in the project (Real Power, 2008: 35). Efforts subsequently focused on the equivocal development of onshore wind. The first onshore wind farm in the UK was eventually constructed in 1990.

In the beginning of the 1990s UK policy was characterised by the assumption that the costs of offshore wind were prohibitively expensive and the focus remained on the development of

[5] The CEGB was the state-owned monopoly electricity generation company at the time.

onshore wind. R&D funding was concentrated on technologies close to commercialisation while OSW technologies were deemed to be unlikely to be economic even by 2025 (Ends Report, 1994). However, towards the late 1990s John Battle, the Energy Minister at the time, proposed eight OSW demonstration projects to help meet a pre-election promise of 10% of electricity to come from renewables by 2010. This followed lobbying from the wind industry for more investment in OSW, referring to rapid increases in OSW power by countries such as Denmark and Germany (ENDS Report, 1997[a]). During this period a number of small, engineering based companies were trying to develop the first offshore wind farm in the UK and applying for EU and UK government funds. One of the motivations to develop offshore wind, despite its costs, was the desire to escape the planning restrictions faced by onshore wind farms (Greenacre, Gross et al. 2010).

The early 2000s can be characterised as the phase of early offshore wind experiments in UK waters. The UK's first offshore wind farm was developed in Blyth and started operating in 2001. In the same year the Crown Estate[6]awarded 13 Round 1 leases for OSW farms (Toke 2011) and announced a second round of licenses in 2003 focused on larger farms further out at sea (BWEA, 2003). The government announced a series of capital grants for offshore wind farms. Consented projects received grants of up to £10m per project, approximately 10% of project costs (BWEA, 2010). Round 1 consisted of 18 demonstration projects in 13 locations but developments on the ground were slow. Also in Round 2 developments were slower than anticipated. In contrast to earlier periods, government was now more convinced that offshore wind would be the biggest new contributor to meet the renewables targets. OSW development was given a further impetus in 2007 when the UK government signed up to binding EU targets of 15% of all energy to come from renewable sources by 2020 (Toke 2011).

The last couple of years are characterised by a step change in government involvement in OSWF development as well as rapid deployment. One important element in this process was a change of the Renewables Obligation (RO), a policy which had previously done very little to support far from market technologies like offshore wind (Woodman and Mitchell 2011).

[6] The Crown Estate is a company set up by government to manage Crown owned land which includes almost all of the seabed of the UK outside of the 12nm zone. Its profits go back to the Treasury. Developers need to license to develop an offshore wind farm and have to pay a license fee for using the seabed to the Crown Estate.

With two changes in the RO in 2009 and 2010 the government essentially doubled the deployment incentive for OSW. The revised support level has been described as an ‘emergency’ response that was essential to the continued development of OSWFs (Greenacre, Gross et al. 2010: 94). Another important element in this acceleration process was Round 3 of the licensing process in which the Crown Estate offered 9 zones with the potential for 25GW of offshore wind. While in Rounds 1 and 2 developers bid for self-selected wind farm sites, the Crown Estates now became more strategically involved, identifying zones which its own research indicated had greatest potential. The Crown Estate also co-invested together with project developers up to the point of planning consent and developed a new Zone Appraisal and Planning process intended to reduce risks to project delivery and to accelerate the programme. The government now considers OSW as a key part of its decarbonisation strategy and set up a number of additional support schemes (see Table 2 for an overview).

Table 2: Summary of public offshore wind support schemes

Initiative (Funder)	Years	Funding provided
Offshore Wind Accelerator (CT)	2008-2010 (stage I) 2011-2014 (stage II)	stage I: £1.5m stage II: £10m for R&D; £30m for demo projects
Offshore wind manufacturing funding through business investment grants (DECC/BIS); similar scheme also exists for Scotland	2011-2015	£60m from DECC/BIS; £70 from Scotland
Offshore Wind Component Technologies Development and Demonstration scheme (DECC, TSB)	2011-	£15m
Offshore Renewable Energy Catapult (TSB)	2012-2017	£50
SUPERGEN Wind Energy Technologies Consortium (RCUK Energy programme)	2006- 2010 (phase I) 2010-2014 (phase II)	Phase I: £2.55m Phase II: £4.83m
UK Wind Energy Research – Doctoral Training Centre at University of Strathclyde (EPSRC)	2009-2014	£5.8m
Industrial Doctorate Centre in Offshore Renewable Energy at University of Edinburgh (IDCORE) (ETI, EPSRC)	2012-	£6.5m
Offshore Wind Programme (ETI), incl. test rig at NAREC	2009-	£40.23m (excluding funding for IDCORE)
ETF Offshore wind demonstration call (DECC)	2009-2011	£27m
Co-investment in developing projects to the award of consent and 'enabling actions' (Crown Estate)	2009-	£70m co –investment; £30m 'enabling actions'
direct government innovation support for offshore wind cost reduction (DECC)	2011-2015	£30m
		Total: £453m

By mid-2012 offshore wind capacity in the UK had reached 2.5GW (DECC 2012). In its Renewable Energy Roadmap the UK government expects offshore wind to reach a capacity of 18GW by 2020 and over 40 GW is seen as possible by 2030 (DECC 2011: 42).

Offshore wind in the Netherlands

In The Netherlands, too, the idea of offshore wind power first emerged in 1973 after the oil crisis. An optimistic assessment was made of the technological potential of "aero-generators at sea" (IRO, 1974). The idea was taken up into broader wind power research programmes, but remained marginal as costs were deemed prohibitively high. Offshore wind resurfaced in the late-1980s, as a result of societal resistance to the implementation of wind power onshore. Modest goals for offshore wind (OSW) were articulated in the early 1990s, which led to two very small (2MW and 17 MW) OSW 'pilot projects' in the IJsselmeer lake in 1994 and 1996 initiated by energy companies.

By then, the government had decided it couldn't realize its renewable energy goals on land alone, and ordered a feasibility study for a far larger experimental OSW park in the North Sea. This study would, in different ways, lead to the two 'Round 1' OSW parks:

- In 1999, the Ministry of Economic Affair's executive agency proposed to proceed with the experimental park (Novem, 1999). The government selected a location inside the 12-mile zone, which was deemed a necessary step in the development of parks further out. The park received a capital subsidy from the government's CO2 mitigation budget. A tender was issued for its construction and operation, which a Shell-Nuon consortium won in 2002. Objections against various licences delayed the start of construction until 2005, and the 108 MW park started operating in 2006.
- Also in 1999, a private-sector project developer applied for licences to construct and operate several offshore wind parks. One was eventually granted for a location *outside* the 12-mile zone. Although both parks were eligible for various renewable-energy related tax breaks as well as a production subsidy, this park experienced difficulties attracting investors. When two energy companies committed in 2006, construction began, and operation of the 120 MW park commenced in 2008.

The private sector's unexpected applications for OSW licences at a moment when no clear policy was in place led to a moratorium on new applications in 2001, pending a new licencing system. But this did not reflect disinterest in offshore wind: by the early 2000s, offshore wind was considered by government to be feasible and necessary in the medium-to-long term. A goal of 6000 MW was set for 2020, and energy sector actors, offshore industry, project developers, research institutes and NGO's formed a consortium for achieving it.

In 2003, a proposed new licencing system whereby market actors would compete for licenses for OSW parks on locations strategically determined by government was rejected by the Council of State, and a first-come-first-served system based on exclusion zones was put in place. When the moratorium was lifted in 2005, the government was flooded with applications for 'Round 2' licences. Fearing that costs would soar, the government revoked the (uncapped) production subsidy for offshore wind in 2005 and suspended the application procedure again, pending the treatment of those received already (12 licences were eventually granted).

In 2008, the government restated its commitment to the ‘6000 MW in 2020’ goal and promised a coordinated approach to licencing and market stimulation through a new production subsidy, which this time had a capped budget. In 2010 a tender, open only to parties that had already secured licences, was won on price by the German Bard Gruppe for its twin adjacent 300 MW parks proposal. After Bard Gruppe went bankrupt, Dutch developer Typhoon Capital acquired the rights in 2011. In the same year, the tender’s remaining budget was allocated to Eneco’s 129 MW park proposal. These three parks (neither of which has been realized yet) constitute ‘Round 2’.

In 2008, the government imposed another moratorium on applications: no new requests for licenses would be accepted until it had decided on the specifics for ‘Round 3’, which it expected would take place between 2015 and 2020. In 2009, it designated two large geographic areas for this future Round. A Taskforce Offshore Wind was formed to devise a strategy for reaching the 6000 MW goal, and a new consortium of OSW actors emerged to lobby for, and do, R&D for ‘far and large’ OSW parks.

In late 2010, a new government terminated production subsidies for offshore wind: the new guiding principle was cheapest-possible short-term climate gains. OSW was still seen as an energy option for the long term, as well as a sector with (job) potential for Dutch industry – a view confirmed by OSW being named as a key energy area in the new government’s ‘Top Sector Policy’. But before a large-scale roll out could take place, costs would have to decrease significantly through technological innovation - a view committed to paper in the 2011 ‘Green Deal’ between the government and wind sector representative NWEA, and in the 2012 ‘Innovation Contract Offshore Wind’. After the government resigned prematurely in 2012, its successor’s new coalition agreement increased the overall goal of ‘14% renewables in 2020’ to 16%. This was understood to likely be impossible without OSW, but instead of announcing new roll-out subsidies, the earlier route of cost-reduction-through-innovation was reiterated. Deployment of OSW in the Netherlands has stalled since deployment subsidies were eliminated.

4. Discussion

The cases discussed above clearly differ in terms of the status of these sustainable energy niches. While PV has had a chequered and difficult history and has seen relatively limited deployment in both countries compared to international leaders such as Germany or Spain, offshore wind has clearly received some high level policy interest in both countries for some time. While initially the Netherlands were a leading offshore wind country with its early experimental wind parks, deployment has stalled since. In contrast the UK has seen enormous recent growth of this niche and is now the world leader in offshore wind deployment (Toke 2011). Rather than discussing the dynamics of how the provision of protective space has influenced the development and socio-technical configuring of the niches in more detail, this section will focus on the agency and politics involved in the construction of protective spaces and why some sustainable energy advocates in these four cases have been more successful than others in creating a protective space for their niche. As indicated in the theoretical framework, the analysis will shed light on the actors involved, the networks they build as well as the narratives they draw on to enrol support by other actors.

Important actors and networks

One lesson learned from across the case studies is that the entry of powerful and prominent actors (e.g. oils companies such as BP and Sharp in the case of PV or large utility companies like E.ON or manufacturers such as Siemens in the case of offshore wind) provides legitimacy and credibility to sustainable energy niches and helps advocates to argue for favourable reforms and niche protection. Especially policy makers seem to be particularly responsive to the demands of such players compared to bottom-up small niche players, civil society organisations or researchers/technology advocates. Small independent actors and companies which were very active in the beginning of the offshore wind activity in the UK (such as Borderwind, Haldens, Tecnomar, Wind Energy Group) seem to have disappeared or play a minor role. However, environmental groups such as Greenpeace also helped create space for both PV and offshore wind by supporting the technology.

In terms of the actors interested in offshore wind, these are much more closely associated with regime actors (e.g. utilities such as E.ON or equipment manufacturers such as Siemens) as the configuration of the technology in terms of multi-MW wind parks fits much better into existing electricity regime compared to for example PV.

One important lesson on the coordination of networks seems to be that while for innovation processes variety is normally considered important and helpful (e.g. PV is used in a variety of niche markets and in very different applications, from space satellites, to water pumps to solar farms), for the political influence of niche actors, coordination and displaying a 'united front' seem to be important. In the case of PV in the UK, several PV niche actors were competing with one another in obtaining continued support through the FIT (e.g. large-scale versus small scale installation interests; Renewable Energy Association and Micro-Generation Council versus RenewableUK). Different actor networks were interested in different socio-technical configurations of PV (e.g. small-scale versus solar farms; building-integrated versus retrofits etc). We argue that this impedes the political power of solar PV advocates and therefore did not lead to a stable or consistent protective space for PV in the UK as developments were dispersed and contested most of the time (Smith, Kern et al in press).

In contrast, empowering offshore wind was aided by the fact that the offshore wind niche in the UK and the Netherlands were created by relatively homogenous networks of actors promoting essentially one socio-technical configuration (large scale, offshore wind parks). The research showed a distinct lack of disagreement or contestation among advocates of offshore wind.[7] This contrasts with the findings on solar PV developments in the UK described above. In addition, the Crown Estate, a quasi-public but independent actor with a strong commercial interest in developing offshore wind, took the lead in bringing together offshore wind actors in a variety of ways (e.g. through coordinating a developers forum and a cost reduction taskforce). The Crown Estate has credibility with both public and private sector organisations and acted as kind of 'system builder' in Hughes sense. Such a central actor as well as several of the functions it is fulfilling is absent in the Netherlands (Verhees, Kern et al 2013). However, also in the Netherlands a number of formalised networks such as the Taskforce Offshore Wind and new consortium of OSW actors to lobby for OSW parks emerged and coordinate their strategies for creating protected space for offshore wind.

Narratives

Looking across the four cases analysed in this paper, we find that sustainable energy advocates used a range of similar narratives in all four cases. While wider societal concerns around the oil crisis, energy security and more recently climate change are strategically exploited to argue for government support for the niche technologies, their other benefits

[7] In the Dutch offshore wind case there was some evidence of contestation between independent project developers and incumbents like Shell and Nuon in term of which licensing concession system would be most beneficial. Also more generally, subsidizing offshore wind was politically contested (Verhees, Kern et al, 2013).

such as providing jobs, exploiting untapped natural resources or contributing to economic growth are also emphasised. These narratives are often skilfully combined and are targeted at a variety of audiences (from government, to civil society organisations, investors and the public at large). Which ones are foregrounded, seems to depend on the audience as well as the wider energy and climate change contexts and which concerns are most prominent in this sphere. Given the similarities of narratives used across the four cases (see Table 3), it seems that it is not the narratives per se which have a significant impact on which niches receive support through protective space measures but rather who voices them and in which context than renders them more or less influential. For example the claim that PV would create jobs in the UK was often readily dismissed by policy makers as these jobs were believed to be mainly relatively low-skilled installation jobs whereas policy makers are very enthusiastic about attracting offshore wind turbine manufacturers to the UK to create new manufacturing jobs which chimed with their wider commitment after the financial crises to rebalance the UK economy away from financial services to more manufacturing.

Table 3: Summary of findings of the four cases in terms of actors, networks and narratives

Case	Actors	Networks	Narratives
PV in the UK	UK ISES, University research groups, environmentalists/green movement, IT Power, Solarpak, Shell, BP, ETSU, Department of Energy, Department of Trade and Industry, architects, roofing contractors, Sharp	two competing renewable energy trade bodies (RenewableUK; Renewable Energy Association) as well as Micro-Power Council; public mobilization through 'we support solar' and 'cut don't kill' campaigns	Climate change and renewables targets Creating low carbon jobs Micro-generation as a way to break 'big 6' part of diversification strategy away from oil and gas PV as small scale, off-grid technology PV as building material
PV in NL	Philips, Ministry of Economic Affairs, research institutes like ECN and individual academics, Novem, ISES, Holland Solar trade organization, Mastervolt, OTB, Holecsol, Greenpeace, WWF	Solliance as a collective initiative geared towards research into the production of thin film PV cells and modules (set up by ECN, Holst Center, TNO and TU Eindhoven); Solar Industry Platform	PV as suitable for off-grid projects in developing countries PV as (long-term) climate mitigation option in NL Creating jobs in industry producing PV manufacturing machinery (new high tech industry)
Offshore wind in the UK	BP, Shell, DONG, Fluor, Centrica, Vattenfall, Scottish and	Crown Estate operating as 'system builder'; several formalised	Climate change and renewables targets Job/industry creation

	Southern Energy, RWE Npower renewables, E.ON, Renewable Energy Systems, Mainstream Renewable Power, Vestas, Siemens, DECC, Crown Estate, ETI	networks (Cost Reduction Taskforce; Developers Forum; Supply Chain Events); RenewableUK as central trade body	Making use of unexploited resource Tackling energy security Escape from onshore restrictions
Offshore wind in the NL	Shell, Eneco, Ministry of Economic Affairs, Nuon, research institutes like ECN, wind sector representative NWEA	Taskforce Offshore Wind; new consortium of OSW actors emerged to lobby for R&D for 'far and large' OSW parks (involving energy sector actors, offshore industry, project developers, research institutes and NGOs)	Medium to long-term potential of offshore wind to contribute to climate change mitigation Job creation potential Escape from onshore restrictions

5. Conclusion

This paper has analysed the history of four cases of sustainable energy niches in two different countries over the last 40 years. After a brief description of each case, the analysis focussed on the actors networks and the narratives they draw on to create a protective space for their respective niches in order to shed light on the politics of low carbon transitions. The research question of the paper was about the mechanisms explaining why some sustainable energy advocates are more successful than others in creating a protective space for their respective niches. It has to be emphasises again that the points made below are still very preliminary. The project will also conduct another two case studies (on carbon capture and storage) which might also change the insights generated.

So far, the analysis finds that while narratives are important in enrolling support for alternative niches, they are on their own not explanatory of why some niches receive more support than others. Only through constructing supportive narratives which gel with wider policy and public agendas and assembling well-coordinated networks of powerful actors, can advocates successfully create and maintain protective space for their sustainable niches as indicated by the case studies. In terms of developing a 'theory' of protective space we therefore suggest the following hypothesis for further empirical testing:

Hypothesis 1: Advocates of different sustainable energy niches use similar narratives to enrol support for their endeavours which strategically respond to and try to create changing policy agendas. (all four cases)

Hypothesis 2: Creating supportive narratives is not sufficient to create protective space. Their influence on policy processes is larger if powerful, credible (regime) actors (at least temporarily) join the advocacy network. (e.g. offshore wind in the UK/NL compared to PV in both countries)

Hypothesis 3: Well-coordinated actor networks and strategies and the absence of internal politics and contestation help the creation and maintenance of protective space. (e.g. offshore wind in the UK compared to the NL as well as offshore wind in the UK/NL compared to PV in both countries)

However, the analysis also poses the question to what extent the differing fortunes of the PV and offshore wind niches can be explained by their different socio-technical characteristics. The fact that offshore wind has been configured as a large-scale, centralised alternative ‘power plant’ which therefore has a closer fit with existing regime practices possibly might partly explain its more dynamic development compared to the small-scale, decentralised PV niche but doesn't neccesarily explain the different experience in the UK compared to the Netherlands.

The four cases also illustrate that the processes of creating protective space are fraught with difficulties and involve long-term political and economic struggles between competing options. Like other sustainable energy technologies, PV and offshore wind have received attention as potential alternatives to fossil fuels since the 1970s but only very recently some significant deployment has been achieved (at least in the case of offshore wind in the UK). This supports the generic finding of the literature that socio-technical transition processes can take around 30-50 years. While niche advocates have tried to empower alternatives since the 1970s, incumbent electricity systems have changed remarkably little over the period of analysis. Concepts such as path dependency and carbon-lock (Unruh 2000) have been developed to describe this phenomenon. The analysis presented here shows from a micro perspective on the agency of individual and collective actors how difficult it has been to convince powerful and resourceful actors of the benefits of the sustainable alternatives.

The findings also indicate that the suggested framework insufficiently pays attention to a number of factors which were found to be important in explaining the difference outcomes across the four cases (also see Verhees, Kern et al 2013), including:

- competing issues on the policy agenda (economy, financial crisis) as well as competing solutions to policy problem (e.g. new coal fired generation to solve energy security concerns in the NL) shape the opportunities for creating 'protective space'
- institutional settings shape possibilities for creating 'protective space': e.g. the institutionalisation of concerns about climate change in the Department of Energy and Climate Change keeps this issue on the agenda in the UK even during times when other concerns dominate public discussions; another example is the fact that the Crown Estate was set up as an independent company tasked with creating revenue for the Treasury is an important factor. Such an actor is unlikely to be set up in the Netherlands due to different institutional histories.

Based on these findings, it seems necessary to amend to suggested framework to better take into account the wider institutional set up within which the niche politics processes are enacted as the institutional framework shapes and constrains the room to manoeuvre for niche advocates (Kern 2011).

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