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List of abbreviations

German abbreviations

BDI	Bundesverband der Deutschen Industrie (Federal Association of German Industry)
BMU	Bundesministerium für Umwelt, Naturschutz und Reactorsicherheit (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)
BWE	Bundes WindEnergie (German Wind Energy Association)
CDU	Christlich Demokratische Union (Christian Democratic Union)
CSU	Christlich-Soziale Union (Christian-Social Union)
DENA	Deutsche Energie-Agentur (German Energy Agency)
DEWI	Deutsches Windenergie-Institut (German Wind Energy Institute)
EEG	Erneuerbare Energien Gesetz (the Renewables Energy Sources Act of 2000)
FDP	Freie Demokratische Partei (Free Democratic Party)
ISET	Institüt für Solare Energieversorgungstechnik (Institute for Solar Power Supply Technology)
SPD	Sozialdemokratische Partei Deutschlands (Social Democratic Party)
StrEG	Strom-Einspeisungs-Gesetz (the Electricity Feed-in Law of 1991)
VDEW	Verband der Elektrizitätswirthschaft (Association of the Electricity Supply Industry)
VDMA	Verband Deutscher Maschinen- und Anlagenbau (German Engineering Federation)
VDN	Verband der Netzbetrieber (Association of Electricity Network Operators)
VIK	Verband der Industriellen Energie- und Kraftwirthschaft (Association of the Industrial Energy and Power Industry)

British abbreviations

BWEA	British Wind Energy Association
CCGT	Combined Cycle Gas Turbine
CCL	Climate Change Levy
CPRE	Campaign for the Protection of Rural England
CPRW	Campaign for the Protection of Rural Wales
DTI	Department of Trade and Industry
EWEA	European Wind Energy Association
ESI	electricity supply industry
EU	European Union
FoE	Friends of the Earth
GW	gigawatt
GWh	gigawatt hour
IEA	International Energy Agency
kW	kilowatt
kWh	kilowatt hour
MW	megawatt
MWh	megawatt hour
NGO	non-governmental organisation
NFFO	non-fossil fuel obligation
NFPA	Non-Fossil Purchasing Agency
NPPG	National Planning Policy Guideline (in Scotland)
ODPM	Office of the Deputy Prime Minister
PPA	power purchase agreement
PPG	Planning Policy Guidance (in England)
PPS	Planning Policy Statement (in England)
PV	photovoltaic
REFIT	renewable energy ‘feed-in tariff’
RES-E	renewable energy sources – (generating) electricity
RO	Renewables Obligation
ROC	Renewables Obligation Certificate
RPS	Renewables Portfolio Standard
RSPB	Royal Society for the Protection of Birds
SPA	Special Protection Area (protected site created under EC Directive 79/409/EEC on the conservation of wild birds)
TSO	transmission system operator
TWh	terawatt hour
WWF	World Wide Fund (for Nature)

Executive summary

- Wind power in Germany is considered to be a major 'success story'. Germany has the largest operating capacity in the world and enjoys world leadership in terms of its turbine manufacturing base. In contrast, the UK has the best wind resource in Europe, but it has little installed capacity and an underdeveloped manufacturing base.

- However, despite their differences in current context, Germany and the UK are now facing similar challenges brought about by, for example, the closure of old generating capacity, the liberalisation of electricity markets, and concerns over climate change. Each country has hosted debates this year on energy sources and conversion technologies.

- Critical to the discussions on the need for reform are such questions as: What are the reasons for the markedly higher rate of expansion in Germany? Are there elements in each country's policy and practice that are worth preserving and perhaps sharing cross-nationally?

- We tackle these questions by comparing the energy sector issues, policy dimensions and factors related to local implementation that affect the industry in each country. We discuss the contrasting policy instruments that Germany and the UK rely upon to promote renewable energy sources, and we stress the importance of the institutional and socio-economic contexts that support these policy instruments. In doing so, our analysis contributes to the growing literature comparing 'feed-in tariffs' with 'quota systems'.

- It is clear that the German 'feed-in tariff' has proved a highly flexible and manageable policy instrument. In contrast, the UK's Renewables Obligation (RO) has proved more costly but less productive. Moreover, the RO is making wind power progressively more expensive to the UK consumer at a time when degressive 'feed-in rates' are making it cheaper in Germany.

- On the other hand, the RO provides a mechanism for the market integration of renewables by developing commercial relationships between actors in the electricity supply industry. In Germany, the route to market integration has yet to be identified.

- We cannot over-emphasise the need to provide a stable investment environment for new technologies. The lower risks to investors in the German system contribute to its superior performance. However, strategic support should not be allowed to turn into permanent subsidy.

- In contrast to the 2004 amendment of the German Renewables Energy Sources Act), the 2005 UK consultation led to no policy renewal. Whereas German policy-makers had recognised the need to adjust the levels of 'feed-in tariffs' to changing circumstances, their British counterparts drew few lessons from national experience or international comparison. Nevertheless, the 2006 UK ‘energy policy review’ and its implementation offer opportunities to revisit energy policy options and the calibration of policy instruments.

1 Introduction

Despite having average wind conditions, Germany has the largest operating capacity of wind power in the world (18,427 MW in January 2006) and enjoys world leadership in terms of a turbine manufacturing base. Thus, wind power in Germany is considered to be a major 'success story'. In stark contrast, the UK has the best wind resource in Europe but little installed capacity (1,342 MW in January 2006) and an underdeveloped manufacturing base. This research project investigated the reasons for these different outcomes.

A comprehensive analysis of wind sector developments was based on two main research strategies. One was recourse to the literature, both academic and the extensive 'grey' literature available from administrative bodies, associations, firms, etc. The other was by fieldwork interviews in Germany and the UK between 2004 and 2006 with a wide range of stakeholders, including policy-makers, industrialists and civil society actors. Using this material, this report aims to explain the contrasting development paths of the wind sector in the two countries. While we argue that an important part of the explanation concerns the effectiveness and efficiency of the different *policy instruments* used to promote renewable energy sources in the two countries, the report also stresses the importance of the institutional and socio-economic *flanking conditions* which support the policy instruments per se. In doing so, the analysis contributes to the growing literature comparing 'feed-in tariffs' with 'quota systems', while shifting the level of analysis from broad-brush distinctions to the 'fine grain' of policy instrument calibration. A further distinctive feature is to locate policy choices within their political, institutional, industrial and socio-economic contexts. These contexts create path-dependent contingencies which both explain current outcomes and limit the scope for future policy reform. Nevertheless, cross-national comparison will allow identification of opportunities for incremental policy improvement. Throughout the report, we will stress the *evolution* of policy design, and the role for policy learning in adaptation to changing circumstances.

The report proceeds in three main parts:

1. Energy sector issues, which set the *context* for the wind-power study;
2. Policy dimensions related to wind power – in particular, the choice and setting of *policy instruments*; and
3. Local implementation, dealing with institutional and socio-economic *flanking conditions*. Core findings will be set out under these headings, with a concluding section exploring how the dimensions interact.

2 Energy sector issues

The changing structures and strategies of the ESI create a particular operating environment, offering both opportunities and constraints to renewable energy projects. Two developments are of crucial relevance: the rapidly ageing nature of the power station 'fleet' and the liberalisation of the electricity and gas markets. Debates over energy supply – for example, the 'energy summit' talks in Germany in April 2006 and an 'energy policy review' in the UK in 2006 – concern both energy sources and conversion technologies. Although both countries are facing similar challenges, 'path-dependence' is an important explanatory variable,[1] given that energy policy is implemented within specific national contexts and in the light of prior decision-making with regard to development paths.

The UK needs to replace large quantities of generating capacity. The House of Commons Environmental Audit Committee (2006: 3) noted that 'by 2016, it is likely that between 15 and 20 GW [gigawatts] of electricity generating plant will be decommissioned. This amounts to nearly a quarter of UK generating capacity.' The UK has not taken any political decisions to phase out either nuclear or coal plant. Its nuclear power stations are simply reaching the end of their operational life. Eleven Magnox power stations were built in the 1960s; seven of these have closed, and the remaining four are scheduled for closure over the period 2006–10. In addition, seven Advanced Gas-cooled reactors will shut down between 2011 and 2023 (House of Commons Environmental Audit Committee, 2006: 10). As well as the loss of some 11 GW of nuclear power, more than 10 GW of coal plant will be decommissioned in the next decade. The exact figures vary according to source because of uncertainties regarding the impact of the new EU Large Combustion Plant Directive. At the same time, demand is growing by around 1.5% per year. All this adds up to a potential 'generation gap' in the next decade, for which measures need to be considered and planned now. Indeed, in 2005, Prime Minister Blair called for an 'energy policy review' in response to such energy security issues.

Germany, on the other hand, is the largest electricity market in Europe (IEA, 2002: 10), with coal and nuclear as the main sources of primary energy for electricity generation. A key element in the restructuring of the German ESI relates to the nuclear industry. The strength of anti-nuclear protest in Germany restricted the development of nuclear power, particularly after the 1986 Chernobyl disaster. In June 2001, the 'red-green' coalition agreed to phase out nuclear power while reinforcing measures to promote renewable energy sources. The agreement between the federal government and the electricity suppliers placed a limit of approximately 32 years on the operational life of Germany's 19 nuclear plants. The decommissioning of some 23,500 megawatts (MW) of nuclear-sourced electricity has been programmed.[2] The first plant affected was Stade, which closed in November 2003 after 31 years of operation.

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[1] The core idea of path-dependence is that institutional and strategic choices, once made, are often self-reinforcing. This is because the costs of switching between options tend to increase over time, so locking actors into an existing arrangement.

[2] For details, see Mez and Piening (2002).

In addition, some 17,000 MW of coal capacity will need replacement. Thus, over 40,000 MW of German electricity supply are likely to disappear by 2020, from a total of about 121,000 MW.

This raises major implications regarding scope for new build. Proposals for new power plants are further advanced in Germany than in the UK. They include major expansion for the wind energy sector, and other renewable sources besides. However, they also include conventional plants. In April 2006, a press release from the Association of the Electricity Supply Industry (VDEW) announced a list of 20 projects totalling 15,000 MW of capacity, of which nearly 10,000 MW would be coal-fired (VDEW, 2006). This is in line with established policy related to energy security and the preservation of a national coal industry: 'the German government wishes to maintain a significant coal-based electricity generation capacity to avoid over-dependence…on imported energies' (IEA, 2002: 8).

In brief, the closure of old generating capacity, the liberalisation of electricity markets, new operating conditions brought about by more stringent environmental standards, and concerns over climate change have created an unprecedented 'window of opportunity' for renewables.

3 Policy dimensions

Electricity generated from renewable energy sources (RES-E) remains more expensive than from conventional sources. Cost estimates vary significantly. The main reasons for wide variation are:

1. the discount rate used;
2. fluctuations in fuel costs for conventional sources; and
3. weather and site-specific variables for renewable energy sources.

For the UK, the following table nevertheless gives representative guidelines to costs today.

Table 1
Cost comparisons between conventional and renewable electricity generation sources

	Capital cost (£ per kW)			Generating cost (p/kWh)		
Type of generation	**Scottish & Southern***	**EDF***	**Centrica***	**E.ON****	**EDF**	**Centrica**
CCGT***	450	440	400	2.2–4.9	3.8–4.2	1.9–2.6
Coal				2.8–5.2	2.5–3.9	2.1–3.3
Nuclear	1500	1150	1100	2.5–4.0	2.3	2.3–3.4
Wind: onshore	800	715	850	4.2–5.2	3.7–5.4	3.1–3.7
Wind: offshore		1250	1300	6.2–8.4	5.5–7.2	5.5–7.0
Wave and marine		1750			6.6	6.0–7.0

Source: The House of Commons Environmental Audit Committee (2006: 43).
* UK energy companies
** a German energy company
*** Combined Cycle Gas Turbine

Two comments are called for on these data. One is that the liberalisation of electricity markets in the 1990s forced the utility companies to extract maximum value from their power plants in a context of over-capacity. The second is that the low prices of an era characterised by a combination of plentiful, cheap energy sources with ageing, fully depreciated capacity are unsustainable over the long term. Investment in *any* form of new capacity required to fill the 'generation gap' will increase costs. Furthermore, the 2005–06 period has seen sharp rises in oil and gas prices.

Policy frameworks to support renewable energy sources have to be placed in these contexts. During the 1980s and 1990s, unsustainably low fossil fuel prices and limited technological progress made renewables uncompetitive. Support to electricity generation from renewables has been based on the need to compensate for structural disadvantages. These include historical subsidies that have gone to nuclear and coal, while the external costs associated with those energy sources have not been factored in. They also include the problems of developing and integrating new technologies in a context of vested energy interests and market dominance by the utility companies. This report will look closely at policy measures to overcome these disadvantages and draw policy lessons from current developments.

The German framework

Germany has experienced a boom in wind power not because of its natural resources, but due to a favourable political climate. Few onshore sites have wind speeds above 7.5 m/s (Rickerson, 2002). Yet strongly supportive policy initiatives – together with an advanced engineering base – have made Germany a pioneer in wind power.

We will now set out the policy background and discuss the main instrument that supports renewable energy sources in Germany, the 'feed-in tariff'. A policy discussion will follow: this will locate the choice of the policy instrument within Germany's institutional contexts, and clarify the roles of political and industrial actors in the *evolution* of its design.

Policy background

Early German policy with regard to renewable energy sources gave generous support to research and development (Ibenholt, 2002: 1183). The GROWIAN project of the 1970s was a government-initiated scheme that sought to build a 3 MW turbine. However, the project failed and the prototypes were dismantled in 1987. Meanwhile, a number of private firms in both Denmark and Germany sought to produce small turbines in the sub-500 kW class.[3]

Support was then switched to 'demand-pull' policies to encourage the move towards renewable energy. The 100 MW Wind Programme was introduced in 1989 by the Ministry for Research and Technology; this offered a subsidy of 8 Pfennige/kWh with recipients obliged to provide performance data to the Ministry, thereby enabling the compilation of a database by the Institute for Solar Power Supply Technology (ISET); the scheme was enlarged to 250 MW in 1991, albeit with a reduction in subsidy to 6 Pfennige/kWh or around 3 eurocents/kWh (Bechberger and Reiche, 2004: 49; Rickerson, 2002). These measures encouraged the construction of the first wind farms, which sometimes received additional support from *Länder* initiatives through investment loans at preferential rates (Badelin et al., 2004: 7). By 1990, installed wind-power capacity was 56 MW (BMU, 2005a: 12). These early experiments laid the foundations for a manufacturing base *and* identified a promising policy instrument – the 'feed-in tariff'.

The main policy element: the 'feed-in laws'

The first Electricity Feed-in Law of 1991, the *Strom-Einspeisungs-Gesetz* (StrEG), introduced fixed prices for RES-E and caused a step-change in the wind-power sector. It set the 'feed-in tariff' at 90% of average electricity prices for wind and solar, with a price

[3] For development of the wind turbine industry, see Bergek and Jacobsson (2003).

of about 8.2 eurocents/kWh up to 1999 (Wüstenhagen and Bilharz, 2005: 6). Its other cornerstone was to impose a 'must take' clause on the regional utility companies: this made it obligatory for them to purchase *all* RES-E generation in their catchment areas. The law also restricted eligibility for the preferential tariff to a ceiling of 5% of power supply from RES-E. These measures produced *guaranteed returns to investors, low levels of risk and long-term stability*. In addition, soft loans totalling some 6 billion DM for capital investment were available between 1990 and 1998 from the state-owned *Deutsche Ausgleichsbank*, as well as from federal RES promotion schemes known as the Environment and Energy Conservation Programme and the Environment Programme (mainly administered by the KfW, a government-owned development bank) of some 10 billion euros, 95% of which went to wind projects (Bechberger and Reiche, 2004: 50–2). In this phase, the utility companies kept their distance – apparently because they considered the early wind-power projects to be small fry. In any case, the payment of premium tariffs to public-sector firms would have been problematic in being liable to lead to undue profits and an unfavourable reaction by public opinion. This combination of measures sparked a boom in capacity, which rose from 98 MW to 4,444 MW between 1991 and 1999, while generation increased from 140 GWh to 5,528 GWh (BMU, 2005a: 12).

However, a number of problems were encountered with the StrEG. These concerned the structure and price level of tariffs, the lack of differentiation regarding the quality of sites and related wind speeds, and regional disparities (Grotz, 2002: 116). The geographical concentration of wind farms – mainly in coastal northern Germany – meant a disproportionate impact on particular transmission systems operators (TSOs) and their customers (Ringel, 2006: 6).[4] The pegging of tariffs to average prices was heavily criticised by the utility companies and wind farm owners. Although quite high initially, the tariffs fell in value due to price reductions as a result of liberalisation. Meanwhile, the ceiling of 5% of supply from RES-E proved too low. Adjustments were also required for compliance with new EU directives. In particular, the 1998 law on liberalisation of the electricity sector introduced new challenges. Prior to 1998, regional companies held distribution monopolies, meaning that consumers were captive. With consumers free in principle to change suppliers, the 'feed-in' arrangements needed to organise a national distribution of costs.

Policy was adapted to these evolving circumstances. The EEG of 2000 introduced several innovations. Its stated aim was to 'facilitate a sustainable development of the energy supply in the interest of managing global warming and protecting the environment and to achieve a substantial increase in the percentage contribution of renewable energy sources to power supply'. The 2010 target was to at least double the share of RES in energy consumption. Additional aims were to reduce dependence on energy imports, increase security of supply, and encourage economic development and technological progress.[5] The EEG placed an obligation on German TSOs to purchase all RES-E produced and sell it on to customers. The same share of RES-E was incorporated into the electricity mix of all suppliers, not on the basis of physical flows but by distribution of costs – i.e. payments for RES-E were 'equalised' on a national burden-sharing basis, requiring complex settlement mechanisms. The EEG clarified arrangements for grid costs, with

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[4] There are four TSOs in Germany: RWE (west), EnBW (south-west), E.ON Netz (north to south-east corridor) and Vattenfall (East). As of April 2003, E.ON Netz had 5,500 MW of wind power in its catchment (Luther et al., 2005: 233).

[5] See German Parliament (2000).

connections paid for by the developer and upgrading by the operator. Costs for energy intensive industries were capped.

The *effectiveness* of the 'feed-in tariff' in bringing large quantities of capacity on-stream had been demonstrated during the 1990s. The challenge in 2000 was to improve economic *efficiency*. The core policy shift within the EEG was to improve competitiveness by price differentiation at four levels:

1. Between different technologies and categories of RES-E sources (with photovoltaic [PV] receiving the greatest price support);
2. Between different sizes of plant (in relation to biomass, methane, hydro etc. but *not* wind farms);
3. In terms of a year-on-year reductions in tariffs (both to reflect a context of falling turbine prices and to stimulate further price competition in the turbine sector; and
4. In relation to high-wind versus low-wind sites.

Tariffs were decoupled from average prices. For 2000–01, the onshore wind tariff offered an initial rate of 9.1 eurocents/kWh, falling to a base rate of 6.19 eurocents/kWh. All sites were eligible for the initial rate during their first five years of operation and to applicable tiered rates for a further 15 years, giving guaranteed support for 20 years. The fall to the base rate was triggered at the point where a 'reference yield'[6] threshold had been passed. Thus, higher wind-speed sites dropped to lower remuneration more quickly than lower wind-speed sites. This was intended to encourage wider dispersion of wind farms across Germany, rather than the 'wind rush' phenomenon of concentration at the windiest sites. It also facilitated assessment of the efficiency of turbine types, thereby stimulating competition.

Furthermore, the principle of 'degression' was introduced, with a yearly tariff reduction of 1.5% for new installations (with the applicable tariffs remaining valid for the entire payment period). This meant that wind farms built later would receive lower rates of income. The measure aimed to reflect and encourage increased competitiveness and productivity in the technology supply sector at a time when turbine prices were falling. It also aimed to avoid 'windfall' profits arising from developers postponing new installations to take advantage of falling building costs. Thus, although the 'degression' element has sometimes been criticised for lowering incentives to switch to RES-E, it actually encouraged fast build by offering higher tariffs early. This is clear from wind sector growth rates: installed capacity rose from 6,112 MW in 2000 to 16,629 MW in 2004, with output nearly trebling from 9,500 GWh to 25,000 GWh (BMU, 2005a: 12). Thus, despite very significant policy revision, the EEG sparked a second wind boom. This was because it inspired investor confidence by retaining the policy instrument's core characteristics of long-term stability based on guaranteed returns and low levels of risk.

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[6] 'Reference yield' is an administratively determined level of yield which expresses a performance standard. Actual yield is determined by the relationship between a turbine's rated capacity and available wind energy over a given period of time. High-wind sites are more productive than low-wind sites. In other words, they generate more electricity and more money. Therefore they need less subsidy. The German system includes thresholds to reflect this. One type of threshold regulates the point at which an installation on a higher wind site drops to a lower level of remuneration. This mechanism seeks to make the tariff more 'cost reflective'.

Furthermore, the EEG was not set in stone but made subject to periodic review, providing scope for incremental improvements. This led to the 2004 amendment, which set higher targets for RES-E. It incorporated a target of 12.5% for 2010 – thereby transposing the European directive 2001/77/EC – and also included an aspirational target of 20% for 2020. There were decreases in payments to new wind farms to 8.7 eurocents/kWh for the initial period, falling to a base rate of 5.5 eurocents/kWh. The year-on-year 'degression' increased to 2%. Once rises in inflation are factored in, these decreases represented a significant tightening of support, directed towards closing the price gap between conventional and renewable sources of electricity and avoiding excess profits.[7] Support to low wind sites was adjusted by a requirement to meet at least 60% of the 'reference yield' in order to 'quash any economic incentive to install wind turbines on sites with poor wind conditions' (BMU, 2004b: 8). On the other hand, 'repowering' (the replacement of old and small turbines with multi-megawatt machines) was encouraged while tariffs for offshore installations were improved, with the stipulation that only wind farms built outside nature conservation areas would be eligible.

Policy discussion

Turning to detailed lessons from the German experience: firstly, the recourse to systematic review demonstrates *willingness to revisit the policy regime*, rather than allow it to freeze a particular distribution of privilege and disadvantage. Secondly, it shows that the scope exists to amend renewables policy while *maintaining investor security*. Thirdly, although the term 'fixed' prices suggests a rigid system, in practice the German 'feed-in tariff' proved a highly *flexible and manageable instrument*. It gave scope both to exercise 'steer' (to make sure that policy was going in the right direction) and to practise 'fine-tuning' (to improve instrument calibration).

Turning to broader issues, the most important feature of German renewables policy was its linkage of energy policy with industrial policy, using environmental policy as the connecting ground. The intent was not just to increase output in megawatt hours, but to revitalise Germany's manufacturing base. This brought the added benefits of creating jobs in a diversified range of conventional energy technologies while improving environmental performance. According to the German Engineering Federation (VDMA) (2005), [8] half the global wind industry is located in Germany and producing a third of all wind turbines, with a total value added of 3,800 million euros. The German wind industry has created some 40,000 jobs in manufacturing, and another 10,000 in services.

The German policy frame was based on the concept of 'ecological modernisation', which places stress on synergy between economic and environmental desiderata. One of the clearest statements of this policy frame can be found in a policy document, issued during Jürgen Trittin's term as Federal Environment Minister, which stressed the need for 'an "ecologically optimised" development path for renewable energy sources' (BMU, 2004a: viii), by which was understood a reconciliation of technological, economic and environmental objectives to achieve a sustainable energy supply. The 'feed-in tariff' proved a judicious experiment in the achievement of 'ecological modernisation':

[7] As noted by Ragwitz and Huber (2005: 5): 'In the case of onshore wind, the support level has been decreased significantly for installations at locations with very high yield.'

[8] The VDMA is a lobbying organisation for the mechanical engineering industry and has been instrumental in promoting wind power jointly with the BWE (German Wind Energy Association).

it diversified energy sourcing, increased supply, stimulated technological innovation, and promoted industrial development and market leadership. The extended nature of the policy frame has been acknowledged by the German Energy Agency: 'wind power has attained industrial policy significance due to its enormous growth rates and its prospective further development, onshore and offshore, as well as due to its export potential' (DENA, 2005: 4).

This policy frame contributed towards resolution of the problems posed by the market dominance of the utility companies. Up to and including the 1980s, the oligopoly exercised by major electricity companies hindered the uptake of renewable energy resources. This was realised early on by RES technology entrepreneurs, and led to alliances between turbine manufacturers, such as Enercon, and engineering firms represented by the VDMA. The aim was to stimulate the renewables sector by coalition with powerful industrial interests, so as to bring diversification of energy sourcing and renewal of Germany's manufacturing base into congruence. Meanwhile, the growing influence of the environmental movement provided a legitimising discourse for the use of renewable technologies. This discourse stressed the need to tackle atmospheric pollution from generator 'smokestacks' and, more recently, to contribute to the fight against global warming. Thus, a comprehensive set of actors contributed to a redefinition of the energy debate along the lines of 'ecological modernisation'.

This new conceptualisation was taken up by the German Parliament. The 1991 'feed-in law' was promoted by all major parties (with the exception of the liberal Free Democratic Party [FDP]), although the *Grünen* played no role in the legislative process as they had no MPs at the time. In this phase, Wüstenhagen and Bilharz (2005: 8) considered that politicians led public opinion rather than responded to popular pressure.

However, the law went against the preferences of the utility companies (Menges, 2003). In the 1990s, Preussen Elektra (now E.ON), the RWE group and the VDEW opposed the implementation of the StrEG. Hostility was partly explained by the costs of providing grid access to renewable sources, and the disproportionate burden placed on those utility companies which had high levels of wind generation in their grids. Also, as a consequence of the 'must take' clause, existing generators were losing market share to new entrants. Taking legal action to redress the situation, Preussenn Elektra sued Schleswag (its own subsidiary company) for repayment of 'additional costs' arising from the StrEG and amounting to 500,000 DM. The legal argument was the purported incompatibility of the 'feed-in law' with European legislation. The case went before the European Court of Justice, which ruled on 13 March 2001 that the provisions of the StrEG conformed to EU regulations, and that the law neither represented unacceptable state aid nor interfered with the free movement of goods (Wüstenhagen and Bilharz, 2005: 7). This ended legal insecurity in Germany and opened the way for new 'feed-in laws' both there and elsewhere in Europe.

The EEG of 2000 benefited from cross-party support, but the consensus was weakening. The 'red-green' coalition strongly favoured the reform, as did a coalition of pro-wind actors, including farmers who hired out their land, the wind-power manufacturing sector and the environmentalist non-governmental organisations (NGOs). The VDMA was also in favour, given the importance of policy promoting new build to the turbine manufacture and mechanical engineering sectors. On the other hand, while the Christian Democratic Union (CDU) agreed with the general aim of increased sourcing from renewables, it disagreed with policy details. Opposition from industrialists was also stronger than against the StrEG, with the Federal Association of German Industry (BDI), the VDEW and the Association of the Industrial Energy and Power Industry (VIK) expressing concerns over the effect of rising electricity prices on the competitiveness of their members. Among the utility companies, RWE was the most strongly opposed, while E.ON and Vattenfall were also against. This was because the established utility companies faced loss of market share to subsidised, independent players while, as TSOs, they paid the costs of prioritising renewable over conventional sources.

Criticism has since continued. The coal sector lobbied the Social Democratic Party (SPD) and mounted a 'virulent campaign' against wind power in 2003, leading to Chancellor Schröder agreeing to subsidise hard coal-mining by 17 billion euros between 2006 and 2012 (Bechberger and Reiche, 2004: 55). In addition, international bodies sought to exercise influence. The International Energy Agency (IEA) argued that 'fixed' prices were too high and that 'the government should therefore consider increasing the yearly reductions in "feed-in tariffs" for wind power' (IEA, 2002: 97) due to the pace of technological development and economies of learning by developers and utility companies.

The EEG amendment of 2004 had the support of the 'red-green' coalition and renewables manufacturers (who had become a significant lobby). Furthermore, the shift of responsibility for renewables away from the Economy Ministry and into the Environment Ministry reinforced support for the 'feed-in' system, with Federal Environment Minister Trittin (a leading member of the *Grünen*) being strongly proactive. Meanwhile, the opposition parties (CDU-CSU and FDP) grew restive, but their criticisms were restrained by favourable public opinion towards renewables and by the support of institutional actors. The role of the manufacturing sector has already been stressed: to this must be added the banking sector which, having made loans to RES-E entrepreneurs, wished to preserve the profitability of their investments. The utility companies, however, continued to complain about the costs of integration of wind power into the grid, particularly due to balancing requirements[9]. Badelin et al., (2004: 7) noted that 'the German TSOs claimed that the country's wind-power plant needs reserves equal to half their installed capacity. This is up to 10 times more than is needed in other countries'. The *underlying* cause of the utility companies' opposition can probably be traced to the restructuring of the electricity industry implicit in the higher target of 20% RES-E sourcing by 2020.

The review process inevitably spills over into current political debate. In the run-up to the 2005 general elections, opposition leader Angela Merkel was critical of 'red-green' energy and climate policies. She argued for reform to streamline the 'feed-in tariff' and to co-ordinate it with the subsidies for co-generation and the eco-tax (*Windpower Monthly*, 2005: 20). Furthermore, the VDEW (2005) argued for an end to fixed purchase prices for wind, and for a switch to a 'quota' system. However, with the CDU-CSU unable to win a clear majority, they entered into a coalition government with the SPD. The 'grand coalition' pact has left support measures to renewables unchanged. The stipulation in

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[9] Because of random variation in the availability of wind, output from wind turbines is affected by intermittence, meaning sudden power surges (and losses). Grid stability is dependent on an exact match between supply and demand in real time. Consequently, in order to preserve grid stability, these surges (and losses) have to be compensated by conventional generation. This forms part of a process known as 'system balancing' and entails a cost. In the German system, the provision of balancing services is paid for by the distributor, and not by the wind-power sector.

article 20 of the 2004 EEG amendment (German Parliament, 2004: 23) that a progress report be submitted to the *Bundestag* by 31 December 2007 provided the justification to leave renewables policy on hold. However, it also offered an opening for reform at a later, more propitious, date. Thus, further modification can be expected from the 2008 review.

In summary, the establishment of a broad consensus contributed to the efficacy of the 'feed-in' system. 'Green' organisations were not the sole – nor perhaps the most important – component of support to renewables policy. The influence of actors from across the political spectrum traditions and from industry proved crucial. Thus, the German 'feed-in' system has to be placed in a context of *lobbying* and *coalition-building* by interest groups, some of whom favoured the policy while others opposed it. Negotiations between policy-makers and stakeholders led to sequential trade-offs, while a *legislative process* conferred legitimacy on outcomes. Furthermore, once longevity embedded the policy instrument within the political landscape, categories of support deepened, making wholesale change unattractive. Nevertheless, the German approach avoided 'fossilisation' of RES policy. A review process was built into the legislation, leading to incremental reform at periodic intervals with a wary eye kept on both environmental and economic outcomes.

The UK framework

Policy background

Despite promising early initiatives, the UK has not taken a pioneering role in renewable energy sources. While the high proportions of RES-E in France, Austria and Norway are due to hydro-electric power, the UK has limited hydro resources. During the 1980s, progress in other conversion technologies – such as wind and marine – was stymied because of the Conservative government's preference for nuclear power and the exploitation of North Sea oil and gas. The non-fossil fuel obligation (NFFO) was introduced in the 1990s, but was intended to prop up nuclear power and offered only limited support to renewables.[10] Even in 1997, RES-E stood at a low 1.7% of supply. However, expressions of political will from the Labour Party suggested that it was receptive to the case of renewables. Collier (1997: 105) noted that the Labour Party programme of 1994 set RES-E targets of 10% by 2010, and 25% by 2025; but, although the Blair government came to office in 1997, no major renewables initiative was taken until 2002.

One catalyst for policy renewal was European legislation. Directive 2001/77/EC contains indicative targets for RES-E *consumption* within member states, with the UK's being 10% by 2010. Policy drivers contained in the 2003 Energy White Paper were to:

1. progress towards a 60% reduction of CO2 emissions by 2050;
2. maintain the reliability of energy supplies;
3. promote competitive markets; and
4. ensure that homes are heated adequately and affordably (Secretary of State for Trade and Industry, 2003: 11).

[10] For discussion of the NFFO, see Mitchell (2000). For a wider review of UK renewables policy, see Mitchell and Connor (2004).

The main policy element: the Renewables Obligation

The Renewables Obligation (RO) was established for England and Wales in April 2002, and was followed by matching instruments for Scotland and Northern Ireland. The RO is a variety of the Renewables Portfolio Standard (RPS), requiring that a given quota of electricity comes from renewable sources. The financial incentive to attain quotas is achieved through the issue of a 'green certificate' for each unit of generation; being tradeable, these certificates acquire a market value. RES-E generators must find buyers for both their electricity and their 'green certificates', with the prices of both fluctuating on the basis of supply and demand.

The RO is a market-oriented mechanism which *excludes* the two cornerstones of the German system – namely, guaranteed prices and the obligatory purchase. A core neo-liberal principle of the Blair government is to avoid prescription of the energy mix. In principle, the policy instrument leaves it to the 'market' to decide on the best technologies to take forward. Hence, the RO claims to be 'technology neutral' in making no official differentiation between energy sources or conversion technologies. This approach contrasts with the German context, where politicians have offered a partial prescription of the fuel mix by:

- the political decision to phase out nuclear;
- long-standing and continuing support for the domestic coal industry;
- a renewables policy which targets technologies in a differentiated fashion.

The RO places an obligation on all electricity suppliers to derive specified proportions of electricity from renewables. The proportion increases each year in order to promote investment and expansion in RES-E. The target for 2002–03 was 3%, rising in gradual annual increments to 10.4% for 2010–11, thereby matching the target set in the Renewables Directive. In December 2003, in order to reinforce industry confidence in the RO, the annual increment mechanism was extended further, making 15.4% the target for 2015–16. As a way of providing investment security, this scheme is guaranteed to run for 25 years, ending on 31 March 2027.

The UK regulator, Ofgem, provides accredited generators with one Renewables Obligation Certificate (ROC) for each MW of their electricity. Suppliers can either secure sufficient ROCs to cover their obligation, or make up the balance by paying a 'buy-out' price. In 2002, this was set at £30 per MWh (3p per kWh). It is adjusted annually in line with the retail price index. For 2006–07, it stands at £33.24 (Ofgem, 2006b). Thus, the ceiling value of ROCs is set on an interventionist basis: monies raised by the 'buy-out' fund are recycled to suppliers in proportion to their ROCs. For 2004–05, the total 'buy-out' fund was over £135 million for England and Wales and over £17 million for Scotland, giving a return to suppliers from the buy-out fund of £13.66 for each correctly presented ROC (£19.99 for each ROC [Scotland]) (Ofgem, 2006a: 3). Thus, individual suppliers can find themselves paying – or receiving – substantial sums. For example, with regard to 2004–05, British Energy paid nearly £35 million while SSE Energy Supply, British Gas Trading Limited and Powergen each received over £20 million (Ofgem, 2006a: 8 and Appendix 3). These large financial movements act as an incentive to invest in renewables.

According to Ofgem (2006a: 4), a ROC in 2004–05 was worth £45.05 on average to a supplier in England and Wales, and £51.38 in Scotland. Moreover, ROC prices move up and down in auction: in April 2006, the auction price was £40.65 (NFPA, 2006). Generators also sell their electricity, and over the 2002–05 period wholesale prices ranged between £17 and £25, with significant increases in winter 2005–06.[11] Because of such variations, it is difficult to put an exact figure on the total worth of RES-E. A typical figure during 2005 was of the order of £70 per MWh. This was equivalent to 10 eurocents/kWh (depending on fluctuating euro to pound exchange rates). But, because of wholesale price increases in the winter of 2005–06, the price of wind power rose to 12–13 eurocents/kWh.

These levels are considerably higher than the 'feed-in' rates in Germany. They indicate the problems associated with the artificial market created for UK 'green certificates'. As the wholesale market price of electricity *increases*, the need for subsidy *reduces* – but there is no mechanism to guarantee this. Indeed, outcomes during the period 2002–06 indicate not only that the RO is failing to provide a more cost-effective system than continental 'feed-in tariffs', but worse – the RO is making wind power progressively more expensive to the UK consumer at a time when degressive 'feed-in rates' are making it cheaper in Germany. This is a problematic outcome, especially when Britain's more abundant wind resource is factored in. The *efficiency* of the RO is therefore lower.

We next turn to consideration of the *effectiveness* of the RO – namely, the scale of new capacity being built and the timeliness of build in relation to targets. In the UK, it is extremely difficult to estimate future supply from current developments for several reasons. First, there is the general problem of the limited predictability of generation from weather-dependent renewables (such as wind or hydro), with major differences in generation between 'good' and 'bad' years. Second, there are uncertainties over the sourcing mix in 2010 because no official targets have been set for individual technologies. This is a consequence of the principle of 'technology neutrality' and is a specifically British problem. The main components of the sourcing mix in UK renewables generation in 2004–05 were landfill gas (30%), co-firing (19%), hydro (18%) and wind power (16%) (Ofgem, 2006a: 18). However, this 'pecking order' is expected to be inverted, with wind power becoming the leading source of RES-E by the end of the decade. Energy Minister Mike O'Brien told the House of Commons on 25 October 2004 that:

> The UK has set a demanding target for 10% of our electricity generation to be supplied by renewable energy by 2010. (…) We expect 7 or 8% of the 10% generation to come from wind energies. Other technologies will be hard pushed to produce the rest. (…) Roughly half the 7 or 8% wind comes from onshore wind generation and half from offshore wind generation.

However, these percentages need to be converted into generation targets and, on the basis of the latter, capacity targets by technology can be calculated. It is a curiosity of the British approach that these figures are not stated in government documents, unlike in Germany or Spain. However, a 'semi-official' set of calculations can be found in the report by the Sustainable Development Commission (2005: 11), which claimed that, with an average capacity factor of 30%, 9,500 MW of installed wind capacity would produce 31,500 GWh of electricity. Added to the approximately 10,000 GWh generated from RES-E in 2004, this would put the UK on track for the 2010 target of 10.4%. These figures invite caveats about assumptions on average capacity factors, demand increases and the

[11] In addition, for industrial users the worth of renewable generation is increased by 0.43 p/kWh, which is the level of the Climate Change Levy (CCL), introduced in April 2001. The CCL is raised on electricity purchased by industry from all conventional (including nuclear) sources, but RES-E is exempt.

scale of generation from other renewables. Nevertheless, 10,000 MW of wind-power capacity for 2010 serves as a convenient benchmark to assess progress to targets. This is equivalent to just over half of capacity for 2006 in Germany, where 10,000 MW of new capacity went online between 2000 and 2004. In a sense, the challenge for the RO is to match the effectiveness of the German 'feed-in tariff' during the 2006–10 period.

Table 2 gives data on progress towards renewables targets. The data indicate that the UK has so far fallen short on annual targets contained in the RO. In relation to wind power, 1,342 MW of capacity were operative in January 2006. Thus, around 2,000 MW need to go online each year to meet the implied target. Considerable new wind-power capacity has the necessary consents – notably in Scotland – and is expected to come online between 2006 and 2009. Other sources of RES-E will contribute. Nonetheless, whether the 2010 target will be reached hangs in the balance.

Table 2
Progress towards RES-E targets in the UK

	2002	2003	2004
% target set under RO	N/A	3.00	4.30
% attained on RO basis	1.80	2.21	3.08
% attained on Renewables Directive basis	3.23	3.37	4.39

Source: DTI (2005a: 169).
The RO target is for production, the Renewables Directive target is for consumption. The Renewables Directive states targets for 2010 but not for intervening years as the RO does.

In brief, the effectiveness of the RO is in question according to two criteria. The first is purely quantitative – namely, additions in capacity per year. The second is operational: in a system where policy-makers spell out official RES-E targets differentiated by technologies – such as exists in Germany and Spain – policy can be 'steered' in the direction of those targets. In the UK, there are no official targets on a disaggregated basis, differentiated by technology. The lack of a clear direction raises the question of where policy is heading. An embedded issue is whether the current RO is even capable of being 'steered' to its destination by government.

Policy discussion

Through the RO, the policy-makers sought to establish a secure and predictable environment for investment, using consumer subsidies to shape electricity supply. Because of the nature of the market-based mechanism, it had to bring industry on board. With an increase in wind-power capacity of 446 MW in 2005 alone, the market response has been far more positive than under the NFFO. There appears to be two main explanations for this: one is the increased level of profitability under the RO as compared to the NFFO, and the second is the opportunities offered to the utilities to exercise control over the ROCs market.

New capacity has been brought online by both utilities and specialist developers (who often sell their projects on to the utilities). Meanwhile, the non-corporate sector – farmers, co-operatives and citizen investment initiatives – that is so important in Germany and Denmark (and will be discussed later) barely exists in the UK.[12] In Germany, the non-corporate sector is emerging as a significant competitor to the utilities – especially as generation levels pass the 10% level. But in the UK the utilities face no such competition. While there are longer term causes for the absence of a non-corporate sector – above and beyond a single policy instrument – the RO has probably sealed its fate. Owing to the operation of the RO, few new competitors are emerging to the established utilities. The market uncertainties and price risks associated with quota schemes usually drive out small investors,[13] with the UK experience as a case in point. This reinforces the position of the established players.

Opportunities to control the market have arisen in relation to the ROCs system itself. In principle, the price of ROCs is set by market forces. But the 'green certificates' system is far from being a perfectly functioning market. The market quota for RES-E and the 'buy-out' price for ROCs are set by government intervention. Furthermore, as explained by Oxera (2005: 18), 'the value of ROCs will fall towards the buy-out price as the total volume of renewable generation approaches the obligation size'. Indeed, analysts sometimes refer to a 'cliff edge', beyond which the value of ROCs collapses. Therefore, current recipients of ROCs have a material preference for quotas *not* to be met. The National Audit Office (2005: 18) noted that 'as the supply of Renewable Obligation certificates increases relative to the obligation level, their price reduces, thus decreasing the incentive for generators to build new capacity'. In other words, a cap on expansion is encountered some way short of any quota because the financial incentive reduces in proportion to the attainment of targets. The Carbon Trust (2006: 2) has quantified this effect in predicting that 'renewable energy penetration would be only three-quarters towards achieving the target for 2010, and only halfway towards achieving the 2020 aspiration for 20%'.

A core design failure of the RO is revealed by the opportunities offered to major players to control the ROCs market. Although there are several dozen suppliers in the UK, the bulk of the obligation falls on very few due to market concentration. In England and Wales, just three suppliers (E.ON UK, RWE npower and London Energy/EDF) account for over 50% and the biggest six account for 90%; in Scotland, two suppliers (ScottishPower and SSE Energy Supply) discharge over 70% of the entire obligation (Ofgem, 2006b: 5–6). It should be noted that ROCs only have value for the suppliers. These multinational utilities are incentivised to own and operate RES-E facilities themselves. Consequently, they have been active in building up their portfolios. Although the 'independent' generators (which are sizeable companies) are responsible for some 60% of RES-E output, they can only extract such value from ROCs as suppliers will allow them. In theory, 'independents' can auction their ROCs (and electricity) to the highest bidder, but this is not always possible in practice because of low 'liquidity' in the ROCs market and because they generally need power purchase agreements (PPAs) to be eligible for financial-market loans. PPAs are the subject of negotiations between generators and suppliers, in a context of dissymmetrical market power in which suppliers hold the upper hand. Only a proportion of the worth of ROCs is effectively passed on to developers and generating firms, with the suppliers retaining the balance. This 'leakage' of subsidy can be partly justified by the conditions surrounding the forward contract in that the supplier who

[12] Exceptions such as Baywind in Cumbria and the Westmill Wind Farm Cooperative in Oxfordshire tend to confirm the rule.

[13] Mitchell & Conner (2004: 1939) identified three types of risk: price risk, volume risk and market risk.

offers the security of a 15-year contract accepts an element of risk, as well as the cost of providing balancing services, both of which merit remuneration. However, evidence is emerging that suppliers use their market power to their advantage. As noted by Oxera (2005):

> …suppliers may be able to capture a significant proportion of the ROC value for themselves. Furthermore, the high concentration of RO share among the six main suppliers means that they may have an incentive to restrict the total volume of renewable generation available in the market in order to maximise the total value of the ROCs that they control. (p. 19)

This highlights a major shortcoming of the RO in that the total cost to consumers is the same, *irrespective of how much renewables capacity is built*.

An associated question is therefore about 'value for money'. That the Renewable Obligation orders would increase consumers' bills was understood from the outset. The Department of Trade and Industry (DTI) estimated in 2001 that the increase would run at £1 billion per annum at 2002 prices by 2010 – equivalent to a price increase of 5.7% (National Audit Office, 2005: 12). However, the National Audit Office (2005: 40) found that 'the level of support provided by the obligation is greater than necessary to ensure that most new onshore wind and large landfill gas projects are developed', going on to quantify this excess support as being between a third and a half more than what is required. Similarly the Carbon Trust (2006: 11) found that 'onshore wind is nearly cost-competitive today, with current cost estimates at around 5 p/kWh net of balancing costs (to deal with intermittency issues). This compares to a current wholesale price in the order of 4.5 p/kWh.' These figures indicate a need for subsidy, but at a lower level. In other words, the RO is failing to be sufficiently 'cost-reflective'.

An additional method to assess the 'value for money' given by the RO is to consider its effect on CO2 emissions. While the National Audit Office (2005: 36) acknowledged that 'there is considerable uncertainty regarding the reliability of carbon abatement costs', it estimated that carbon avoidance through the RO mechanism cost between £70 and £140 per tonne of CO2. This was 5–10 times greater than other measures being implemented. In the auditors' assessment, 'the RO represents an expensive means by which to reduce CO2 emissions' (National Audit Office, 2005: 6).

A different kind of 'value for money' argument relates to administrative or transaction costs. Thus, it is sometimes argued that RPS systems are simpler to implement than 'feed-in tariffs'. Discussion with practitioners in Germany demonstrated that the reconciliation systems dictated by the Renewables Energy Sources Act (EEG) are highly complex. But so too is the RO. The British regulator Ofgem (2004: 41) complained that 'administering the Orders with all their complexities has been challenging for Ofgem and has created a great deal of administrative, technical and legal work. This work has been increased by the lack of clarity in various areas'.

These shortcomings have attracted criticism from the House of Commons Environmental Audit Committee (2006: 50), which stated that:

> the Renewables Obligation is an inflexible and inefficient mechanism for bringing to market a range of different renewable technologies due to the single flat rate incentive it provides. It effectively 'picks winners' by rewarding only the cheapest renewable technologies — mainly landfill gas and onshore wind — and offers little or

> nothing to bring to market more expensive technologies such as offshore wind and marine. Such a mechanism contrasts sharply with the feed-in tariffs which have proved so effective in Spain and Germany in incentivising a range of different technologies.

The consultation process required by the 2003 Energy White Paper (Secretary of State for Trade and Industry, 2003) offered the opportunity to draw lessons and make improvements. Organised by the DTI, the terms of reference were set out in November 2004, with the consultation running from March to June 2005. Issues for discussion included 'extending the profile of the Obligation, altering aspects of the working arrangements; modifying the rules for low cost technologies and energy from mixed wastes' (DTI, 2005b: 2). From the outset, the government was wary of undermining investor confidence, and trimmed its scope to alter the RO by giving assurances not to lower the buy-out price, or reduce the scale or duration of the obligation. During the 2005 consultation, established players lobbied for no change. The 'final decisions' taken concerned minor technicalities, but left the RO's substantive features intact. In relation to the question of excessive support to 'lower cost technologies', the DTI (2006: 3) stated that 'we do not believe there is a strong case at the present time for tapering support for onshore wind, though we will continue to monitor the situation'. In contrast to the 2004 amendment of the German Renewables Energy Sources Act (EEG), the 2005 UK consultation led to no policy renewal. Whereas German policy-makers had recognised the need to adjust the levels of 'feed-in tariffs' to changing circumstances, their British counterparts drew few lessons from national experience or international comparison.

In summary, the RO is questionable on the grounds of effectiveness, efficiency and flexibility. It needs to steer between two categories of risk:

1. Market undershoot (too little investment in renewables and inflated ROC prices); and
2. Market overshoot (the 'cliff edge' effect of substantial investment and collapse of ROC values).

Yet, it has been characterised by the lack of a 'steering-wheel' – namely, the institutional capacity to adjust policy to evolving circumstances. Nevertheless, the UK 'energy policy review' and its implementation offer opportunities to revisit energy policy options and the calibration of instruments.

Comparative discussion of the German and British policy instruments

The effectiveness of renewable energy 'feed-in tariffs' (REFITs) in the promotion of wind power is now widely recognised (Commission of the European Communities, 2005). Germany is one of the few EU countries capable of reaching its 2010 RES-E target of 12.5%, as set out in the European directive 2001/77/EC. The contrast between Germany having 18,427 MW of capacity in January 2006 and the UK 1,342 MW is clear-cut. A very high rate of new build in the UK in the near future could reverse this assessment, but it is currently unlikely. In *efficiency* terms, the price equation also points to REFITs as performing better (see Table 3).

Table 3
Prices of wind-generated electricity, 2004–05 (in eurocents per kWh)

REFITs		**RPS**	
Germany	8.5 (6.5)*	UK	10.1
France	8.4	Italy	15.5
Portugal	7.5–7.9		
Austria	7.8		
Spain	6.3–7.5		
Greece	6.4		

Source: BWE (2005: 17).
*Once the reference yield is passed, generators are remunerated at a lower level.

As regards current developments, in Germany the average tariff level for *all* categories and ages of RES-E as given by the Association of Electricity Network Operators (VDN) was 9.53 eurocents/kWh in 2005, rising to 9.96 in April 2006.[14] Lönker (2006: 30) quoted 13 eurocents/kWh for UK onshore wind at the start of 2006, this higher level being related to rises in the wholesale price of electricity. In REFIT systems, generators are insulated from wholesale price fluctuations: this is an advantage when prices are under downward pressure. However, when wholesale prices move upward for an RO producer, the subsidy remains much the same but *total* income from ROCs and electricity sales will tend to increase.

Experience has shown that the advantages of the German policy instrument of 'feed-in tariffs' are:

- low risk due to guaranteed and predictable prices together with the 'must take' power purchase clause, which inspire investor confidence, decrease dependence on the utility companies and promote industrial-scale development and production;
- a cost-reflective approach, achieved by explicit price differentiation, in relation to different RES-E technologies;
- degressive rates encourage competition among manufacturers and drive down costs for consumers;
- flexibility, which allows policy-makers to 'steer' the policy regime;
- no adverse effects on government budgets because subsidies are paid through consumer bills.

In contrast, the only advantage listed above that is shared by the RO is the last one – no adverse effects on government budgets. This is because:

- high risk arises for investors from uncertainties over the mid- to long-term price evolution of ROCs;
- the lack of a 'must-take clause' increases dependence on utilities;

[14] Source: http://www.vdn-berlin.de/actuelledaten.eeg.asp (consulted 3.4.2006).

- the lack of price differentiation between technologies results in a pricing system which fails to be cost-reflective;
- the capacity of the RO to foster industrial development and competition has yet to be demonstrated;
- the inflexibility of the instrument makes it difficult for policy-makers to 'steer' the policy regime.

On the other hand, the RO provides a route to the market integration of renewables by developing commercial relationships between actors in the ESI. In Germany, the route to market integration has yet to be identified. Its absence may cause concern in the future.

Where the German REFIT has proved most successful is through the development of an instrument which serves the *energy policy* purpose of promoting RES-E, the *environmental policy* purpose of avoiding emissions and the *industrial policy* purpose of promoting the manufacturing sector. Higher energy costs have been offset by environmental gains, and by technological leadership, employment creation and export opportunities in a new industry. In the UK, stress has fallen on energy policy and environmental policy, with little attention to industrial policy. The RO has proved more costly but less productive.

Recommendations on the development of policy instruments

Is wholesale change an option?

The debate over the relative merits of 'feed-in tariffs' and 'renewables portfolio standards' is far from over. In both the UK and Germany, calls are still heard for a wholesale change to policy instruments closely resembling that of the other country.

In the UK, the Carbon Trust (2006: 24) concluded that 'the option of retaining the current policy in its present form is very costly', and recommended a transition to a 'renewable development premium', a variety of 'feed-in tariff'. Yet, it was clear from the 2005 RO review that the British government had ruled out wholesale change in order to preserve investor security.

In Germany, the REFIT system has been the subject of continual debate, with various lobbies arguing their case to politicians during the run-up to the 2005 elections. Representative of this debate is a proposal for reform from the VDEW (2005), whose main contentions were:

- the high costs of the EEG (rising from €1.2 billion in 2000 to €3.4 billion in 2004, and projected to rise to €7.4 billion in 2010);
- distortions in competition arising from insulation of RES-E market segments;
- the development of renewables and of the grid needed to be undertaken conjointly;
- European harmonisation of support schemes was needed.

To achieve market integration, the association argued for the replacement of the guaranteed 'feed-in tariff' by trade in 'green certificates'. A variety of environmental premium was proposed during a transitional phase to allow wind-farm operators to gain experience in market competition and move more smoothly from one scheme to the other.

However, the Federal Ministry for the Environment (BMU, 2005b) responded with a vigorous rebuttal, arguing that:

- quota schemes led to higher prices than 'feed-in tariffs' because of lower security of investment;
- Germany would meet its EU target because of the 'feed-in tariff', whereas RO quotas were not being met in the UK;
- the REFIT stimulated new entrants while a switch to certificate trading would disadvantage small companies and compromise RES-E growth;
- the EU Energy Commissioner concurred that harmonisation of RES-E policy was premature.[15]

These examples illustrate a divergence of preferences between German and British policy-makers that is currently irreconcilable. They also reveal the extent to which governments become locked-in by previous policy decisions. Consequently, we take the view that wholesale policy change cannot be recommended in the short-to-medium term, owing to the problems raised by 'regulatory risk', the opposition of key actors and the uncertain marginal benefits. However, 'path dependence' constraints do not rule out all options for incremental improvement. Proposals to improve the 'manageability' and 'steerability' of the policy instruments will be made in the subsections below.

Technology blind or technology differentiation?

A core principle of the RO is that it is 'technology blind' – in other words, that it should not differentiate between technologies in terms of price, scale or location. At the level of *principle*, this is an ancillary and disposable feature of RPS systems. The social construction of a category of energy sources called 'renewables' and the designation of particular conversion technologies as falling within that category are clear instances of a policy which must be 'sighted' and not 'blind'. Such designation is far from being self-evident, with frequent disputes arising over whether a source qualifies as renewable (for example, energy-from-waste or geo-thermal). One renewable source – hydro-electric power – is arbitrarily divided into two varieties (large- and small-scale) to avoid deformation of RES-E markets.[16] Furthermore, at the level of *practice*, the RO is not 'technology neutral': it fails to support emergent technologies while exercising positive discrimination in favour of near-market technologies. Indeed, the RO was 'designed to "pull through" lowest cost technologies sequentially' (Carbon Trust, 2006: 2). In so doing, it reflects a market dynamic created elsewhere. For wind power, that dynamic was created by historical 'feed-in tariffs' in Denmark, Germany and Spain. In addition, the RO discriminates between locations by offering incentives to seek out the windiest sites. Although this makes economic sense, it encourages the 'wind rush' phenomenon of concentration of build in a limited number

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[15] See Commission of the European Communities (2005).

[16] Arbitrary threshold values encourage the reconfiguration of medium-scale hydro as small-scale in order to benefit from subsidies.

of areas, often of high landscape value. In brief, the labelling of the RO as 'technology blind' is inconsistent in both principle and practice. Instead, policy-makers must be 'sighted' if they are to 'steer'.

The first option to address this inconsistency is the 'banding' of technologies at comparable points of their life cycle – for example, onshore wind and landfill gas as close to market, offshore wind as intermediate and other marine technologies as distant. Such 'banding' allows the creation of multiple (or fractional) ROCs in order to respond to market realities and levels of need.

An associated second option is to make the support system more 'cost reflective' in terms of scale and location. Advanced 'feed-in tariffs' of the German variety factor in cost savings related to scale and benefits related to location (such as the level of the wind resource). The RO fails to do so, thereby ignoring both 'traditional' economies of industrial scale and 'new' location-specific variations associated with RES. Whereas the German REFIT encourages dispersal of wind installations on varying scales to both high and medium wind zones, the British RO encourages concentration of large wind farms at the windiest sites. This has two drawbacks. One is that the best sites draw excessive subsidy. The other is that the medium wind speed locations needed to meet the target of circa 10,000 MW receive inadequate support, and fail to be built. A 'cost reflective' system is desirable therefore on both effectiveness and efficiency criteria. It would be more 'market compliant' than an RO whose blindness is not towards technology but towards market reality.

Strategic support or permanent subsidy?

The need to provide a stable investment environment for new RES-E technologies cannot be over-stressed. The lower risks to investors in the German system contribute to its superior performance. However, strategic support should not turn into permanent subsidy.

In the UK, the main revenues of RES-E generators are from sales of electricity and ROCs. The value of one moves independently of the value of the other. Recent electricity wholesale price increases have been caused by conventional fuel price hikes. However, the latter do not increase the generation cost of renewables; nor do they have a direct impact on ROC values. The net effect is a 'windfall' increase in profitability for RES-E generators and suppliers. In the German system, this situation does not arise. On the contrary, a hidden benefit manifests itself. Controlled tariffs meant that RES-E was subsidised at a time when renewables were uncompetitive, resulting in higher costs for consumers. In the current context of rising fuel costs, German consumers are partly cushioned. This is because regulated wind-power prices have been falling whereas market prices from conventional generation have been rising. Over time, convergence between the two price curves can mean that German consumers receive a measure of compensation for subsidies.

However, in the UK system, consumers can expect to pay permanent subsidy, regardless of wholesale price movements and accompanying 'windfall' profits. A more equitable and efficient solution would be to reduce the revenue stream from consumer subsidies (e.g. ROCs) in line with increases in the revenue stream from electricity sales, making the generator no worse or better off.

An embedded problem arises from the management of a long-term policy frame. Current systems are based on subsidies for output in kilowatt hours, which allow a gradual accretion of revenues to reward heavy initial capital investment. Hence, the German system guarantees tariffs for 20 years, while the RO has a guaranteed life-span of 25 years. These time periods reflect the life cycle of individual installations, but they only approximate output levels and the need for subsidy. A more precise remuneration system would express rewards in terms of *quantities*, not *time*. This is feasible because of the (so-called) 'no fuel' nature of renewables such as wind and water: thus production costs are limited to investment plus maintenance costs. This means that their lifetime costs are known fairly accurately at the time of investment – unlike gas generation, where fuel costs are a major component of total costs and fluctuate heavily, making lifetime predictions impossible. Thus, the support regime to wind power would cross-relate costs and income streams to define a cap on subsidies to installations that no longer need them. This would allow better implementation of the cost-reflective approach. The German system already comes close to this, with the setting of precise 'reference yield' thresholds and tariff levels which are symmetrically amended in response to changing market conditions.[17] On the other hand, the RO uses time-based and arbitrary quotas characterised by their catchiness: e.g. 10% for 2010, 15% for 2015. The initial, government-administered, calibration of the 'buy-out' price remains shrouded in opacity, while its subsequent revisions were linked not to cost developments in the renewables sector but to the retail price index. Thus, the UK system is marked by arbitrary political choices, whereas the German system uses precise calculations based on industry knowledge. Nevertheless, in both cases, an improvement in efficiency could be sought by linking remuneration to output *quantities* at the level of individual renewables installations. A capping of subsidy in relation to quantity of output – rather than to time periods – reflects the intrinsic character of both the natural resource and the structure of investment. Setting a cap on subsidy need not affect the overall functioning of a particular system, nor prevent capped producers from selling electricity into the market. It would merely *filter eligibility*, diverting public resources from those who no longer need subsidy to those who do.

The question of 'permanent subsidy' can also be explored through the notion of 'tapering'. 'Tapering' can relate to the support system per se – in other words, its programmed phase-out – or to a progressive reduction in the support afforded within a system to *particular* technologies once they enter the market-ready phase. It is premature to discuss the former; hence, only the latter will be explored. The National Audit Office (2005: 7) made the recommendation that 'to balance the interests of taxpayers and consumers with those of the renewables industry, the Department ([i.e. the DTI]) should establish the criteria for reducing or withdrawing support'. Implementation of this strategy need not undermine *existing* projects, but would set predictable framework conditions for the medium to long term under which support would be progressively reduced to defined categories of *future* projects. This recommendation is of course premised on the capacity of policy-makers to identify at what point technologies enter the market-ready phase. That capacity can only stem from a database of commercial knowledge built up through applying a 'cost reflective' policy framework. As such, it constitutes a further reason for having such a framework. Longitudinal and targeted tapering of support need not alarm stakeholders. On the contrary, it can speak to their

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[17] See, for example, Gerdes and Rehfeldt (2005).

sense of realism and guide their decision-making. The Carbon Trust (2006: 13) argued that:

> …there is now a wide consensus (and expectation) that the RO needs to be adapted or changed – not doing so would introduce a greater amount of risk to the future of renewables policy due to it becoming associated with sustained high ROC prices and failure to achieve targets.

It is stressed that the current proposal is *not* that support be removed immediately or 'at a stroke'. Rather, the need is to set out the conditions and time-frame under which support will be progressively withdrawn from the technologies or categories of installation that no longer require it, while reinforcing support to those that do.

In Germany, the situation is less problematic in that targets are being achieved and at lower public cost. In addition, a tapering of support to onshore wind was already present in the 2000 EEG, was retained in its 2004 amendment and may be accelerated within the 2008 review. However, policy success brings new challenges. As the quantity of wind power in the electricity supply passes the 10% level, the question of its market integration and management becomes more acute. No doubt market actors will explore a range of initiatives, drawing on national and international experience. The policy framework can be used to deepen promising initiatives. One example is to shift a proportion of subsidies to the development of regional wind-farm 'pools', in order to improve the capacity to forecast and deliver output. Here, tapering of support would involve taking a more collective and less individualistic approach.

In short, capping and tapering of subsidies are recommended in relation to specific categories of renewables. The aim is *not* to end support in the short term, but to provide strategic targeting of support over the medium-to-long term.

Towards new regulatory challenges?

The rise of the renewables sector introduces new actors into the electricity supply industry and triggers changes in structure, conduct and performance. This raises regulatory challenges for the future. These arise from the policy support framework but go beyond it.

First and foremost, the provision of a subsidy framework requires accountability to consumers. Accountability is based on transparency. In general, a regulator is needed to achieve transparency and accountability. Yet, national energy regulators have not been enjoined with particular responsibilities or powers to achieve those purposes in relation to the substantial and increasing consumer subsidies to RES-E.

In the UK, the regulation of the relationship between renewables generators and suppliers is not part of the duties of the regulator, Ofgem. Yet, 'subsidy leakage' of the value of ROCs to the supplier means that a proportion of consumer subsidies either fails to reach current generators or fails to incentivise further RES-E generation. This is unsatisfactory in a subsidy regime where the total cost to consumers is the same, regardless of the amount of renewables generation. However, not enough is known about why and how such failures occur, and to date it would appear that nothing has been done about it. Given the large sums at stake and the importance to energy and environmental policies with which renewable power is credited, the case for the effective involvement of the regulator needs to be made. A recommendation, therefore, is that Ofgem be entrusted with investigation into the operation of ROC markets and the distribution of ROC receipts between market actors in the case of long-term power purchase agreements, and thereafter be charged with the issue and monitoring of guidelines on 'good practice' regarding the equitable apportionment of ROC receipts between generators and suppliers. Such surveillance and reporting would reassure the public that ROC subsidies go to renewables and that, where other costs *necessarily* enter into the equation (such as balancing and other services), these are identified clearly, and distributed efficiently and equitably. These undertakings could also identify routes to greater liquidity in ROC markets.

In Germany, the regulator is a recent invention and therefore faced with a range of challenges. Among these, high grid charges by monopoly TSOs is a major issue for independent generators, whether from conventional or renewable sources. However, of particular concern to the wind-power sector is the high cost attributed to balancing services by TSOs and the mechanisms by which 'feed-in tariffs' are billed to consumers. The German Energy Agency (DENA) studies are contributing to better understanding of the problems. Nonetheless, avoidance of inflated charges is a typical responsibility of the regulator and there is scope for requiring greater transparency as the precursor to greater equity.

In summary, the flexibility of the policy instrument to respond to evolving economic and technological contexts is a key criterion for assessment of its worth, along with the criteria of effectiveness, efficiency and equity. The main recommendations to improve flexibility are to respond to differences in technology life cycle by a banding of comparable technologies, by a more price-reflective structure of support in relation to each band, and by a capping of subsidies in relation to aggregate output. The authors have made a case for tapering of support for near-to-market technologies, both to enable their transition to market readiness and to improve the targeting of support towards other categories of renewable. To respond to the challenges of a major expansion of renewables, greater involvement of the regulator is recommended.

4 Local implementation

While national policies determine the general framework for the development of renewable energy, policy outcomes are influenced to a significant extent by regional and local conditions. These arise from material conditions (such as average wind speeds, land availability, etc.), but also from institutional factors (principally, planning regimes) and socio-economic factors (such as local benefits). These we term the *flanking conditions* for wind-power development. We stress that they have a considerable impact on the implementation of *any* support instrument.

Regional concentration

Due to higher wind speeds, most development in Germany has been in the northern coastal *Länder* – namely, Schleswig-Holstein, Lower Saxony and Mecklenburg-Vorpommern. These states enacted ambitious and proactive policies – for example, Schleswig-Holstein set a target of 25% of electricity to come from wind, and this was met by 2002 (EWEA and Greenpeace, 2002: 14). By 2005, these three states accounted for 8,274 MW of installed capacity out of a total 18,427 MW in Germany as a whole (DEWI, 2006). The northern non-coastal *Länder* of Brandenburg, Saxony-Anhalt and North Rhine-Westphalia together accommodated a further 7,037 MW. Over time, development spread into the lower wind regions of southern Germany. Nevertheless, Bavaria and Baden-Württemberg – both very extensive *Länder* – together had only 520 MW of wind capacity in 2005 (DEWI, 2006). This is largely because the drop in wind speeds is significant: from around 7 m/s at coastal sites to well below 6 m/s (Lehmann, 2003: 40). Hence, there is a marked north-south split in the location of wind farms in Germany.

This results in grid saturation problems. Luther et al. (2005: 236) noted that 'in the Northern part of the power system, the transmission capacity of the [high voltage] system reaches its limits during times with low load and high wind power production'. Because of problems with the grid integration of wind power, reinforcement has been scheduled.[18]

However, the regional distribution of wind installation is unlikely to change significantly, because the 2004 EEG amendment only gave entitlement to 'feed-in tariffs' to installations meeting 60% of the 'reference yield'. Limited availability of new sites has led to a peak in onshore growth rates. The biggest year-on-year growth in capacity was 3,211 MW in 2002 (BMU, 2005a: 12). It fell to 2,020 MW in 2004 and to 1,808 MW in 2005. Although very sizeable increases, they are considered unsustainable. Thus, the BMU (2004a: 9) stated that 'the potential for wind energy utilisation at onshore windy sites is

[18] Subsequent to the 2005 report by DENA (the German Energy Agency), some 850km of new extra-high tension lines are planned for construction by 2015 to resolve current grid integration problems related to wind energy (DENA, 2005: 9). The aim is to remove bottle-necks and ensure grid stability.

already largely exhausted'. Although the 2004 EEG amendment encouraged 'repowering', interview respondents differed in their assessment of its importance. On balance, given unfavourable experience in Denmark and the time-frame of the two German wind booms – with 90% of capacity being less than 10 years old – the impact of 'repowering' is unlikely to be significant until the next decade.

In consequence, substantial new RES-E capacity will come either from offshore wind or other renewables. However, although the offshore boom has been much talked about, it has yet to materialise. Numbers of offshore installations worldwide are small. Denmark has two 'large-scale' offshore wind farms as does the UK, though with more in construction. But Germany has yet to build a single one. Although a test field at Borkum West is used for trials and a number of offshore projects are in the licensing process, operational issues are proving problematic. These run from inadequate subsidies and underdeveloped investment models, to building constraints in deep sea conditions in the North Sea, through to grid connection costs. We have noted the north-south split in relation to onshore wind. The problem would be magnified should ambitious plans for 20,000–25,000 MW of offshore capacity materialise by 2030 as planned, all of which would be in the north.[19] Meanwhile, the major load centres are in the industrial conurbations of the west (Essen-Cologne-Bonn) and south (Munich), while the deindustrialisation and depopulation of Eastern Germany subsequent to reunification have continued. To transmit a potential 30 TWh of electricity from offshore sites to inshore conurbations would require massive expenditure. It would entail not so much grid reinforcement as grid reconfiguration, given the scale, distance and potential for significant power losses en route. In addition, there are the 'normal' planning issues related to high-tension lines (impacts on landscape, nature, housing, etc.). These are expected to lead to planning objections and delays.

Clearly, no assessment of such a long-term (25-year) set of proposals can be attempted here. Rather, attention is drawn to the debates, questions and challenges that are currently unfolding.

Planning issues

In Germany, a spatial planning regime is in operation, whose major output is a regional development plan. This plan provides for a 'bottom-up' approach, which allows local authorities to nominate areas as suitable or unsuitable for wind-power development. Moreover, the spatial planning regime is embedded within a federal system. Decision-making takes place within the *Land*, rather than at central government level. These institutional features encourage societal participation (although they do not guarantee deliberative democracy).

The building of wind farms in Germany was encouraged by a change in paragraph 35 of the Federal Building Code, which specified the structures that were permissible in the countryside (Rickerson, 2002). From 1996, wind turbines were included in the list.

[19] Details of the German offshore wind strategy come from BMU (2002) and Viertl and Bömer (2005).

This gave wind farms the same level of priority in relation to gaining planning permission as accorded to conventional power plants. Furthermore, the spatial approach to planning eased the process of wind integration in that a presumption was created in favour of wind farms within identified zones. Exclusion zones are also identified within the regional development plan. Thus, conservation interests are protected as designated sites (national parks, bird sanctuaries, wetlands, etc.) are – in principle – excluded during the spatial planning process from zones identified as suitable for wind power.[20] In this way, the spatial planning regime has been a major facilitator in the uptake of wind farms in Germany.

Nevertheless, problems have arisen due to timing and sometimes the adequacy of the zoning measures. In the northern *Länder*, regional development plans mostly contain clear provisions for wind-farm zones, but the authorities in some southern *Länder* have still to designate these. Even in the north, planners experienced difficulties keeping up with the pressure of the 'wind rush'. In Schleswig-Holstein, ambitious plans for wind-power expansion were accompanied by a broad-based consultative process over the period 1997–98, leading to the identification of 166 *Vorrausgebiete* ('special wind areas') covering just one 1% of the state's land mass, with wind farms banned from the rest. In Brandenburg, the regional development plan for the picturesque tourist region of the Uckermark identified 26 'special wind areas'. However, it was only completed in October 2000. Meanwhile, the first wind turbines had been installed in 1993, when guidelines had not been formally approved and legally binding development plans were unavailable. There was a largely unregulated and uncontrolled boom in wind development in the Uckermark during the 1990s when relatively small turbines (less than 1 MW) were installed, sometimes in quite large numbers and close to villages and houses (often no more than 400 metres' separation distance), with no provision for the removal of installations at the end of their life span. The pace of development often outstripped official projections. While in 2000, a projected target of 222 turbines in the Uckermark region was considered controversial because of the so-called *Verspargelung* ('asparagus-isation') of the landscape, 336 turbines with a total capacity of 417 MW had been installed or given approval by the end of 2004.

To respond to these pressures, some applicable measures have been amended. As a result of technological progress and 'repowering', some previously suitable sites have been reduced in size, but areas for potential new developments are being explored. In the late 1990s, regional planning procedures included a provision for a total height limit (tower plus rotor radius) of 150m. Because the next generation of multi-MW turbines are larger than this, planning provisions will probably be modified (Lehmann, 2003: 42). Also, turbine blades must display red flashing lights at night-time as an air safety measure. Small installations (three turbines or fewer) need only a building permit, but clusters of over three require an environmental impact assessment. With the proliferation of wind farms, 'cumulative effect' has become an issue and, since 2004, it has to be considered in the environmental statement which has to accompany a planning application. In the case of the Uckermark, the 2006 review of the regional development plan provides for a greater separation distance between housing and turbines (increased from 800m to

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[20] In consequence, the nature conservation NGOs such as BUND have rarely needed to engage in local campaigns to protect designated sites. But exceptions exist, with offshore projects proving problematic, given the extensive nature reserves off Germany's northern coastline. Thus, BUND opposed development at Solt because of its designation under the Habitats directive.

1000m), and the distance between individual wind parks is to be increased to 5 km. Improved compliance with Special Protection Area (SPA) requirements is to be implemented.

The UK does not have a spatial planning regime as do Germany and Denmark, but relies instead on 'criteria-based' decision-making. As noted by Cullingworth and Nadin (2002: 49), 'the British system embraces discretion and general planning principles, rather than certainty for the landowner and developer'. These general principles were contained in a series of documents known as Planning Policy Guidance (PPG) notes, of which PPG22 applied specifically to renewable energy.[21] However, PPG22 was dated 1993 and therefore considered out of date by the turn of the century. Interested parties such as the British Wind Energy Association (BWEA) viewed the planning regime as an impediment to the expansion of wind power, and lobbied for its reform.

The impact of the planning regime is complex. As noted by Toke (2005: 1529), 'almost two-thirds of the capacity of contracts issued under later NFFO rounds was never even subjected to a meaningful planning application'. So planning was not self-evidently the obstacle in those cases. An overview by the National Audit Office (2005: 22) stated:

> Between 1999 and 2003, 94 per cent of planning applications in Scotland received approval against 50 per cent in England and 40 per cent in Wales, although this latter figure masks a significant legacy of wind farms in Wales that were approved before 1999. Within England, between 1999 and 2003, local planning authority approval rates for wind farms ranged from zero to nearly 100 per cent, with most authorities reporting approval rates of between 50 and 80 per cent. As regards the average time for applications to go through the planning process, for England this is 8.5 months, for Scotland 10.0 months, and for Wales 23.4 months. There is also significant variation at a regional level.

According to Toke (2005: 1530), the relatively low level of approvals in England has been explained by 'three (independent) variables, namely the opinion of the parish council, the planning officer's recommendation, and the opinion of the countryside protection group [usually Campaign for the Protection of Rural England (CPRE)], are strongly associated with the decision of the local planning authority (the dependent variable)'. The much higher level of approvals in Scotland is often attributed to the reformed National Planning Policy Guidelines of the year 2000, known as NPPG6.[22] However, institutional processes are crucial because all large wind-farm applications in Scotland are referred to the Scottish Executive which, up to 2005, had approved all except two. Nevertheless, pro-wind actors considered reform of PPG22 along the lines of NPPG6 as a priority.

The reform was completed by the Office of the Deputy Prime Minister (ODPM) in 2004, bringing into force a new Planning Policy Statement (PPS) applicable to renewables, numbered PPS22. In order to facilitate the expansion of renewable energy, PPS22 specified three elements to be taken into consideration in planning decisions: targets, criteria-based policies and locational considerations (ODPM: 2004b: 21). However, the notion of 'locational considerations' was understood in a generic rather than a regulatory sense as indicating 'broad areas' but 'without definable boundaries' (ODPM: 2004b: 22),

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[21] See Department of the Environment (1993).

[22] See Scottish Executive (2000).

rather than continental inclusion/exclusion zones.[23] The emphasis on criteria-based decision-making apparently left intact the core philosophy of the British planning regime. However, the stress on renewables targets has been mediated by new, non-elected Regional Assemblies. In the words of the ODPM (2004b: 21):

> Regional spatial strategies are to set out each region's approach to a very broad range of planning issues, including economic development, housing, transport, energy and the environment. They will be subject to public consultation and examination, and must be approved by the Secretary of State before adoption. Once adopted they will have statutory weight and subordinate policy tiers (local development frameworks and supplementary planning documents) will be expected to have general conformity with them.

The requirement for approval of regional strategies by the Secretary of State reinforced central supervision over elected local authorities via the non-elected 'Regional Assemblies' (to whom the local authorities are now beholden). The 'top-down' approach of the OPDM has created frictions at local levels.

The consequences are still working through. According to BWEA figures for the 2002–05 period, success rates for wind-farm proposals in England were 77% for applications and 38% for appeals, in Scotland 59% and 51% respectively, with 63% and 41% for Wales. These data suggest that approval rates have risen since the introduction of the new planning guidelines. In 2005, the outcomes of three public inquiries in England, held under Section 36 of the 1989 Electricity Act, point in the same direction. Although the inspector ruled against the construction of the Whinash proposal for a 67.5 MW wind farm in the Lake District, approvals were granted in relation to Scout and Knowl Moors (a 65 MW wind farm near Rochdale) and to Little Cheyne Court (a 78 MW project on Walland Marsh/Romney Marsh, Kent). However, in all three cases, PPS22 received due weight.[24]

The core differences in planning regimes between the German 'spatial planning' approach and the British 'criteria-based' philosophy are deeply embedded within institutional routines and as such are set to persist. To date, the German approach has proved the more consensual and effective of the two in promoting wind power, while, since the introduction of PPS22, the English approach has become perhaps more efficient but also more conflictual.

Local benefits

In Germany, availability of subsidies for investment in wind farms and guaranteed 'feed-in tariffs' encouraged ownership by farmers and by the general public, leading to large numbers of community ventures called *Bürgerwindparks* (citizens' wind farms). In Schleswig-Holstein, which has mainly small and medium-sized wind farms, some 60–70% are citizen-owned, often by local farmers. Larger wind farms have been financed through investment funds whose shares have been bought by companies and individuals. Estimates of total numbers of investors have varied greatly. EWEA (European Wind

[23] This phraseology allowed for sub-national differentiation. Thus, whereas 'spatial planning' of renewables is avoided in England, Wales now has a system of 'areas of search' under TAN8.

[24] For the relevant inspectors' reports, see Rose (2006), Durrant (2005) and Richardson (2005).

Agency Association) and Greenpeace (2002: 15) stated that over 100,000 Germans own shares in wind farms. Rickerson (2002) claimed that 90% of turbines were owned by private citizens, with some 200,000 subscribing to ownership via co-operatives. However, no database on wind-farm investors appears to exist. Despite uncertainty over precise figures, it is clear that the numbers of investors are several orders of magnitude greater in Germany than in the UK.

In struggling rural economies – especially in Eastern Germany – the economic benefits of wind have been especially welcome to small farmers. German farmers sometimes own turbines outright and sometimes lease their land to wind-farm operators. Wind turbine rents are an important source of income for some German farmers (EWEA and Greenpeace, 2002: 15).[25] The local community can also benefit economically from wind farms. Associated local taxation gains (from the *Gewerbesteuer*) are a boon for municipal authorities, especially in economically depressed areas. However, the first tax returns are payable only after 4 to 7 years of operation. In addition 'environmental compensation payments' are set up as a way of recycling some wind-farm profits to municipal projects to benefit locals, or used for nature protection funds at local level. In northern Germany, local politicians are often enthusiastic about the development of wind energy, emphasising job opportunities in the manufacture and servicing of turbines, together with secondary employment effects. In summary, a range of community benefits contribute to the social acceptance of wind farms in northern Germany – namely, ownership of turbines and land rents as sources of local income, local taxation and job creation. This contributes to perceptions of equity: those most affected by wind-power installations are often those who benefit from them.

In the UK, most of these local benefits do not arise. Cases of local ownership are a rare exception, with wind farms mostly owned by large operators (including the utilities) which are national or international firms. Local or regional job opportunities are rare because onshore wind-power technology in the UK is almost exclusively imported, while developing and consultancy is undertaken by national firms.[26] Local tax gains are few in the highly centralised UK fiscal system. Fieldwork contacts have established that 'community funds' set up by wind-farm developers are becoming the norm in Wales and Scotland but revenue is modest, especially once distributed across several municipalities. Thus, the major source of wind-farm income in the UK accrues to distant developers/owners of wind farms, while the second largest source of income comes from land rents. The latter are spread unevenly and usually benefit large landowners. Consequently, whereas a range of local socio-economic benefits accumulate in northern Germany, very few can be identified in the UK. If local benefits act as an incentive to encourage wind farms, the accrual of income to distant third parties can contribute to a sense of injustice, polarise local opinion and foster social rejection.

[25] Tensions can arise in rural communities if individuals capture the benefits while the majority experience disadvantages.

[26] Exceptions are often subsidiaries of foreign firms such as Vestas in Campbelltown. Scotland. There are few British-owned firms in manufacturing, despite expertise in R&D, consulting and developing. The 'Wind Supply' project aims to promote the entry of UK engineering firms into the supply chain, but it is in its early stages (see www.windsupply.co.uk).

Local resistance

As a result, resistance to wind power has generally been higher in the UK than in Germany. The complaints against wind turbines are similar in both countries (though with some differences in emphasis) – namely:

- visual and landscape impacts;
- size and number of turbines per wind farm;
- 'cumulative effect' (especially in northern *Länder* and increasingly in Scotland);
- noise and 'flicker' (day-time shadows);
- flashing of lights on blade-tips at night-time (in Germany);
- decline of property prices near wind farms;
- impact on biodiversity, especially rare species (cranes, bats, storks, etc.);
- impact on quality of agricultural land and ground water level, because of the 25m deep foundations plus gravel bed of the 100m plus turbines (to blade tip), which are now common;
- locals do not benefit from the development, while profits go to outsiders, employment opportunities go to specialist firms (which are not local), and promises of tax returns or other payments to local councils have either not materialised or remained opaque.

In the UK, opposition to wind power has led to the formation of several national 'umbrella' associations. Formed in 1992, Country Guardian is the 'umbrella' organisation for anti-wind protest particularly in England and Wales. In addition, Views of Scotland provides a focal point for anti-wind protest north of the border. In England, the Renewable Energy Foundation originated from anti-wind protest, but has developed a broader based stance, which seeks to promote renewables – albeit over and against wind power. These organisations undertake research and lobby government to change policy. They also support local groups who lodge objections to planning applications, giving advice on campaigning tactics and legal procedures. The aim of local groups is to encourage rejection of wind-farm applications by local planning committees. In this, they have enjoyed a measure of success. However, the precise influence of anti-wind protest is hard to measure, given the complexities of planning procedures, the scope for multiple causation in the making of planning decisions, and the involvement of national government (including the Scottish Executive).

In Germany, too, local anti-wind groups have arisen. But, unlike the UK, no 'umbrella' organisation exists to federate them. In the UK, long-established landscape protection groups such as the CPRE and the Campaign for the Protection of Rural Wales (CPRW) exercise influence on planning decisions and have sometimes made common cause with anti-wind protestors. The Ramblers' Association and the Open Spaces Society have also been vocal in their criticism of government policies towards wind power. However, there seem to be no comparable cases in Germany. Thus anti-wind protest has a rather different profile in the two countries: national organisations make a case against government policy in the UK, but not in Germany.[27]

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[27] In both countries, the major national environmental NGOs (Greenpeace, WWF, FoE/BUND, RSPB and NABU) take a positive stance towards renewables in general.

Because in Germany resistance occurs in local pockets (with few national-level echoes), we looked at one such case in Brandenburg where the most prominent organisation is *Rettet die Uckermark*. Four of its representatives were elected onto the county council on a single issue, anti-wind ticket. Local protest activities are mostly organised in informal networks, with comparatively little co-operation between them. Protest focuses on specific wind-farm projects. Typical activities are the collection of signatures for petitions and mobilisation of attendance at consultation meetings. Objections tend to be on legal grounds, related to technical deficiencies in the licensing process. Representatives of these 'citizens' initiatives' insist that they are not opposed to wind energy as such, but that it should not happen in the beautiful scenery of the Uckermark, or at least not on the scale projected. Indeed, certain villages are already surrounded by wind farms. Protests have often been led by newcomers who post-1990 moved to the area from Berlin. Indigenous locals retain a level of scepticism towards the 'foreigners', which impacts on the ability of the latter to mobilise support. Activists have been unable to sustain commitment for the extended period that runs from the initial application to the construction phase. In consequence, citizen protests in the Uckermark region have not scored any major successes. Given their non-institutionalised and non-professional structures, anti-wind groups in Germany have found it difficult to compete with a highly organised and professionalised pro-wind lobby that mobilises environmental arguments and offers material inducements. Although linked to a broader context of political disaffection, anti-wind protest in Germany has not notably strengthened civil society capacity-building, with the inability to create a national umbrella organisation being a case in point.

In summary, the *flanking conditions* of local socio-economic benefits and consultative spatial planning have made a significant contribution to the 'success story' of wind power in northern Germany. That contribution is well understood in Germany, but it is underestimated in the UK. As discussed in Chapter 4 under 'Planning issues', the spatial planning process places a major part of the discussion of where to build upstream of individual applications. This allows for a bottom-up approach involving broad consultation, but it also makes the process more opaque and difficult to assess. However, lessons have been learnt about the handling of wind-farm development from earlier phases of regional development planning – for example, in relation to separation distances and the implementation of European nature conservation directives. The 'wind boom' in Germany has fuelled objections in the recent period but, with new build slowing, the cause for protest later this decade is perhaps decreasing. In the UK, the 'criteria-based' decision-making process has allowed anti-wind groups to gain entry to local planning procedures. However, even where the local authority has rejected a proposal, a significant number of applications are being won by developers on appeal. Thus, the pace of UK wind-farm build in the late 2000s is set to increase (especially in Scotland), although it is unlikely to resemble a German 'wind boom' due to the design of the RO, limited grid connections and turbine shortages.

5 Conclusions

Germany is on track to meet its EU RES-E targets, whereas it is questionable whether the UK will. Even with slower new build, achievement of the 12.5% target for 2010 is credible, because 10.2% of electricity in Germany came from renewables in 2005 (BMU, 2006: 5). However, the breakdown of energy sources is revealing, with wind supplying 4.3% in 2005, hydro 3.5%, biomass 2.2%, and with PV and geothermal making up the balance. Meanwhile, the UK target of 10% for 2010 has relied heavily on wind and landfill gas. Whereas Germany needs 4–5% of electricity generation from wind to reach its targets, the UK needs 7–8%, mostly from onshore. This order of difference is challenging, even given the greater wind resource in the UK and the smaller electricity supply. Although the RO offers generous subsidies, it is a flawed instrument in that investment incentives evaporate before targets are achieved. In Germany, the effectiveness of the 'feed-in tariff', *together with* the bottom-up spatial planning regime and multiple local benefits, explains the wind-power 'success story'. In the UK, these three main facilitators are absent.

Furthermore, the German approach to renewable energy policy was organised around a significant industrial policy core. The rise of the wind sector is an example of pursuing market opportunities for German engineering at home and abroad. Mobilisation for renewables was communicated through a 'win-win' scenario – attaining environmental and economic goals simultaneously – within a general policy frame of progress to 'ecological modernisation'. On the other hand, in the UK this combination does not hold. The opportunities to develop a manufacturing base for wind turbines are now severely limited by the 'early mover' advantage gained by Denmark, Germany and Spain. Marine technologies (offshore wind, wave and tidal) and micro-generation may offer better long-term opportunities for the UK.

In summary, the key lessons drawn from this Anglo-German comparison of wind power are that:

- successful renewables policy in Germany has combined energy policy, environmental policy *and* industrial policy to create 'early mover' advantages;
- where policy instruments are based on economic incentives, their effectiveness, efficiency, equity and flexibility are key criteria for assessment and up-dating;
- appropriate *flanking conditions* in the institutional and social domains need to be developed to support the policy instruments and give positive incentives for societal participation.
- this *integrated policy framework* should include the aim of encouraging new entrants (rather than just privileging vested interests), in terms of investment, manufacturing, generation and energy services.

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