Britain and Offshore Windpower:
How to make the dream become a reality?

A report on what Government can do to help develop economies of scale in the offshore wind power sector.

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Preface and Acknowledgements

This report is the result of out first year project for M.Sc. Environmental Policy at RUC. We are happy with what we have accomplished, with everything we have learned, and ultimately with our attempt to make a difference for people and the environment. We are glad our cooperation worked so well.

We'd like to thank our supervisors for the support and feedback they gave us, Roskilde University and Teksam for making resources and funds available for research and fieldwork. We are grateful to our opponent group and their supervisors for comments and evaluation, and to the interviewees who agreed to speak with us and helpfully provided information. We thank Nikos and Sune, and friends and family, for care and support in both the difficult and the happy times.

Executive Summary

Some of the environmental problems we face today are related to the use of energy. There are many conflicting opinions about the abundance or scarcity of the forms of energy we most use, about their environmental effect. Agreements, such as the Kyoto Protocol, have tried to curtail greenhouse gases, pollution, depletion of natural resources, with differing rates of success. There are possible problems looming ahead with access to fuels such as oil. Many countries have attempted to develop alternative sources of energy to avoid the possible problems of energy depletion, lack of access, and environmental effects such as pollution. This paper reflects on the fact that the UK has the best potential for wind energy in Europe. Over the years they have depended on coal, then oil and gas from the North Sea, but in the last years they have, for the first time in decades, become net importers of energy. They will soon face an energy crisis and are in the midst of an energy review to find solutions to the problem, but there are a number of barriers to the development of a solution. The UK states objectives and targets related to the deployment of renewable energy, but these targets are not being met. The mechanisms being proposed have not been well designed, the targets are not far enough into the future to provide investor confidence, there is little money going towards research, and their political style is not one of setting strict targets. Government, like energy and environmental policy, is fragmented and cannot agree to a long-term plan. We have used offshore wind energy as an illustrative example of policymaking in the UK, and we believe it can help reach the targets proposed, if there is commitment on the part of Government. This kind of energy has much potential to be developed off the cost of Britain, which has some of the windiest sites in the EU.

The UK is under pressure by the EU for meeting certain agreed-upon targets, aside from their own self-set targets, and they are under the influence of powerful industry and use opaque decision making methods and agreements. Understanding energy policy history, both in the UK and the EU, is important as it demonstrates long-term trends that are visible today. Understanding who are the stakeholders of energy policy and it's current reform, and the

development of industry, gives clues to decisions made by the UK. We will look at the roles of these stakeholders, focusing on actions by the government and their role in promoting the innovations they claim to seek.

Our use of empirical data is extensive because our study is based in a current affair which has not been resolved yet. The lack of stabilization of the problem has its advantages and disadvantages. On the one hand our contribution to the body of knowledge could be important in time, but due to the fact that we may not be able to perceive all aspects which are relevant to understand the full problem, this limits our analysis.

The main results we have found are the following: concerning the development of energy policy in the EU, since the formation of the Union, security of supply has been behind the development of nuclear and renewable sources of energy, and has been the motivation for research programmes and the search for alternatives. There has been some conflict between the EU and the UK concerning policy styles: in some areas, the UK has had to adapt to the styles successfully lobbied into EU legislation by other countries, and the UK's consensual, cooperative, opaque government-business agreement way of doing things has not always adapted well. This can be seen in way some of the stakeholders of energy policy have been included or excluded, and it can be seen in the development of energy policy. This has occurred thru fragmented government bodies assigned related and sometimes overlapping duties, there has been a lack of consensus and long term planning, policies are piecemeal and remedial rather than pro-active. Under the theoretical structure we proposed and using our empirical data, we can see that the government does not take an active role in promoting the development of renewable energy, their capacity for environmental policy is not strong, there is no coordination between departments or a meaningful strategy for energy policy. Specifically on offshore wind, targets have been set, but the promotion mechanisms being used have been inefficient and the Energy Minister has been clear on asserting that the industry was responsible for achieving those targets, and should not expect help from the government. Offshore wind is at a crossroads, government help is crucial and without it, the industry may be relegated to expensive and slow development, if any.

However, if the government could be convinced to play a more active role in the development of offshore wind, they might want to signal political commitment and do long term planning, ease planning permission bureaucracy and constraints, perhaps choose different promotion mechanisms or at the least adjust the existing ones to include other owners, for instance, fund more RD&D and owners/developers granted building sites.

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Abbreviations

BWEA	British Wind Energy Association
CCL	Climate Change Levy
CCP	Climate Change Programme, in the UK
CHP	Combined Heat and Power, a type of power plant
CO_2	Carbon dioxide, a greenhouse gas
Defra	Department of Environment, Food and Rural Affairs, in the UK
DTI	Department of Trade and Industry, in the UK
EC	European Commission/European Community
ETS	Emissions Trading Scheme
EU	European Union
EWEA	European Wind Energy Association
FOE	Friends of the earth
FP	Framework Programme for Research and Development
kWh	Kilowatt-hour, electricity use unit
MW	Megawatt, electricity unit
NFFO	Non Fossil Fuel Obligation, in the UK
NGO	Non governmental organization
OECD	Organization for Economic Coordination and Development?
Ofgem	Office for Gas and Electricity Markets
ORED	Offshore Renewable Energy Decommissioning
RE	Renewable energy
RES	Renewable energy sources
RO	Renewable Obligation, in the UK
ROC	Renewable Obligation Certificate, a green certificate in the UK
UK	United Kingdom
WWF	World Wildlife Foundation

Chapter 1. Why energy?

This chapter aims to describe why energy is an important theme, the pressures it is under, and our choice of research area. The chapter also describes how we have designed our work and our report, the questions we want to answer and how we plan to go about answering them.

1.1. Energy

Energy is one of the driving forces of all natural processes, and is used by humans as extensively as by the rest of the planet. Primary human needs for energy, nowadays, include fuel for transportation and electricity for light and power, among other things. As the human population grows, the demand for this increases, as does depletion of unsustainably extracted natural resources (Miller, 2003).

Much of our energy needs are supplied by fossil fuels such as petrol, natural gas and coal. The burning of these fossil fuels releases gases such as CO_2 into the atmosphere, and there has been an increase in the amount of these gases over the last hundred years, roughly equivalent to widespread industrialization of the developed countries. CO_2 is one of the so-called greenhouse gases (GHG), which are part of what controls the Earth's temperature. These are gases in our atmosphere that trap heat emanated from the ground and keep it from escaping into space, much like a glass greenhouse for plants would do, keeping the inside warm (Ibid).

Over the last 100 years, the temperature of the atmosphere and the oceans has been rising, and the IPCC (Intergovernmental Panel for Climate Change), among others, believes that "human activities have increased the concentration of greenhouse gases and aerosols since the pre-industrial era" (IPCC, 2001). In 1997, as a follow up to the Rio Earth Summit in 1992, the Kyoto Protocol was drawn up, and (some) countries have committed themselves to lowering their CO_2 emissions in order to keep the Earth's temperature from rising, an event which could have serious effects such as changing climate patterns from the local to the global scale, causing sea level rise and inundating coastal cities, and thereby changing whole ecosystems, causing extinctions, etc. The incidence of extreme weather is also expected to rise as a result of climate change (PU, 2005). For example, increased ocean temperatures may cause changes in the characteristics of tropical storms, such as frequency, duration and intensity. It can be argued that this is already happening, for instance: the Katrina hurricane. Yet there is no conclusive evidence that global warming is in fact of anthropogenic origin, but this evidence becomes more and more certain, as can be seen in successive IPCC reports on Climate Change, news stories about extreme weather events such as floods and storms, glacier ice melting, etc.

There are, however, other sources of energy that can be explored, that don't contribute to greenhouse gas warming of the atmosphere. Among these is

nuclear, which doesn't have those emissions, and so is supported by some as the answer to the global warming problem. But nuclear energy creates very toxic waste that hasn't been successfully neutralized and is responsible for many health problems that can persist for generations. Nuclear accidents can happen as no technology is completely safe, and the harm from these can persist for a long time. Taxpayers end up paying the very high monetary and external health and environmental costs for this. Fossil fuels, being non renewable, are expected to be drained at some future point, and some believe that we have already reached the 'peak oil', in which half of the world's reserves of fossil fuels have been used up and the other half is expected to be used much more quickly due to increased demand, population, growth (Rimini, 2005, SA, 1998). There are renewable sources of energy such as wind and solar. They have several advantages that include being more sustainable over long time periods, and not releasing greenhouse gases, among other things. Advantages to exploring such kinds of energies also lie in the fact that they can be harnessed in many different places around the world, whereas many fossil fuel resources are concentrated in countries with unstable political systems which erupt into trouble from time to time.

The EU has been one of the main driving forces of the Kyoto Protocol and has attempted to incorporate environmental concerns into their policies, for instance, into transport fuels (by the creation of a directive that calls for cleaner and more sustainable bio-fuels), and indirectly by linking environmental protection with security of energy supply, job creation and market competitiveness, among others. In terms of energy these concerns revolve around making energy use sustainable, which means less depletion of resources at the current rate, using more renewable energies and increasing energy efficiency, securing the supply of energy in places within the EU instead of in politically problematic and unstable regions. These measures are also meant to generate jobs and increase the Em's competitiveness in the world market (White Paper, 1997).

1.2. Wind and the UK

Wind is the renewable energy closest to being profitably marketable nowadays (excluding large hydropower). Other kinds of renewable energies are at different states of development, and many studies point to a lack of investment in renewables as largely responsible for their lack of development and market penetration. We must then ask, *why isn't renewable energy, particularly wind power, more widely used?* If the answer is a combination of choices and barriers, what can be done about it?

We have chosen to look at, specifically, the UK, but also to note best practice examples from other European countries such as Denmark, Germany and Spain. All countries are part of the EU, providing them a common framework within which they must operate. The EU has signed the Kyoto protocol and pledged itself (it's Member States) to achieving those targets. It has energy framework policies related to R&D and other types of pilot programmes. But

there are differences between the countries, and the reasons for choosing the UK against Denmark, for instance, is well expressed in a Financial Times (2005) article which says that Denmark has concentrated most of the wind-power generating capacity to date, and "wind provides more than 20% of electricity", while in the UK, "between 1990 and 2004, the percentage of electricity generated from renewable sources increased 1.6% to 3,6%, and the largest increase in electricity was from landfill gas" (SOER 2005). And this is in the windiest country in Europe, with the best sites for wind farms in all of the EU. The UK "government has pledged to generate 10% of energy from wind by 2010, requiring heavy investment" (Financial Times, 2005). There are many reasons why the UK is not a world leader in windpower despite it's obvious resources.

"The share of renewable energy has gradually increased over the last ten years (in Denmark). In 2003 renewable sources including waste, constituted 24.8% of the national electricity consumption. Wind energy accounted for the majority of the consumption (15%) but biomass also increased in importance contributing in 4% in 2003" (SOER 2005). Denmark is one of the first countries to invest broadly in wind energy development, while the UK has been a laggard for most of the history of environmental issues as such (Dryzek, 1997) (See Chapter 3 for additional references on this). In the 2003 Energy White Paper the British Government stated the need to "scale up substantially the deployment of renewables in order to secure economies of scale and reduce costs significantly". Offshore Wind energy is the first of all renewable energies options listed by the government to deliver the reduction carbon targets (Energy White Paper, 2003: 58) Three years after the publication of the White Paper, the offshore wind developments are still finding barriers related to cost, investment, technological reliability and marine environmental impacts (Strachan et al. 2006: 15). Why is this important? Because the UK is facing an energy crisis soon, caused by several factors, among them depletion of North Sea oil and gas, rising energy prices, and they are no longer net exporters of energy. There is no significantly large enough framework in place for alternative energies and there are barriers for the development of alternatives, even in the face of a crisis. Perhaps there is something that can be recommended to the UK, based on knowledge of past and present, of historical trends, of other countries and other policies, in order to more effectively develop alternatives.

Summing up, our use of energy continuously increases and shapes our lifestyles, our political and power relations, and affects our environment. In the search for alternative sources and solutions, we have landed on renewable energy. We have chosen to focus on a country with large wind resources, claimed commitment, and under pressure from various sides: the UK. We have found that this commitment is in fact lacking. We will investigate the reasons for this and try and propose solutions.

1.3. The Research Question and Structure of the Report

In the light of this introduction to the research area, we then ask:

How has politics in the UK led to lack of development of the offshore windpower sector?

We plan to make some recommendations of what could be done to increase the development of offshore wind energy at the end. But first, we have some additional questions that will contribute towards answering the research question above.

The UK is part of the European Union and so must comply with legislation. Understanding the drivers behind energy policy in the EU will provide a context in which to set the development of these same policies in the UK. In this light, we seek to understand

1. *What is the development of EU energy policy and how has this affected the UK renewable energy policies?*

The drivers for energy policy in the UK are of importance in determining the causes that have led to lack of development of offshore windpower in Britain. So we want to trace

2. *What is the development of the UK energy policy and how has this affected the sector?*

Our theoretical base requires that we understand the stakeholders involved in energy policy and their influence in the promotion of offshore wind. They are crucial players who have differing interests and roles. We must also estimate the level of public participation in the development of renewable energies and offshore wind in particular, in order to understand the influence and scope of this. So we must ask

3. *Who are the stakeholders influencing the UK energy policymaking processes?*

In the light of our theoretical approach, we need to have an idea of what the policy drivers are, who are the stakeholders and what is their interest, and the role of environmental and technological innovation policies. Thus we ask

4. *How are energy, environment and technological innovation policies working in the UK in relation to the double goals of energy security and mitigation of climate change?*

We believe that technological innovation policy is a key aspect of the development of a new way to harness energy in large scale. Fostering innovation is a practical way of achieving the UK Government's goals. And finally, based on the policy tradition, the stakeholders, and the environmental and technological innovation policies, we can determine

5. *What strategies does the British government have in place to stimulate the (large scale) development and implementation of offshore wind power plants?*

These strategies are the signal that Government gives to the public, and reflect the political traditions of the UK and of the EU, they reflect the policy strategies in relation to the environment and to technological innovation, and are closely related to (and determined by) stakeholders and their influence. Knowing this background enables us to suggest realistic changes and make feasible recommendations. These questions will be addressed throughout the report. Specifically, Chapter 3 on the EU will contribute to answering the first additional question, Chapter 4 and 5 on the UK will contribute to the second and third additional questions. The theory in Chapter 2 will provide a framework under which to answer the fourth additional question, which will then be done, together with last additional question and the principal research question, in the discussion and conclusion chapters.

In Chapter 2, we will introduce our theoretical framework and methodology. We will explain how we have chosen to carry out the study, and briefly explain how the capacity building, social innovation and transition management theories are appropriate and will be applied to our data. In Chapters 3 and 4, we describe the patterns and drivers for energy policy, environmental policy and renewable energy policy in the EU, and in the UK. We trace the history of these kinds of policies, and identify security of supply as the main thread under all energy-related policies. There is a description of incentives and the tools chosen by the EU to reach its objectives. In the UK, we describe the history of fuel supply, of energy related policy, of policy driven frameworks for investment incentives. Chapter 5 deals with the stakeholders for energy in the UK and tries to briefly describe them and their interests. They are key in defining political decisions and ultimately guiding the country's energy policy.

Chapter 6 is where we specifically introduce offshore wind power in the UK. Upon a theoretical background and the backdrop of history, policy, and stakeholders, we can describe and analyze the mechanisms used to promote technological development, renewable energy, and wind energy in particular, in the UK.

Chapters 7 and 8 are where we discuss and conclude our paper. Here we reiterate and delineate barriers and drivers for the development of offshore wind energy in the UK, and try to propose solutions, based on research, selected experiences from other countries, and interview results. We propose topics for further research as well.

The Annexes contain a description and short discussion of policy incentives for renewable energy (Annex A), and a few comments on conferences we attended and interviews we carried out (Annex B).

1.4. Target Audience

This report is aimed at supporters of offshore wind energy and renewable energies in general. Politicians, NGOs and activists will benefit from the analysis and information, gain insight into historical patterns and use it to back policy suggestions, based on an understanding of energy policy in Britain. Academics will be able to use this report, as it condenses a considerable amount of information from many sources and discusses a wide range of aspects related to energy. We aim to update the body of knowledge on energy policy in the UK, and we are aware there are other studies that examine the same aspects of lack of development of windpower in the UK.

Chapter 2. Theory and Methodology

2.1 Theory

In the further chapters, we will describe the political, economic and regulatory contexts in which the transition to other types of energy sources is happening, or not. As already stated, offshore wind energy in Britain is still finding barriers related to cost, investment, technological reliability and environmental impact disputes. To answer our problem formulation, we intend to know the policy and regulatory strategies the Government has in place to stimulate growth in offshore development, to identify the policy gaps to overcome the barriers mentioned, to make recommendations. The theories we intend to use to this end are those referring to social innovation, transition management and capacity building. This analytical framework will allow us to present a clear picture about what has been done and what is necessary at policy and regulatory level to achieve the government's energy goals. The theory will guide us thru the importance and advantages of long term planning, into how to measure the success of energy policy and then into the definitions and advantages of innovation. We think a systemic framework for this, which incorporates policy mechanisms and includes long term planning and management, while still remaining flexible, is an ideal approach to developing renewable energy. Government's role in this is the defining trait which determines the success of such a system.

We start by Transition Management theory, which states that long-term planning should be done in order to achieve successful (in this case, energy) policy. This planning should not establish one single goal to be achieved by a single instrument, but a vision for the future, to be achieved by acquiring knowledge, by testing policy instruments and learning from them, by establishing both short and long term goals, to be re-evaluated periodically, along with the means of achieving them. Next, we introduce Capacity Building theory, a good tool to delineate a country's capacity for successful (energy) policy, which rests on it's actors and their skill and influence, it's strategy for solving the problem, several structural conditions related to diffusion of knowledge, to culture, norms, and wealth, and to the character of the problems themselves. We can then assess where the UK stands related to their capacity for solving energy related problems. A third theory we will use is Innovation, more specifically social innovation. According to Kemp (2000), this concept is central to environmental policy, and the framework he proposes in this paper from 2000 will be used to estimate the effects of energy policies on innovation in the sector, in the UK. What could be termed capacity for innovation is not explicitly mentioned in capacity building theory, but we think it's an important aspect when it comes to the environment, and capacity for innovation can be evaluated as well.

2.1.1 Transition Management

The many environmental problems we have nowadays have not been eliminated by the measures we have managed to carry out so far. End of pipe measures have solved some environmental problems, such as some specific pollutants, but a long term sustainable strategy needs to be in place to deal with some of the more difficult problems. This long term strategy needs to include more than just 'ecological modernization', it needs innovative approaches to problems.

Kemp's articles on the Dutch government's transition management offers to us some methodological tips which we will apply in the our discussion section. (Kemp et al. 2003:4). According to Kemp and Rotmans (2001), a transition to a new system can be divided into four phases: predevelopment, take up, acceleration and stabilization. This transition does not preclude the use of already present systems and technologies, it's a gradual change that incorporates the existing expertise into a new way of dealing with problems. Transition management is a model for governance, for structural change. The guidance of government is different for each of the transition phases, but always present. It advocates not specific policy instruments as solutions, but a 'basket' of long term goals, a search for solutions to any given problem. These solutions are delimitated by social constraints, in which several policy instruments may be used. It does not pick which instruments or which technologies will be successful. It makes the distinction between system improvement, (usually technological) improvements that reinforce the current paths (for example more fuel efficient cars reinforces the use of cars, the overall effect still being pollution), and system innovation, changes larger than technological innovations and 'a new logic of appropriateness' (in the same example, alternatives to cars). Even though this distinction is made, it does not mean that transition management does not aim at both, they are not necessarily mutually exclusive. It is based on integrating long term planning with short term goals, and the time scale of this long term planning is decades, long by a policy perspective, so it may be difficult to overcome short term concerns (for instance on the part of politicians). The transition between the short term goals and the long term goals needs to be managed, guided, and it needs to be a change in technology, behaviour, belief systems and culture, institutions and the economy, and ecology. These different domains reinforce each other, also within a transition process, with faster and slower change, positive and negative feedback loops. The 'assumptions, practices and rules' are the most important change, and technological changes are secondary, a result of these ideological changes.

Change can be analyzed at multiple levels: micro, such as technological niches and consumers of these products, meso, such as regimes with established and self-reinforcing practices, rules and shared assumptions, and macro, such as the socio-technical landscape with it's policy belief systems and political culture, globalization, macroeconomics. Change must take place at multiple levels, include multiple actors and multiple domains.

The Dutch model for transition management developed by Kemp and Rotmans (2001) consists of: "The need to orient myopia of actors, both business actors and government actors, towards the future and to societal goals; The existence of barriers to system innovation, having to do with interests, costs, beliefs and assumptions favouring incremental change; The need for coordination of fragmented policy fields: Science & Technology policy, economic policy, innovation policy, environmental policy, transport policy and agriculture policy, all of which have a role to play in a transition to a low-emission energy system; The need for legitimising policies towards structural change and democratically setting goals; The need for opting for an approach of gradual change and learning about a variety of options; The need for flexibility both with respect to the goals and paths towards the goals;" (pg. 10).

The goals are not specific technologies, for instance, but learning, and institutional change, flexibility and evaluation rounds. Policies can be used to achieve these goals, so "policies have a process goal and a content goal" (pg. 10), in other words, they must be evaluated on how much they have contributed to the process of achieving the final vision, and whether they have achieved their specified goal in the overarching context. Transition management requires a goal and associated risk management: for instance if the goal is reducing pollution, this should be done not by a specific policy instrument, but by allowing a 'policy corridor' in which solutions may be proposed, and this corridor is hedged in by integrated risk analysis, which determines the margin of risks acceptable for the different domains. This goal needs to be one of a set of inspiring long term visions, which have a broad support base (public support is essential), and goals will be adjusted as more is learned about their effect and feasibility. Shorter term goals can be set in view of contributing to the long term objectives, and frequent evaluation rounds should be carried out, not only of the policy goals but of all the factors related to the transition - all the domains.

So, the first relevant point for us is to determine is the energy policy planning tradition in the UK. The purpose is to establish if the necessary preconditions for transition management (commitment, reliability of government policy and room for innovation) existed in the 2003 Energy White Paper titled "Our energy- our future". Kemp (2003) quotes "that management of transition requires a form of process management in which uncertainty, complexity and inter-dependencies are addressed". To establish how energy transition is managed in the UK, we want to check which are the scenarios in which the government is designing their goals, how policy is stimulating knowledge and technological change, how long term goals are perceived by short term policies, how the government stimulates, mediates, and engages in brokering services, creates the right conditions, enforces its laws and engages in steering.

2.1.2 Capacity Building

According to Weidner and Jänicke (2002), to have the capacity for successful policy, certain pre-conditions must necessarily be present, and an understanding of the limits beyond which no success is possible. In a changing society, where new problems arise and others fade away, capacity to deal with such things must also constantly update itself, in many cases turning capacity building into problem solving. Factors that influence capacity are: actors, strategies, systemic framework conditions, situative contexts and problems. These factors are complex and interrelated, and all must be present for successful policy. There is a difference between having capacity and using it to maximum effect. It's possible to have actors and systemic framework conditions, but the use of this capacity depends on the strategy and skills of the actors and the situative context, and the problem itself. In the UK, some of these elements are missing. Below, we will tailor the factors above to describe British politics.

Actors are the proponents and opponents of policy, and their support groups. These will be described in the chapter dealing with stakeholders. They can be broadly divided into government institutions, and non-government agencies such as environmental organizations, the media and private enterprise. The description of the actors, their skill, influence, support and competence in promoting (or blocking) renewable energy policy will be undertaken. Skills and influence change over time, so an assessment of this change will also be made.

Strategy is the approach to the problem. How the problem is perceived, even phrased, influences the kinds of solutions it will respond to (Dryzek, 1997). The strategies related to energy and environmental policy in the UK have been expressed, for example in the UK Energy White Paper, which proposes the application of certain instruments in trying to solve the looming energy crisis and aggressively promotes renewable energy. Another example is the Climate Change Programme. The UK is under pressure from the EU to fulfil commitments and transfer directives, which also outline strategies.

Structural framework conditions can be divided into three categories: use and interpretation of knowledge (technical information related to the policy field) and cultural aspects; formal and informal rules, norms and politics; and economic situation and wealth available to deal with a problem. These will be characterized separately.

The use of knowledge, it's presence along with public awareness of it, are key factors to even perceive a problem. There has been a long debate on whether environmental degradation is real, on whether it's a problem, on if and how it should be responded to. The openness to perceive new problems must also be present. We start by assuming that these problems are real, as described in Chapter 1, and action should be taken. We will explore the relations between the EU and the UK, since they are part of the structural framework conditions.

The popular paradigm governing renewable energy, the environment, science, is crucial in noting the patterns followed by environmental policy (for example, the application of the 'ecological modernization' paradigm). The norms and politics can be divided into 'participative capacity', meaning the openness of a system or society to it's citizen's participation, 'integrative capacity', meaning the level of coordination and cooperation between different government departments or even sectors of society, and 'capacity for strategic action', meaning the possibility of designing long term policy in the face of short term conflicting interests. We will investigate the presence of these capacities in the UK, the availability of information and public discussion, the presence of strategy, long term planning and commitment. The economic situation of a country can mean it's citizens demand more (or less) policy solutions in a particular area. We will estimate the UK public's demand for more or less solutions from their government.

The situative context is the opportunity, the driver for creating and/or solving the problem. In our case, this is both the physical availability and access to fuel, the depletion in the North Sea, energy prices. Environmental concerns such as global warming also offer an opportunity for energy and environmental policy, but the consequences are diffuse enough that some countries have chosen not to deal with this at the present time. Strategies related to energy may, of course, positively affect the environment. These things have prompted Government statements and an attempt at designing strategy - we want to find out what this strategy is and how successful it's been at addressing the problem.

The problem's own character influences the capacity building process. The situative context (above) delineates several related problems, and they are all hard or costly to solve, they challenge vested interests, are based on imperfect or incomplete knowledge, and involve politics and diplomacy. The environmental aspects mentioned are not close to most people's realities, governments are not under substantive pressure from most of the population. Solutions are hard to negotiate and carry out. We will analyze how these factors play themselves out in the UK.

2.1.3 Innovation

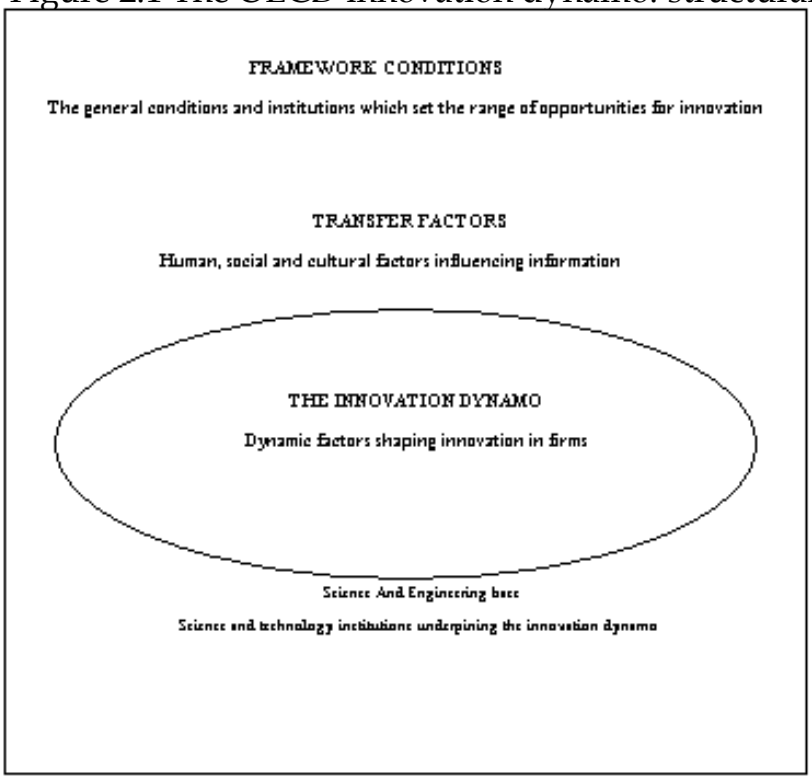
According to some researchers, there are more than forty different definitions of the Innovation concept (Hawks, 1999:99). For our study we want to focus on social innovation, on the role of governments in fostering innovation. In this report we are only concerned with what the European Commission and the British Government understand by innovation. The two different conceptions offer us tips about the styles of innovation policy making. For the UK Government, innovation is: "The successful exploitation of new ideas – incorporating new technologies, design and best practice into the key business processes that enable UK businesses to compete effectively in the global environment" (Innovation.gov.uk, 2006). For the European Commission, innovation is: "the renewal and enlargement of the range of products and

services and associated markets; the establishment of new methods of production, supply and distribution; the introduction in changes in management, work organization, and the working conditions and skills of workforce" (The Green Paper on Innovation Com 1995/688 .P4).

The British definition starts with the good idea (the individual innovator as initiator) and puts the accent on competition and business opportunities. The European Commission's definition, while not dwelling on the economic, social and institutional framework where innovation happens, hints at a more holistic understanding of what innovation involves, which is not just business ideas and it is not just the creation of a competitive commercial environment. For the British definition, innovation is good ideas transformed into business opportunities, therefore the importance of innovation centres on how profitable inventions are. Our perception of what the European Commission offers as a concept of innovation is consistent with the EU "raison d'etre": new products and services to serve economies of scale. Technological innovation is emerging as a by-product of continental integration (enlargement), and as part of the geo-political agenda, is dependant for its development on policy and regulation. In our case, as we will see, the external conditions for technological innovation for the deployment of Offshore Wind Energy are not optimal in the UK.

Innovation is, according to other studies and institutions, recognized as a

Figure 2.1 The OECD innovation dynamo: structural



systemic phenomenon which involves the interplay between technology, economy and politics (Sweeney 1985: VIII) (OECD 1997:6). For system theories, the external system condition of a firm has a decisive impact on the extent to which firms can make innovatory decisions and on the way innovation is undertaken (Kemp et al: 2000 44-45).

The OECD pictures the framework conditions as structures surrounding the so called "innovation dynamo" (OECD 1997:19). Figure 2.1 will help us to approach the problem by analyzing the economic and social institutional system where innovation occurs. An OECD document referred to as the Oslo manual, suggests six areas for investigation to understand the factors that determine innovation (OECD 1997: 27): corporate strategies, the role of diffusion, sources of information for innovation and obstacles to innovation, inputs to innovation, the role of public policy in industrial innovation, innovation outputs.

In our case study, we propose to concentrate on the public policy aspect of innovation. We want to understand how innovation policy, which can help achieve CO_2 mitigation targets and energy supply security, is produced in Britain. We want to test whether and to what extent the Kyoto targets and the energy supply crisis are pushing the traditional, free market style of British policy making towards public intervention. We categorize the deployment of renewable sources of energy in the electricity grid as an example of social innovation. Social innovation consists of the adoption of products for social performance reasons. This type of innovation relies for its development on social regulation, unless, according to Leone, there are important gains for the user (Leone et al 1998:17-18). The rationale to place renewable energy in the category of social innovation is that the introduction of the technology at an economic scale, namely in Denmark, Spain and Germany, was made possible by the introduction of policy instruments. Even though innovation in renewable energy was, in some cases, initiated by consumers (e.g. early wind energy projects in Denmark), the "technology push" and "demand pull" needed for it to compete with conventional sources of energy in the electricity grid did not come from consumers, but from Government.

Social innovation should be understood as the process of governments guiding society, in our study case, towards affordable, environmentally sustainable and available energy, by fostering the use of innovation, by applying and testing policy. This is our vision of what the British government should do. Social innovation deals with the government's role in managing transition towards this affordable, environmentally sustainable and available energy system. As mentioned in the Transition Management section, it's the philosophy behind the policy instruments that matters more than the technological changes brought about by them, it's the philosophy that shapes the instruments and not the other way around. Even though there is no one-instrument solution, we can argue that innovations tend to come about as technological responses first, even as environmental regulation is the product

of a philosophy. Policy interventions should take into consideration the domains they affect, and the skill and capacity stock of actors. Kemp says sustainability policy should be the goal, which would align the objectives of environmental and innovation policy. The policy instruments will be described and compared in the next part of our study.

According to the OECD innovation policy is an "amalgam of science and technology policy and industrial policy". Innovation policy can strongly influence the direction of the innovative process (Heertje, 1988: 3). The making of technological innovation policy has effects in areas such as: research and development, taxation policy, accounting policies, industrial regulations, environmental regulations, planning regulations, and the operation of the capital market (OECD 1997:28). In its publication "The Measurement of scientific and technological activities proposed guidelines for collecting and interpreting technological innovation data" (OECD 1997), the OECD proposes the above policy aspects should be studied via questions on firms' perceptions and obstacles to innovation.

2.1.3.1 Technological innovation, policy instruments, modulation

The theoretical discussion in this section is based on the text written by Rene Kemp: "Technology and environmental policy: Innovation effects of past policies and suggestions for improvement" (2000). We intend to interface Kemp's discussion with our case study. We want to screen Kemp's analysis, on the impact of environmental regulation on compliance, innovation and clean technologies, against examples emerging from our case study. The examples given to illustrate the theoretical discussion have been taken from regulation made under two relevant policy frameworks: The 2000 Climate Change Programme (CCP) and the 2003 Energy White Paper (EWP). In the CCP the government set a target to increase the proportion of electricity provided by renewable energy sources to 10% by the year 2010. In the EWP, the government encourages innovation to meet the EWP goals, recognizing that some renewable technologies required additional support (DEFRA, 2000, Energy White Paper, 2003). Some of the points which we will raise in this section are discussed in more detail in the following chapters.

The bibliographical research made by Kemp on the impact of regulation on environmental innovation indicated that, in the year 2000, the focus of the few studies made was on technical innovation and not on organizational innovation[1]. The literature showed that the common technological responses to regulation are: diffusion of exiting technology, incremental changes in processes, product reformulation to product substitution, and development of new processes. The studies also demonstrated that the level of rigour of an environmental regulation could determine the degree of innovation. According to the OECD, significant innovatory processes occurred in response to stringent regulations that gave firms in the regulated industry enough time to develop comprehensive strategies. The OECD suggested that

1 About organisational innovation see Kemp and Arundel 1998 pp 5-6.

regulations should be incremental and flexible towards compliance. Experience shows that time to accommodate new standards contributed to the development of superior technological responses. Kemp says that social technological innovation is not just a response to regulation. The knowledge for such innovation is already available. According to the author a large number of innovatory technologies producing ecological benefits such as eco-efficiency options are adopted for business reasons. Also, innovation often comes as a result of the threat of regulation. These facts are not denying the need for regulation, as regulation is needed to diffuse innovation. Good regulation can be one of many stimulus for research, development and diffusion of new technologies. Regulation has to be created, introduced and managed with care as it is hard to craft regulations that are not disruptive in some sense. The regulator has to understand the goals of environmental innovation before regulating. Regulation has the difficult task of targeting one domain (see Transition Management section for definition) without affecting the others, or at least making sure that the effect on other domains is positive. Regulation should help the offshore wind industry to have scope for expansion, which could encourage the supply chain to engage in scale production, research to find solutions to turbine problems and investors to invest. And to fit other processes and meet requirements in terms of performance, the technology should have guarantees of competitive access to the grid.

Kemp quotes that the innovators cannot be "elicit by legal fiat" and that there is a dynamic interplay between innovation and regulation, with innovation often paving the way for regulation. In offshore wind energy there are several examples illustrating this dynamic. For instance, the first projects emerged as the result of a policy assessment on the best available technologies to mitigate climate change[2]. With the first offshore project developments, new regulatory difficulties were identified in maritime planning. Currently there is a review of maritime legislation aiming to accommodate offshore renewable technologies into the regulations. A second example (which is in process) are the considerations the industry asks the electricity regulators to make in the creation of rules for the technology to compete with other electricity generation sources.

The discussion which follows is on environmental policy instruments, on compliance, on how they have fostered energy innovation and renewable technology. Under this we will give a description of taxation and innovation waivers existing in Britain to foster renewable energy innovation. We will mention some results that we have found to illustrate our points. They will be discussed later in the report.

Subsidies: Subsidies are relevant environmental policy instruments to stimulate technological innovation, if they are given to new and

2 The policy instruments were subsidies under the Non Fossil Fuel Obligation, the leases offered in maritime areas for the installation of offshore farms known as "Rounds 1 and 2".

environmentally friendly technologies. In Britain the main policy mechanism through which the government supports renewable energy development is the Renewable Obligation (RO), formerly it was the Non Fossil Fuel Obligation (NFFO) (DTI 2006b). The RO is also a tradeable permit system. It is an instrument aiming to give to different renewable technologies the subsidy needed to make the generation cost per KWh equal to the pool price. The limited impact subsidies have on business decisions has been proven in our study, as will be seen. In the past NFFO Round 1 for offshore wind project developments, only a quarter of the 1000 MW of potential developments were built (Edge, 2005). The government's major financial instrument was not enough to encourage decisions towards higher investment. In the examples Kemp offers in his article, subsidies were the first but not the only reason for investment in environmentally beneficial technologies and in most cases it is unclear to what extent they encouraged technological innovation. In our case, financial incentives stimulated the diffusion of technological innovation for onshore wind. Those companies which made the decision to invest had the guarantee of selling energy to the power generators at competitive prices, and the only way to do this was through the RO. Though the incentive exists since 1998 it has not been enough for the expected development of the offshore wind industry in Britain. The cost of electricity generated by wind is the most expensive in Europe. In this study we will examine the reasons why this happens.

R&D Subsidies: Kemp is uncertain if statutory funding is encouraging R&D. The author mentions two different experiences and outcomes. The Danish story tells us that funding encouraged innovation and the Dutch experience says that funding towards innovatory technologies achieved low results and development of 'mediocre research'. We tested the assertion that innovatory firms develop environmental technologies not because of subsidies, but because they believe a market exists for the new technologies, when interviewing industry actors in the BWEA Offshore Wind conference. We asked two leading companies about the funding sources for their research programmes. The answer from one of the interviewees was that research funding was generated by earnings from the company's gas and oil projects and that the firm prefers to be self sufficient. The same question was asked to another company representative whose reply was that funding is always welcome but not essential for their R&D projects.

Taxes and trade permits: Kemps wonders if they promote innovation, since taxes are usually set at low level, so the expectation of it's effects onto innovation should also be low. In the UK the climate change levy (CCL), a tax on the use of energy in the public sector, industry and commerce, aims to encourage the above consumers to reduce fossil fuel energy consumption. The levy expected, in 2001, to raise around £1 billion in the first year. Under the levy there are tax exemptions for electricity generated from renewable energy and other carbon mitigation technologies. Only £50m of the revenue is allocated per year to stimulate "the take-up" of renewable energy (Defra,

2005). In this case the income from the tax is not negligible but the contribution to innovation is low[3]. A trading permits pilot scheme started in the UK in 2002. It was also open to the 6000 companies with Climate Change Agreements (Defra, 2006c). According to the government, the scheme reduced emissions in excess of the planned reductions. The EU introduced to the electricity industry, in 2005, the Emissions Trading Scheme (ETS), the UK government took it up and says that the trading will give the electricity generators and suppliers direct incentives to reduce emissions. The scheme allows companies to buy and sell permits to release carbon dioxide (CO_2) into the atmosphere. The European Commission and Defra stated that the ETS is a cheaper alternative to fines, and the hope is that the EU-ETS will not only create incentives for companies to reduce carbon but also will invigorate innovation (EurActiv, 2006c).

Covenants or Agreements: Kemp refers to the covenants as a new instrument in policy making. In fact, they are common in several policy areas of the UK. They are used in environmental policy frequently in Germany and the Netherlands where the research findings are indicating that the covenants generally are not promoting innovation and technological diffusion directly. For instance the Dutch Energy Efficiency Covenant is making possible emission reductions with the existent technology. In Britain, the Climate Change agreements between energy intensive industrial sectors and the government, are considered by the government "part and integral response to climate change". In 2001 there were forty sectoral agreements. The aim of the initiative is to provide a 20% levy reduction to those participants who agree to meet energy efficiency or carbon saving targets. In the British case we found that energy efficiency agreements promoted, for instance, diffusion of innovation through the use of CHP. The Future Energy Solutions team (FES, formerly ETSU, Defra's professional advisers on energy efficiency in industry), in its "Climate Change Agreements - Sectoral Energy Efficiency Targets" paper, aims to encourage innovation when it pointed out that "sectors must consider not only how to reduce the amount of delivered energy they use, but also to what extent they can use Combined Heat and Power plants (CHP). CHP is more efficient, in terms of primary energy, than using electricity from the grid" (Defra, 2001a). The FES showed flexibility in the introduction of the technology when they said that "the potential for increased use of CHP has been omitted at this stage since there is insufficient site by site knowledge in the sector. The agreement calls for an assessment of the potential over the first 2 years of the agreement: targets will then be adjusted as appropriate". There are not agreements with the electricity power generators.

3 "The revenue raised by this tax is to be redistributed back to businesses by reducing the level of National Insurance contributions, so that the measure is described as 'revenue neutral'. However, it is not neutral in each case, since a business with many employees and a small energy requirement will obviously benefit, whilst a company with a high energy requirement and few employees will feel the financial effect of the increased taxation" Caltherm (2006).

Innovation waivers: Waivers are incentive devices provided by the environmental regulation, like 'breaks'. The waivers are theoretically attractive for innovators and the regulatory body. Kemp described few innovation waiver experiences, which could be improved. The author proposes two ways to approach waivers for the promotion of environmental innovation and diffusion. The first is to focus on policy instruments and examine its aims and objectives (stimulation of innovation or diffusion or both) and the context in which they can be applied. The second is to take the dynamics of socio-technical change as the starting point for a discussion of governance. Waivers are voluntary, open arrangements, and the sectors exempt from the CCL, for instance, have not been given waivers. In fact, despite the fact that gas and electricity suppliers are intensive industrial polluters, the sectors are simply exempt of the climate change levy (Inland Revenue, 2005), and not required to reduce energy use of brought into a policy discussion on the CCL matter.

Merits and limitations of environmental policy instruments

Kemp analyses the policy instruments from an innovation point of view, saying that to stimulate clean technologies, different policies are needed, depending on the context in which they are to be implemented. Environmental standards, economic incentives, subsidies, communication, and covenants, are suggested as policy instruments which may be used to favour the environment through the use of technology. The barriers Kemp found with the instruments are as follows:

Current, technology based environmental standards commonly use existent technologies and provide little support to innovation. Technology-forcing standards that require the development of new technologies are a way to stimulate technological innovation. The barrier is that sometimes these standards are expensive if the regulator is not flexible enough to soften and delay them. There are two ways suggested to implement the standards successfully: the standards should be imposed only when the technology is available, and long term standards that require the development of new technology should be set up. Here, the key is that that the regulator will have a long term standard and will support the necessary R&D and deployment to make the technology available to force the desired standard in the future. The FES arrangements mentioned above are an example of flexibility on the part of the regulator with the deployment of innovation.

The economic incentives are presented as alternatives to "command-and-control policies". The stimulation of innovation through these incentives is one of the preferred tools of international organisations and liberal economists. The theoretical argument is that incentives provide a strong inducement to innovation. The incentives reduce dependency on standards based policies, which rely mainly on available technology. The incentives can introduce innovation by reducing demands on the regulatory process which

has to make decisions on complex economic and engineering questions. The inconvenience presented by the economic incentives system is that, most of the time, the stimulus provided has a marginal impact on innovation. In Britain the users of renewable energy receive tax exemptions under the Climate Change Levy. This incentive did not affect the offshore wind R&D's low performance or help subsidize the higher costs the industry faces, which provoke delays for the opening of new offshore wind farms[4]. Furthermore the incentives did not help encourage the domestic use of CHP technologies.

Matchmaking and technology compacts: Kemp recognizes matchmaking as a way to encourage technological innovation, by the government facilitating the formation of networks of technology suppliers, users and research institutes. Such activity requires special competence on the part of policy makers. We identify in our research that a serious problem exists related to the synergy between departments in relation to their task to foster renewable energy. A matchmaking recommendation can be part of the solution to unify forces between public offices, speed the development process and create further commitment from the public administration towards innovation.

The technological compacts are tools which are helping technological innovation by setting an agenda and phased increments. The inconvenience found with the arrangements and compacts, which are of voluntary nature, is that the objectives could be economically inconvenient for the private sector.

We agreed with Kemp's conclusion that there is not a single best policy instrument to foster environmental innovation, to succeed regulations should complement each other. In this process, the policy maker needs to know how to manage the fine dynamic between innovation and legislation which should be implemented in an incremental and flexible fashion.

The Modulation View

The modulation approach is based on the insight from technology dynamic studies. It is a solution to ineffective innovation along the same lines as transition management, it is a form of managing this transition. The point of departure for public intervention is a recognition of the capabilities, interests, interdependences and interactions of actors around an environmental problem instead of the environmental problem itself. The aim of the intervention should be to search for solutions through the use of environmental policy instruments. The rationale for the modulation method is that the regulation to resolve an environmental problem cannot be effective in securing goals if the goals can be obtained through other developments. It could also happen that

4 The rising costs of steel has hit the construction of offshore wind turbines, only three of 18 sites that should have opened in 2006 are operational. From 2004 the rate of growth of turbine size coming from R&D centres is slower than had been predicted. (BWEA and Renewables East, 2006) Fewer people than expected are switching to energy efficient condensing boilers". The RO and the waivers given to the gas and electricity industries were not significant to encourage the diffusion of the technology (The Guardian, March 2006).

policies are not efficient because the same results at lower cost can be obtained or that the costs exceed the benefits. The explanation for regulatory failure is that the instruments did not fit the economic institutional context where they were applied. The context consists of different sectors with different interests, resource views, assumptions and values of policy actors. The tensions and prevalence within the different sectors and even within the government will be reflected in their influence over the regulation design. The modulation approach focuses on the different societal interactions over an environmental problem. The aim of the method it is to see how different stakes could contribute with their participation to the common good. The modulation idea proposes to governments to modulate the dynamics of socio-technical change towards a common accepted strategy. The public sector task, under Kemp approach, is to articulate the interaction between actors with the view of ensuring a desirable outcome.

The starting point in policy intervention for the different sectors: participating in an environmental round table is profitable for the public body to acknowledge the variety of interests and set up the terms of reference for the policy making process. The public role, when modulating technical change policy making, should involve the facilitation and centre point of the network, articulation of inter sector dynamics, and process management. The aim of policies should be to foster participation by this articulation. Kemp proposes as a way to resolve conflict through consultation, the idea of "game management". The purpose of game management is to obtain the best environmental regulatory solutions by gaining consensus with stakeholders. The problem we found with the proposed "game management" idea is that the manager's own agenda can be the starting point of conflict. It could be the case that the resolution of an environmental problem has to be found under a situational paradigm questioned by some stakeholders. For instance if the British government wants to mitigate CO_2 emissions by building more nuclear reactors, the stakeholders which the government will consult and listen to will be those who believe nuclear is a technical environmental solution. The question resides then into who is defining the concept of "environmental technologies" and presenting them as an important option. In other words, it is important to include in the modulation analysis who, why and how the agenda is set, this will determine who are the stakeholders influencing a round table and shaping the innovation policies decided upon.

To synthesize, we take into consideration some of the elements that technological innovation theory offers and the importance of the general socio-economic and institutional framework conditions for innovation to happen. The rationale to opt for an analysis of public policy in the innovation process has to do with our characterization of the case as a "social innovation". We want to look at cost, investment, technological reliability and environmental barriers for the establishment of offshore wind energy. The structure Kemp offers in his analysis about environmental regulation will allow us to identify and analyze the different policy instruments created in Europe and Britain to

foster innovation in RE. Finally the modulation model will help us to describe and analyze the different consultations related to energy the British government has set up in order to resolve the CO_2 and fuel security problem.

2.1.4 Summary

To sum up what we have learned from these three theories, we can use the concept of transition management as an overarching theme. We need to deal with energy-related problems in an integrated manner, and we need transition management to guide us in this, and help design an overall plan in which all domains are satisfied in the quest for affordable, environmentally sustainable and available energy. Transition management offers a set of needs to be fulfilled for successful transition, and governments are responsible for trying to bring about many of the needed changes in philosophy: government can guide actors and their choices thru policy mechanisms, they need to agree to the need for these changes and they can coordinate policy fragmented in different departments, they can try to reduce barriers to new ideas by providing information and long term, credible, reliable planning, they can be flexible. One way of estimating the current state of affairs, in the field we advocate change for, is using the capacity building framework, for evaluating different aspects that all need to be present if this quest is to succeed. As will be seen in our analysis, several aspects are missing, including a long term strategy, a guiding concept of transition management. Using transition management means being open to innovations, as a way to try to find solutions to the problems, and in this light we need a framework to evaluate innovation as well as capacity. We can even say that an innovation-friendly framework is part of the capacity to solve looming energy problems.

Our framework for evaluating innovation starts with stating policies that generate innovation (system innovation policies): they are technology forcing standards (when risks are large and there is a consensus on their severity), innovation waivers, tradeable permits and R&D subsidies, and network management to teach everyone about problems and solutions. Policies that diffuse innovation or cause incremental innovation (system optimization policies) are technology based standards, taxes, covenants, investment subsidies, communication measures such as labels, environmental management and auditing, and network management. A more general view of policies that are helpful for innovation include ideas present in transition management: sustainability foresight studies, which may change fixed mind sets, long term planning to shape expectations and provide clarity, game management for radical innovations causing companies to try to manipulate the market in case the innovations are not good for them, and strategic niche management for win-win radical innovations or a basket of sustainable goals. We will thus investigate the presence of these mechanisms in the UK and the effect they have had, for compliance, for innovation and for environmental benefits.

Adding together, then, what we have learned from capacity building theory, transition management and innovation theories, we can set out the following framework for investigation: evaluation of the capacities of the UK, in terms of their actors and their associated skill and influence, their approach to the problem, structural conditions such as the availability of knowledge, cultural aspects, norms and politics, and economic situation, the opportunities for change and the difficulty of solving the problem; evaluation of regulatory instruments and their effect on innovation processes, evaluation of modulation and game management on the part of government and it's own agenda, presence of long term planning and vision, flexibility. This knowledge will help us determine where the UK finds itself with regard to solving their energy related problems, present and future, and this framework allows us to make suggestions as to improvement.

2.2. Method and Design, Data Collection

Being that the question is interdisciplinary, that it is complex and can be looked at from many different perspectives, we have had to make some choices regarding the design. We have chosen to analyze the problem from a hierarchical, multi-layer approach, identifying different spheres of influence, different stakeholders, and chosen to bring into the answer considerations from a historical perspective. Thus this is a political, qualitative and in depth analysis of the problem, and this is the approach we think is the best to answer the research questions. The use of primary and secondary sources is as follows:

Libraries

For the assignment we use secondary sources of information obtained from the Danish library Network (Bibliotek.dk) where a number of specialist books were requested and obtained without major difficulty. We also accessed the Westminster reference library to search for old UK energy policies, plus Risø and Roskilde University libraries.

Internet

Through the www we reached articles and papers related to our topic. As primary sources, we obtained the most recent British and European energy policy papers, statistics, newspaper articles. The internet was also the portal by which we became aware of the three thematic conferences we attended. We use the e-mail system to have topic exchanges with officials from the British Department of Trade, The European Environmental agency, The European Commission, Greenpeace UK and Friends of the Earth UK. We also followed the UK energy policy review, through the national/regional press and specialist web sites. The British government launched a programme of consultation at the beginning of the year. A number of seminars and conferences were designed at present to engage into the debate academics, the private sector, the scientific sector, NGOs and other experts (Marris MP, 2005). We think that by following this debate our research was strengthened in

terms of better understanding the dynamics of the consultation and what is the place of wind energy in the discussion.

Interviews
By critically analyzing all the documents collected on the development of renewable energies, we were able to direct our work to qualitative research methods. The method of choice was interviews with experts. The idea of the face to face interviews will be to identify how much the wind energy supporters are influencing policy makers with the energy policy review, confirm statements about reasons for lack of higher investment, planning, regulation and policy gaps in general related to wind energy. We had the opportunity in the two conferences we attended in Athens (the EWEA EWEC 2006: European Wind Energy Association - European Wind Energy Conference) and London (the BWEA Offshore Wind conference) to interview several onshore and offshore wind energy actors: businessmen, consultants, politicians, students, members of NGOs and academia. In both cases the interviews were informal and we did not take notes at the time of the talks to avoid loosing fluency in the dialogues. We briefly introduced ourselves and explained shortly about our interest in the UK developments. The interviewees in Athens were all asked the same questions, which were at that stage related to wind energy in general. In the London conference we focused on offshore wind energy and the questions were coming from the first readings on technological innovation and transition theories. We chose to speak to people who are specifically in favour of wind energy as one important source for the electricity industry. The reason why we chose those actors and not opponents or civil servants working on the energy review is because the first group will give us arguments which we do not have the space to develop fully in this assignment (such as visual pollution, nuclear energy being a more realistic possibility among other kinds of energies). As to the second group, we believe that the civil servants won't be in a situation were they can freely reply to our questions.

2.2.1 The Problem formulation and the use of theory
The purpose of this section it is to demonstrate to the reader how the theory above described fits into the study's problem formulation questions. Above we examined the theories in their ontological (specification of concepts), and epistemological presuppositions (what is known), now we want to see how they will contribute to find a solution to the research questions.

The questions
We will treat each one of our problem formulation questions separately, as it happens that the same concepts can be introduced from different angles to the discussion.

How has politics in the UK led to lack of development of the offshore wind power sector? All the theories will be used for this question. Specifically, the capacity building theory offers a frame for the analysis of the political pre-conditions

which influence capacity for policy making. We will include in our case description and discussion of actors, strategies, systemic framework conditions, situative contexts and problems which pave the way for the current energy crisis the UK is facing.

What is the development of EU energy policy and how has this affected the UK renewable energy policies? To answer this question, we will make use of the transition and technological innovation theories. The structure offered by the transition theory will be use to see the process in which the common European energy policy developed and its impact on British national legislation. The theory framework will be used to analyse the predevelopment, take up, acceleration and stabilization of European energy policies leading to harmonisation. Instead of centring the analysis merely under technological innovation, we propose to frame the problem versus regulatory harmonisation. We will try to identify the impact of EU policy on British RE by using Kemp's theoretical contribution to technological innovation policy instruments designed to fulfil national energy strategic policy goals.

What is the development of the UK energy policy and how has this affected the sector? Here, we will focus on the policy instruments created mainly since the Non Fossil Fuel Obligation in 1990 onwards towards the promotion of renewables. Kemp's theoretical contribution to Technological Innovation policy will allow us to identify critically instruments designed to fulfill the strategic energy policy goals. The innovation dynamo will be used to analyse how the policy system is affecting the sector.

Who are the stakeholders influencing the UK energy policymaking processes? Here Kemp's modulation view, plus capacity building theory, will structure the discussion.

How are energy, environment and technological innovation policies working in the UK in relation to the double goals of energy security and mitigation of climate change? We will use Innovation and Transition theories to describe how policies are working in synergy (or not) towards a common innovatory goal. Capacity building theory will help to discuss the government's capacity for solving energy related problems.

What strategies does the British government have in place to stimulate the (large scale) development and implementation of offshore wind power plants? The Transition, Innovation and Capacity Building theories will be used to answer this question. Transition will offer the tools to describe the short and long term strategies, and if the monitoring and evaluation systems are in place to follow the agreed strategy. Through Capacity Building we will analyze how the problem is perceived and phrased. Innovation theory will allow us to present the existent financial mechanisms the government has to foster offshore wind energy deployment.

The discussion about public participation and the theory

By answering the questions we will be lead to a discussion of what the UK government needs to do to deliver significant offshore wind capacity into the UK energy mix. Policymaking is always influenced by the sector and the public in general. The discussion on current public awareness and participation in decision making will be guided by the Capacity Building theory.

Chapter 3. Historical Drivers and Change in the EU

The guiding thread of this chapter is security of energy supply. It underlines the inclusion of energy concerns in the workings of the EU: thru directives, programmes, debate. Security of supply and energy efficiency, in the last few years, are two of the main reasons behind many energy-related initiatives in the EU. The attempt here is to put things into perspective, to understand the historical and current background of European energy policy as a whole.

"National politics … has been deeply transformed by EU membership and to that extent cannot be properly understood outside of a EU framework of analysis"
(Liefferink and Jordan, 2002:15)

3.1 Energy in the Union

Energy resources are a critical and sensitive issue among the Member States. Since, and due to, the oil crisis of 1973 and in the early 1980s, security of energy supply and the growing reliance on energy from sources outside the EU have been large concerns in the Union. Environmental protection, although mentioned, was not a driver of energy policy until the 1990s, and it's previous mentions were in the scope of security of energy supply thru diversification and exploitation of indigenous sources in the EU. There is a 1975 Council communication regarding energy and the environment, stating the need to fairly balance these two concerns. In 1983 a Council regulation was put in place to financially assist the UK and Germany with the implementation of energy projects and measures, to bring these two countries closer to compliance with the Em's energy policy and strategy. This strategy made no mention of renewable energy and was unspecific about environmental protection (Council Regulation, 1983).

The European Coal and Steel Coal Community (ECSC), established in 1951, was the first institution of what is now the European Union (EU). It was formed by six countries which, upon the success of this enterprise, decided to integrate other parts of their economies, thru the Treaties of Rome (Euratom and European Economic Community - EEC). Such a union created business and profit opportunities for all the countries involved, and has kept them from going to war against each other. The EEC was a first step to politically unite Europe and "to transform the conditions of trade and manufacture on the territory of the Community", by creating a common market, a customs union and common policies (EEC Summary, 2005). The Euratom Treaty was intended to foster the development of a new kind of fuel, nuclear energy, as an answer to security of supply issues, and the reason the Member States came together to do this was the high cost of any country undertaking such research and development on it's own. Any Member State all the way down to individuals could join the institutions created by the Treaty and benefit from it (Euratom Summary, 2004).

There were some large structural and supply changes related to energy in Europe since World War I. In the 1940s there was a large nationalization wave of the coal, gas and electricity industries. Both oil (in the Middle East) and nuclear entered the scene in the 1950s, upsetting the use of coal as the major fuel for energy. The security of supply issues began after World War II. There were upheavals in supply and demand, with shortages of coal for nearly a decade after the end of the war (Ezra, 1993). Under this light, the creation of the ECSC, the EEC and Euratom seem timely and adequate. After this shortage of coal came the oil crisis in the early 1970s, and as of the 1980s, the liberalization of the afore-nationalized industries. All these changes have had an impact on energy related energy policy (Ibid).

The United Kingdom (UK) joined the EEC in 1973, after two failed applications and much negotiation. The British protection of their own internal market against international competition is credited as one of the reasons for the delay of the UK's entry into the EEC (for a counter analysis, see Rollings, 1998), aside from French opposition and veto.

It can be hard to trace the impact of the EU in local, regional and national legislation. Frequently national legislation will be put in place in anticipation of EU legislation, or at the same time, each getting feedback from the other. In the case of directives, they are transposed into national law. The dates when laws were instituted may provide a clue about which came first, but still it's not always evident (Bishop, 2000). In the case on environmental policy, though, some countries had already started to develop their own policy before the EU, and in that case it's possible to study this impact. 'Europeanization' is defined as the process thru which the EU has started impacting national policy (Liefferink and Jordan, 2002). Börzel (2002) has come up with a classification of Member State's responses to 'Europeanization', to help trace this impact: pace-setting, foot-dragging and fence-sitting. Pace-setters are the highly industrialized countries that have (for example) highly regulated environmental standards, and try to manipulate EU policy towards their preferences. Denmark is a pace-setter in environmental policy. Foot-draggers are the opposite of pace-setters, blocking policies or seeking compensation for the large cost of implementing them. Fence-sitters form coalitions with either side, depending on their interests. The UK has a reputation for being a laggard in environmental initiatives but the author states that this is a result of German-style environmental regulation being pushed thru the EU in the 1980s. She adds that Germany and England have very different styles of regulation, highlighting the UK's 'reactive' approach, relying on quality standards, voluntary action and negotiation, and the expense of shifting to a German-style policy. The author also states that 'Europeanization' is a 'two-way process', in which Member States both try to influence policy and then must comply with whatever final decision was made. Liefferink and Jordan (2002) classify the UK as a middle-of-the-way country in terms of the adaptations it had to make to EU environmental standards, meaning that it

had to make some adaptations, set tighter standards, but overall it was a case of fine-tuning existing regulation.

3.2. Electricity

In 1973, 38.2% of electricity generated in the EU came from coal, and this percentage changed little over the next 20 years (Key World Energy Statistics, 2004).

The fuels used to produce electricity in the Union are coal, oil, nuclear, natural gas and renewable sources of energy such as solar, wind, biomass and hydropower. Each country is endowed with different natural resources and has made different choices in the planning of power plants and such. For instance, France produces and relies heavily on nuclear energy, and Denmark does not produce it at all (Eastern Denmark is connected to the electricity grid of Sweden, and the latter uses nuclear power, so when Denmark buys electricity from them, Danes arguably use electricity generated thru nuclear power).

Primary energy is defined as "energy contained in raw fuels", and raw fuels are defined as "a material with one type of energy which can be transformed into another usable energy" (Wikipedia, 2006a). Primary energy can thus be transformed into different kinds of secondary energy, such as electricity, for example. The total production of primary energy in the EU-25, for 2003, was nearly 884 million toe (this is the most recent year official statistics are available from: Eurostat, 2006). This production was roughly evenly distributed among the first four types of fuels (coal, oil, nuclear and natural gas), with percentages varying between 16 and 28%. The Em's total production of primary energy is nearly the same as the net import in 2003, and of this total (production plus import) only 5.7% came from renewables, mainly hydropower. The UK alone produced more than a quarter (27%) of the Union's primary energy in 2003, and most of it came from crude oil and natural gas. The UK used to be a net exporter of energy, it's final energy consumption being 15% of the Em's. Only 3% of the UK national production came from renewable energy. Currently, there has been rapid depletion of oil and gas in the North Sea and fall in production, and the UK has become a net importer of energy in 2004 (DTI, 2006).

3.3. The Energy Crisis

The energy crisis has many elements to qualify it as such. The ever increasing depletion of natural resources, the forecasts that 'peak oil' is upon us and world supplies of oil will only diminish from now on, soon followed by gas (Rimini, 2005, SA, 1998), are one side of the energy crisis. Markandya et al (2005:5) state that "it appears that the estimated availability of reserves [of oil] is sufficient to meet demand well beyond the medium term, [yet] there could be a reason to be concerned: in the medium run the energy system will have to count on unconventional oil - at the moment substantially more expensive than the conventional oil - with the risk of increasing energy cost". On this

same side are environmental concerns, including pollution and global warming, and the massive changes that can take place as a consequence. The other side is a more practical, economical concern with fuel supplies in politically unstable countries (such as in the Middle East and Russia), which affects prices, diplomatic relations, and access to energy (a current example was the Russia-Ukraine gas row, see The Economist, 2006a). Thus the question of security of energy supply has two sides: physical availability of fuel and access to this fuel, the latter mediated by geo-politics. "External dependence does not of course raise the same problems for all energy products. The world markets for coal or uranium being highly fluid, well distributed geographically and not suffering from price volatility, there is no problem concerning these products. In the case of oil or gas, however, the market is very precarious and reserves are also distributed unequally. Price fluctuations can seriously affect our economy. What will happen when the demand for energy explodes in the developing countries?" (EC, 2002). As the 1st oil shock in 1973 made clear, countries in the Middle East, who own much of the oil used all over the world, can manipulate prices and affect the supply of affordable energy. Political tensions among them and between them and the EU (for instance) can result in supply cuts. The EU has been trying to deal with this crisis, and a central point in it is to guarantee the security of supply of energy. The EU Green Paper from 2000 regarding this security of energy supply has stated that, currently, the EU imports 50% of it's energy and that by 2030, it would be importing 70%. The Paper highlighted the need for an environmentally minded solution, emphasizing policies to curb energy demand and the importance of the internal market in fostering competition. Ultimately the idea is to try to diminish the risks of dependence on external energy, making sure the public has available, affordable, environmentally responsible and sustainable energy (Green Paper, 2000). There have been recent rumblings that "concerns about security have driven the liberalization of Europe's energy market into reverse". These have been based on the concern that a free energy market cannot guarantee the security of supply either, but since they come from energy companies with monopolistic tendencies, no one is sure how seriously to take them (The Economist, 2006b).

The meaning of security of energy supply has been interpreted by institutional bodies and by academics in different ways. Egenhofer et al (2004:2-3), compared several versions of the concept and noted that the different energy security of supply definitions avoid the term policy: "this reflects the growing conviction that security of supply is a shared responsibility among governments, firms and customers that goes beyond command and control and towards stakeholders". The other two common features the author found are the cost-risk judgment, which implies a risk/management strategy, and the physical availability and supply, due to its impact of energy prices on the economy (growth, wealth and the competitiveness of industries). Finally for the author defines security of supply as "a variety of approaches aiming at insuring against supply risks,

which becomes a cost/effective risk management strategy of governments, firms and consumers".

3.4. Kyoto

In 1997, the EU signed the Kyoto Protocol, which was a follow up for the Rio Conference in 1992, and the signatories were to reduce their CO_2 emissions in an effort to combat climate change. The US later reneged on their commitment to the Protocol, stressing technological advances were the answer (SU, 2006), and a EU spokesperson at the Montreal UN Climate Change Conference (Nov-Dec 2005) commented that 'they are clearly not moving forward on long-term cooperative action' (Nature, 2005). Nonetheless, Pasztor (2006) considers it a success that everyone has finally agreed that global warming is a problem. Up to date, the reduction of emissions from the countries still committed has been, for the most part, negligent. The EU regards the Kyoto commitments important in maintaining and increasing a lead in the renewable energy industry, in setting a successful example for the rest of the world in CO_2 reduction, and so showing what a strong institution the Union actually is, consolidating it's power and leadership.

The EU is on track to meet it's commitment of 8% reduction in CO_2, but that is only since the EU-15 countries were joined by an additional 10 countries in 2004. In fact, the CO_2 emissions per capita have remained relatively stable at around 8.5 tonnes per year, as have the UK's, at 9.1 tonnes in 2003 (albeit larger fluctuations). As of yet, any energy efficiency achieved has been offset by increased consumption. The system being used in the EU is one of permits for emission and credits for efficiency and greenhouse gas capture. This presents some challenges in the face of liberalization, because "the liberalized market in terms of it's trans-boundary character will make it difficult for Member states to regulate the national production and consumption of energy. As an example, to concept of free trade will complicate the use of national emission quotas" (Lorenzen, 1997:106). But this concept of free trade is the guiding light of current policies: "around the world, new markets are being set up to harness the power of competition and self interest in the service of the environment. It is still too early to judge whether these new trading systems will succeed, however. Markets work well only when well-defined products enable smooth transactions, when a trusted exchange instils confidence, and when trading volumes are high enough to foster competition" (SA, 2005).

The functioning of the EU Emissions Trading Scheme (ETS) is the following: companies are given a number of allowances (EUAs) of CO_2 emission free of charge, initially 95% of their emissions. Then they can evaluate the cost of mitigation vs. buying more EUAs. The scheme equates EUAs with CERs (certified emission reductions, from countries with no targets) and ERUs (emission reduction units, from non-EU-15 countries party to the Protocol), meaning that the EU ETS can stimulate the creation of a more global trading market and the development of CDM (clean development mechanism) and JI

(joint implementation) projects. There will be independent monitoring of obligations and fines for non-compliance (EC, 2005). Some authors, such as Kofoed-Wiuff (2004), argue that the EU ETS is a needed but not strong enough incentive for the development of renewable energy, and others say that this may make electricity prices 'rise significantly'. But ultimately, the EU ETS is still in a learning phase, and it remains to be seen how well the scheme will work (BBC, 2005).

In 2001, the EU published the Large Combustion Plant directive, to regulate the emissions of power plants, diminishing sulphur dioxide and oxides of nitrogen from already existing plants, and dust reduction along with the above for new plants (LCP, 2001). Both this directive and the ETS have the potential to significantly change the fuel mix used by countries.

3.5. Energy Policy

It was only in 1986 that a first step towards a common energy policy in the EU was made, with a call for common political goals (Council Resolution, 1986a). This common political goal, where it concerned energy supply, was for integration, in order to increase security of supply, reduce costs and strengthen the competitiveness of national economies. The discussion was initially strengthened by France, which wanted to export its large electricity surplus, and had lodged a formal complaint against German coal subsidies, claiming it affected their export interests. The French soon withdrew their support when it became clear that liberalization of the electricity market, as it was being designed, might not benefit them. Their electricity supplier, EdF, was state controlled, and the government wanted to keep that control. The British were the only Member State with a liberalized electricity market at that time, but since other country's electricity suppliers were mainly national monopolies, they could not expand beyond their own borders. Most electricity suppliers were against liberalization, proposing harmonization of financial and political measures that controlled the electricity market of each country. A proposal for third party access to the electricity grid was supported by only a few countries, the UK among them. This is one of the major bones of contention in the common electricity market debate (Schmidt 1996). According to the EU, the benefits of the 1986 Single European Act, a call for a single market in every sector of the Union, regarding energy, were to create "the most effective, safest and most competitive energy market", ensuring price transparency, affordable energy, and environmental protection (Energy: Introduction, 2005).

The European Energy and Transport Forum is the main advisory body for energy (and transport) policy. It is composed of members from various sectors, such as "operators, infrastructure and networks, users and consumers, trade unions, representatives of environmental protection and safety, especially in the field of transport, and academic experts and think-tanks". The mission of the Forum is to monitor energy policy, give opinions on the avenues of approach and proposals by the Commission, and also give

opinions on competitiveness and structural adjustments, which incorporate environmental, social and safety concerns. The idea behind this Forum is to increase public participation and transparency (E&T DG, 2004). Keeping in line with the idea of transparency, the EU also makes available its record of expert groups, be they formal or informal, all of which offer advice and assistance in the preparation of policy initiatives. The energy sector of the register contains 32 groups, and includes all sorts of energy. The environmental sector has more than 100 groups, dealing with many different aspects of the environment (REG, 2006).

3.6. Liberalization vs. Harmonization

Liberalization of the electricity markets means instituting a system of competition, where suppliers and distributors are separate entities and consumers are able to buy their electricity from any company they choose. It entails less government control of the sector being liberalized and encourages a market model. This is one method to try to increase security of supply of energy, and "the key security-relevant results of liberalization are thought to be diversification, both in a geographical sense and with regard to fuels; and flexibility, through open networks and demand-side measures that seek to improve energy efficiency and conservation" (Egenhofer et al, 2004:1). It is a controversial subject, because frequently electricity is a natural monopoly, controlled by companies large enough to supply most or all of the needs in a given area, at the lowest cost in relation to production. The costs associated with starting up in this industry are high, and natural resources may already be in the ownership of a single company, so it's hard for newcomers to get into the market and long established companies don't want to give up their monopoly. Harmonization is one of the solutions proposed by companies against liberalization, and it entails different areas (or countries, in the case of the EU) making roughly the same types of rules and laws regarding the electricity market, allowing companies to trade but still remain in control of the prices. Strong regulation is needed to keep a system like this functioning against the will of the electricity utilities (Wikipedia, 2006b). Ezra (1993) says that regulation is the middle-of-the-way option since nationalization and liberalization/privatization cannot, alone, achieve the "diverse and sustainable supplies of energy" (pg. 395) needed by the people.

By July 2007 the Commission requires that the electricity market be fully open to all customers. This opening up has been done in steps, first by allowing state-decided 'eligible customers' access to the transmission and distribution systems, then non-household customers (in 2004), then all. Up to today, there are still differences in the liberalization of the Member State's electricity markets, and there are both critics and defenders. Since the liberalization of the UK energy market, the electricity prices have fluctuated but there is no marked increase or decrease tendency (Ogasawara, 2005), which means that one of the supposed benefits of liberalization, lower prices, may not happen in the EU either. At EU level, the electricity market liberalization is progressing in stages, and now stands with geographical groups in the Union fully or in

the process of integration. The next step will be to integrate these groups. De Jong (2004:23) has said that "regional models would be appropriate in reflecting physical and commercial realities", stressing that bottlenecks would still need to be dealt with and suggesting that the integration of the groups is not necessarily the right step. According to Ahvenniemi (2005), the Nordic group (Nordpool) is fully integrated. The author calls for more transparency so that customers can make better-informed choices about who they buy their electricity from, and also more robust transmission capacity between countries to keep bottlenecks from happening. Boisseleau & Hewicker agree and add that there is little integration between the UK and the rest of Europe (the same goes among the European regions). They state that "although the Member States decided at the sixth Electricity Regulatory Forum in Florence meeting [Nov. 2000] that their allocation procedures should comply with an agreed set of rules based on market mechanisms, in practice different methods are still being used and non market-based methods remains in many cases. … The characteristics of the actual European market design with respect to the separation between transmission pricing and power exchanges represent the main reason why little integration between national markets in Europe remains" (pg.9). Kofoed-Wiuff (2004) argues, on a broader scope, that the whole design of the liberalization of the market is flawed in the sense that it does not provide the sufficient incentive for a renewable-energy based energy supply (which he concludes is the only answer to CO_2 and security of supply concerns). A European Commission Memo (EC Memo, 2004) describes Denmark as one of the countries where there is complete competition in the electricity market, and Matthes et al (2005) say that Scandinavia and the UK are the regions of Europe where the power market is not concentrated. Despite this, Danish newspaper Ingeniøren (2006a) states that the liberalization [in Denmark] is a 'failure' since electricity prices have gone up on average, because the market is still dominated by a small cartel of large players able to manipulate the prices. The presence of wind power in Western Denmark has caused a decrease in electricity prices (Ingeniøren 2006b), but not enough to offset the taxes levied on electricity against CO_2 and for wind power, and the alleged market abuse by the electricity companies. Nordpool is set up so that there is trade when there is capacity to transfer the energy, but since there is not enough capacity between the countries, when production peaks, the Danish near-monopoly electricity companies can control the prices. The proposed new cable to link Eastern and Western Denmark may improve the average price of electricity but will not improve competition, the paper adds (Ingeniøren 2006a). Greenpeace (2005a) says that 10 companies dominate the European electricity market, and the Eurometaux (metal industry trade association) agrees and states that costs for the electricity-intensive metal industry have gone up due to "distortions in the ill-functioning European electricity market. Electricity producers … have adopted commercial practices allowing them to indicate prices that do not reflect cost fundamentals. Producers … have created the illusion of competition through wholesale trading, but in reality, the large producers continue to dominate the market. 'The current power exchange model should

be replaced by a true market design that allows cost fundamentals to be properly reflected and gives equal weight to all market participants'" (EurActiv, 2006a). In fact, the IEA (2005) says that "retail prices are poor indicators of whether performance development is positive in the electricity industry", so, whether liberalization has been successful or not, prices that do not reflect the real cost (such as of subsidized sectors of an industry) may not be a good indicator of success.

The liberalization of the electricity markets is providing challenges for the transmission system operators (TSOs), related to predicting energy needs and avoiding bottlenecks. "Meeting long-term electricity demand in the EU is a complex issue which needs to take account of several factors including environmental commitments … and geopolitical issues related to the Em's high dependency on imports. The share of each energy source in the EU electricity generation mix (gas, coal, nuclear, oil and renewables) ultimately reflects those political choices". According to European TSO's president, a specific directive on security of electricity supply is needed to avoid blackouts and "clarify the role and responsibilities of all stakeholders, including the Commission, member states, industry players, transmission system operators (TSOs), traders, suppliers and consumers" (EurActiv, 2006b). The lack of grid access (bottlenecks) between countries, as highlighted by an EWEA Press Release (2005), creates a problem given the fluctuations of wind-generated electricity, because this energy cannot be stored and must be transmitted (EurActiv, 2006b). Grid access is therefore a crucial element of the liberalization process and thus of security of energy supply.

3.7. Gas

Natural gas "is regarded at the preferred fuel for electricity production in the EU" (Gas Security, 2004). The Gas Directive (2003) includes liquefied natural gas (LNG), biogas and gas from biomass and others, and is meant to regulate the organization of the sector, operation of the system, market access and licensing of transmission, storage, distribution and supply. The 'Madrid Forum' was established to regulate effective trading thru non-binding agreements.

An EC Report (2005) on the implementation of the gas and electricity internal markets claimed progress in some areas but in general highlighted that most Member States had not transposed the directives as expected and thus the functioning of the internal market was not as it should be. The report stressed that, given the current rise of energy prices, it was more important than ever that the Member States cooperated. The small cross-border trade and lack of regional integration are in need of expansion, and market structure and the independence of transmission and also distribution system operators leaves much to be desired. The gas sector was considered still very rigid, implying that the few months difference between the electricity and gas internal market directives was not the only cause for the ill-functioning internal gas market compared to the electricity market (gas is the most recent of the two).

3.8. Energy Efficiency

One of the paths to security of energy supply involves energy efficiency and the rational use of energy (RUE). The European Commission, in a 1998 communication, brought RUE up for discussion, proposing an 18% reduction of energy use thru efficiency, by 2010. Voluntary agreements were the main vehicle for this, and an action plan was scheduled pending the results of the discussion (Commission Communication, 1998). Accordingly, the EU created an Action Plan in 2000, which mentioned institutional and commercial barriers to energy efficiency and proposed measures to integrate efficiency into other EU policies, new policies and measures, and initiatives to strengthen the existing policies and measures. It's due to last to 2010 (RUE Action Plan, 2000). In 2005 a new Green Paper was published to re-launch the discussion and highlight what still needed attention regarding the Action Plan objectives. These included an increase of energy efficiency in buildings, which claim 40% of the Union's energy in heating and lighting, changes to the transport sector, which is highly petrol dependent and dominated by road travel and accounts for almost 30% of consumption, and electricity production itself, which can use 40 to 60% of the raw fuel input during production (Green Paper, 2005).

3.9. Framework Programmes for Research and Development

Also known as FPs, "The Framework Programmes have been one of the mechanisms through which the European Union has been building a more integrated R&D community" (Katz, 2005). They were created to encourage research and development by providing funding. It's a flexible programme, in that it's revised every few years, and yet provides continual funding for key areas. Each FP has lasted about four to five years, since the 1st in 1984. The 7th FP is due to start in 2007 and last seven years (Wikipedia, 2006c). The new time scale is supposed to be representative of the Em's commitment to research, and this FP is designed to foster the most competitive knowledge society in the world (7th FP, 2005). The idea of the frameworks was to create a Single Market for ideas. The priorities of the programmes have changed over time, going from technology to a "more holistic" approach (Brite-Euram, 2006). The most recent ones aim to encourage transnational cooperation, dissemination of results and participation by small and medium-sized enterprises (SMEs) (5th FP, 1998).

"Both the 1st and the 2nd FPs focused research on areas like information technology, advanced materials and environmental science". The 3rd programme "introduced new activities in reinforcing Europe's innovation infrastructure" and the 4th broadened more than ever the integration among different research areas (Brite-Euram, 2006). The 5th FP established the European Research Area and tried to stimulate the finding of solutions to current problems. One of the thematic priorities is related to energy, and is divided between nuclear and non-nuclear research (5th FP, 1998). The 6th FP is divided into 7 thematic priorities, one of them (sustainable development,

global change and ecosystems) includes renewable energy in its scope, but otherwise there is only funding for nuclear energy (6th FP, 2002). The 7th FP, starting in 2007, has as objectives furthering the European Research Area, and its goals are about achieving excellence in science, human potential, creativity and innovation. Nine thematic priorities have been designed, energy being one of them (Wikipedia, 2006c). The funding has been drastically increased, as can be seen in Table 3.1.

Table 3.1 - Funding for FPs, for energy-related research, for non-nuclear energy related research.

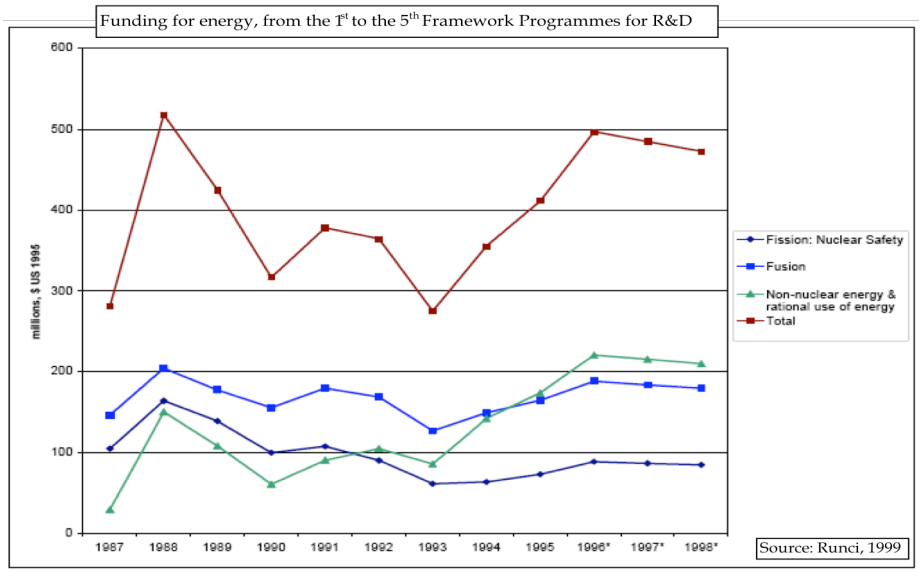
Budget for Research Framework Programmes				
	Total	*Energy*	*Energy*	*Non-Nuclear Energy*
4th FP (1994-1998)	13215	2366	17.9	7.8
5th FP (1998-2002)	14960	2302	15.4	7.0
6th FP (2002-2006)	17883	2955	16.5	9.6
7th FP (2007-2013)	73000	7840	10.7	6.5
	in Millions of Euros		*As % of Total Budget*	

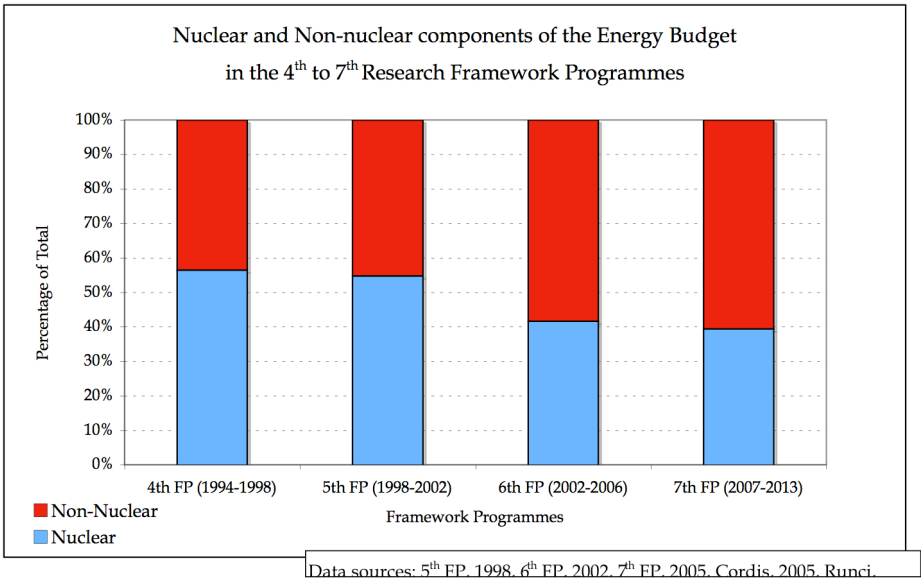
Sources: 5th FP, 1998, 6th FP, 2002, 7th FP, 2005, Cordis, 2005, Runci, 1999

Energy has always been a continual research priority since the oil shocks in the 70s, "but the overall share of the budget devoted to energy R&D has declined steadily, from nearly 50% in the 1st FP to 14% in the 5th FP" (Runci, 1999:6). Table 1 shows the funding allocated in the last four Research FPs, and funds for energy research have been declining steadily as a percentage of the total budget. In part this is because security of supply concerns, though present, have been less urgent, especially since the low energy prices after 1986, and also economic and environmental concerns related to energy have become more prominent (Runci, 1999).

Non-nuclear energy has grown in importance and surpassed nuclear energy in terms of funding, as Figure 1 shows. In the top graph of Figure 1, note that if you add nuclear fission and fusion funding, the quota for nuclear energy is higher than for non-nuclear. This trend is only reversed in the 6th Framework Programme, seen in the bottom graph of Figure 1.

Figure 3.1 - Comparison between funding for nuclear and non-nuclear energy in the Research Framework Programmes.





3.10. Renewables

"Renewables go against the perceived interest of the dominant actors in the electricity system"(Jacobsson and Johnson, 2000)

Renewable energy was mentioned as one of the many objectives related to energy in the EU (Council Resolution, 1986a). At the end of that year the Council published a resolution in which it stated that new and renewable energy were the paths in which energy research would be encouraged (Council Resolution, 1986b). In 1988, a Council recommendation for the exploitation of renewable energy sources was published. In essence, it reflected a lack of investment and knowledge regarding each Member State's reserves and potential for use of renewable energy, which needed to be

corrected (Council Recommendation, 1988). The Rio de Janeiro Conference in 1992 brought environmental concerns to the forefront, and they started to be included in energy policy objectives (which up to that point had revolved around economic measures to guarantee security of supply).

In the same year the Maastricht Treaty was signed, transforming the EEC (European Economic Community) into the EU. The treaty gives the EU a 'political dimension'. One of the principles outlined in it was that of subsidiarity. This principle states that the EU can only take action: in it's area of jurisdiction; or where objectives can best be reached by EU rather than Member State action (TEU, 1992). This means that the EU influences policy content but not how it is transposed into the Member States' law, and only in areas it feels the Member States are not performing as well as they could. The EU has been a driver for renewable energy research in most countries of the Union. The power (or lack thereof) of the EU has been exposed by the application of the subsidiarity principle. When it comes to environmental policy, there is a 'chronic implementation gap', but that assuring compliance by economic means, such as levying fines, while effective, goes against subsidiarity as it's applied. According to Jordan (1998) in Jordan & Jeppesen (2000), The Member States are reluctant to "surrender control of tax affairs to supranational bodies. Significantly, taxation is one of the five areas of environmental policy that are exempt from qualified majority voting in the Environmental Council of Ministers".

In the 4th FP, between 1994 and 1998, two programmes regarding renewable energy were incorporated into the FP structure. This is reflected in the jump in funds for energy research seen in the top graph of Figure 1. They had previously received funds not connected to the R&D FPs (Runci, 1999). The Joule and the Thermie programmes started out as separate entities but an attempt was made to harmonize the two. This was not achieved with the expected level of success (RE Support Audit, 1998). The intent of the programme(s) was research (Joule) and demonstration (Thermie) of, among other kinds of energy, wind power, and also promoting rational use of energy. The attempt to harmonize and merge the programmes was intended to try to merge the research and demonstration phases of (non-nuclear) energy technologies. In 1993, the first Altener programme was started, lasting up to 1997. It's objective was also to promote renewable energy sources in the Community, but it's functioning was different from the Joule-Thermie programme(s). During the same Audit it was also found that Altener lacked transparency and thus equal opportunity for funding for all projects submitted, and management and financial irregularities were found. The Altener programme was continued thru 1998 to 2002. In 1996 the Commission circulated a Green Paper on Promotion of Renewable Energy Sources (Green Paper, 1996), which constituted the 1st phase of the Commission's White Paper "An Energy Policy for the European Union" from the previous year (White Paper 1995), designing a strategy and starting a discussion to lead to a White Paper on renewable energy. These were key documents regarding the Union's

energy policy. This happened in 1997, and took into account a 1996 Council conclusion that EU energy policy should actively seek to lessen climate change (White Paper 1997). Since the Single Act there has been increasing opening up of markets in the Union, but it wasn't until 1996 that a directive demanding common rules in the electricity sector was established (Internal Energy Market, 1996, revised 2003). In 1998 a Council Resolution on renewable sources of energy reinforced the support for RES and for a campaign for take off, to raise interest for renewables in the industry. This Campaign happened from 1999-2003, and the final report "Sharing Skills and Achievements" is a showcase of success stories on the uptake of renewable energy (CTO, 2004). In 2001, the RES-E Directive was laid down. It refers to electricity generated from renewable energy sources (RES) and states that this potential is underused and should be encouraged (RES-E, 2001). 2002 and 2003 have seen two more directives related to renewable energy but not electricity. They pertain to bio fuels for transportation and energy efficiency in buildings. In 2003, a Parliament and Council decision created the Intelligent Energy - Europe programme, spanning 2003 to 2006 (EU Decision, 2003). This programme brought together Altener, for promoting renewable energy, Save, for promoting energy efficiency, Steer, for promoting clean transport fuel, and Coopener, for promoting international cooperation in the energy field. It is a political tool to try to remove the market barriers keeping renewable energy from being more competitive (IE, 2003).

The justification for policy intervention and subsidies for R&D for renewable technologies is that they are not yet mature enough to be competitive against fossil fuels. They need to become cost competitive and "innovation that leads to cost reduction is therefore crucial" (Klaassen et al, 2002:232). "If … environmental costs were levied on electricity generation according to their impact, many renewables, including wind power, would not need any support. If, at the same time, direct and indirect subsidies to fossil fuels and nuclear power were removed, the need to support renewable electricity generation would seriously diminish or cease to exist. EWEA recognizes that it is not politically feasible to remove energy subsidies to conventional sources overnight or agree on measures to fully internalize external costs" (EWEA, 2004). Additionally, in spite of the fact that "some organizations and actors from the conventional power sector are increasingly calling for more competition in the European market for renewable electricity, … effective competition in the conventional power market is a precondition for creating an undistorted and well-functioning market for renewable electricity". It is claimed that competition in the conventional power sector is a 'myth' (EREC, 2004a).

The EU has set a target of 21% for the percentage of electricity generated from renewable sources in comparison with other types of sources. The UK has set itself a 10% target, both of which are to be achieved by 2010. The EU, in 2003, stood at 12.7%, and the UK at 2.8%. The latter figure has grown only slightly

in the last ten years and at the current rate, has no hope of achieving 10% over the next 5 years.

3.11. Summary

Upon the formation of the European Communities, there was also the signing of the Euratom Treaty, essentially to finance what nations could not handle alone: expensive nuclear research. To some extent this initiative is related to energy shortages after World War II, and investment into nuclear continues quite high, but it was not until the energy crisis in 1973 that the European Union concerned itself again with energy issues.

The environment had not been a consideration in energy policy, or any type of policy, in most countries up to the 80s and 90s. The EU has been the main pusher of environmental policy in Europe, and it has faced much resistance. In the last decades, environmental problems associated with the Industrial Revolution and the sheer population and the structure of our society and market have emerged. They are pollution, of air, land, water, and even plants, animals and people, and depletion, of natural resources, of renewable resources, of biodiversity, of value that cannot be priced. A whole cascade of related problems have unfolded. Concerning energy, the problems that have become prominent have been addition of greenhouse gases and air and pollution due to burning fossil fuels, causing global warming, acid rain and health problems, the depletion of these fuels, around which much of our lives today are structured, the unsustainable and polluting extraction of these fuels, the problems dealing with waste, in other words, a large range of issues that touch every aspect of our lives. We must not forget the political issues associated with energy use either. Most oil in the world is controlled by politically unstable countries operating under different government regimes, most European gas comes from Russia, which has troubled relations with many countries. Thus the threat to the security of energy supply encompasses both physical availability and geo-political factors, all of which threatens the availability of affordable energy for everyone.

At international level, some solutions have been proposed. The Kyoto Protocol was one of them, of which the EU is an enthusiastic supporter, to reduce emissions of greenhouse gases. One of the mechanisms proposed by the protocol is the basis for the EU ETS (emissions trading scheme). The EU is on track to meet its commitments by a fluke not having anything to do with actual reduction of emissions, namely the enlargement in 2004. Some pollutants associated with acid rain have been dealt with, as have some ozone layer destroying chemicals. Other solutions are being discussed, in the UK as well as at EU and international level. One is the diversification of energy sources and the sustainable use of renewable sources. Only in the mid 1990s has the EU tried to increase investment and research with renewable-specific programmes. Another solution is promoting energy efficiency. The EU has published several discussion papers, directives, funded research thru the framework programmes. The overall funding for them has grown steadily but

yet, the percentage devoted to energy research has dropped. The EU has also tried to make a European-wide single market for energy, in line with single markets for other types of goods. This has run into reluctance from national governments in giving up their national, in many cases state-owned, monopoly of energy companies. There is much discussion on the current liberalization of the electricity and gas markets, about why it is working or not. If the market is designed correctly, if there is enough capacity between countries, if there is political will and true competition, it works. But the lack of competition among Member States, for instance, harms the rather successful UK market, and the lack of competition in countries (which unbundled and then the companies proceeded to re-merge in many cases) and the lack of capacity can cause high prices and monopoly behaviour. A design that leaves nearly all responsibility to the market and nearly none with governments can cause a lack of long term investment, such as in the UK.

Chapter 4. Historical Drivers and Change in the UK

The guiding thread of this chapter is also security of energy supply. It underlines the choice of fuels for electricity generation in the UK, but it could be argued that in several opportunities across the years, political factors other than security of supply influenced the policy making.

The attempt is to put things into perspective, to understand the historical and current background of British policy, before moving on to current events and stakeholders, and in that way to introduce the state of the art in development of wind energy in Britain, which will allow us to identify key barriers to the development of renewable energy in that country.

This section intends to describe briefly how the electricity industry took off at the turn of the 19th century and summarize across the years the reasons why different sources of energy were adopted: coal, gas, nuclear, hydroelectric.

4.1. Historical development of the electricity industry in Britain

The electrical industry started to develop in the UK only thanks to the initiative of private foreign capitals which were coming from the United States and Germany, and the free trade economic structure offered by Britain facilitated the introduction of foreign electrical technologies (England, 1982). The development and application of technologies in those countries was more dynamic than in Britain. The reasons for such a difference could be attributed to the uncompetitive price of electricity compared with gas as a source of energy (Byatt, 1979:1-10). Electricity provision needed to be shown to be profitable before it developed in other British regions (Byatt, 1979: 96-98). One aspect that deserves mention is that, in the 1930's during the construction of the national grid, the landowners were objecting to the aesthetics of the steel towers for the transmission lines. The same reaction from the same social group, happened a century before with the construction of the railways. (Hannah 1977: 215). Currently the same reaction, from the same sector, is targeting the aesthetics of the turbines to produce wind energy.

4.2 Sources of energy for electricity

Across the last 100 years, electricity in Britain has used different fuels for its supply. In 2004, the sources for the generation capacity of the utility, which was of 80.870 megawatts, were diverse. DTI reported that in 2004, 22% of the electricity in Britain was produced by coal fired stations, 33% by combined gas turbines (both are part of the conventional thermal supply, which is 76% of the total), nearly 15% of the electricity was produced by nuclear plants, 6% by hydropower, and 2% by other renewable fuels (DTI, 2005c).

4.2.1. Coal

Coal had been, since the inception of the electricity industry, the principal fuel used for power generation. Over time the power generation industry gradually increased the consumption of coal, to the point of becoming the principal purchaser of the commodity produced by the domestic industry and currently mainly imported. In 2004 the total domestic demand for coal was of 60.6 thousand tons, of which 50.5 was used for power generation (DTI, 2005a). In 2004, coal-fired generation accounted for about 39.5% of electricity production (DTI, 2005b). In 2001 for the first time the coal imported exceeded the domestic production (British Geological Survey 2005:20).

Table 4.1. Electricity generating power: volume of coal consumed in the UK, Mto.

Year	1913	1929	1937	1950	1960	1970	1980	1990	2000	2005
Vol.	4.9	9.8	14.8			43.07	51.01	49.84	28.67	31.34

1 million tonnes oil per year: year equivalent to = 1.1 mrd m^3 gas (1.3 mrd Groningen) = 1.5 million tonnes coal. Sources: Buxton, 1978 & DTI, 2005d

The reasons for the high or low consumption of coal for power generation in Britain since 1913, when records began, could be associated to different economical, political, technological circumstances. Below we explain briefly the impact on the coal and electricity industries of nationalization after the 2nd world war and how the coal industry workforce influenced national energy policies.

Miners Trade Union and the Industry

If we focus on the industrial relations between miners and governments, we can see that the coal industry has been always controversial because of the working conditions of miners, because of their trade union organization and as such their incidence in the labour party politics. All these conditions lead the miner movement to be a powerful force in the political arena (Millward, 2005:211).

For many, these are the reasons why the British Conservative Government (1979-95) dismantled, in the mid 80´s, the mining industry. Along with this comment we would like to integrate an analysis on the coal production decline. In 1981 the annual production was 128 Mt, and it dropped to 28.2 Mt in 2003/4 (British geological survey 2005:21). In 2001 the number of miners employed was just 8200 while in 1984 the industry employed around 250000 people, which represented 1% of the national workforce.

Nationalization

In 1945 the general public perception about the coal industry was negative. The coal shortages, for the public opinion, were due to the inefficient management of the industry under private ownership. In fact the situation after the war was that a large proportion of mines had its reserves exhausted and the industry was heavily in debt with the Central government (Buxton, 1978: 225). As a response to the low mining performance, an influential report came out from the colliery engineers and managers of the Ministry of Fuel

and Power´s Technical Advisory Committee. The Reid report recommended the need of a number improvements for the industry to be efficient (Reid, 1945), which in order to happen, it was essential for the state to be in control of the coal industry. In May 1946 the British parliament passed an act for the nationalization of the coal industry, which enforced from 1947 that all coalmines, machinery used and mineral rights, were passed to the National Coal Board (NCB, 1945) For some authors, nationalization was interpreted as an institutional reaction supported by public discontent of the industry's poor performance, more than an inflection point for a radical change in the management and efficient future supply. (Greasley, 1995: 51-62). According to Buxton, in the first ten years of nationalization, the National Coal Board gave priority to the organization of the industry over the need to develop a long term vision, where re-equipment and restructure of the sector was needed (Buxton, 1978: 234).

Prices of coal also have been controversial and this sometimes affected the cost of generation of electricity. For example, during the interwar period, the electricity prices were maintained despite the increase of coal prices. In those years the output ceased to grow for the first time since the industrial revolution and as a consequence the number of mines between 1913 and 1937 fell to a third (Buxton 1978: 164) (Greasley, 95:51). For Chick (1995: 258) part of the success of keeping down the electricity costs against the higher prices of coal inputs was due to the efficient performance of the CEB, which built power stations with higher net generation capacity (Hannah, 1977: 218) (Chesshire, 1996:15).

As the theory indicates, cartel prices are those established by a group of sellers, operating together to keep above competitive levels (Marcus, 1992:61). Monopolization of the national coal production allowed the British government to run the coal supply with the same cartel methodology. In the mid 50's, in order to assist the mining sector which was loosing demand from important users[5], the power stations and other utilities were pressured by the government to purchase set quantities of British coal at predetermined prices. In the next years the consumption of coal from power stations increased while the purchases form other utilities decreased. Buxton claims that as the industry was required to pay above world prices for British-produced coal, electricity prices became excessively high, and with this the British coal industry became dependent on the electricity industry for its endurance. The table below indicates that in 1975 the power stations where consuming 60% of the total British coal production, as opposed to 18% in 1955. (Buxton, 1978: 242-243) (EIA, 1997a).

5 Railways, industrial, and domestic users, who were switching to cleaner fuels.

Table 4.2. British Coal Consumption in Power Stations (Mtons)

Year	*1955*	*1960*	*1970*	*1975*
Power Stations	43.5 (18%)	51.9 (25%)	76.0 (49%)	73.4 (60%)
Industrial	45.4 (20%)	34.9 (17%)	19.3 (12%)	9.5 (7%)
Collieries	8.7 (3%)	5.0 (2%)	1.9 (1%)	1.2 (0,9%)
Railways	12.3 (5%)	8.9 (4%)	0.1 (0.6%)	0.1 (0,8%)
Domestic	38.1 (16%)	35.5 (17%)	19.9 (12%)	11.5 (9%)
Total Cons.	229.1	202.2	157.6	122.1

Sources: Digest of Statistics DTI in Buxton 1978: 242

The trend initiated in the 50´s continues to date, in 2003, 86% of the coal consumption in UK was destined for electricity generation. The difference between past and present provision is that at present Britain has to buy abroad part of the coal consumed. This trend started in 1970 and went to a record level in 2004 with 36.2 million tonnes of steam coal imported (DTI, 2005c).

4.2.2 Gas

As pointed out above, coal had long been the prevalent fuel in electricity generation and the electricity industry had long been the principal purchaser of British coal until the 1980's. This tendency started to reverse due to the changes in the political environment and the privatization of the electricity, coal, and natural gas industries. The 80's scenario created an environment which converted natural gas to be the main fuel for electricity generation (EIA, 1997c).

The economic importance of natural gas in the UK started in the mid 60´s when Britain began to exploit its important offshore resources in the North Sea. The venture lead the country to be, in the next decades, the largest producer of gas in western Europe and a net exporter of the commodity. The policy makers of the late 60`s, in order to optimise the income of the natural resource, decided as a strategy to convert all gas appliances in the country to natural gas. The option entailed massive infrastructural investment and great depletion of resources but also high income for the country (Atkinson, 1983: 17-19). With the years, the consequence of the domestic policy for gas consumption, and the fact of being a net exporter, is leading Britain at the end of this decade, to be a net importer due to the steadily declining production (EIA, 2005b). Currently the UK produces near 90% of its own gas from the North Sea. Most of the remaining 11% is imported, mainly from Norway (BP, 2005).

Table 4.3 Gas Production and Consumption in the UK, in billion cubic m.

Year	*1994*	*1995*	*1997*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*
Production	64.6	70.8	85.9	99.1	108.4	105.8	103.6	102.9	95.9
Consumption	66.1	70.5	84.5	92.5	96.8	96.3	95.1	95.4	98.0

Sources: BP, 1995 - authors own elaboration

In 2004 the change in the production from the year before represented -6.7% and the consumption for the same period increased by 2.7%. According to the EIA the natural gas consumption in the UK has increased an average of 4.6% per year since 1980, while the percentage of total natural gas input to electricity generation has increased from 20% in 1980 to 33% percent in 2004 (EIA, 2005b) (BP, 2005).

Table 4.4. Total gas consumed for power generation, in Mtoe

Year		*1997*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*
Total consumption		76.06	79.1	83.2	87.1	86.7	85.6	85.9	88.2
Electricity	*Generation*	21.7	23.0	27.1	27.9	26.9	28.3	27.9	29.1
Consumption		28%	29%	32%	31%	31%	33%	32%	33%

Sources BP, 2005 and DTI, 2005b - authors own elaboration

Chapman attributed the expansion in the use of gas only to technical advantages such as: higher thermal efficiency than traditional stations fired with oil and coal; lower capital costs for the energy production; incremental additions to capacity are relatively easy to make. In addition, the technology used for the power plants referred to as combined cycle gas turbines, has a low amount of emissions of harmful atmospheric gasses, especially no sulphur dioxide. According to the author this last fact helps the UK government to meet its international obligations related to CO_2 equivalent emissions and helps the industry because "it reduces the liabilities to retrofit expensive flue gas desulphurization equipment to existing coal firing stations" (Chapman 2004:16).

4.2.3. Electricity Generated by Nuclear Plants

In 2004 nuclear power plants were generating, according to the DTI, 23% of UK electricity. There are 23 reactors totalling 11.852MWe capacity (Uranium Information Centre, 2006). Since the inception of nuclear power in Great Britain, 27 naval propulsion reactors have been built in the country.

Nuclear power in the United Kingdom started soon after World War II. The arguable purpose of the programme was to construct nuclear raw material for military purposes during the Cold War years. The first plant in the country was at Windscale, currently known as Sellafield Nuclear Plant (IEE, 2000).

The roots of the transition from coal to oil and nuclear supply in the power stations can be identified with the re-organization of the coal industry caused by its nationalization in 1947, according to Greasley (1995:39). The reasons for this move were based on the fact that the industry supply during the war years, as pointed out above, failed and by the end of the war the industrial

and technological capacity of Britain was perceived as inadequate by the policy makers. In 1955 the British government, with the purpose of developing a strategic power programme to meet growing energy needs, initiated the first commercial nuclear programme.

To conform the Governmental decision in 1956, the first nuclear power station in the world to provide electricity commercially was connected at the national grid. The Calder Hall reactor was designed to produce plutonium with electricity as a by-product (Hayes 1993). The second reactor was made to apply the Magnox technology, Uranium/Graphite moderated gas-cooled (Magnox Prototype), under the "Magnox programme". Nine other similar reactors were built by the time the programme ended in 1971 (DTI, 2003).

The 1956 the Suez crisis accentuated concerns about shortage of coal and oil, so the electricity industry was authorized to convert power stations to oil burning and the nuclear program was boosted as a way of taking off pressure from the coal industry. The British government promoted, at the time, nuclear power as a safe and economical source of electricity. This promotion of nuclear power can be seen also as a way to financially sustain the nuclear industry, as a U.S. Energy Information Administration report argues. The EIA says that the large subsidies given to the nuclear industry had been, as it was with the case of coal, defended by the electric utility industry. "Nuclear power has also generally been a target of large government-imposed subsidies, again underwritten by the electric utility industry. As elsewhere in the world, when the United Kingdom embarked upon its nuclear power program, nuclear power was perceived as an economically viable form of energy and as a means of achieving energy security. In reality, nuclear power's full costs have far exceeded the costs of non-nuclear forms of electricity generation" (EIA, 1997a).

Currently the British government is reviewing, again, its nuclear energy policy, in a way which was not contemplated five years ago when the British government's Energy White Paper was published. The defenders of nuclear power are arguing that nuclear power is clean as it does not produce CO_2 emissions and the fuel is cheap. Nuclear power also cannot be de-associated from weapons production and nuclear accidents, as the known Windscale fire in 1957, where the nuclear reactor at Windscale, Cumbria, caught fire, releasing substantial amounts of radiation to the surrounding area. The accident was considered the world's worst nuclear accident until the Chernobyl event in 1986. The current debate about nuclear is also related to decommissioning of nuclear reactors. The UK has at present a problem with the decommissioning of the existent reactors and according to a Greenpeace representative, "The nuclear decommissioning authority is struggling with the amounts from current reactors. How the UK can cope with a massive increase ... has not been answered by anyone" (The Guardian, Jan 2006).

4.3 Security of supply

Energy supply in the United Kingdom could be discussed from two different angles: the security of fuel supply and security of electricity supply. In this section we are concentrating on the provision risks in the diverse fuels used by power stations, and the current debates on management strategies to secure fuel supply, between the central government, the industry and consumers.

In the last few months the issue of energy security dominated the British domestic news, the parliamentary and other public debates. The subject also stimulated an avalanche of reading materials. The shared points in most papers and debates related to energy security are: gas depletion in the North Sea, increase of international gas prices, seasonal demand, new financial requirements in the transmission infrastructure, nuclear reactors coming to an end in less than 20 years, coal supply to power stations as a high emitter of CO_2, and expensive renewable energy which is not ready to supply fuel in scale as is needed.

4.3.1. Gas Depletion, Price Increase And Infrastructural Problems

Depletion

In at least two opportunities the British Government, during the last five years, omitted or underestimated the amount of oil and gas in the North Sea. The omission or denial of such important information could have a direct effect the management strategies which are needed to face the crisis.

In 2001 the coal industry representatives (COALPRO) wrote to the DTI (Joint Energy Supply Group, JESS) a letter which expressed concern due to the deterioration of the UK diversity of energy supply and growing over-dependency on gas. COALPRO pointed out in that opportunity that the DTI Jess group was omitting to recognize that the gas depletion was higher than expected. "Based upon figures in the DTI Brown Book, it is clear that the lifetime of reserves have fallen significantly over the past eight years as the dash-for-gas has unfolded. The lifetime of reserves have fallen from 33 years in 1992 to 14 years in 2000… Clear indication that security of supply has been much eroded over the past decade. COALPRO is surprised by the DTI omission".

Table 4.5. Remaining Lifetime of UK gas reserves/year

Year	*1992*	*2000*
Proven	10.9	6.3
Plus Probable	24.1	10.4
Plus possible	33.1	14.2

Source: DTI brown book, gas energy reports 1973--01

In February 2006 the Royal Bank of Scotland recognized that the UK will become a net importer of gas and oil at least three years earlier than the government predicted. The figures from the Royal Bank of Scotland Oil & Gas

Index showed that the production from the North Sea "unexpectedly shrank" suffering a 14% fall in the year to October 2004 (RBS, 2005).

High Prices

Part of the current energy crisis in the UK is related to the effects of the utilities privatization in the 80's and 90's. Since 2004 the consumers have been affected by rapid increases of gas prices, from February 2005 to February 2006, gas prices rose 25% while the cost of whole gas increased 75%. According to many, the reasons for the rise in the costs of gas, are not only due to the international price increases, but also due to the monopolization of the supply. In the UK, the "20 energy suppliers which flourished with the deregulation have merged and are the six major gas suppliers" (The Guardian, Feb 2006b). The expectation among the British policymakers is that Europe can offer secure supplies of gas and electricity in a more transparent market (House of Commons, 2006:2). As 40% of electricity generation in England and Wales is gas fired, the electricity consumers also suffered a 12% increase in their electricity bills.

The British parliament made an inquiry to determine if the price rises were a temporary response or were the beginning of a long term increase in UK energy prices. For the House of Commons Trade and Industry Committee, the current energy crises in the UK it is not only for matters beyond the governments' control (international price increase and gas depletion) but also "by a legacy of slow development of infrastructure, and the lack of a true European market for gas. These are matters that do lie, at least partially, under the control of the UK" (House of Commons, 2005).

Infrastructure

Gas depletion in the North Sea presents Britain with a new dilemma related to the need to upgrade its gas storage infrastructure. Recently £15 billion have been invested in the gas network (Energy White Paper, 2003), however the investment was not directed to cope with the increased use of Liquefied Natural Gas (LNG) and piped gas from Europe.

The financial strategy to overcome the current problem focuses on the expectation that the gas operators are going to provide the funds to increase the entry capacity of imported gas to the network. The government is keen to encourage these investments with price incentives. At present there are several initiatives to ameliorate the supply of LNG, though the recent gas crisis between Russia and Ukraine adds to the debate a dismissed concern: the country's insecurity of supply by depending on imported fuel. There is a recognition that attracting new gas investors is not easy. The Parliamentary Committee in energy points out that "financial institutions that might have been expected to take part in or finance trading in the forward market for gas are not interested in doing so: the UK market is not big enough, and they are unlikely to become involved unless there is a Europe-wide forward wholesale

market…it underlines that the liberalized UK market is heavily dependant on the un-liberalized Continental Europe one" (House of Commons, 2006:5).

4.3.2. Coal

The power stations run with coal are producing at present a third of the electricity output. The future of the supply of coal will be affected by the "Large Combustion Plant Directive" (LCP, 2001), which establishes a deadline for the cutting emissions of large power plants by 2008. The Em's directive sets new limits for the emissions of CO_2 equivalent gasses from power stations. Those plants which are not meeting the new emissions standards are going to be shut over the period to 2015. Also coal is not an attractive fuel since the introduction of the EU Emissions Trading Scheme (European Commission, 2005). The British government is estimating that by 2020 coal contribution to electricity generation will be much lower than at present (Energy White Paper, 2003: 88). The paradox is that in response to the current gas prices, power stations are switching from gas to coal and the government is considering not penalizing the emissions currently produced by the power stations (House of Commons, 2006).

4.3.3 Nuclear renaissance

Currently, the United Kingdom is operating 12 nuclear power stations, which are housing 23 nuclear reactors. In 2025 these power stations will end their period of life and the nuclear capacity will be reduced to one station (Poortinga et al, 2006).

In 2003 the Government produced an energy white paper, which aimed to set out the framework for energy policy over the next 20 years. The document did not make specific proposals to build new reactors but left the possibility open for the future, if there was a need to meet CO_2 reduction targets. The two main inconveniences for the government at that time to go ahead with proposing nuclear were the high costs involved in building new reactors for power generation, and the un-resolved issue of nuclear waste (Energy White Paper, 2003: 48, 90-91).

As has happened with other energy supplies and following the energy security theory (Egenhofer et al: 2004), the markets are the ones determining the development of nuclear (in an institutional setting). The DTI stated that "in common with all generation options, the initiative for bringing forward proposals to construct new nuclear plant lies with the market and the generating companies", also the department was committed in 2003 to develop a public consultation before deciding on the building of new nuclear power stations which will lead to a White Paper setting out the Government's nuclear development proposals (DTI, 2003).

In 2006 the Government is reviewing the 2003 Energy White Paper through a public consultation, were nuclear was not only a part of the solution to meet the CO_2 emissions targets but also a way to overcome the energy supply issue

with reliable access to uranium supply. Nuclear waste and the cost of building the reactors and decommissioning are still a main consideration for the review. Renewable energy has seemingly been put on the back burner, because nuclear energy, now as in the past, is more straightforward, it gives the UK a competitive advantage which is has not been able to achieve in any renewable energy technology (Greenpeace representative, BWEA Offshore Wind 2006).

4.4. Energy efficiency in the UK

As an illustration of how intense the debate is at the time we are writing our study, we want to mention that in March 2006 the Government's independent watchdog on sustainable development, the Sustainable Development Commission (SDC), has urged a rejection of the nuclear option towards an "aggressive" expansion of energy efficiency and renewables (SDC, 2006).

The 2003 the UK Energy White Paper established four strategic goals for future national energy policy, they were: a 20% reduction of CO_2 gasses by 2010 and 60% by 2050; to maintain the reliability of energy supplies; to promote competitiveness while maintaining sustainable growth; to ensure that every household is adequately and affordable heated. The government aims to meet the targets with policies and actions promoting energy efficiency in all sectors and the incremental use renewable sources of energy. At the end of 2004 the government recognized that "on the basis of current policies and measures the CO_2 reduction expected by 2010 will be 14% below the 1990 emission levels". In other words the UK is not on track to meet the 2003 White Paper Goals (HM Government, 2004). In 2006 the government launched the 2003 White Paper Energy Review, which aims to define what needs to be done to meet the 2010 and 2050 targets (Energy White Paper, 2003). To achieve their goals, the government introduced in 2000 the Renewable Obligation, which we will describe below, and the Climate Change Levy, a tax relief and special treatment to electricity providers using renewable fuels and delivering power and heating through the combined heat and power schemes (HM Inland Revenue, 2002). We would like to point out that civil society organizations argued, after the publication of the Energy White Paper, that there were no clear incentives for business and the public to bring about energy changes for a "low carbon economy". The British branch of the World Wildlife Fund (WWF) criticized the government by postponing the definition for a clear framework for increasing the use of renewable energy and that the £60 million budget for renewable projects until 2007 was insufficient (WWF, 2003).

Energy efficiency

In the UK the barriers impeding the energy efficiency optimization affect different sectors. In our study we will concentrate in the building and electricity generation sectors because heating and electricity security and CO_2 emission problems can be resolved by energy efficiency measures working in synergy with renewable fuel sources. Due to the different ways to define

energy efficiency[6], we are adopting as an intensity indicator the carbon efficiency, as our objective is to analyze policies and actions related to the environmental problems and pose possible solutions[7].

The electricity generation in Britain accounts for 29% of all the UK CO_2 emissions. Households, public and commercial sectors are responsible for 23% of the total CO_2 expelled to the atmosphere (DTI energy trends, 2003:23). The current debate about how to overcome energy inefficiency in power stations and buildings, is divided between two groups: the civil servants advocating for the redevelopment of nuclear power because energy efficiency measures are not working, and the civil society organizations and politicians arguing that energy efficiency optimization is possible (The Guardian, July 2005). According to the second group, the enforcement of energy efficiency measures can be more effective not only for the CO_2 mitigation, but also environmentally sustainable and cheaper than nuclear in the long term. It is also know that energy efficiency is superior to any energy supply option including the development of renewable sources of energy (Nørgård 2002). Since recently, the British government's emphasis on energy efficiency is focusing on "final energy use more than primary energy use" (House of Lords, 2005). The Government recognized that the barriers affecting the implementation of energy efficiency measures in the domestic, business and public sectors are: the investment costs, the hidden costs, split benefits and ignorance and inertia on the part of users. The drivers to achieve change are the value of energy savings, intangible benefits on the reduction of CO_2 emissions, public awareness and motivation. Among the policy options the civil servants are presenting to the decision makers to overcome the barriers, we see: economic instruments to reduce equipment cost, finance cost or an increase in energy prices (EEIR, 2005:14). Some non-governmental agencies are concerned that the outcome of the 2006 energy consultation will be a recommendation which would weaken the "new emphasis upon the energy demand side" as the government is presenting nuclear power generation as the option to reduce CO_2 emissions. The defenders of building energy efficiency are asking for more public expenditure delivered in the form of subsidies for upgrading buildings to present energy efficiency standards. The government relies in private sector investment for the energy efficiency take off. The reality suggests that earnings for private investors are not optimal, therefore it could be possible that the delivery of goods to society, as well, won't be optimal. To resolve this matter the House of Lords recommends the government to intervene via regulation. Also the Lords are asking caution to the government when using "the potential misleading term 'cost effective' to describe investment in energy efficiency" and recommends private and public

6 The House of Lords recommends the government to adopt "a more rigorous approach to the measurement of energy efficiency in terms of carbon" as different policy statements and the Energy White Paper are not expressing clearly how energy efficiency is measured (House of Commons, 2005: 15).

7 Energy Intensity indicators are depending on the policy objectives to be analysed: for economy, energy expenditures; for energy security, fuel reliance; for the environment, carbon emissions (EIA, 1996)

sectors to consider lifetime costs in committing expenditure to long term capital projects (House of Lords, 2005).

Heat and Electricity Generation

"If we step outside this country, we see that 50% of Denmark's energy is generated by local energy systems, in the Netherlands, 60% is generated by decentralized energy systems…In this country we are not even beginning to look at local energy networks, although they are infinitely more efficient than our national energy system, which leaks like a sieve" (Alan Simpson MP, 2005)

Two thirds of primary energy inputs in the UK are wasted due to the generation, transmission and supply of electricity produced by centralized power stations. It is widely accepted that to increase efficiency the Combined Heat and Power (CHP)[8] model is offering a solution which for a long time has been applied in Eastern Europe and the Scandinavian countries. In the UK, only recently has the CHP model emerged as a possibility for the provision of electricity and heating at domestic, industrial and district level.

Despite CHP not being an important item in the energy efficiency agenda, the present government has currently set a target of producing 10GWe of CHP capacity by the year 2010. In 2002 there were 1500 CHP schemes running at a capacity of 4742 MWe. The CHP schemes counted 80% as mini schemes and 2% as large scale schemes which were producing 2980 MWe (63% of the CHP qualifying capacity). In 2004 the environment minister recognized that the CHP industry experienced, in the past, serious economic difficulties to progress towards the 2010 target. Then the government established fiscal incentives in the form of tax exemptions, capital allowances to stimulate investment, business rates exemption for CHP power generation plants and machinery, and a £50 million grant support (Defra, 2004a). In the 2006 energy review the government was keen to look at micro CHP for home use and shelved large scale developments due the high costs involved (Energy review 2006, pp53-54).

Groups are lobbying to include in the budget funding for the changes required to encourage the uptake of CHP and domestic renewable energy generation. Their most important recommendations are to use the tax system to reward business and homeowners that install decentralized energy systems (DE), introduction of requirements for new buildings to incorporate DE technologies, regulations removing the current limits on the development of private wires and limits on the export of electricity from local systems. Also the lobbyists are recommending that electricity suppliers should buy, at a reasonable price, the surplus of electricity from domestic power generators, and the publication of a decentralized energy white paper where the

8 The Combined Cycle Gas turbines operating in the UK are 45/60% efficient. The CHP system of conversion and generation makes the operation 80% or more efficient (House of Lords, 2005)

government set up the basis for a transition to decentralized energy systems (Greenpeace, 2005b).

The EU Green Paper on Energy Efficiency (Green Paper, 2005) highlighted the need for energy efficiency improvements in the European power stations. The paper argues that to follow growth at 1.5% per year, huge infrastructural investments are needed. Among the issues to which the EC has given consideration for its 2006 energy efficiency action plan, one of them is the energetic waste in the electricity supply produced by the generation, transmission, distribution and supply[9]. The Commission is ready to encourage future investment through the ETCs towards cleaner and more efficient decentralized distribution of electricity generation. The British government calculates that the introduction of the ETCs could add up to 4 GWe to the CHP at district level (Defra, 2004a).

4.5. Renewable Sources Of Energy For Power Generation

In 2004, 3.6% of the electricity generated in the UK was produced from renewable sources such as landfill gas, biomass, wind and hydro. The government is expecting other technologies such as solar, wave and tidal power to contribute in the future (Energy Review, 2006: 65). The 'ambition' of the 2003 UK Energy White Paper was to double the share of electricity generation from renewable sources by 2020, up to 20% of the total electricity demand. The paper is putting the emphasis on the need for energy diversity through "many sources of energy, many suppliers, many supply routes" as a way to avoid energy over-dependence on imports. (Energy White Paper, 2003) (DTI renewables, 2005). In order to achieve this goal the government highlighted, in the document, the importance of maintaining a "healthy research base" and the need for renewables to penetrate the electricity market. By healthy research base we understand that the government recognized research and development to be closely linked to the commercialization of the technology, which means that the state is keen to promote those technologies which can generate economic returns, as we will see below (Fountain and Atkinson, 1998). The financial tools adopted to achieve the market penetration of renewables are, until now, the Renewables Obligation (RO) and the Climate Change Levy, already mentioned above. The RO is a key measure which requires suppliers to increase the proportion of electricity generated by renewables year by year (Energy White Paper, 2003: 12). The RO has been reviewed in 2005 by the Department of Trade and Industry and the Carbon Trust[10].

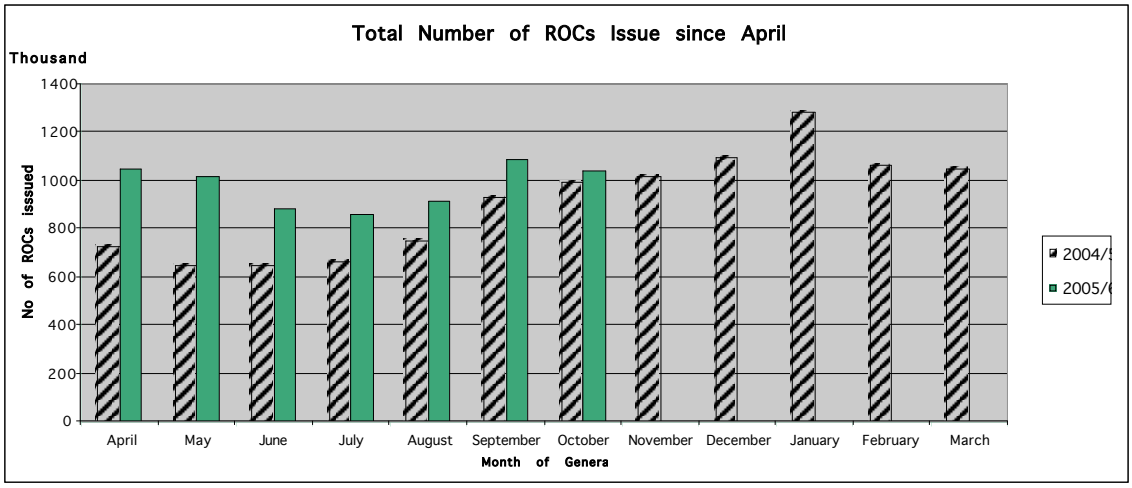
The review stated in its conclusion that the 2010 White Paper target can be met mainly through wind power, which is at present, according to the

[9] The main waste concerns are the unused heat which escapes in the cooling of the generation process, the transport to consumers also generates further losses, mainly in the distribution.

[10] The Carbon Trust is an independent company funded by Government. Their role is to work towards a UK low carbon economy by helping business and the public sector and identifying commercial opportunities for renewable and energy efficiency technologies.

document, the dominant renewable technology. In 2004 on- and offshore wind were the only economically viable technologies, despite this fact, biomass accounted for the largest generation of electricity under RO. From all technologies considered by the review, wind, the development of fuel cells and wave/tidal have the greatest potential to provide economic benefit to the UK in conjunction with positive environmental impact. The review recommended the government to adopt "consistent policy and strategic spending to deliver maximum environmental and economic benefit from renewables". The recommendation's rationale was based on successful outside UK experiences related to the development of renewable energy. The policy paper also pointed out the following aspects: the need for long term policy measures which could incentive the change to renewables; the need to increase the level and longevity of funding for demonstration and pre/commercial trials; the need for a clear demarcation of roles across the innovation chain (Renewables Innovation Review, 2005).

Figure 4.1. ROCs issued in the UK.



(Source: OFGEM 2006)

4.6. Summary

The UK joined the EC in 1973. For a long time, the UK was responsible for providing a sizeable portion of the energy used in the Union, but it has, as of recent years, become at net importer of energy. The electricity industry was slow to become established in the UK. There was much local resistance to the steel towers supporting transmission lines, as there is now resistance towards wind turbines. Coal was the main fuel for electricity generation, partly because Britain had a lot of it and partly because the government intervened to make it so. The failure of coal after World War II prompted Britain to look for alternatives, namely nuclear power and later, natural gas extracted from the North Sea. The British government has been accused of knowingly over-reporting the reserves. Now that it's become clear that there is less than expected, the UK has a security of supply problem. There has been a lack of investment in infrastructure and a period of international high prices. Because of this, power producers are turning again to coal, even though polluting power plants will have to be shut down over the next 10 years, and to nuclear,

an option kept open exactly for an occasion like this. Energy efficiency also has an important role to play in this crisis, and a series of measures are suggested for buildings and power stations, which account for more than half of the UK's CO_2 emissions. Yet there are barriers for their implementation. There is an emphasis in demand side measures in buildings, in which heating accounts for most of their emissions, and on CHP plants for heat and electricity generation. Renewable sources of energy have only recently been recognized as an alternative.

Some Concluding Comments to Chapters 3 and 4

Security of energy supply has been a guiding thread for EU actions in the energy field. The current supply crisis has invoked a series of measures, delivered in the form of directives, funding and experience. New energy technologies offer some solutions to the problems we face today, but their development has been unequal in the Member States, due to the policy mechanisms favoured in each country.

The liberalization of the electricity and gas markets has not progressed as quickly as the European Commission hoped, and this has direct influence in the choices made by the UK government concerning their energy policy and choice of fuel for supply. The UK is also interested in the functioning of the EU ETS (Emissions Trading Scheme), so ultimately the Em's performance on some selected issues is crucial for the UK's security of energy supply.

In the UK, there is much uncertainty about the future of renewable energy. The simple mention of nuclear in the current energy review is enough to send renewable energy investors flying for cover, damaging a sector much in need of funds and long term government commitment. Lack of consistent strategic planning for renewables penetration into the market, lack of longevity in R&D funding and a clear demarcation of roles across the innovation chain hamper the growth of clean, sustainable, renewable energy in the UK. Political will is key.

The table below summarizes energy policy practice in the UK and EU since energy became a concern. Note that after the Maastricht Treaty, the EU became a 'political entity' (TEU, 1992) and was given more power to push issues it felt the Member States were not dealing with satisfactorily on their own. After that energy related directives and more programmes and funding came into play.

Table 1: Summary. Timeline-summary of energy-related policies and relevant events in the EU and UK

Year	*European Union*	*United Kingdom*
1973		The UK joins the EEC
1975	Council Regulation indicating need to harmonize energy and environment	
1983	Council Regulation for aid to UK in implementing energy policy	Electricity Acts of 1983 and 1989 leading to deregulation and privatization
1986	Single European Act, Council Resolutions on 'common political goals' and renewable energy	Natural Gas Act leading to privatization and deregulation
1988	Council Recommendation on exploration of renewable energy	
1990		Non-fossil fuel obligation (NFFO), for the purchase of nuclear and renewably generated electricity at higher than market rates
1992	Maastricht Treaty, Rio Earth Summit	
1994		Coal privatization: Coal Industry Act
1995	White Paper on energy policy	
1996	Green Paper on renewable energy	
1997	White Paper on renewable energy, Kyoto Protocol	
1998	Commission Communication on RUE (rational use of energy), Council Resolution on renewable energy	Electricity industry deregulation completed
1999	Campaign for Take Off of renewable energy	
2000	Green Paper on energy security, RUE action plan	UK government Climate Change Programme and Introduction Climate Change Levy (Finance Act 2000)
2001	Directive on electricity from renewable energy, on emissions from large combustion plants	
2002	EU ETS (emissions trading scheme) started, Directive on energy efficiency in buildings	Introduction of the Renewables Obligation (RO)
2003	Liberalization of the electricity and gas markets started, Directive on bio-fuels for transport, Intelligent Energy - Europe Programme	White Paper on energy
2004	Directive on security of gas supply	Introduction of Energy Act 2004, which provides the legal framework for the placement of offshore renewable energy projects
2005	Green Paper on energy efficiency	
2006		Energy Review

Chapter 5. Energy Stakeholders in the UK

This chapter aims at describing the stakeholders of energy policy in the UK. Based on a background of fuel supply history, we can determine who the main stakeholders are in the current energy debate and the pressures within it. A brief description of current policies will be included to help the understanding of the politics, although a more thorough description will follow in another chapter. The first section deals with the structure of the electricity market, and the following sections describe the stakeholders and their role in promoting renewable energy.

A stakeholder is defined as someone who will be affected by, or has an interest in the success of action taken by a particular group, organization, etc (Wikipedia, 2006c). In a classical business model, the stakeholders of a company will be: government, environment, shareholders, management, consumers, suppliers, employees and the local community. Each of these has a different main interest in the success of the business: the consumers want high quality and low prices, the environmental spokespeople want sustainability and pollution control, the government wants taxes, health and safety, etc (Bized, 2006). In an energy related context, such as in the energy review being carried out by the DTI (Department of Trade and Industry), examples of energy policy stakeholders might be the government, environment, industry, and consumers. Spokespeople for these shareholders would be, in the UK, DTI, Defra, Ofgem and local authorities representing the government, NGOs (non-governmental organizations) and pressure groups, such as Greenpeace and Friends of the Earth, representing the environment, pressure groups such as the BWEA (British Wind Energy Association), generators, suppliers, transmission and distribution companies representing the industry and business sectors, and NGOs and pressure groups representing the consumers. These different stakeholders can have, and often do, opposite interests. Therefore the designers of energy policy must decide who and how to address and prioritize. In the light of our theoretical base, we need to evaluate the skills of these actors and their interest and influence in promoting offshore wind energy. Specifically, the government actors are the ones we are most interested in, since they are the ones responsible for setting the scene and encouraging innovative development, or not.

5.1. Structure of the Electricity Market

The UK electricity market is separated into three distinct areas: England and Wales, Scotland, and Northern Ireland. The latter is not on the British mainland and so is rather isolated. Betta (below) was designed to bring down prices by integrating the areas of England, Wales and Scotland into one grid (ECN, 2005). The integration of Northern Ireland with Ireland is expected soon (ECN, 2006).

The Office of Gas and Electricity Markets (Ofgem) is the energy regulator in the UK. It was formed by the merger of OFFER and OFGAS, (Office of

Electricity Regulation and Office of Gas Supply) (DTI, 2000), to protect consumers and promote competition in the sector (Ofgem, 2006a). Ofgem oversees the free market in electricity and gas in Britain. The electricity supply system can be classified as consisting of five parts: "Generators (1), the National Grid (2), distribution companies (3), supply companies (4), and consumers (5)" (BWEA, 2006a). All five groups are influential UK energy stakeholders. The first four parts clearly have links to business and industry. This is another way of looking at who are the stakeholders of energy policy, directly related to the electricity industry.

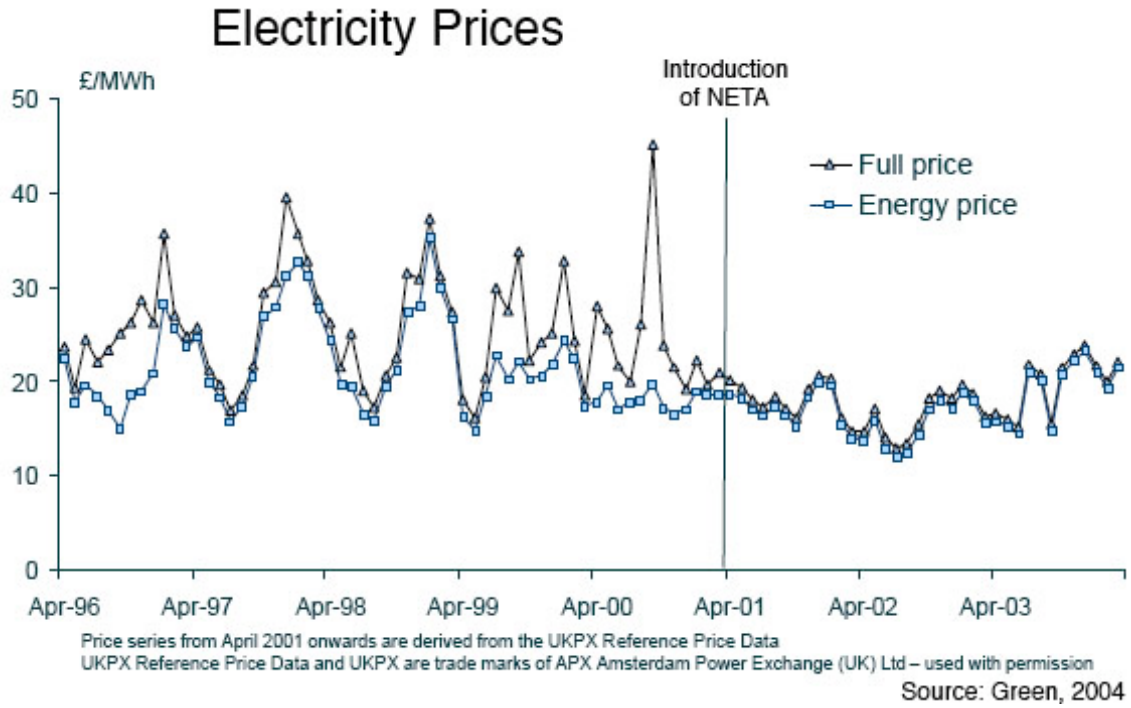
In this model, the generators are the power stations: coal, gas and nuclear. Renewable energies such as wind power frequently bypass part of this scheme, entering the grid locally (embedded generation). The National Grid is the transmission system, it carries high voltages long distances, and then hands over the power to the distribution companies, "which own and operate the local distribution system at grid supply points." The supply companies are the ones who the consumers buy their electricity from. "From a supply point of view, the system moves from 1 to 5" (BWEA, 2006a).

The Renewables Obligation (RO) under which the supply companies must now operate mandates that they purchase a certain percentage of their electricity from renewable sources (RO, 2005). This is likely to change the role of distribution companies, which traditionally transferred high voltage electricity from the transmission grid to low-voltage electricity to be sold by the supply companies. Embedded generation may cause the distribution companies to transfer electricity back to the transmission grid (Ofgem, 2006a). A more thorough description of the RO, and the past and current support systems for renewable energy in the UK, will be given in chapter 6.

A trading system called NETA (New Electricity Trading Arrangement) was put in place in 2001. It is meant to be a wholesale electricity market, between generators and suppliers of electricity. The objective was to stimulate competition and bring down prices for all customers. Generators agree on a price with suppliers and 90% of the expected trading volume is to happen in forward contracts (Ofgem, 2001). This system has been expanded to BETTA (British Electricity Transmission and Trading Agreement), which includes Scotland (Ofgem, 2002). The objective is to increase interconnections between England, Wales and Scotland and make the British mainland and integrated market (ECN, 2005).

In 2000 the Climate Change Levy was also instituted. It is supposed to cut greenhouse gas emissions. It is meant to increase energy efficiency and stimulate new investment by non-domestic users. It is a tax on energy use, that is cycled back to the non-domestic users by a 0.3% cut in the National Insurance Contributions that employers must make. It has a series of items that it does not apply to, such as electricity generation or transport fuels, making it a tax on energy use alone (Defra, 2005).

Figure 5.1. Price of electricity, before and after NETA. Energy price is what consumers paid and full price is the full cost of the electricity delivered.



In order to get permission to use the National Grid and distribution system, the supply companies have to pay a system charge. In order to distribute electricity in the UK on the distribution system, the distribution network operator (DNO) must also have a license. Following a number of corporate mergers and acquisitions since the liberalization and privatization of the electricity market in 1990, the licenses for the 14 distribution areas in the UK are held by 8 companies (Ofgem, 2006a). These companies are important energy stakeholders, they are: EdF Energy, CE Electric, Central Networks, Northern Ireland Electricity (NIE), Scottish Power (SP), Scottish and Southern Energy (SSE), United Utilities, and Western Power Distribution (NG, 2006). Due to the nature of electricity as a natural monopoly (see Chapter 2), each of these distribution companies has a 'virtual monopoly' in the area they operate in. It's expensive and inefficient to establish competing networks of this sort in a same area. This would allow the distribution companies to abuse their monopoly position, to increase profits for their shareholders, so Ofgem puts a cap on their prices, which is reviewed every 5 years (Ofgem, 2006a). This propels them to look for efficiency gains, which benefit consumers in the long run. The distribution companies would also choose the cheapest generator of power such as coal and neglect the more expensive renewable sources of energy. However, under the RO, the suppliers must sell renewable energy, in which case distribution companies will not be able to only choose the most cheaply generated electricity.

5.2. Government

The different government stakeholders can be opposed to each other. Local, regional and central government have different but overlapping areas of responsibility and constituencies. For instance, local or regional government may object to the central government's placing of a nuclear waste facility in their jurisdiction (Laughton, undated).

5.2.1. National Government Agencies

The UK has a long history of environmental policy and a complex regulatory system as a result. The policy style is cooperative and "regulatory impacts that threaten to reduce profits will meet with substantial, and influential, political resistance" (Weale, 1997:93). There is a plethora of decentralized agencies: advisory and adjudicatory bodies, executive agencies, public corporations, central departments, ministries of State and local authorities (Carter and Lowe, 1998). The main national agencies are as follows.

DTI, in their own words, works "to create the conditions for business success and help the UK respond to the challenge of globalization". They have an Energy Group that "is committed to working with others to ensure competitive energy markets while achieving safe, secure and sustainable energy supplies. It's role is to set out a fair and affective framework in which competition can flourish for the benefit of customers, the industry and suppliers" (DTI, 2006a). The DTI has been developing the regulatory framework for offshore wind power. They consult with the industry before drawing up final rules, and have great power of decision. They appear at first to have no favourites, but some suspect their energy review of 2006 was not about 'the energy challenge', fully exploring all possibilities, but about nuclear and paving the way for it to be back on the agenda. In this case, their role in promoting offshore wind will not be indifferent.

Defra is the Department for Environment, Food and Rural Affairs, and they work "for the essentials of life: water, food, air, land, people, animals and plants". They are responsible for the UK Climate Change Programme, the government's Action Plan on energy efficiency, among other programmes (Defra, 2006a). There are some who criticize the division of energy policy into two departments (three, if you consider the DTLR (Department for Transport, Local Government and the Regions) and it's stake in energy policy). The separation keeps the "functions of government concerned on the one hand with the promotion of competitiveness and business interests and those concerned on the other hand with regulation promoting the consumer interest and sustainability" (Skea, undated:34). They deal with the more ethical side of environmental concerns and would favour the adoption of offshore wind power, but since they are not in charge of developing a whole energy policy framework, their contribution to this cause may have less impact than of other government institutions such as the DTI.

Ofgem: Like stated above, Ofgem is the energy regulator in the UK. It states it's first priority as being to protect consumers. It regulates the market to make

sure that there is 'adequate investment' in the networks. Ofgem is controlled by an Authority, which makes all major decisions and specifies policy. The Authority is formed by experts and a management board. It's funded by energy companies 'licensed to run the gas and electricity infrastructure' (Ofgem, 2006a). An example of Ofgem's activities is a scoping document that was passed to businesses attending the BWEA Offshore Wind conference in London early in April 2006. The scoping document required an answer (from businesses) on Ofgem's plan for offshore electricity transmission, developed together with DTI. Ofgem defines their regulatory approach as 'broad', "encouraging effective competition and regulating only where necessary", and they add that onshore, where "competition is not appropriate in electricity transmission", price controls are set to protect the interests of consumers (Ofgem, 2006b). This approach exemplifies the whole British approach to policy-making: consensual agreements between business stakeholders and government, and as little interventionism as possible. The consequences of this are made obvious in the lack of development of renewable energy in the UK, compared to other European countries, in spite of the government's stated commitment. Ofgem's role in promoting offshore wind energy is a large one, since they are involved in the design of policy mechanisms and incentives that could make or break renewable energy technologies. Their idea of 'regulating only where necessary' has led the UK towards a quota system of policy incentives (more on this in further chapters) that requires more decisions to be made by the market, directly affecting the amount of funds available for new technologies that are not quite market-mature. In this way, their role has been a negative one for offshore windpower.

Something must be mentioned regarding the Department of the Environment. It has now been divided up, but when it was created, it was also the department for transport and energy, among other things, so it's environmental scope was not all-encompassing. Environmentalists noted that it was the department *of* the environment and not *for* the environment (Weale, 1997).

In conclusion, the government's interest is in providing a reliable service to consumers, and helping companies be competitive and profitable. They do not see financially helping market-immature energy technologies as their role. Consumers now have better access to information and are more able to complain if they wish to, but in the UK, they seem to trust their government. As to the companies, the large and well established ones are the main beneficiaries of policy. This is a legacy from the Thatcher Era, where having a growing economy was the main accomplishment, and this is still the direction in which policy leans.

5.2.2. Local Government

Local government had the main responsibility, in the UK, of implementing environmental measures. The logic was that they would know what was best to do given that the problem was local, such as pollution due to a factory for example (Carter and Lowe, 1998). However, they have no say in energy planning or economic regeneration measures imposed by central government. They can influence energy use and promote savings, but they do not hold much sway in manipulating the energy supply side. In this way, they have much responsibility over their constituents' behaviour but little power to make changes to deal more efficiently with possible problems. Nowadays, some have argued that local government has lost influence due to the EU. There is the idea that national governments now must respond to the EU based on the actions of their local governments (and their populations), so they have tightened control of them. It's a disproportionate distribution of responsibility, based on energy planning policies and philosophies that change with each of the political parties. Some local authorities have realized the potential of dealing directly with the EU. Some of the largest cities have sided with the EU as a way of gaining leverage against the national government, they can get funding and they can also lobby and respond proactively, but even so, more than half of local authorities in the UK have not taken advantage of this opportunity (Lowe and Ward, 1998).

5.3. Environmentalists

British environmental policy is old and therefore fragmented and uncoordinated. There are voluntary organizations such as the Fauna and Flora Preservation Society, the Advisory Committee on the Pollution of the Seas and the International Council for Bird Preservation, among many others. Environmental groups are involved in decisions concerning nature conservation, landscape planning and historic preservation, but they are mostly excluded from other 'industrial' fields (Lowe and Ward, 1998). In those, green groups don't play a very influential role, because policy is frequently the result of government and business agreements, geared towards economic growth, and environmental groups are not given much say in the process (Weale, 1997).

Environmentalist groups such as FOE, WWF, Greenpeace, and others, have wide membership. Some of these groups are very active in lobbing activities at the EU and national level. They are an important media influence as referrers of green politics. Their limitation resides in their articulation with local issues. The inverse problem occurs with local grassroots associations (many of them formed by unpaid environmentalists). Generally, the local associations set of activities are not covering actions concerning the macro political agenda. The agencies have indirect influence at EU and national level through a system of local umbrella organizations. Despite the differences between local and national groups' roles, in the UK, environmental groups have gone from being considered 'outsiders' to being, at least to some degree, 'insiders', in the sense that their influence over policy has grown. For the local

groups, an inflection point was the introduction, in 1992, of the *Local Agenda 21,* at municipal level (Local Agenda 21:2006).

For the national agencies, European social and economical harmonization played a pivotal role in their influences, especially since the signing of the Maastricht treaty. The European Commission helped with the creation of the Pan European Networks of Associations. The aim of these networks was, and still is, to have influence in Pan European policy. This fact provided the National Agencies an authority of representation (without having been elected) unknown before[11].

In spite of the role national agencies have at European policy making level, the environmental organizations still have less influence in the UK than their counterparts in some other countries. In the 90's Europe offered the national environmental agencies and opposition political parties, a possibility to bypass the National Government (which at the time was anti-European). These actors learned since them how to interpret and use the policy tools offered by the Commission and the European Parliament to appeal against controversial environmental policies, on the grounds that the UK is not implementing EU legislation in a satisfactory manner (Carter & Lowe, 1998, Lowe and Ward, 1998). Regarding offshore windpower, green organizations tend to agree with more deployment, but they don't have a say in these decisions. The low influence on policy makers could be due to the fact that the dominant group involved in the lobbying and influencing of policy making is formed by the important corporate actors such as the electricity utilities industry, represented by the BWEA[12].

5.4. Industry and Business

These are, next to government, the most powerful stakeholders in energy policy in the UK. We will begin by identifying the main companies and then briefly discuss their main interests as a whole. A section on wind energy companies follows.

5.4.1 Generators: There are many electricity generators in Britain, the largest one being British Energy, with a 20% market share. It is a private nuclear company (NG, 2006). Other main generators include Scottish and Southern Electricity (SSE), E.On UK, RWE npower, Scottish Power(SP) and EdF Energy (EIA, 2005a and ENA, 2006). Some generators of conventional power have been branching out into renewable energy. They appreciate what little government support there is, but mostly don't count on it. Renewables is a peripheral business to most of them, and none seem to expect that this will change.

11 From author's own experience of working at municipal level with environmental groups in West London and at European level as UK representative in the European Antipoverty Network

12 Greenpeace at the BWEA Offshore Wind, 2006

5.4.2. The Grid: The company The National Grid owns and operates the transmission system in England and Wales, and since BETTA, operates the transmission system in Scotland as well. Scottish Power (SP) and Scottish and Southern Energy (SSE) actually own the grid in Scotland (NG, 2006). NIE owns and operates the Northern Irish transmission grid (ENA, 2006). The transmission system operator follows the policy framework designed by Government. Their role in promoting renewable energy has been indifferent, which means they charge offshore wind farms for extending cables to connect to the grid, which is considered unfair since conventional power companies had this service provided for when their power stations were built.

5.4.3. Distributors: In Britain, the distributors are EdF Energy, CE Electric, Central Networks (owned by E.On), Northern Ireland Electricity (NIE), Scottish Power (SP), Scottish and Southern Energy (SSE), United Utilities, and Western Power Distribution (ENA, 2006 and NG, 2006).

5.4.4. Suppliers

There are over 70 suppliers of electricity and gas in the UK. Most of them are subsidiaries of the large companies, these being: British Gas, EdF Energy, RWE npower, PowerGen (owned by E.On), Scottish Power (SP), Scottish and Southern Energy (SSE), and NIE (ERA, 2006 and ENA, 2006). Additional companies include Basic Power, Countrywide Energy, Ecotricity, Green Energy (Energylinx, 2006).

Table 5.1. Main electricity companies operating in the UK. Nation. means nationality, gen means generator, tso means transmission system operator, dno means distribution network operator, and sup means supplier.

Nation.	*Company*	*Subsidiaries*	*Gen*	*Tso*	*Dno*	*Sup*
German	RWE	npower, Innogy	X			X
German	E.On	PowerGen, Central Networks	X		X	X
French	EdF Energy	LE, Seeboard, SWEB	X		X	X
UK	SSE	Scottish Hydro, Swalec…	X	X	X	X
UK	SP	Manweb…	X	X	X	X
UK	British Gas	Centrica…				X
UK	CE Electric				X	
UK	United Utilities				X	
UK	Western Power				X	
UK	NIE			X	X	X
UK	British Energy		X			
UK	BNFL		X			
UK	National Grid			X		

Looking at it from a company perspective, the major players are shown in Table 5.1, along with the (original) nationality of the company and which phases between electricity generation and supply they are involved in. Note that SSE and SE own the transmission network in Scotland but it is being

operated by the National Grid.

The companies that are involved in all phases are Scottish Power and Scottish and Southern Energy. Northern Ireland Electricity has large stakes but the Northern Irish market is separate from the rest of UK. German companies RWE and E.On, and French company EdF are large stakeholders in the UK market, aside from British Energy. These four companies are among the 10 most powerful energy companies in Europe (Greenpeace, 2005a). Their investments into offshore windpower have been present but not very large. They are willing to endorse renewable energies if there is government support.

5.4.5. Wind Energy Companies

In terms of wind energy, the UK market comprises of large electricity companies that have wind energy in their portfolio, wind farm developers, wind turbine manufacturers and companies supplying parts, and companies providing services and advice. In 2005, the largest onshore wind power generators were, by order of highest installed capacity: Beaufort Wind, CRE Energy, Powergen (belonging to E.On), National Wind Power, Rothes Wind, Crystal Rig Windfarm, Celt Power, Androssan Windfarm, Yorkshire Power, Cemmaes Windfarm and SSE Generation (part of SSE, above). The largest off-shore wind generators at that time were Innogy and Powergen, both belonging to two of the largest European companies. Offshore generation is still more expensive than onshore, so only the big companies can afford those costs and still make a profit (Strachan et al, 2006). All these fall into the business and industry sector, therefore making a profit is just as important as with non-renewable energy companies.

Industry and business want high profits and low taxes and cost, so it is very easy for them to make agreements with a willing government, such as in the UK, that eases their costs and encourages profits and growth. In the case of the offshore sector, however, Government is not willing to give as much as are needed, so development has progressed slowly. It is easy for power companies to use non-renewable fuels, like coal, because the infrastructure is already in place, it's cheaper fuel, the technology and expertise needed is readily available, and there are fewer barriers.

Groups such as the BWEA (British Wind Energy Association), while promoting renewable energy, have also a large interest in the industry and business sector. Ultimately, they exist to push the interests of renewable energy companies. One of the main complaints of the wind energy industrial sector in the UK is the lack of government commitment to renewable energy. Constant policy reviews and staff changes cause uncertainty and raise costs. This uncertainty cascades into the workings of the green certificate market, to be discussed in chapter 6. Planning and permit barriers decrease the scope of action for these companies, as does lack of public acceptance. Regarding the energy review, the BWEA believes that the government should either change

to RO to make sure funds go towards the emerging technologies of offshore wind, wave and tidal, or in some other way guarantee funding, aside from setting a 20% renewable energy target for 2020. These things would be a test of the government's real commitment to a low-carbon future (BWEA, 2006c).

Where it concerns offshore wind, the BWEA considers it to be 'at a crossroads'. The current energy review, if it provides no further support for offshore, would in essence be dooming the industry to low and expensive development, but if new policies are put in place that help offshore, it could (cost-effectively) take off. One of the problems of too-slow development is that an offshore-specific supply chain would not have sufficient reason to develop, further harming the industry, and the 'economic gap' between cost and funding given must be closed (by more government subsidy) if the offshore industry is to take off (BWEA and Renewables East, 2006). It's a very new kind of industry and rules, institutions, practices, are still being set up. The BWEA is a strong supporter of offshore windpower.

5.5. Consumers

The stakeholders for an offshore wind farm comprise specific sectors of the population, usually not every consumer. Fishermen have raised questions about windfarms in fishing areas, but as long as the site is well chosen, it will not interfere with fishing and small boats should be able to sail in between the turbines.

Consumers in general are a somewhat passive stakeholder group. Frequently they make their interests known thru grassroots groups, usually environmentally oriented. Despite the large memberships of Greenpeace and similar NGOs, there are few groups that deal with wind energy in the UK, for instance. One possible reason for this is that people feel they have done their duty by donating money to the large NGOs, and feel that the environment will be taken care of. Support for more 'traditional' areas of environmental policy in Britain is more active, such as for the Royal Society for the Protection of Birds (Chapman, personal communication). Consumer's role in promoting offshore wind has thus been negligible. Lack of public acceptance for wind energy is not as pervasive as some people may argue, Chapman (2004:14) says that "opponents of windfarms represent a small, vocal fraction of the public and government, but receive disproportionate media publicity", fact which is confirmed by a BWEA speaker at the EWEA EWEC 2006, along with a mention of the Embrace Wind campaign to increase public support. Arguably offshore wind power plants are not as visible and will not create the 'not in my back yard' problem that onshore plants have dealt with, so consumers will not be as vocally against offshore wind power, but expecting their active support may be a bit of a stretch.

Regarding the electricity and gas market, the interests of consumers are defended by Energywatch, an independent gas and electricity market watchdog. They provide advice and help consumers get the best deal possible when choosing their electricity and gas supply companies. They also work

with Ofgem and companies so they may meet consumer demands (Energywatch, 2006). They don't express any preference regarding where the electricity comes from, theyare more of a company-consumer conflict mediator.

5.6. Nuclear *vs.* Renewables, Public Awareness and Participation

Our study shows that renewable energy in general and offshore in particular don't have too much scope to develop in the current policy scenario. The policy impetus the BWEA is asking the government to establish, to achieve a 20% supply from renewable energy for electricity generation by the year 2020, looks difficult to be created if there is not higher public involvement (BWEA and Renewables East, 2006).

The participative capacity in energy policy making in the UK has been historically low. We identify four factors which are affecting the public opinion's indifferent attitude, they are: a) the fossil fuel wealth of the 80's and 90's created the perception in society that energy was well managed; b) Low community involvement in the development of renewable energy specially wind energy; c) Wind energy industry led by the private sector profit and environmental interest but not social; d) Psychological distance between the power generators and the users.

In the UK renewables development, in contrast with other EU countries like Denmark and Sweden where the level of community involvement is high, the tendency is that the wind energy industry is private sector led and is driven by economic and environmental concerns rather than social. One of the characteristics of the energy system in the UK is that power generation is centralized, and this fact creates psychological distance between the power generators and the consumers (Devine Right, 2002).

At present more than half of the public opinion, according to the polls, would support new atomic power stations as long as renewable energy sources were developed and used at the same time, but also three quarters said that nuclear power should not be considered as a solution for climate change before all other energy options had been explored. (The Guardian, May 2006a). This opinion could change if the nuclear debate goes in a systematic national consultation were the public is informed about the pros and cons of nuclear.

The capacity building theory argues that to gain public participation in the policy making process, public awareness is of paramount importance. In our opinion, the communication strategy by which the BWEA, which represents more than 300 companies, is trying to gain public support for wind energy is not the best. The BWEA style to convince the public about wind energy is by appealing to the environmental gains of the technology, and avoiding to be perceived as opponents of nuclear (EWEA EWEC 2006). While NGOs like Greenpeace, WWF, FOE (among the most representative organisations of the environmental movement) are opposing nuclear energy, the BWEA is saying

that the energy review should place wind, wave and tidal energy as well as nuclear power at the centre of the energy future (Rand, 2005). The NGOs are arguing that nuclear power is unnecessary, unsafe and uneconomic. They are qualifying nuclear power as a red herring in the energy review. Among the strong arguments against nuclear we found are that "if the UK replaced all 23 of its operating reactors, the nation would just save ten per cent of its CO_2 emissions and that the £56 billion of taxpayers money being used to fund nuclear waste management and decommissioning could be used instead to install wind turbines to meet 20% of the country's electricity needs" (Greenpeace, 2005c) (WWF, 2005) (FOE, 2005).

5.7. Summary and Comments

We began the chapter by describing the structure of the electricity market in the UK. It was liberalized and has since been privatized, and can be divided into 5 phases: generators, transmission system, distribution system, suppliers and consumers. Companies have the obligation of supplying some amount of electricity from renewable sources due to the Renewables Obligation, and they participate in NETA, a wholesale electricity market intended to bring down prices for consumers.

Stakeholders can be divided into the categories of government, environmentalists, business and industry, and consumers. The parts of government concerned with energy are several, with departments such as DTI, Defra, and Ofgem, and several committees. Each of them has an interest in energy policy, but not necessarily offshore windpower, and they share the British policy style: cooperative, consensual, based on agreements between the relevant parties, in this case government and companies. Another characteristic of British policy is that they tend to let market forces implement their policy objectives, and thus the results are not always optimal for renewable energies. Some technologies need more active government support, and in the absence of this we can say that their role in promoting offshore windpower has been weak and lacking. Environmentalists have little influence in the shaping of environmental policy or energy policy, despite a wide membership base. Business and industry stakeholders include generation, transmission, distribution and supply companies, aside from pressure groups. They have an interest in keeping their consensual government agreements, and in high profits, which means they would not invest in renewable energy unless forced to, by such mechanisms as the Renewables Obligation. Consumers also have little influence. The case about both consumers and environmentalists is that up until recently, they did not have access to information, which was secured in opaque government-business agreements, so they don't have a history of active involvement in energy-related decisions.

Another way of looking at stakeholders for an offshore windfarm is expressed in Table 5.2, below. Statutory consultees are usually regulators with which communication is essential and obligatory, such as government. Their role in

promoting offshore wind is crucial. Strategic stakeholders represent organizations or associations, can be consulted but this is not a requirement, yet there is a definite benefit in doing so since their opposition could put considerable strain on the development of a project. Examples of these are environmental groups, business and industry associations and large companies. Community stakeholders will be locally affected by a windfarm development, such as consumers. These categories are fluid, stakeholders may belong to more than one (BWEA, 2002). The reason we are presenting this data in this way is to try to summarize the stakeholders in a simple and straightforward manner. We have not dealt with each of the ones specifically mentioned below because this list is not complete, and can change from one location to another, as do fishing areas, archaeological findings areas, locations considered important by the Navy, the Coastguard and Aviation Authorities. The support of environmental groups will be there depending on the location of the farm, and the same goes for support of the Royal Society for the Protection of Birds and sailing clubs, among other groups.

Table 5.2 Offshore windfarm stakeholders: a different view.

Statutory Consultees	*Strategic Stakeholders*	*Community Stakeholders*
DTI, Defra, Ofgem, Local government, various quangos, Environment Agency, Health and Safety Executive, the Coastguard and Aviation Authorities, the Navy, among others.	Environmental groups such as Friends of the Earth, WWF, Greenpeace, archaeological interest groups, conservation societies, large companies, fishermen's organizations, the Royal Society for the Protection of Birds, fisheries managers, trade unions, BWEA	Individuals, local companies, residents' associations, sailing clubs, church and community groups

Adapted from BWEA, 2002, author's own elaboration

The stakeholder that we think is the most important in promoting offshore wind energy is the BWEA. The organization could and should engage NGOs and the public in a national consultation process much like the one Michael Meacher conducted over the GMO issue, but this would be focused on nuclear energy and how it compares to offshore wind energy. This would clearly establish the BWEA's position and link it to the public, which we think would consolidate their views and importance.

The other stakeholder that could induce more development of the offshore wind industry would be the EU. If stronger, stricter policy could be designed and enforced, the UK would have little choice but to comply.

Chapter 6. Energy Policy in the UK

6.1 The UK approach to renewable energy and innovation policy

How can continental Europeans be so successful? How can Europeans have installed so much generating capacity that the Danes produce 20% of their electricity with wind, the Germans 10% with wind, solar, hydro, and biomass, and the Spaniards 6% with wind? The answer is surprisingly simple: they pay for it. They pay for renewables by … [an advanced feed-in system]. They set a price high enough to ensure that they get the kind of renewables they want. The results speak for themselves."(Gipe, 2006:50)

To set the UK in context, we will repeat two figures from the EU: it has set a target of 21% of RE electricity vs. other types of sources, by 2010, and in 2003 it had achieved 12.7% (from around 6% two or three years earlier). The UK has set itself a 10% target, also for 2010, and by 2003 it had achieved 2.8% (from a little over 1% from two or three years earlier). The latter figure has grown only slightly in the last ten years and despite having about doubled in a few years, has no hope of achieving 10% over the next 5 years without "heavy investment" (Financial Times, 2005). In the 2003 Energy White Paper the British Government stated the need to "scale up substantially the deployment of renewables in order to secure economies of scale and reduce costs significantly". Offshore Wind Energy is the first of all renewable energy options listed by the government to deliver the reduction of carbon targets (Energy White Paper, 2003:58). The methods being used by the government agree with the needs quoted, but not with the specific RE targets mentioned above.

We will briefly describe the Danish system, considered very successful in the deployment of RE (up to the late 1990s), and then the British system, which has obtained less prominent results. Each country has chosen different policy mechanisms. Annex A provides an explanation of the policy incentive mechanisms currently being tested by various countries. In this section we will discuss how they have been designed and applied in the UK and Denmark.

Denmark and Wind Power

The Danish government has introduced as mechanisms, throughout the development of wind energy: power companies are obligated to buy all electricity generated by wind at above market prices; wind producers get a subsidy; everyone pays a carbon tax, in which case wind producers, who get this subsidy, get (a little over half of) this value refunded; and producers get a tax break, differentiated for cooperatives and single owners of turbines. Thus the government subsidizes about half of the wind power produced, and the feed-in is set at a high value, which has stimulated the rapid development. But nowadays this is quite a lot of money, so the present government in 2000 made some changes. They decided the subsidies and the carbon tax would be replaced by a green certificate market, and wind producers would not sell to

conventional power producers, but on the electricity market (NordPool). There would be a phase in period where new turbines would get both a (smaller) feed-in and certificates. Consumers would pay extra to have green electricity, by buying the certificates (which may be done by suppliers on their behalf) instead of by taxes. The green certificate market demands that consumers have a certain amount of their electricity generated by renewable sources, and renewable energy producers. Denmark was one of the only countries to have a legal provision for their certificate market, and to place the quotas on consumers rather than producers (Nielsen & Jeppesen, 2003, Morthorst, 2000, Fristrup, 2003). However, this market never got started. Denmark now uses a feed-in system again, but the price paid is not a percentage of the market price, as before, but a fixed premium. Danish wind energy companies have mostly gone out of business or been bought out as a result of market forces plus this confusion, and only Vestas remains, according to Gipe (2006).

6.1.1 The Climate Change Levy, the NFFO and the RO

Long-term RE targets are a precondition for sufficient investment by the RE industry, and the UK is a notoriously expensive and uncertain market due to the lack of political commitment. Constant revisions and reviews have not been helpful, according to both academics and businesses: the RO (Renewables Obligation) has been reviewed at least once a year since it's establishment (BWEA Offshore Wind 2006, ECN, 2005).

The Climate Change Levy is a tax on energy use. It is meant to cut greenhouse gas emissions and increase energy efficiency, and so stimulate investment. The tax is recycled back to the non-domestic users by a 0.3% cut in the National Insurance Contributions, and it has a series of items that it does not apply to, such as electricity generation or transport fuels, making it a tax on energy use alone (Defra, 2005). By recycling it back to the users, it doesn't increase their tax load but sends a clear signal that energy use and the environmental problems it can cause need to be dealt with (and paid for). Aside from that, renewable energy users are exempt from the levy (Varma, 2003).

The NFFO (Non Fossil Fuel Obligation) started in 1990 and was a tendering process with bands for specific technologies, and it's successor, the RO, started in 2002 and is a green certificate mechanism (without tech-specific bands). The idea for the NFFO began with the Fossil Fuel Levy: the UK asked permission to the EU Commission to charge the consumers to fund nuclear power plants, when it was seen that they were not commercially profitable and could not be sold with the rest of the utilities during the privatization process. Renewable energy generators used the opportunity to ask to be included in the subsidy scheme, which rang well with the Commission's friendliness towards renewable energy, and the NFFO was born. In reality, then, it was meant mainly to fund nuclear energy, not renewable energy (Agnolucci, 2005a). It was carried out in rounds of bidding, and was

substituted for the RO when it did not yield the expected results (ECN, 2005). Under the NFFO, suppliers were obligated to buy RE electricity, RE producers participated in a tender and the lowest bidder got the right to build and got a subsidy based on his production. This subsidy came from public funds. One of the problems seen with the NFFO was that the "emphasis on low cost resulted in a greater risk that winning bids may not be built", and only 30% of contracted capacity was installed in Britain under the NFFO. Another was planning barriers that were not taken care of by the government before the start of the tendering process (Gipe, 2006:34, Morthorst et al, 2005). Mitchell & Connor (2004) add that there was no penalty if the winning contract was not built, which meant companies could bid and have the advantage of keeping the competition from getting the contract, even if they did not build. Many projects from Round 1 still have not been built, and BWEA and Renewables East (2006) state that there is an 'economic gap' between the cost of offshore projects and the support given. Gipe (2006) says that the DTI's emphasis was to support nuclear energy[13] and show that it's competitive RE policy worked in principle, even if not in practice.

The RO has equivalents in Scotland and Northern Ireland, and these certificates are fully tradeable in all three markets (ECN, 2006). Under the RO, suppliers are obligated to buy RE electricity to fulfill a government set quota. If they don't comply, they must pay a fine that is recycled back to RE producers participating in the scheme. RE producers sell their electricity at conventional-electricity prices, and sell certificates (which prove how much they generated) so suppliers can comply with their obligation. If the certificates cost more than a penalty (maximum) price, the funds paid to that also get recycled to RE producers. Offshore wind producers can also apply for capital grants. The RO, like all certificate systems, works (deploys more RE) only if quotas are not met, which keeps prices for certificates high, and market players have an incentive to keep it that way so their certificates don't lose their value. RE targets have been set at increasing levels up to the predicted duration of the RO (2027), and no minimum price exists. Certificate prices thus depend on the difference between the target and the real deployment, and are linked to the spot market price of electricity (and not long term contracts), so they are volatile, which means investment into British wind energy is quite expensive. Long-term contracts are possible but have not been the norm, because suppliers require generators to share the risk and the rewards, so generators don't get the full value of the ROCs under long-term contracts (5-10 years in the UK). They have been the norm in the US and there, show good results (ECN, 2005). As a consequence, only large energy companies that can handle the risk have been able to invest there, and small producers have not had a chance to get financing without long-term contracts and thus enter the RE market. Market players consider that the RO is working (at least for onshore wind), even of Morthorst et al (2005:13) say that "promotion of competition is not only about creating a level playing field, but also about getting a multitude of players onto that field". Deployment has

13 Chapman (2004) states that over 90% of funds from the NFFO went to nuclear producers.

increased, even if not even close to the (ambitious) stated objectives (only 60% of needed certificates were produced in 2004). The penalty fund is recycled back to compliant suppliers, which means non-compliant suppliers are in fact subsidizing compliant suppliers, and it increases the value of the ROCs, but also adds complexity to the market. In fact, the RO is generally considered complicated by the market. Where it concerns the offshore wind sector, uncertainties related to the RO are that ROC prices (set to 2015) and the duration of the mechanism both fall within the lifetime of wind farms being built, so support is not guaranteed for perhaps a sizeable amount of the farm's lifetime. Aside from that, if a higher percentage of biomass burning in co-fired plants is allowed certificates, that could affect the ROCs market (Gipe, 2006, ECN, 2005, Morthorst et al, 2005, BWEA and Renewables East, 2006, BWEA Offshore Wind 2006).

6.2 Offshore wind

Britain's total offshore wind capacity is estimated at some 30000 MW, which could deliver 92 TWh per year. According to the BWEA, the wind resource is equivalent to three times the UK's annual electricity consumption. It is calculated that by 2010 around 5% of the UK electricity can be generated by offshore wind. There are some arguing that the 10% government target for renewable electricity generation could be met by offshore wind (Wilson, 2002) (BWEA, 2006d).

The first application for the installation of a wind offshore farm was made in 1996 under the Non Fossil Fuel Obligation (now replaced by the Renewable Obligation). The first offshore wind energy site established in the UK was the North Hoyle Wind Farm, installed in 2003 with a capacity of 60 MW, providing electricity to 50000 households. The project investment was £70 million and received very little opposition compared to other wind onshore projects (BBC 2003). Currently there are 4 offshore farms providing 213.80 MW (BWEA, 2006d).

6.2.1 Offshore: the planning process, development of the farm, decommissioning and environmental impact

Companies involved in the UK offshore market now include multinational energy companies like VESTAS, the Dutch NACAP, Shell and utility companies such as PowerGen (electricity and gas suppliers) and RWE (owners of Thames Water and also electricity and gas suppliers). The sites for offshore wind farms are offered by the Crown Estate. Companies and consortiums wishing to run an offshore wind site are due to go trough several planning procedures known as consents required to establish a farm.

The Energy Act 2004 provides the legal framework for the placement of offshore renewable energy projects (wind, wave and tidal) beyond the UK territorial waters. The Act establishes a Renewable Energy Zone (REZ) neighbouring the territorial waters, where renewable energy installations can be set up. The act introduces a safety zone scheme and decommissioning of

offshore renewable energy installations which will be explained in the next section (Energy Act 2004).

The Leases

The sites for offshore wind projects in the United Kingdom are awarded by the Crown Estate, which owns almost all the UK coastline out to 12 nautical miles. The present system for the allocation of sites in the UK is categorized by rounds. Round 1 started at the end of 2001 and Round 2 was released at the end of 2003.

Round 1 of the UK offshore wind development consisted of the offering for lease of 18 sites for the development of wind farms, of up to 30 turbines, around the UK Coast. Round 1 offered 1000 MW of potential developments, of which a total of 213MW were built and around 70 MW more are under construction (Edge, 2006).

Round 2, issued at the end of 2003, offered leases for the development of 15 projects of 5.4 and 7.2GW of wind capacity, which would be able to offer electricity to 4 million households (BWEA, 2006c).

The Consenting Regimes

There are several consenting regimes operated by the DTI and Defra, the Department of Transport (DfT) and the National Assembly for Wales (NAW). The procedure has been simplified with the creation of a "one stop shop": the Offshore Renewables Consents Unit (ORCU). The consents are required by five different parliamentary acts[14] (DTI, 2004). Consents are not considered hard to get, but before the one-stop-shop it was a cumbersome process and had some costs associated with it (Agnolucci, 2005a).

The bureaucratic process to obtain planning consent for the establishment of wind farms is recognised by the applicant companies[15] as a potential bottleneck due to the lack of resources by regulators to deal with the procedure, which sometimes duplicates the requirements to the applicants with other consent bodies (BWEA and Renewables East, 2006:9). Currently the government is running a review of the consenting process for marine development. The BWEA is recommending a consent system based solely on Section 36 of the 1989 Electricity Act[16] (BWEA, 2006b). If the recommendation is accepted by the government, it could be perceived by the sector as a

14 Electricity Act 1989 Sec 36; Transport and Works Act 1992 Order (TWA); Food and Environment Protection Act 1985 (Part II) (FEPA)-Section 5; Coast Protection Act 1949 (CPA) Sect 34

15 Companies involved are multinational energy companies like VESTAS, the Dutch NACAP, Shell and utility companies such as Power Gen (electricity and gas suppliers) RWE (owners of Thames Water and also electricity and gas suppliers).

16 The Act rules that the consent authority for offshore installations greater than 1 megawatt is the DTI and that all proposals must have to produce an environmental impact Statement produced as result of an environmental impact assessment (DTI 1989)

positive sign which could encourage investment. The Marine Bill would decide on consents, create a Marine Management Organization (MMO), do marine Spatial Planning, marine Nature Conservation, and management of estuaries, coastal areas, fisheries and enforcement. BWEA has prepared a document in which they ask industry representatives to forward opinions and make a unified stance so the government will take their interests into consideration in the final design of the bill. This method of consultation, both of the BWEA with it's industry and the government with businesses is characteristic of British policy-making. The BWEA document states their suggested position as an industry, and the overarching theme is that the marine environment has multiple uses and will therefore always be the subject of controversy, and that the Marine Bill must provide a conflict resolution method (one example is that an offshore farm can harm archaeological artifacts off the coast). The other themes of the document are to unify consents under one department, to unify conservation areas under one legislation, to keep the MMO not a consenting but an independent, advisory and a spatial planning body with public access to data. They would like the spatial plan to be flexible and changeable, and for conservation areas to be open to renewable energy developers (but not other marine 'users'), and they recommend that the precautionary principle to be applied only if there is confirmed harm caused by marine uses (BWEA, 2006b) - which counters the idea of a precautionary principle. The DTI is the only consenting authority for onshore wind energy farms, the BWEA believes that the same system should apply for offshore.

Offshore wind farms decommissioning

The Energy Act 2004 introduces, under the legal framework for offshore renewable energy projects beyond the UK territorial waters, a statutory scheme for decommissioning of offshore renewable energy installations and its electricity lines (Energy act 2004 chapter 2 sec 95). The Act defines "decommissioning" in relation to an installation and or an electric line, which has to be removed from the bed of any waters by demolition or by dismantling. Renewable offshore decommissioning is a new feature in Marine legislation which the European legislation does not contemplate yet (EC, 2006).

Wind turbines are made to last for 20 to 25 years. The industry's allegation is that, at variance with other technologies like oil, gas or nuclear, it is possible to remove all traces. Furthermore, it does not produce dangerous emissions or residues and there is no "legacy cost" of its sitting (Hong Kong Wind, 2006). It is accepted that the direct effects of decommissioning are similar to those associated with construction.

Only the Netherlands and Denmark have some provisions related to decommissioning (CCC 2006). The legislation taken into account to enforce the decommissioning is provided by UNCLOS (United Nations On the Law Of the Sea, convention article 60 (3)) and The Convention for the Protection of

the Marine Environment of the North-East Atlantic , known as the OSPAR convention. In 2003, the OSPAR convention provided guidance to the 15 country member and the European Commission, on a common approach for dealing with Applications for the construction of farms. The document describes the procedures for the Environmental impact assessment, which includes the sites decommissioning (OSPAR: 2003).
Surprisingly the European Commission in its revision on maritime law is not considering the RE offshore decommissioning, aspect which we consider deserves to be study and regulated(EC: 2006).

It is recognized that the decommissioning is a complicated process which should not to be confused with a simple building des-construction. The process has to be by regulators and developers with its many geophysical, legal, technical and financial aspects (Person 2004).

DTI has an Offshore Renewable Energy Decommissioning (ORED) office. Currently ORED is consulting with companies about the decommissioning costs and the best way to charge for them. The government approach to decommissioning in general has been to require the owner of the site to pay for the disposal of its own waste (Ayoade, 2003).

The average offshore wind farm decommissioning costs are around £40,000 MW which represents around 2,5% of the total project cost. It is calculated that until the year 2020 this could create a maximum £288 million in offshore wind decommissioning liabilities. There is a possibility for developers to underestimate the decommissioning costs creating unexpected liabilities for the government. To address the problem, the government proposes to create a fund scheme which accrues early or late into life of the installation (CCC 2006). This money has to be paid by the first owner of the installations and the cost cannot be passed to the next proprietor of the farm.

Decommissioning and Technological Bias: We need to stress under this section the technological difference nuclear decommissioning and other decommission processes. The nuclear industry is obliged by law to set aside funds for nuclear decommissioning. In our opinion, the management of these funds by the nuclear industry is questionable, as they can be used for activities other than decommissioning. It is recognised that this is having an impact on the electricity market and especially in the renewable energy sector. In the UK, waste and decommissioning funds are estimated in the region of €58 billion. Some utilities retain the funds and only pay when waste is delivered. The problem is that these funds are at the disposal of the utility at any time and are used for other purposes than to cover the waste and decommissioning costs. In the United Kingdom, it is alleged that the nuclear industry is using the funds to buy out competitors who do not have the same access to funds (Froggatt 2005) (Turmes 2006).

The Costs

The Cost for an offshore wind farm are divided into capital expenditure, operating expenditure and revenue. The BWEA released a report this year which portrays the expenses the offshore wind industry is incurring in its different stages. The report forecasts that if the government does not support the industry through capital grants and legislation, offshore wind energy won't succeed in the UK. Under the present policies the offshore projects will develop an increasing annual capacity until 2010 when 400 MW will be reached, and after this capacity will decrease to 200 MW in 2017.

The BWEA described the difficulties the industry as follows: regarding capital expenditure, the products introduced to operate offshore are new, the quality of the materials used is reported to be poor and the testing inadequate, this was evident with faults in some turbines, the price of raw materials has increased due to the demand in China and India, the grid connection costs are uncertain. Regarding operational expenditure, operational costs are exceeding the original estimates as a result of component failures. In terms of revenue, offshore wind projects received support for Round 1 developments from the government via the Climate Change Levy tax on electricity (0.43p kWh), the Renewable Obligation, and £117m in grants between 2002 and 2008 for R&D and demonstration (DTI, 2005). With Round 2 there is no evidence of a financial support programme as happened for Round 1 (BWEA and Renewables East, 2006). Uncertainty with ROCs, as we described in the last section, is considered with the project lifetimes.

Supply Chain Capability

The offshore wind industry in the UK depends on the global wind industry supply. The main limitations are turbines, installation vessels and cable availability.

Turbines: As global demand is high, it will be only in 2015 that at least 6 turbine suppliers will be 'available' in the United Kingdom. The new suppliers will be a mix of new and established onshore companies. The problems the turbines are facing today are related to the gearbox supply and reliability, carbon fibber supply for making the blades, and slower R&D than predicted (specially in the two last years) due to higher focus on testing and resolution of faults.

Installation Vessels: There are indications that due to the lack of activity in offshore wind installation, the new installation vessels constructed are for gas and oil offshore sites. The funding for vessels suitable for 5MW turbines is limited. It is calculated that the turbine sizes needed by 2015 are of 4.8 MW. The BWEA reports that "the investment time to prepare suitable vessels is significant; hence a steep ramp in capacity is unlikely to be available".

Cables: Developers are concerned with the sub-sea cable supply. The cables required for the offshore installations are: medium voltage, intra turbine array

and high voltage cables. On average, 0.4 km of medium voltage cable per MW is installed. The present demand for cables is low, the suppliers are producing half the expected global supply capacity, which is of 3000 km per year. The suppliers are frustrated by the lack of long term perspectives the offshore industry is offering. Suppliers are willing to invest at the forefront if an early commitment in the right environment exists. The BWEA recommendations to the government, to mitigate the supply chain problems, are to build confidence in a long-term stable market, through the early formulation of Round 3 calls and enable cooperation between different actors on grid access and consenting process. Financial support for Round 2 has to be evident.

Difficulties with in contract negotiations

Gordon Edge of Offshore Wind at the BWEA recognized in 2005 that "difficulties in contract negotiations for some Round 1 projects have forced a rethink of these deals" (Edge 2005). The experience with the first round is that the contractor is expected to deliver the full working project to the client. Under this type of arrangement, called 'engineering, procurement and construction' (EPC) contracts, the contractor arranges a fixed price with the client and takes all the financial risks related to the construction. The experience indicated that in a construction with EPC contracts, the subcontractors have to meet the liabilities jointly even if these are outside their competence. Most of the offshore developers in the UK recognize that there is an economic gap of up to 25% of installed project costs (BWEA and Renewables East, 2006).

The BWEA proposed in 2005 to move to a "multi-contracting system". Instead of a contract to be allocated to a company, with a new contracting arrangement, the contracts are between the developer and the different suppliers. The developer will be able not just to arrange liabilities with the subcontractors but also to accommodate all the stakeholder's concerns affecting the sites before the work starts. If the developer cannot guarantee that 75% of the project can be delivered they can move sites. The difficulties encountered could be related to navigation problems, archaeological, military or bird protected areas.

Offshore Wind Farm Environmental impact

The Copenhagen strategy on offshore wind power deployment report considers the assessment of the impact the installations of wind farms has on the marine environment, as one of the most important challenges the technology faces (Copenhagen Strategy 2005).

The arguments about the ecological impact of offshore wind farms on the marine habitat are considering a range of direct and indirect environmental effects are during the Commissioning and Decommissioning periods. The most significant effects are related to the disturbance to the local environment. The underwater noise, emission of electromagnetic fields and collision with energy structures are among the environmental impacts considered by

research studies (Gill 2005). The DTI (which acknowledges the inconveniences nature conservation faces with the installation of wind farms) suggest that the wind farms may also contribute to increase the biodiversity in the area. The DTI *Environmental impact study for offshore wind farms developments*, argues that the farms can offer support to some species that are a new source of food for some predators, give refuge to fishes from fishing gear and may strengthen populations by providing shelter to shellfishes and fishes (Hiscock et al, 2002: 39). In our opinion, however, this is a weak argument: upon decommissioning at some distant time in the future, the removal of the long-established structures will threaten the biodiversity supposedly created thanks to the farm.

As response of the environmental concern, the Copenhagen strategy recognizes that, according to the present biological knowledge, there are suitable marine areas of "low importance for conservation resources" . To ensure good quality assessments, there is a recommendation to use marine spatial planning instruments.

As part of the consent procedure, the authorities request the developers to include, with the application for the establishment of a farm, an environmental impact assessment. The Centre for Environment, Fisheries and Aquaculture Science (CEFAS) produced guidance notes for the EIA of the offshore wind energy farms (Cefas, 2004). The Assessment should include considerations on the environmental impact the offshore installations will have on fish habitat and resources, marine navigation, archaeology and historical uses of the seabed and bird life. The EIA must have details and design specification of the materials which will be used; the construction methodology; the equipment used and the precise location of the development. In the EIA developers should also present the decommissioning arrangements. "The decommissioned site will need to be left in a state that will no longer interfere with other uses of the sea or have any adverse impacts on the marine environment".

Despite the EIA's decommissioning requirements, we noticed during the attendance of the London BWEA Offshore Wind conference that several senior construction and installation representatives gave elusive answers, when asked by the ORED manager about design and materials considerations for decommissioning. Only the representative from the concrete industry was able to say that their pillars were environmentally sustainable. This observation, and the fact that the BWEA in their cost list quoted above did not take into account the decommissioning costs, leads us to conclude that companies and the British Wind Energy Association are not devoting much time to think through to the matter. (BWEA and Renewables East, 2006) (BWEA Offshore Wind, 2006). Our view is that, where the life cycle of the installations and cables is considered, the decommissioning plans should take on board the environmental effects. As pointed out by Gill, "ecology needs to be part of the process of ORED and at the same time offshore energy

extractors need to be made aware of their role within the coastal ecosystem" (Gill 2005).

6.3 The European dimension and the development of offshore energy in the UK

As we saw in Chapter 3, the EU offers policy instruments which are favouring the development of RE. In relation to offshore wind we identified that there three relevant policy proposals which could make a difference to the fate of the sector are a. the introduction, in the EU 7th Framework Programme, of a Wind Energy Technology Platform. (Copenhagen Strategy 2005); b. the European Council's ambition of creating a common European offshore electricity grid, which will be the opportunity of making the industry compete on fair terms with the internal electricity market. (European Council 2004: 12); c. the importance of setting mandatory targets for renewables may allow the EC to launch legal action against Member States which fail to implement Community legislation on the internal energy market and renewable electricity (European Parliament 2005).

Among the most important research fields identified by the participants to the Copenhagen Strategy are those related to turbine technical performance, meteorological forecast, grid access, storage technologies, transmission technology, the establishment of methodological environmental assessment standards. As we are writing this section, we did not find concrete signals the creation of a 7th Framework Programme Wind R&D platform.

The ambition to create a Pan European grid should be harmonised with a common quota system. At present the European Commission and other research centres are looking at the behaviour of the European member countries' quota systems, we believe that if the Pan European grid is created a previous harmonisation of the quota will have to exist. Also making mandatory the RE targets in Europe could strengthen the need to integrate Offshore Wind in the Pan European grid.

6.4 Summary and Comments

In summary, the UK's approach to encouraging renewable energy is a mix of quota, subsidy and tax schemes. The Climate Change Levy is an energy tax that should increase investment into energy efficiency and renewable energy, and RE users are exempt. The NFFO was a tendering system with a subsidy, and failed to reach the government's objective (quota). The RO is a quota system with green certificates.

The offshore wind energy case offers us a good sample to analyse how the innovation and transition process are resolved in the present policy scenario. Above we described the state of the art of an industry which has potential but needs policy reassurances and public financial support to emerge. The red tape for the consenting process should be cut. The decommissioning plans should incorporate the environmental principal and be shaped so innovatory

technology could be introduced to force sustainable standards in a way where the procedure could be not be considered an impediment for further wind offshore developments. Financial incentives should be given in Round 2 and reassurances for a long term policy which could make the projects economically viable should be in place. If the European ambition for a Pan European grid is materialized together with the imposition of RE mandatory targets, this could be an important factor for the economic development of the industry .

Chapter 7. Discussion: Answering the research questions

Concerning our general objectives using theories, our framework for investigation included an evaluation of the capacities of the UK, an evaluation of regulatory instruments and their effect on innovation processes, presence of long term planning and vision, flexibility. To illustrate the case with one example, we took the offshore wind energy developments. We wanted to look at cost, investment, technological reliability and environmental barriers for the establishment of offshore windpower. We questioned businesses on perceptions, obstacles, and current results related to the present trends of capital investment and the level of stimulus that public policy offers. We questioned them on the extent to which offshore technological reliability R&D and demonstration may depend on public funding and public research or private initiatives, we asked about the existing environmental regulation regarding offshore wind energy and if it is a barrier or a hinder for innovation? We will start by the additional questions, since their answers will lead to the answer of the main research question. The first question we will address is *What is the development of EU energy policy and how has this affected the UK renewable energy policies?*

European nations formed the European Union after World War II and banded together to fund nuclear research. This was one of a few diversifications of energy sources going on at the time. After the war, supplies of coal fluctuated and security of energy supply was a main driver for this diversification. Security of supply encompasses both physical supply (availability of fuel), and geo-politics, meaning the access to fuel whose deposits are located elsewhere. But slowly, these concerns were pushed to the background, until the energy crises of the 1970s. At that time, nations began diversifying and renewable sources of energy were given serious consideration. This process was not significant in the UK, which at that time joined the EU and supplied oil and gas from the North Sea. This supply is now declining and the UK has joined the EU in finding itself without significant indigenous sources of the fuels most used for energy. Security of energy supply has been the main driver for pushing renewable energies. They are the safest way to generate power that doesn't pollute (whereas nuclear energy still lacks truly safe waste disposal).

The environmental aspects of energy use have been a concern in EU policymaking, but up to the Maastricht Treaty, the Union had not been able to openly push this. The EU has had a transition management sort of approach, even if covertly before Maastricht. Countries are no longer sceptical of the effects of burning fossil fuels on the atmosphere, or the threats to energy security, but they have been reluctant to allow the formation of a true single market for electricity, which would undermine the monopolies of national champion companies. A liberalized market is not a system that works well with national targets such as greenhouse gas reductions, so governments need to help fund the development of innovative energy sources. They have different preferences when it comes to policy mechanisms used to stimulate

this development of the needed renewable energies. This is seen in the UK and it is affecting the development of offshore windpower. The Em's direct effects have been monetary incentives for research, for use by local governments, and directives. The effects of these incentives may have been to help generate innovation in countries that are open to such innovation, but it has upset the balance in the UK, where a different approach, cantered on harmonization rather than innovation, was more typical. Government funding for renewable energy is the second-best option (along with removal of market distorting subsidies for nuclear power), the optimal situation would be an internalization of the environmental and social costs of conventional power generation. Since that is not a realistic option at this time, and if cutting greenhouse gas emissions and achieving security of supply are key objectives, then governments must intervene into the market to push renewable energy generation and use.

Next, we will address *Who are the stakeholders influencing the UK energy policymaking processes?* Under the lens of capacity building theory, we can affirm that the actors in British energy policy are broadly divided into government institutions, such as the DTI, Defra, Ofgem, etc, and non-government agencies such as environmental organizations like Greenpeace, the media and private enterprise such as the conventional and renewable energy power companies. Historically, the energy policymaking style of the British has been based on free market postulates (except during the nationalization period), which allowed the utilities' privatization. The relation between the private sector, civil society organizations and consumers has been based in participative exercises such as consultations, and sector agreements between government and relevant industry and business. In the past years, there has been an avalanche of semi-public consultations related to energy issues, which makes the government loose credibility with the public, due to the lack of regulatory devolution to the problems raised by the consultations. The sector agreements are an opaque system geared towards economic cost efficiency and growth. There is little room for funding research, which can be considered very cost consuming relative to the innovations which come out of it. The public itself has no tradition of energy related grassroots action, they've always had ample sources of coal and then oil and gas in the North Sea, and nothing to warrant grassroots action. And until the UK joined the EU, not having information campaigns or awareness of the problems, the public has contented itself with giving to large environmental organizations so they can defend the environment or their interests. Even today, information is fragmented and access to it is a messy and complicated business, which keeps people from investing time in it. There is little tradition of setting strict targets, thus little experience in estimating achievable goals and even less experience in how to achieve them.

Generally speaking, consumers are in favour of renewable energy in an abstract sense, theyare in favour of environmentally friendly options, but passionate support will not be there for offshore windpower. The

stakeholders for an offshore wind farm comprise specific sectors of the population. A small group of consumers has been very vocally against onshore windpower, but their fears cannot reasonably extend to offshore wind power plants, which may not even be visible from the shore. Their fears that this will affect bird life are not substantiated if the power plant is well placed - birds will be just as affected by wind turbines as by electricity transmission lines and towers. There has been a backlash against onshore wind turbines placed in beautiful windy areas attractive to tourists. Voices against offshore power may be fishermen, conservation groups and perhaps the military, but that would depend on the location of the farm. Only experts have voiced concerns over the environmental impact of farms. Public support would be greater if there were a sense of ownership towards wind farms, if cooperatives or even single farmers could have a small windfarm, but that is much more difficult with more-expensive offshore windpower. The public is not very aware how their government's policies are stimulating, or not, the development of renewable technologies or nuclear power, and they have little influence in planning. They can pressure the government, but only if they think Government is not doing it's job, which seems not to be the case.

Environmentalist groups are generally in favour of offshore wind power as long as a wind farm is well located and does not cause undue harm to bird or marine life. Greenpeace teamed up with npower to offer 'Juice', electricity generated from North Hoyle offshore power plant. Both environmentalist groups and consumers, however, are mostly 'outsiders' when it comes to designing energy policy, and have no say in it. Evidence for this can be seen, for instance, at the Athens and London conferences. There were few NGOs, and the space into the agenda to talk of the environmental impacts was small. The business sector is carefully avoiding nuclear power, saying it's not an issue, so an approach that might increase their public support and thus their government support, which would mean to involve NGOs and grassroots action, is not being pursued, perhaps for fear that involving NGOs would mean complaints against nuclear and less government support. The fallacy in this rationale lies in the fact that if the lay citizen is informed and involved (directly or indirectly through the civil society organizations) he/she could put pressure on his/her member of parliament, and then the government will have to act upon it. The 2006 British government's review is creating frustration across the environmentalist movement. As we have said several times, nuclear is vigorously back into the political agenda. As far as we can see, at present with the energy review, there is no intensive nationwide campaign to mark the differences between the nuclear and the renewable energy supply. Despite 74% of people in the UK wanting nuclear power not be considered as a solution for climate change before all other energy options had been explored, the government is officially endorsing a new generation of nuclear power stations.

It is not enough to have a few NGOs denouncing the inconvenience of nuclear for gaining policy impetus on renewables. We believe that Government

commitment to RE will come from public pressure in the constituencies. National organizations need to articulate better with local agencies in a way in which local actors could be empowered through knowledge about the energy options. The information will make them able to lobby their democratic representatives. For this to happen human and other communicative resources are needed.

The BWEA as a leader in the sector should work in partnership with the voluntary sector to influence public opinion in an awareness campaign, mainly providing the funding resources and the sympathy to run the task. We noticed that in the two day BWEA Offshore Wind conference the participation of environmentalists in the panels was non-existent. Nuclear power was not perceived as a challenge in the Association's recent statements. The BWEA's lukewarm attitude at this time could go against their interest in the future if they do not build on the negative economic and environmental aspects of nuclear energy. To create awareness about the rights and wrongs of the energy options, a massive campaign is needed, in which all RE interested sectors: industry, local authorities and civil society organizations, should find a common communication strategy. For the public to act, they should believe that they can influence policy making.

Business and industry are main stakeholders. The UK's preference for cost-effective policy instruments mean that not enough funding is directed at research and development. The business sector is generally willing to diversify and invest in windpower if they are given a clear government signal, in the form of a long term plan, commitment to this plan, and economical measures. They have influence in designing how the rules will affect them, but they cannot change the philosophy of government. They would be happy to receive government funds for research and development, but as businesses with responsibilities towards their own shareholders, cannot invest in expensive technologies by themselves.

Government has the main role in promoting renewable energy. Energy Policy is managed by different departments in charge of different aspects of energy. We noticed, as many others have, that there is no coordination between programmes, funding and policy priorities. There are many policy revisions, no long term commitment to any, and piecemeal measures and policies from several time periods and in several places. The things make it very difficult to understand the framework, to know about planning, to see clearly through the muddle. We found that, concerning climate change mitigation goals, policies and financial instruments, all of these actors are dealing with this subject: the DTI, Defra, the Department for transport (DfT) and quangos (Quasi Autonomous Government Organizations) like the Carbon Trust, The Environment Agency, the Energy Saving Trust, the UK Climate Impacts Programme. In 2005, representatives from these institutions, academics and civil society agencies met to "improve the effectiveness of existing government communications on energy efficiency and other climate change

related issues by ensuring that they are more clearly linked a) with each other and b) with the issue climate change" (Futerra, 2005). Speakers at the London Wind Offshore conference were saying that most politicians are miles away from being concerned about energy policy. For them, one of the reasons why politicians are not engaged is because they represent their political parties and the people in their constituencies, who are not putting enough pressure on them (BWEA Offshore Wind, 2006). Recent experience indicates that the British public is able to influence the policy intentions on their favour if they are aware about the negative environmental consequences of a policy, as for example massive public rejection to the introduction of GMOs in the UK (IC Croydon 2003). Generally speaking, the skill of the government is undercut by it's fragmented approach to energy and environmental policy, by the presence of a myriad of organizations and departments. The influence, support and competence of the government is more focused on opaque agreements with business than on transparency and clear, target based decisions. All actors must be taken into account in this assessment, along with their relative influence and position in promoting renewable energy. Government has had it's own agenda in relation to nuclear and has not engaged in matchmaking or game management to truly evaluate and promote energy options. Skills and influence change over time, but the actors in British energy policy have remained largely stable, across sectors, and little has changed regarding their influence. Government's opportunities for game management have gone unused due to lack of openness to the participation of all stakeholders in a consultation. As stated in Chapter 2, the strategies related to energy and environmental policy in the UK have been expressed, for example, in the UK Energy White Paper, and in the Climate Change Programme. The UK is under pressure from the EU to fulfill commitments and transfer directives, which also outline strategies. The UK has been constant in their policy style and have not used available knowledge of what works best, they have not always chosen policy mechanisms favoured by the EU and have not designed a long term view or holistic strategies, instead focusing on single instrument solutions such as 'cost effective' solutions that are not always effective, only cheap.

Regarding the question *What is the development of the UK energy policy and how has this affected the sector?*, the development of energy policy in the UK has broadly followed the security of supply track: new technologies or new options are explored when the sources of fuel currently used are threatened in some way. The policy style based on nervous uncertainty and fear of making a wrong choice that will plague the country for a long time has affected the offshore wind sector in a negative way. Using the OECD's innovation dynamo, we can phrase this as the framework conditions have not been good and the science and engineering base is not contributing as much to offshore windpower as in other countries. The search for alternative fuel sources has been a positive thing, but the current cost of offshore windpower and the government's uncertainty and lack of commitment has made the offshore industry uncertain as well, fearful of investing, forecasting a bleak and

difficult future. Businesses need funding help from the government, and contrary to the UK's usual approach that market methods are best, in this case even the market is clamouring for support. The 2003 Energy White Paper was heavily influenced by the then Minister for the Environment Michael Meacher MP. Meacher represented at the cabinet the same environmental values that known NGOs are defending: no to nuclear and active governmental support (providing policy and financial instruments) to climate change mitigation measures and initiatives. Nowadays from his backbench, Meacher is critical to the government by opposing nuclear and advocating for a vigorous renewable energy policy strategy. In his critique to the 2006 Energy Review, Meacher indicated the tactical style of British politics when saying *"the launch of the energy review last week was clearly set up to pave the way for the prime minister to put forward a new generation of nuclear plants, reversing the decision the government reached in its Energy White Paper in 2003. Back then, the conclusion was that the looming energy gap - created as the old nuclear power plants are closed down - should be met by an expansion of renewables, plus much-enhanced energy conservation. The reasons the government rejected nuclear years ago are as forceful today as they were then. First, nuclear is more expensive. The government's performance and innovation unit calculated that, by 2020, offshore and onshore wind could generate electricity at 1.5p to 2.5p per kWh and 2p-3p/kWh respectively, but nuclear would be 3p-4p/kWh. Analysts and market advisers have said that the City would probably not invest in new reactors unless the government underwrote loans, provided tax relief to the industry, or imposed a new nuclear levy on all of us" (Meacher 2006)*. Concerning the theoretical base we introduced for the analysis, we can see that there is no long term plan, no vision. The planning tradition in Britain is of short term, piecemeal, fragmented policies and approaches towards solving specific problems as they pop up. There is no foresight or anticipation of trouble. The 2003 Energy White Paper set out a long term inspiring vision, signalled commitment and established the necessary preconditions for successful transition management, leaving room for innovation in an RE based energy system. But Michael Meacher, the man responsible for this vision, was sacked soon afterwards for being too much of a political troublemaker. There have been many revisions of energy related plans, exactly because Government cannot agree on a strategy. Different actors are allowed to pursue their 'myopic' goals that don't add up to a coherent strategy, there are barriers to innovation in the form of costs, the belief that wind power is 'not credible', and there are barriers in the form of incremental change, for fear of something too radical and uncertain, different departments are in charge of related areas and do not always coordinate on goals. The policies used to achieve the short term and conflicting goals Government has set have not been wholly effective, and this will be explored below. There is no commitment. The irony of this situation is that if a plan were made and stuck to, managing the transition towards this plan would solve much of the insecurity present in the current system. It's a Catch-22 kind of situation: no commitment causes uncertainty, uncertainty causes lack of commitment.

What strategies does the British government have in place to stimulate the (large scale) development and implementation of offshore wind power plants? Government's preferred policy incentive mechanisms have not created enough funds to help the offshore windpower sector take off. The strategies the government does have in place will not foster large scale development and implementation in the short term, and may not foster large scale implementation at all. About the specific policy instruments being used, the British approach to encouraging renewable energy is a mix of quota, subsidy and tax schemes. The Climate Change Levy is an energy tax that should increase investment into energy efficiency and renewable energy, and renewable energy users are exempt. The CCL has had a low contribution to innovation, and the covenants in the form of Climate Change Agreements have not produced innovation in the offshore wind sector. The NFFO was a tendering system with a subsidy, and failed to reach the government's objective (quota). Under this system, companies bid for contracts to build and operate windpower farms, but since there was no penalty for not building, companies tried to outbid each other until the prices were too low to allow for construction. This happened in rounds, and some projects both from Round 1 and 2 still have not been built. The RO is a quota system with green certificates, but the design of the mechanism is not optimal. The certificate market is unstable because no long term contracts are made (in fear of the government changing it's mind again), the quota objectives have not been set far enough into the future to cover the operating life of wind farms being built today, so developers cannot be sure of the return on all of their investment. The design of the certificate system without a minimum price means it's actually in the market's interest to not fulfill the quotas, since when that happens the certificates will be worthless. These uncertainties contribute to large risk premiums being charged by moneylenders, further affecting the offshore windpower sector in a negative way. It keeps smaller companies and cooperatives from entering the market, and their presence could potentially reduce the public opinion backlash. The design of the RO and NFFO subsidies did not even provide enough incentive to encourage full deployment, let alone create innovation. Since there is no long term plan, there have not been any sort of well designed technology forcing standards.

How are energy, environment and technological innovation policies working in the UK in relation to the double goals of energy security and mitigation of climate change? A transition management framework would require us to examine the scenarios in which the government is designing their goals, how policy is stimulating knowledge and technological change, how long term goals are perceived by short term policies, how the government stimulates, mediates, and engages in brokering services, creates the right conditions, enforces its laws and engages in steering. It's hard to look at all these since there is no long term planning, no long term policies, just a plethora of goals and aspirations, but no concrete route plan to achieve targets which includes scenarios under which policy design is taking place, except for business-as-usual reality. We can say the 2003 *Energy White Paper* is the UK's renewable

energy policy framework. Specific goals towards RE development and non nuclear power were considered to meet energy needs while mitigating CO_2 emissions and guaranteeing security of supply. Three years after the white paper was issued, we find that there is no intention to transit the path towards renewables as was stated. The government endorses nuclear and is planning to extend the renewables subsidy to nuclear electricity. In order to avoid conflict at parliament the energy White paper won't be amended and the new nuclear impetus will be hidden (The Guardian, May 2006a). With this recent outcome, the 2003 White Paper is a misleading policy tool and will be used to cover one of the worst solutions for the environment and the pockets of the tax payers.

An example of incompetence in policy implementation is the systematic neglect of the development of knowledge or technological change that's been done by companies committed to learn in spite of lack of government support. The government's involvement limits itself to assigning the market the responsibility of making offshore wind take off.

Under the lens of innovation, we can first state policies that generate innovation (system innovation policies): technology forcing standards (when risks are large and there is a consensus on their severity), innovation waivers, tradeable permits and R&D subsidies, and network management to teach everyone about problems and solutions. In the UK, waivers have been in use for a long time, and they have been ineffective at generating innovation. Tradeable permits are being used, but their design is not optimal and they have not caused the investment of typically small innovative firms in the offshore wind power sector (neither the onshore, for that matter). R&D subsidies have been negligible and are not even expected by a large part of the business sector. Government's network management has been non-existent. Technology forcing standards have existed for some environmental problems, but not for the big and complicated energy related ones we face now. Thus we can argue that the UK has not been keen to, or good at, generating RE system innovation. Policies that diffuse innovation or cause incremental innovation (system optimization policies) are technology based standards, taxes, covenants, investment subsidies, communication measures such as labels, environmental management and auditing, and network management. There has been little environmental management and auditing related to the energy sector in the UK. There have been taxes, covenants, technology based standards, these last ones not always successful and untypical of the UK policy style until the mid 90's (setting clear standards). Investment subsidies exist but have not encouraged innovation in the offshore wind sector. A more general view of policies that are helpful for innovation include ideas present in transition management: sustainability foresight studies, which have not been done in the UK - the current energy review is purportedly one of these, but it is not truly evaluating all or even many options, it's evaluating the feasibility of the nuclear industry. The lack of planning has caused muddled expectations and lack of clarity. There has been no strategic niche

management. At this point in time, it may be that the UK can no longer be competitive or leader in alternative energy technologies, due to the lack of innovative policy and research into those options. Under these circumstances, nuclear power is the only carbon free technology they can use to achieve their Kyoto targets.

How has politics in the UK led to lack of development of the offshore windpower sector? In terms of structural framework conditions, we will look at use and interpretation of knowledge (technical information related to the policy field) and cultural aspects; formal and informal rules, norms and politics; and economic situation and wealth available to deal with a problem. Regarding the use and availability of knowledge, there has been a long debate on whether environmental degradation is real, on whether it's a problem, on if and how it should be responded to. The EU, at least rhetorically, applies the precautionary approach to environmental and energy policy-making (for instance signing the Kyoto protocol and imposing renewable energy targets), and there have been disagreements in the UK regarding following this approach. The relations between the EU and the UK are thus part of the structural framework conditions. Another part is the internal wrangling between companies and Government in Britain, the offshore wind sector is loosing influence over the government, perhaps due greatly to the nuclear possibility and public support given to other renenewables like biofuels. The popular paradigm governing renewable energy, the environment, science, is crucial (for example, the application of the 'ecological modernization' paradigm or discourse to the way they see and solve problems, the conflicts generated by the scientific proof (or lack thereof) of global warming - in part a result of the positivist science paradigm. For more discourse, see Dryzek, 1997). The norms and politics can be divided into 'participative capacity', meaning the openness of a system or society to it's citizen's participation, 'integrative capacity', meaning the level of coordination and cooperation between different government departments or even sectors of society, and 'capacity for strategic action', meaning the possibility of designing long term policy in the face of short term conflicting interests. In the UK, participative capacity for energy policy is low, there is a messy availability of information and public discussion is not very prominent, there is a general trust by the public and a general opaqueness to Government. Integrative capacity is also low, the fragmentation of responsibilities, regulations, responsible actors, translates into lack of strategy, lack of long term planning and commitment. Capacity for strategic action is low because of the lack of integrative capacity, long term planning seems not even to be aspired to. Regarding the public's demand for environmental solutions related to their economic situation, we see that given the UK public's apparent trust in their government, allied to their donations and contributions to environmental NGOs, they feel confident to have done their part and don't actively demand more energy solutions from their government. Their average economic wealth makes them a society that could press their government for more environmentally friendly regulation, for example, but they are mostly content not to. There is a past of

gas and oil wealth that makes the public detached from the current energy crisis, only reacting to prices hikes.

Physical availability and access to fuel, depletion in the North Sea, high energy prices, lifetimes of power plants coming to an end, plus environmental concerns such as global warming, have all created opportunities and drivers for change. The current state of the art in wind power lends itself to help solve some of the problems. The situative context for successful energy and environmental policy exists, but the strategy favoured by Government has not been very successful at addressing the problems. Negligible funding is directed towards research, market mechanisms are favoured but inefficiently designed, commitment is lacking, targets are not being met. Innovative policy has not been present. Of course, the problems' own character influences the capacity building process: they are all hard or costly to solve, so the government is denying funding that business needs to help develop solutions, these solutions challenge vested interests, are based on imperfect or incomplete knowledge, are in need of research, and involve politics and diplomacy. The environmental aspects mentioned are not close to most people's realities, governments are not under substantive pressure from most of the population. Solutions are hard to negotiate and carry out. All of this is present in the UK, perhaps in even stronger measure than some countries.

Regarding synergy between departments and the strategic policy agenda, the goals and aspirations of the 2003 Energy White Paper are very related to the Climate Change Programme set up in the year 2000. Carter and Lowe say that the traditional approach to environmental policy in the UK has been done through different governmental structures, and legislation related to environmental protection were in the past and still are part of the common law, statutes, agencies, procedures and policies. The authors are also describing the fragmented approach to environmental policy that the government has. DEFRA is dealing with matters beyond their competence and the DTI too is dealing with many issues related to the environment (Carter & Lowe 1998:22). The authors say that "there has been not overall environmental policy other than the sum of these elements, most of which have been pragmatic and incremental responses to specific problems and to the evolution of scientific knowledge: a tactical rather than strategic approach". In 2006 the pattern is the same with energy policy, which has been consistent with the style across the years. For instance the nationalization and posterior privatization of the coal industry, the privatization of utilities, the oil and gas North Sea supply which is heading towards a vertiginous depletion and the present energy review, called by some environmentalists "the nuclear review", are all more tactical political moves than strategic vision.

We can summarize the discussion by stating that, regarding transition management, there is not long term planning for any kind of transition, and what goals there may be are ad hoc and the transition towards them is likely to be as ad hoc. According to capacity building theory, the actors in the UK

that have the responsibility of designing renewable energy policy don't have the skills or the freedom to design strategic long term planning. The problem solving strategy has come down to short term opaque agreements between government and business and the use of market mechanisms, but these have not been consistent over time, well designed, or holistic. Long term planning or goals are missing. The offshore wind sector needs more reassurances and financial support. Lack of public participation, perhaps lack of information, especially by the public, opaque policy-making and lack of capacity for strategic action are all features of the UK's structural framework conditions related to energy and the environment. The problems that need to be solved are difficult and no easy solution exists - but a short circuit will ensue if they are not dealt with. Policies have not fostered innovation and investment and the government has not done its part to fulfils it's stated goals over the years.

Chapter 8. Concluding Comments

We can conclude that the UK lacks a well designed energy policy strategy which could foster the development of economies of scale of RE. The reasons could reside in the lack of government's willingness to create the capacity for a successful environmental and energy policy[17].

While we were writing this conclusion, we heard that the UK government is endorsing a new generation of nuclear power stations. On the grounds of climate change and security of supply the nuclear industry is going to receive an extension of the current renewables subsidy. This fact confirms what we identified in the study: British policymaking is affected by the prevalence of political short term interests over long term strategic planning. This policy style does not contribute to a genuine democratic process where the public is informed and clearly consulted on the pros and cons of the energy options available to them. These same interests prevent long term commitment and the development of skills on the part of actors towards successful renewable energy policy. This and the difficulty of the problems themselves keep radical innovation from happening. How could the situation change? This will depend on several things, as for instance more political opposition to nuclear, EU directives on safety and RE mandatory targets, if the costs of nuclear power were put up for public consideration, with a campaign effort to increase public participation in the decisions of strategic options. Another relevant influence could be, despite the lack of governmental commitment and support, the hope and investment that companies such as Vestas and Shell are putting into the UK wind offshore industry.

Switching to a feed-in system would go along with the targets that have been set, would diminish risk for investors, and might even make the UK market leader in new renewable technologies such as wave and tidal energy, but it seems unlikely the UK will think of that mechanism as a real alternative given their historical approach to policymaking. If the UK wants to fulfill the targets it set itself, and still keep using a quota system, it could signal more political commitment. It will take some time for that to be built since trust in the government's support fluctuates. This commitment hopefully will encourage long-term contracts for production and certificates to become more widespread. This commitment would also reflect itself in the removing of barriers for obtaining permits and for planning in general - making these processes more streamlined and less cumbersome. Ofgem, the energy regulator responsible for the certificate system, is adapting to new target-based policy, as are other departments and institutions within government. This adaptation might clear the way for planning and permit procedures. The RO could be slightly modified to add a minimum price for the ROCs (renewable obligation certificates), making sure that the value of the

17 Understood as a well designed strategy consisting of clear goals, long term planning (which includes clear and achievable targets) and the creation of public awareness and participation in all efforts towards RE and energy efficiency

certificates cover at least minimal operating expenses for the current RE producers - but it can't be significantly changed for fear of losing industry trust. The RO could further be modified (although this may be too significant a change) by not recycling the penalty back to compliant suppliers, but using it to fund research into the less-cost-efficient technologies or as subsidies for new RE producers. In the case of offshore wind, which is not as mature as onshore and is still in need of research, funding for research in the UK might help fulfill it's goal of being a world leader in that market. We coincide with the offshore renewable energy business sector in the idea that for the these technologies to succeed, the government should develop regulations and provide financial tools aiming to give enough guarantees to the industry that offshore wind energy is here to stay. Subsidies for R&D and credit facilities should be offered to the developers. Considering that the costs of raw materials have been rising, we have proposed a windfall tax on fossil fuel earnings, to assist the offshore wind industry.

Public acceptance could be improved by information campaigns, and perhaps by the perceived commitment of the government. We believe that the offshore wind industry, represented by the BWEA, can win more if it opposes, in public, nuclear energy, and shows a clear rationale as to why an all renewable energy system (with not just wind) is a better option. A big reason for this is the political intention of extending the RE subsidies to nuclear power, this could endanger the whole industrial take off. The barrier for the BWEA is that some of its stakeholders are colluding with the nuclear industry. We believe that if the industry's environmental concerns are matched with those from the environmental movement, the increase (at economic scale) of offshore windfarms could be more easily achieved. A solution could be the creation of alliances between the sectors with common terms of reference regarding a communication strategy aiming to empower the public on the pros and cons of the available energy options.

The European Union has a role to play, by it's role in the provision of directives. We believe that the European Parliament's recommendation for the creation of mandatory RE targets will make a huge impact in the offshore industry. The harmonization of the quota systems and policy incentives also has to be considered among the challenges to work on before the integration of an offshore Pan European electricity grid. This will allow the sector to compete fairly in the energy market and furthermore could help the industry bypass some of the domestic difficulties discussed in the study. The standardization of policy mechanisms to further renewable energy deployment could give a signal of stability to the offshore investors in Britain. The EC has also a role to play in impeding the British government's intention to extend the RE subsidies to nuclear power.

Recommendations

To the British Government

- Be committed to strategic planning with clear achievable targets;
- Consult at national level for the energy options proposed to mitigate CO_2 and energy security of supply;
- Inform the public and policymakers about the nuclear costs and how much the public purse will have to pay for it;
- Inform the public about the nuclear hazards and the consequences for future generations of the nuclear waste;
- Maintain consistency with the quota system;
- Be more committed to positive regulations and funding support for the wind offshore energy industry;
- Restrict the use of RE subsidies to the RE sector;
- Explore the feasibility for a windfall tax from other industry's earnings, to support renewable energy RD&D and economic scale development;

To the EU

- Set up RE mandatory targets;
- Create a directive restricting the use of RE subsidies to forbid an extension to nuclear energy;
- Reach, in the near future, a standardization of certificate systems and policy mechanisms for the promotion of renewable energy;
- Clearly inform the public of the real costs of nuclear and safety hazards;

To the offshore wind energy industry

- Send a clear signal for the RE offshore sector against further deployment of nuclear reactors;
- Begin an effort from the RE offshore sector to work in partnership with environmental agencies to raise awareness about the current energy options and a clear position against nuclear;

To national environmental agencies

- Articulate with local agencies with the view of raising awareness, at local level, about the energy options;
- Put pressure on the EC for directives which could, for instance, restrict the use of subsidies only to renewables;
- Put pressure on the EC to inform the public clearly about the real costs of nuclear and the safety hazards;

To the local groups

- Inform local citizens about the energy options, pros and cons of nuclear and RE. Ask them to influence their members of parliament on the topic.

Self-Reflection

Our targets when we started writing were unclear at first. With the help of our supervisors, we refined our objectives, our choice of theory, and focused on offshore wind. We learned very much, not only about what we were writing but about how to structure our work and carry out independent research. Our work is very much our own, we had less supervision than we were used to, and opinions expressed are ours.

Our research has turned up subjects we had not been aware of before starting. One example is the idea of decommissioning - it seems no one in the offshore wind industry has given it much consideration, and we were actually invited to participate in consultations on the topic. These interactions exemplify that the outcome of this project is more than what's written here, it's possibilities for the future. We are considering submitting part of our research on this as a paper to the EWEA 2007 conference, in the hopes that we can share our knowledge and affect the direction of policy on this issue.

This topic of decommissioning is one of the things we uncovered that could be the basis for a new project. There were lots of things we could not explore further due to time and space constraints. We had the opportunity to carry out interviews in Denmark, with the president of Vestas Offshore, with specialists at Risø National Laboratory, but unfortunately could not. Further research could be carried out in the direction of public participation and how the BWEA could engage the public and NGOs, or it could study the feasibility of a windfall tax. We are sure readers will be able to identify other opportunities.

Our choices of theory were perhaps a bit broad, we could have afforded to narrow our choices down, and in terms of methodology. Attendance to conferences and interviews with experts were of unimaginable help. More interviews may have been beneficial, but overall, we find that the quality of our data is good and we see our results reflected again and again as we read about the subject and see other conclusions to the same questions. We had hoped to use best practice examples from other countries such as Denmark, Germany and Spain, and we did not have the time or space to specifically analyze cases, but we did get the gist of the policy and methods favoured, and we learned from this.

In our assignment we haven't been able to discuss the preferential treatment the EU gives to the nuclear industry, through R&D and decommissioning funds. But we believe that, if the EC stops subsidizing the nuclear industry, RE will be able to develop which much more impetus than now.

We had a great time doing this project, and are happy that our cooperation was so fruitful. Doing research for this report was instructive both in subject and method, and we are glad to finalize this paper.

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Annex A. Policy incentives for renewable energy

Security of supply encompasses both physical supply – availability of fuel, and geo-politics, meaning the access to fuel whose deposits are located elsewhere (Green Paper, 2000, The Economist, 2006). The liberalization has been an uphill battle for the EU, against national champion power companies and national governments. A liberalized market is not a system that works well with national targets such as greenhouse gas reductions (Morthorst, 2003). The liberalization of the electricity market means that renewable energies cannot compete on their own in market terms. Since externalities associated with conventional power sources, such as environmental and health costs, are not being internalized, and subsidies for conventional power are still present, the second-best solution is to use payment methods for renewable energy as well. If cutting greenhouse gas emissions and achieving security of supply are key objectives, then governments must intervene into the market to push renewable energy generation and use (Morthorst, 2000).

First and foremost, this intervention into the market must signal political will, a long-term public policy framework and a willingness to pay for renewable energy. Without these, support measures will create disappointing deployment. Support mechanisms for renewable energy must include a grid-access component (with strategic grid development), a profit-guaranteeing component, streamlined and appropriate administrative and planning procedures, and public acceptance (Gipe, 2006, Morthorst et al, 2005). Many RE technologies suffer from lack of access or distance to the grid, aside from planning and various permit procedure barriers.

Incentives can be given in association with one another, as is done in many countries (ECN, 2005). There are both technology-push and demand-pull kinds of possible measures. Technology push measures are, for instance, different schemes for funding research, and therefore they are measures related to the RD&D phases. Demand-pull instruments could include setting minimum quotas of renewable energy generated electricity that must be purchased by the power sector and customers, incentives in the form of taxes, and trading schemes, in other words, policies that stimulate the latter phases between creation and competitiveness (Strachan et al, 2006). There are other ways of 'classifying' measures, for instance in direct and indirect subsidies (which incentive 'clean' energy and punish 'dirty' energy, respectively), or as quota and feed-in systems. There is much discussion about which of these last systems is best to achieve the Em's objectives related to energy security and carbon reduction. Gipe (2006) says both systems require a government-set target and use market mechanisms, the quota by establishing a deployment target and letting the market set the price, and the feed-in by establishing a price and letting the market determine how much deployment there will be. He adds that, according to EU data, the feed-in system is not more expensive than the quota system, which is widely claimed by quota-supporters, and also says that quota systems stimulate competition between power plant develo-

pers, whereas the feed-in system stimulates competition between power plant product manufacturers. Morthorst et al (2005) claim the it's not the system that matters, but the 'philosophy' and 'intellectual coherence' that bind a set of measures and it is these that must be harmonized across countries. At the European Wind Energy Conference and Exhibition (EWEC 2006), held by the EWEA (European Wind Energy Association) in Athens late in February, Morthorst (2006) added that he thought a combination of systems was actually the best solution.

The Danish government is a prime example where it concerns the development of wind energy. There has been consistent, long-term support available for the last nearly 30 years. The specific measures have changed to reflect the maturity of wind energy, from funding for pure research to help in demonstration and trials, all the way up to a feed-in system where renewable energy generators get paid extra to generate wind, and an obligation of conventional power companies to have a certain percentage of renewable energy in their portfolio. They tried switching to a green certificate system, then gave that up and returned to a feed-in system (Strachan et al, 2006, Agnolucci, 2005b). The EU has been trying to set up incentives for an EU-wide RE deployment in a liberalized market, and they are designing green certificate and emissions trading markets (quota systems), aside from subsidizing research.

When designing support schemes, it must be decided what technologies will be supported. Differentiated schemes give technologies at different phases of development a chance to mature until they don't need support, and the logic is that we don't know which technologies will prove the cheapest in the future (Morthorst et al, 2005). This article will focus on ways to make renewable energy more attractive, but the reader must not forget that a truly comprehensive energy strategy, including all sources and uses of energy, must be set out if the largest problems looming ahead are to be dealt with efficiently.

Fiscal Measures: Subsidies, Taxes and Tax Exemptions/Rebates:
These don't include a grid-access component, only a profit-guaranteeing component. They can be divided into capital investment subsidies, which stimulate the installation but not the production of energy, and production subsidies, which reward the final product. There are also low-interest loan schemes, which allow the participation of anyone interested in investing (Gipe, 2006). Tax exemptions can take several forms: RE producers are exempt from energy taxes, or get tax refunds, there are lower VAT rates for RE, investors are exempt from taxes on their RE power plant investment. Another form of RE promotion involves customers willingly paying extra on their bills, which then would go to RE producers, but willingness to pay depends on economical factors and sufficient information, aside from trust that the funds will go where intended (ECN, 2005).

Quota Systems

Quota systems are more complex to design compared to feed-in systems, so it's more difficult to get the design right. The term 'quota system' is frequently made synonymous with market mechanisms because the market determines the price. Defenders say it will prove to be cheaper than feed-in systems in the long term (they argue the system hasn't been extensively tested yet, so this claim hasn't been proven), if it's designed with realistic, increasing-over-time targets, and long-term contracts. It can be designed as technology neutral, but this effort to not 'pick winners' does exactly that due to different development stages and thus costs (only the cheapest technologies get developed) (ECN, 2005, Gipe, 2006). Quota systems can involve a financial obligation (not coupled to a purchase of physical electricity obligation) and/or a physical obligation (ECN, 2006).

Tendering processes

A tender process, meaning the call for proposals to set up a production area, thru competitive bidding for a power purchase agreement (PPA), a long-term contract or a government fund, has been described as a feed-in system with the price set by the market (Milborrow et al, 2006). Therefore, I have placed it as a quota system, since it usually reflects a government wish for a certain amount of deployment. It provides variable cycles of development because of the intermittency of the tender process itself, whereas other mechanisms can provide more stable (and larger) increase in deployment. Danish offshore wind projects use this system, and it's been responsible for ample deployment of wind in North America. The British NFFO was a tendering process. In practice, this has shown some problems. Since the objective is low prices, some contracts that have been awarded have never been built, when the developers realize that it will cost more than their winning low bid provided for (ECN, 2005, Gipe, 2006).

Green Certificate Systems

They can both be a system of proof of the production or consumption of renewable energy, and a political tool (the difference is whether it's voluntary or mandatory). In the case of a political tool, the government sets a minimum quota of renewable energy (RE) a country needs to use. This quota will be set above the current availability of RE and can be imposed on producers, suppliers, or consumers. RE producers sell their energy at market prices and get certificates for the amount of power they produce, which represents environmental credits, and which they can then sell to the consumers who must meet their quotas. Quotas will not be met unless there is enough supply of green electricity, thus this development is stimulated, and green producers get a return on their investment (RE is still more expensive to produce than energy from conventional power sources, and under this system they get the same price as conventional producers to sell their RE). So in essence green producers sell both the electricity they produce and the environmental value of it. It's possible to limit the participation of non-new producers, which may add risk to the market (Nielsen & Jeppesen, 2003, Morthorst, 2000).

Compliance from consumers is ensured by sanctions and high-enough penalties, but the presence of the penalty means that the overall quota objective may not be met. There is a maximum and sometimes a minimum value for the certificates. Above the maximum, where demand outstrips supply, consumers can pay a fixed penalty price (the maximum price, thus the highest price a certificate can reach). At the end of each period, say a calendar year, consumers will turn over their certificates so the government can verify compliance. The value of certificates bought then goes directly to the RE producers, and the penalties paid can go to a renewable energy fund that will provide subsidies, or they can be recycled back towards compliant actors, or go towards government or administrative costs, depending on the country. The trade eventually slows as more capacity is added. The price of the certificates will be determined by their supply and demand, so it follows that the quota and the maximum and minimum prices must be set at a rate that actually stimulates the development of RE. A quota that's too high means it's cheaper to pay the penalty price than to buy much-in-demand certificates, a quota that's too low means there won't be enough funds to stimulate adequate development or even addition to existing RE capacity. The maximum penalty needs to be higher than investment costs in the long term, and the minimum needs to cover at least the RE producer's costs. The quota needs to be set close to the expected generation, in order to stimulate new deployment instead of generating a lot of profit for existing producers (if the objective is to develop new facilities. If the quota is too low, there is no incentive to invest in new facilities because this quota can be met by current producers, but if it's so high there will never be enough producers to meet it in the period it's valid, the penalty is paid more often than certificates bought, and in an arrangement where the money doesn't get recycled back to producers, there is no new development). Sometimes weather conditions from one year to the next can influence the amount of RE produced, so a diversified portfolio reduces price fluctuation in this case. Under most circumstances, the price of certificates will be highly volatile, given the inelastic demand (set by the quota. This can be made more elastic, see below) (Ibid, ECN, 2005, ECN, 2006, Fristup, 2003).

Since there is a financial market for the certificates, the influence of the quota must be taken into consideration for this as well, and revisions of it may be necessary when development is reaching the quota. At that point, the government must decide if it wants more RE, or how to deal with the now valueless certificates. The quota can be used as a long term planning tool, because if it's set at the right level it provides investors certainty that they can make large long term investments and get returns. The validity of the certificates can be made limited or infinite, in the latter case it then permits 'banking' and can decrease demand volatility. Supply side volatility can be decreased by a diversified portfolio, and by setting price maximums and minimums. This also serves to increase investment. Financial risks for producers, both established and new, need more study. Lemming (2003) has

identified that the critical risk factors are fluctuations in production and lack of information about supply and demand. The author says production and certificate price are negatively correlated, so fluctuations in production will decrease short term risks even as lack of information increases risk premiums. The author adds that selling forward contracts (as a hedging mechanism) actually increases risk, and that the fluctuation of certificate prices is a natural hedging mechanism.

A certificate system works best if it's international, by stimulating the development of RE where it's most cost effective. Diversified sources of energy may be at different stages of development, and might need additional subsidies until they can be competitive (Ibid). For international trade to happen, though, the definition of a certificate must be the same, such as the technologies covered by it (countries vary in their eligibility of hydropower, wind, biomass and biogas, solar, etc), the types of production eligible (electricity, heat, gas), the validity and maximum and minimum prices, and mechanisms to initiate demand (voluntary or mandatory). There has been some discussion on whether certificates constitute state-aid and how this harmonizes with EU law. Subsidies and tax breaks can be considered uncompetitive and costly, as can differing national rules for certificates traded internationally. Subsidies for new deployment of renewables in a certificate market are also uncompetitive. The EU itself can establish a market for certificates or it can harmonize already existing national markets. In any case, state aid is acceptable on the grounds of environmental protection, to help producers internalize environmental cost and eventually be competitive. Thus, it's temporary, and it's compensation for the lack of internalization of externalities in the conventional power industries (Nielsen & Jeppesen, 2003, Fristrup, 2003, Morthorst et al, 2005).

There is some capacity building that needs to be done to set this system in place. An institution to issue the certificates, another to monitor this process, and an overall supervisory body are needed. The purpose of the certificate system should be defined: is it for monitoring, for more RE deployment, which technologies will be eligible? Also, careful consideration of the price caps and quotas is called for. Comparable certificate content, along with all these practical considerations, is crucial to allow international trade. Trade can be set up for futures as well as current markets, and should be brokered and monitored (Nielsen & Jeppesen, 2003, Morthorst, 2000).

The interactions between green certificates and emission permits

Markets for CO_2 trading will interact with markets for green certificates. Hindsberger et al (2003) say that emission permit costs will be (positively) related to the spot market price for electricity: meaning if permit costs go up, so will the electricity price on the spot market, and green certificates are negatively related to the spot market price: meaning if there are more green certificates and the value of each of them is less, that implies more renewable energy, which has cheaper operating costs than conventional energy, so the

electricity generated from them will be cheaper. This in turn has an effect on the certificate price, and Jensen and Skytte (2003) conclude that the relationship between consumer prices and green certificates in 'ambiguous'. They argue that an emission trading market can be used to increase renewable energy deployment (as well as reduce emissions), and that a green certificate market will help reduce emissions (as well as increase RE deployment). In an earlier paper they say that the introduction of a green certificate does not necessarily mean that consumer prices will go up, and the introduction of an emission permit means that consumer prices will go up. This has implications for the interaction between the two markets. They conclude that, if the objective is to increase renewable energy use, the green quota is sufficient and best at reducing consumer prices, but if the objective is to reduce emissions, emission quotas should only be used when consumer prices have risen as a result of green certificates, otherwise only green certificates will suffice. These results apply to single countries, but in an international market, it's different. Morthorst (2003) tells us that in an international market, the targets set for renewable energy in each country will add up, and (in the long term) equal the deployment in the whole market, but not according to each country's individual goal. Thus countries with ambitious targets will be subsidizing countries with less ambitious targets and will not be able to claim the associated carbon reductions. This situation applies independent of the policy mechanisms used to stimulate development. One possible solution to this is the adoption of emission trading, coordinated with the green quota: if more renewables are to enter the power market then emission targets should be set lower, in other words, if the two markets are coordinated the full benefit from both of them may be achieved, even if this only happens in one country of the international market. The author shows that emission reductions are greatest in a coordinated system. Hindsberger et al (2003) say that the dynamics between green certificates and emission permits that can stimulate the deployment of wind energy are exactly the ones that don't stimulate deployment of other energies needed to balance an electricity system with large amounts of wind power.

Feed-in systems

These guarantee the RE producer a fixed price (premium) or percentage (depending on the country) above the sale of the RE in the market. This sale can be made by the RE producer, or by another body designated for this purpose, and the electricity can be traded at a spot market or sold directly to consumers. These contracts are awarded for the lifetime of the power plant, so it stimulates rapid deployment and can substantially increase the volume of RE power being produced. These have been called Standard Offer contracts in North America, and currently more specialized feed-in contracts have been designed, which differentiate by technology, project size and location, limit time the plant receives feed-in payments (to 15 or 20 years, for ex.), and have scheduled reviews. Germany was the first country to use 'advanced renewable tariffs', and they have helped solve the 'wind rush' problem, where the best sites were taken over by less mature technology and public acceptance at these sites dipped. They instituted a higher feed-in at less windy sites, to be reviewed when a clearer picture of wind production and cost emerged (5 years later) (Gipe, 2006). The feed-in system (not advanced renewable tariff) can be rather rigid, because if costs or interest rates fall, if inflation is low and productivity is good, then RE producers will be getting a high tariff for what they are producing. Conversely, if costs, interest rates or inflation rise, their tariff may turn out not to be a profit anymore (Morthorst et al, 2005, ECN, 2006).

Conclusion

In fact, policy incentives for renewable energy serve different purposes. If the objective is to quickly increase deployment, the feed-in system has shown itself more suited (even though this claim is questionable, since quota systems still have 'teething problems'). The feed-in is claimed to be more expensive in the long run, based on high tariffs set in the early tests of this system, but that doesn't have to be the case any longer. Subsidy schemes are good for research and development, but they don't guarantee production or grid access in and of themselves, and the same goes for tax incentives and voluntary action. If the objective is cost effectiveness, with no regard to how quickly targets are met, the quota system may be best, but only if it's designed correctly, from the start. The presence of long-term contracts seems to be an effective tool for RE development under both feed-in and quota systems. Investors are reluctant to put a lot of money into capital-intensive power plants until they receive a clear government signal of interest, long-term planning and support.

Annex B. Conferences and Interviews

We attended 3 conferences, where we carried out most of our interviews for this assignment. The EWEA and BWEA conferences, especially, were very worthwhile, we gained much knowledge, confirmed a lot of our findings, and were able to listen to and speak to experts in the field. These two conferences were aimed at the business sector and so were fairly expensive. There were few students or members from NGOs, some academics and researchers but not many. Significantly, most of the representatives from the UK were consultants or from the finance and insurance sectors, with no turbine manufactures and few researchers.

The first conference was the UNEP Risø Centre seminar The Global Energy Challenges, in Copenhagen, January 13, 2006. This event was mostly about energy and poverty, it was informative but turned out not to be particularly relevant to our assignment.

The interviews carried out were all informal, we did not want to lose fluency in the dialogue or intimidate our interviewees. At the EWEA EWEC 2006 (European Wind Energy Association, European Wind Energy Conference and Exhibition, Athens, 2006), we spoke to Gordon Edge, head of offshore wind of the British Wind Energy Association (BWEA), a member of Wind Engineering International Journal, a PhD student from Glasgow University, and two members of the Renewable Energy Agency for the East of England (REAEE). These were carried out over February 27-March 2, 2006.

At the BWEA Offshore Wind conference, we spoke to Duncan Ayling, student, Megan McMichael, from PRASEG, had a 'group interview' or conversation with David Milborrow, consultant, Peter Fish, from SLP, and Joseph Kim from the American Embassy. We received enlightening explanations from Nigel Scott from Garrad Hassan, and spoke to Corinna Nunneri, PhD student, and Tyler Chapman from Macquarie, the latter outside of the conference. These interviews were carried out April 2-5, 2006, in London.