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The renewables NFFO

A review

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There have been three Orders of the renewables NFFO and a fourth has recently been announced. This paper explains the creation of the NFFO, the application procedures for each Order and the status of the contracts for each Order. It goes on to discuss the key lessons to be learnt from the process: namely that a market enablement programme should coordinate with the R&D programme; second, that competition as the basis for support of renewables, while bringing prices down rapidly, has a number of disbenefits; third, that the NFFO process has led to the development of renewable energy industry in the UK with a stake in its future; fourth, the deployment of renewable energy technologies as a result of the NFFO has led to a dawning of an understanding by the renewable energy industry of the key issues that renewable energy has to address and the importance of the attitudes of the financial institutions and electricity systems to the successful outcome of those issues; fifth, it describes the development of a *de facto* policy for renewable energy by OFFER; and finally, that the renewable support mechanism should be coordinated with a planning policy.

Keywords: NFFO; Renewables; Support mechanism

Renewable electricity generation was supported by a market enablement programme, as compared to research and development funding, for the first time in the UK as a result of privatization of the electricity supply industry (ESI). Renewable energy projects were able to obtain a premium price per kilowatt hour of generation if they were successful in their application for a contract under the Non-Fossil Fuel Obligation (NFFO). The NFFO requires the public electricity suppliers (PESs, from now on known as RECs[1] (regional electricity companies)) to buy a certain amount of nuclear and renewable electricity. The RECs pay the generators a premium price for the renewable electricity and the difference between the premium price and the average monthly pool purchasing price is reimbursed to the REC by the Non-Fossil Purchasing Agency (NFPA) from the fossil fuel levy (FFL) on electricity, paid via customer electricity bills.

[1]The NFFO legislation refers to PESs. However, only PESs which are also RECs have the obligation; there are other PESs which are not RECs which are not obliged to buy nuclear or renewable electricity.

There have been three NFFO Orders and recently an announcement of the fourth (DTI, 1995b): the first in 1990 (NFFO1) which provided contracts for 152 MW declared net capacity (DNC) of landfill gas, sewage gas, hydro, wind energy, waste to energy and biomass projects; the second in 1991 (NFFO2) which provided contracts for 472 MW DNC for projects based on similar technologies; and a third Order of 626.92 MW DNC was awarded in December 1994 (NFFO3) which included biomass gasification for the first time but excluded sewage (DTI, 1994). The renewable premium prices have been paid for by 1–5% of the FFL, which has been set at between 10% and 11% of the electricity price since 1990 (OFFER, 1991). A fifth Order due to be announced in 1997 for 1998.

The NFFO provided a contract for the supply of electricity to the RECs; it provided a subsidy to the contractors; and it accepted the principle that paying a premium price for electricity from near market technologies is an efficient and appropriate means of transferring those technologies to competitiveness. Each of

these provisions is extremely important because the RECs have no obligation beyond the NFFO to buy renewable electricity, the terms of the 1983 Energy Act having lapsed. Moreover, they are under an obligation through their licence to undertake economic purchasing, to ensure that their customers are not paying more than is necessary for their electricity.

Given the current interest in possible means of support for renewable energy within the evolving deregulated US system, the development of renewable energy support mechanisms within Southern European countries and discussions for improvements or change of the *in situ* support mechanisms within the Northern European countries, it is appropriate to review the NFFO process and to assess its merits and weaknesses.

UK renewable energy policy prior to privatization

The UK renewable energy policy prior to privatization was based on research and development (R&D) programmes and, latterly, a few demonstration projects. The government had undertaken a renewable energy research programme since the mid-1970s. In 1982, the Advisory Council on Research and Development for fuel and power (ACORD) undertook a major review to establish a methodology by which the potential and cost of a technology could be assessed,[2] and this was updated in 1986. A new renewable energy review was then published in 1988 (Energy Paper 55, 1988), which has been overtaken by another renewable energy review in 1994 (Energy Paper 62, 1994), with a commitment to yet another 'fundamental review' in five years (Energy Paper 62, 1994, p 21).

So far, the total UK RD&D expenditure on renewable energy has been £232.3 million (nominal pounds) or £340.2 in 1992–93 prices (National Audit Office, 1994). Energy Paper 62 confirms that the renewable energy R&D programme will extend to 2005, although it makes it clear that its continuation to that date will depend on the outcome of the next review. Furthermore, Energy Paper 62 envisages that government declining R&D support will be offset, and even bettered, by 'industrial and other contributions' (Energy Paper 62, 1994, p 22). However, history is less than reassuring about such optimism. Energy Paper 55 projected industry investment rising from £2 million in 1986 rising to £45 million in 1995. As the National Audit Office (NAO) report states 'analysis showed that funding from non-department sources had not grown as originally expected' (NAO, 1994, p 11).

In practice, renewable energy generation prior to privatization, even including R&D and development projects, was very limited in the UK. Renewable energy generators were able to sell their electricity, providing they were connected to the grid, under 1983 Energy Act terms. Under the Act, electricity boards were obliged to buy electricity from independent generators. However, they paid the renewable generators an average of 30% less than the CEGB for their electricity (AIEP, 1992).

The creation of the renewables NFFO

The renewable NFFO developed out of the need to find a means of supporting nuclear power, once it was realized that the nuclear portion of the ESI could not be privatized in 1989. The Competition Directive required that the government obtain permission from the European Commission (EC) for a levy to pay for nuclear power. This they did, but they asked the Commission to accept a levy to pay for non-fossil generation, specifically not mentioning nuclear power. The Commission agreed to a levy but only until 1998. Just as the government did not use the term nuclear power, nor did it ask for support of renewable energy. However, it was accepted at an early stage that the definition of non-fossil would include renewable energy.

Thus, from the government's perspective, renewables were supported in the privatization process as a result of, and linked to, the need to support nuclear power. No mention of support for renewables occurred in the privatization literature until the announcement of the levy. Furthermore, when the levy was first announced it did not set a capacity of renewable energy to be supported through the renewable NFFO. It was only when the timetable for the privatization process began to slip that renewables and nuclear power were separated and the government announced that the renewables NFFO would support 600 MW DNC.[3]

The legislation

The NFFO legislation is contained in section 32 and section 33 of the 1989 Electricity Act. Section 32 of the Electricity Act states 'the Secretary of State may ... by Order' require the PESs to purchase a certain amount of electricity. Section 33 is responsible for the Levy by which the PESs are able to recover the monies.

However, section 32 contains no reference to the number of Orders which may take place; no time reference (for example, by 1998 or by 2030); no reference to capacity (for example, 100 MW or 100 GW); and no ref-

[2] The implications of ACORD for renewable energy development in the UK have been widely discussed; see Elliott (1989).

[3] DNC = the equivalent capacity of base load plant that would produce the same averge annual energy output; see *The Non Fossil Fuel Obligation: A Background Note* DoEn, August, 1991

Table 1 Status of NFFO projects

Technology	Projects contracted Number	MW	Projects generating Number	MW	Projects terminated Number	MW	Projects to be commissioned Number	MW	Completion rates (%) Number	MW
Wind	9	12.21	8	11.7	1	0.51	–	–	89	96
Hydro	26	11.85	20	8.87	5	1.85	1	0.66	77	75
Landfill gas	25	35.5	20	30.31	5	3.82	–	–	80	88
Waste combustion	4	40.63	4	39.63	–	–	–	100	98	–
Other combustion	4	45.48	4	45.48	–	–	–	100	100	–
Sewage gas	7	6.45	7	6.45	–	–	–	100	100	–
Totals	75	152.11	63	142.44	11	6.18	1	0.66	84	94

Source: OFFER, 1994, Table 5, p 28

erence to technology (for example, sewage gas or wave-power). It appears that a Secretary of State could Order the PESs to buy all renewables without any new legislation being required. Furthermore, sections 32 and 33 are not linked; it would therefore be possible to scrap section 33 while retaining section 32. Thus, theoretically it is possible for a Secretary of State to Order the buying of all renewables without allowing recovery of monies through section 33. Thus the Act is extremely open and a potentially powerful and flexible tool in support of renewables.

The 1998 NFFO end date

The 1998 NFFO end date was extremely damaging for NFFO1 and NFFO2, as is discussed below. The government initially asked the EC for approval for a levy to support non-fossil electricity for an indeterminate period of time, expected to be at least 15 years. A compromise between the UK Department of Energy (DoEn) and the Commission was reached whereby the levy would be set for eight years and the Commission later stated that they 'did not wish in 1990 to grant authorization for support of nuclear power beyond 1998 (House of Commons Energy Select Committee, 1992). It is rumoured that it was the UK government that proposed the eight-year timescale, although this may have been a last ditch attempt to retain any levy at all (Robert *et al*, 1991).

However, the European Commission let it be known in a number of sources for example a letter to Friends of the Earth and later in Evidence to a Select Committee that they would consider an application for the extension of the NFFO for renewables 'with a generally favourable view' (FoE, 1991) and 'there is little doubt, however, that the Commission would look favourably on a proposal for the UK to support renewable energy sources beyond 1998' (House of Commons, ESC (1992) Vol 2, Memo 43, p 151, Q2). This would fit with past, favourable responses that the European Commission had accorded to applications for exemptions to legislation on environmental grounds, although an exemption had not specifically occurred for renewable energy. However, the Commission had 'recently approved a major package of schemes for assistance for energy conservation and renewable energy production introduction in Italy without limit and the price support in Germany in 1990' (House of Commons, ESC (1992) Vol 2, p 16:5).

Nevertheless, an exemption for support for renewable energy was not finally agreed until the summer of 1993, just prior to the announcement of the conditions of the 1994 NFFO. Given the EC's favourable response to the possibility of an exemption as early as 1991, it can be argued that the UK government was at best acquiescent about the eight-year ruling but at worst was responsible for allowing the retention of the factor in the 1991 NFFO which caused more problems for renewable energy development than any other factor. Had the government wished to support renewable energy, it would have sought to exempt renewables from the 1998 end date, at least by 1991 for NFFO2.

The renewable NFFO was justified by the government on two main grounds. First, a 'market-pull' support mechanism such as the NFFO was appropriate policy for supporting near-market new technologies into the market place. Second, new renewable electricity generators would increase the number of independent power producers (IPPs) into the ESI, an aim of the privatization process. Nevertheless, this paper argues that government support for renewable energy technologies via the NFFO and its justification was based on expediency. It is argued that the underlying reason for support of renewable energy was a byproduct of the primary need to support nuclear power. There is no evidence to suggest that a renewable energy would have had such an injection of support without this link, particularly given the minimal level of support for renewables prior to privatization.

The status of NFFO1 and NFFO2

The Office of Electricity Regulation has provided a detailed explanation of the results of NFFO1 and NFFO2 and these are shown in Table 1 and Table 2.[4]

[4]Also provided in *Review* (1995) Issue 24, February, p 15.

Table 2 Status of 1991 NFFO projects

Technology	Projects contracted Number	MW	Projects generating Number	MW	Projects terminated Number	MW	Projects to be commissioned Number	MW	Completion rates (%) Number	MW
Wind	49	84.43	23	47.15	21	25.32	5	10.83	47	56
Hydro	12	10.86	7	10.05	–	–	5	0.81	58	93
Landfill gas	28	48.45	26	44.73	2	2.06	–	–	93	92
Waste combustion	10	271.48	2	31.5	6	214.38	2	25.6	20	12
Other combustion	4	30.15	1	12.5	1	8.45	2	9.2	25	41
Sewage gas	19	26.86	19	26.86	–	–	–	–	100	100
Totals	122	472.23	78	172.79	30	250.20	14	46.34	64	37

Source: OFFER, 1994, Table 6, p 29

Table 1 excludes a column for existing projects. Of the 75 projects awarded contracts, 35 were already existing and generating electricity. Thus, of the 150 MW DNC granted projects, around 100 MW DNC was new or refurbished and about 50 MW DNC was already generating (Mitchell and MacKerron, 1994). The NFFO supported renewable electricity only, excluding heat technologies which skewed development of certain technologies towards electricity when heat might have been a more energy efficient option, for example use of landfill gas. However, as argued above, privatization had created an opportunity for support for renewable electricity via the FFL. It did not create an opportunity for the support of renewable heat in the same way, not least because it would have required additional legislation.

Table 2 also excludes a column for existing projects. Of the 122 projects, 25 were existing with around 37 MW DNC already generating (Mitchell and MacKerron, 1994). More or less all of the hydro contracts were for existing projects.

NFFO1

The price paid for each kilowatt hour in the 1990 NFFO was agreed following a process of 'cost justification' whereby the renewable generators were to provide the RECs with enough information to justify their bids. Each project was assessed separately and no direct competition occurred between projects or technologies. This masked the problem that no one was sure how much renewable electricity was going to cost. As discussed above, the level of renewable development in the UK prior to the NFFO was extremely small. The most numerous renewable projects were small hydro plants, but many of these had been in existence in some form for centuries.

At the same time as vetting the cost justification proposals for the NFFO applicants, the regional electricity boards were occupied with the transfer to becoming privatized RECs. Among many other activities, the regional boards were creating wholly owned generation subsidiaries for the RECs. This meant that not only were the RECs preoccupied when they undertook their NFFO responsibilities but the renewable developers were also unhappy sending their financial and economic details, required for the NFFO application, to the regional boards, which they saw as potential competitors. As the Association of Independent Energy Producers (AIEP) stated 'there seemed to be little evidence of Chinese walls in some area boards' (House of Commons, ESC (1992) Vol 2, p 131:13), an area later investigated by the House of Commons Welsh Affairs Select Committee (House of Commons Select Committee on Welsh Affairs, 1994).

The management of the NFFO1 applications was initially undertaken by the Department of Energy (DoEn) which was responsible for the privatization process. However, as the RECs, the NFPA and the Office of Electricity Regulation (OFFER) were set up in late 1989 and early 1990 they became increasingly involved in the application process. This caused confusion among the applicants (and to a certain extent between the RECs, NFPA and OFFER) about which agency was responsible for what parts of the application process. Furthermore, different RECs appeared to interpret their NFFO functions differently. As AIEP stated 'it was difficult and sometimes impossible to obtain clear information about what was needed by the DoEn, RECs and OFFER or when action should be taken' (House of Commons, ESC (1992) Vol 3, p 142:11.2).

In addition, in order to qualify for a contract the Director General of Electricity Supply (DGES), otherwise known as the Electricity Regulator (Professor Littlechild), with his staff in OFFER had to satisfy themselves that the arrangements made by the RECs in relation to the projects 'will secure' their contracted capacity in accordance with the Act' (NFPA, 1991, 1993, section 32 of the 1989 Electricity Act). OFFER's role is to scrutinize the arrangements made by the generator before the NFFO Order is laid so that OFFER is reasonably satisfied that the scheme will produce the output the generator contracts for from non-fossil sources. OFFER sought assurances from the generator in the following areas that:

(1) a defined site is available, with good prospects for planning permission (if needed and not already granted);
(2) there are satisfactory prospects that wayleaves and other necessary consents for electrical connection to the site could be procured;
(3) the scheme is technically viable and its projected electricity output can realistically be achieved;
(4) the scheme can be made operational by the contracted commissioning date;
(5) the projected capital and operating costs for the scheme have been properly justified;
(6) secure arrangements have been made for supply of fuel and disposal of byproducts (where relevant).

In addition, OFFER also considered the projected financial performance of the project and whether those met 'normal standards of commercial expectation', where normal standards were not defined (NFPA, 1991). Finally, OFFER also considered legal matters concerning the authorization and execution of the contract.

The application procedure itself, because it was required to keep in step with the privatization process, consisted of alternating tight deadlines to coincide with the privatization process deadlines (set by the DoEn) followed by unexplained lulls. For example, the DoEn was under pressure to finalize the renewable energy NFFO before Vesting Day on 1 January 1990 and hurried applicants forward to meet that date. However, when nuclear power was withdrawn from the sale, so Vesting Day was moved back to 1 April 1990 and the renewable energy developers heard nothing during this period (Roberts *et al*, 1991, p 151; House of Commons, ESC (1992) Vol 3, AIEP memo, p 142: 11.3).

The stop–go nature of the process was compounded by a far greater response than that expected by the DoEn, with applications to generate reported at 370 (Roberts *et al*, 1991, p 148). As the number of interested generators increased so it became obvious that the renewable energy levy would cost more than envisaged (although still only 1% of the total FFL in the first year). As the size of the levy became 'of national interest' (House of Commons, ESC (1992) AIEP memo, Vol 3) the DoEn let the RECs know, in confidence, what the ceiling or 'cap' price the NFPA would be prepared to pay for each unit of electricity and asked the host RECs to ask the generators if they would like to resubmit their original cost justified bid.

However, because these discussions between the RECs, DoEn and the generators were notionally in confidence resentment was caused with certain applicants who felt they had been excluded or forgotten by the RECs (Roberts *et al*, 1991, p 149). Anyway, would-be generators came to the conclusion, by discussing the RECs' offers between themselves, that the price the NFPA would pay was between 4.5 p/kWh to 6 p/kWh depending on the technology and assumed to be over 15–20 years.

Thus, at the end of 1989, would-be generators were still unsure of the NFFO contract lengths; what cost methodologies should be used in assessing their electricity generation prices; or what price the NFPA would pay for their electricity. The government anxiety about the increasing cost of the levy was exacerbated by the announcement of the 1998 end date which had serious repercussions for the 1990 tranche applicants. Financing had to be rearranged and many of the new wind and hydro sites could not meet the 6 p/kWh cap. The Department of Energy recognized that 6 p/kWh was not an economic payment at that time for new wind sites. The DoEn agreed to raise the price to some wind generators to around 9 p/kWh. The number of applicants still involved by the late summer of 1990 had fallen from 370 to 100 (Roberts *et al*, 1991), of which 75 received contracts.

NFFO2

The second NFFO in 1991 (NFFO2) differed from NFFO1 in that the contracts were awarded as a result of competitive bidding in technology bands. Wind projects competed against wind projects; sewage gas projects against sewage gas projects and so on. The strike or marginal price of each technology band was to be paid to each contractor within the technology. It was assumed by the would-be developers that if the 1990 NFFO prices were between 6–9 p/kWh then the NFFO2 contracts, which would have less time to run until 1998, would be higher than this. The premium prices paid were therefore high, particularly for wind energy which was paid 11 p/kWh, but provided good returns on investment, thereby attracting investors. The strike price mechanism was criticized at the time because it gave a windfall payment to developers who had bid in a lower level but excluded other projects which came in slightly over the strike price. Nevertheless, it can be argued in hindsight that the high prices provided enough incentives to reduce the risks enough to attract investors (primarily ex-nationalized companies rather than new independent entrants), banks, lawyers and accountants to form the nucleus of a small, UK renewable energy industry.

As many of the NFFO2 projects neared commissioning many of the problems of the NFFO process began to surface. Competition requires the bringing together of a number of projects at one time. This results in 'waves' of development. Furthermore, the cessation of payments at the end of 1998 created a powerful incentive

to commission the projects as quickly as possible. In particular, as several wind farms began to be commissioned at the same time, mainly in Wales, it was felt by some that wind energy development was happening too quickly, with too limited a local involvement and that the link between wind turbines and visual intrusion was not being assessed adequately. This highlighted the lack of coordination between the NFFO and planning process. Although the problems associated in the public mind with wind energy were mostly shown to be exaggerated or incorrect (House of Commons, SCWA (1994) Wind Energy, Vol 1), it became clear that the visual impact of renewable energy technologies and their land use would become a central issue concerning their deployment.

The combination of competitive bidding and the 1998 end date had a number of other impacts. Small-scale projects and independent generators (whether individuals or communities) found it particularly hard to obtain contracts: the smaller-scale projects because they were on the whole more expensive than the larger-scale projects and independent generators found it hard to obtain finance (Mitchell, 1994). In fact, not one project within NFFO2 was developed by an independent developer who did not have their own equity. All such projects initially developed by independent companies were forced to accept equity from companies (either the RECs, generators or water companies or venture capitalists) at a very high capital cost, thereby reducing their own returns. Moreover, the 1998 end date led to project development decisions which were taken in haste which in retrospect were uneconomic and caused problems later on. Furthermore, the 1998 end date obliged contract holders to use foreign turbines. This was because the only UK manufacturer WEG was working with National Wind Power and did not have the capacity to provide turbines to the other contract holders within a short period of time. Thus, of the 1990 and 1991 NFFO contracts 345 of 415 (or 83%) turbines are foreign (*Windirections* 1994, p 13). As the Welsh Affairs Select Committee stated 'it is doubtful that another mechanism could have been more successful in supporting a foreign industry than compelling all developments to occur within a short period of time when the domestic industry is in its infancy and anyway tied to one developer' (House of Commons, SCWA (1994) p liii, para 172).

It quickly became clear that the 1998 end date provided too limited a time for the economic development of waste to energy projects. As a result, over 200 MW DNC was terminated. it can be argued that one of the major pushes for a longer NFFO contract in the third Order (and the decision to ask the Commission for an exemption from the 1998 end date) was to allow the development of waste to energy projects, particularly since stringent emission controls were being introduced by HMIP as part of an EC Directive on Incinerator Emissions and many of the current waste incineration plants will have to be closed (Environment Select Committee, House of Commons (1994) Recycling, para 54, p xxxi).

An announcement of an announcement

The years 1991 and 1992 were an optimistic period for renewables in the UK. The NFFO2 capacity was larger than expected. A House of Commons Energy Select Committee produced a positive report in 1992 on Renewable Energy calling for a higher NFFO target (House of Commons, ESC (1992) *Renewable Energy*). This was followed up by the establishing, and Report of, the Renewable Energy Advisory Group (REAG) which also called for a higher NFFO target (Energy Paper 60, 1992) and was followed by a formal government policy increase to 1000 MW by 2000. However, this optimism dissipated as time passed without an announcement of the next NFFO Order.

Finally, in July 1993, the Minister for Energy (subsumed within the Department of Trade and Industry following the 1992 General Election) announced that the announcement of NFFO3 would be made towards the end of 1993 and took the opportunity to clarify the government's policy on renewable energy (which is still current):

> Government policy is to stimulate the development of new and renewable energy technologies where they have the prospect of being economically attractive and environmentally acceptable in order to contribute to:
> (1) diverse, secure and sustainable energy supplies;
> (2) reduction in the emission of pollutants;
> (3) encouragement of internationally competitive renewable industries.

He explained that:

> the purpose of the NFFO Orders is to create an initial market so that in the not too distant future the most promising renewables can compete without financial support. This requires a steady convergence under successive Orders between the price paid under the NFFO and the market price. This will only be achieved if there is competition in the allocation of NFFO contracts.

This was the first time that the policy of price convergence was mentioned and the Statement has since been recycled in a number of government publications: EP62, R82 (the expanded version of EP62) (ETSU, 1994), *Climate Change: The UK Programme* (Department of Environment, 1994a) and *Sustainable Development: The UK Strategy* (Department of Environment, 1994). These publications make clear that there is government

Table 3 1994 NFFO contracts

Technology band	Contracted capacity MW DNC	Number of projects	Lowest contracted price (p/kWh)	Weighted average price (p/kWh)	Highest contracted price (p/kWh)
Wind exceeding 1.6MW DNC	145.92	31	3.98	4.32	4.8
Wind below1.6MW DNC	19.71	24	4.49	5.29	5.99
Hydro	14.48	15	4.25	4.46	4.85
Landfill gas	82.07	42	3.29	3.76	4.00
Municipal and industrial waste	241.87	20	3.48	3.84	4.00
Energy crops and agricultural and forestry waste					
Gasification	19.06	3	8.49	8.65	8.75
Residual (other)	103.81	6	4.9	5.07	5.23
Total	626.92	141	–	4.35	–

Source: DTI Press Release, 1994, Wardle Makes Third Renewable Energy Order, 20 December

support of market enablement via the NFFO or RD&D for solar, onshore wind, wastes, hydro, energy crops, photovoltaics and fuel cells. However, it also made clear that wave, geothermal, tidal and offshore wind are classified as unlikely to contribute substantially to UK energy supply in the foreseeable future (ETSU, 1994, p 71, para 10.19) and essentially have had their funding cut.

Moreover, they confirm that the government is working towards 1500 MW DNC of new electricity generating capacity from renewable sources by 2000 and state that this would enable the most promising technologies to develop, going so far as to say that renewables may supply between 5 and 20% of energy supply in 2025.

NFFO3

The NFFO3 contracts were announced in December 1994 and therefore, unlike NFFO1 and NFFO2, it is not possible to describe the status of each project. Nevertheless, a number of points concerning the Order can be made. The application procedures for NFFO3 altered again. Competitive bidding within technology bands continued but contractors were awarded their bid price rather than the strike price which occurred in NFFO2. Table 3 sets out the size of the Order and the prices paid to each technology.

The most significant feature of NFFO3 was the price falls from NFFO2, shown in Table 4, which were due to four, possibly five, main reasons. First, NFFO3 contracts were for 15 years rather than for 6–8 years for NFFO1 and NFFO2 contracts. This meant that capital repayments are less per kilowatt hour for NFFO3 contracts. Second, the generators were awarded their bid price rather than a strike price. Many of the NFFO2 projects entered a lower bid than they finally were paid and therefore the prices were artificially high. Third, the prices of planners, lawyers and other individuals necessary to develop a project have also fallen as they have gained more experience. Fourth, there has been a marked fall in the economic costs of renewable energy technology hardware. Together with the reduced prices for lawyers and so on the final cost installed per kilowatt of wind energy installed fell from £1000 for NFFO2 to £700–750 in NFFO3 (Milborrow, 1995). While other technology prices did not fall so markedly, their economic costs also fell, particularly for landfill gas. This is partly due to the efficient introduction of technical improvement of a new vintage of technology (ie 300–400 kW turbines in the 1991 NFFO and 400–750 kW machines in the 1994 NFFO), whereby problems or lost opportunities in one tranche were rectified in the next tranche.

Finally, another possible, as yet unconfirmed, reason for falling prices per kilowatt hour is that the average costs of capital are expected to be reduced. As will be discussed below, many NFFO2 projects, particularly wind, were project financed but it is thought that many of the NFFO3 wind contracts will be financed by in house, cheaper capital.

The long time lag between NFFO2 and NFFO3 also highlighted a serious difficultly for the development of a renewables industry in the UK: the need for, and the significant lack of, certainty with respect to the policy towards renewables. Those considering investing in, or developing, RETs require a measure of certainty so that they feel confident that their development costs will not be wasted. Of course, normal business life is never certain and it would be wrong for the NFFO to produce a

Table 4 NFFO price falls

Technology	Band price NFFO2 (p/kWh)	Band price NFFO3 (p/kWh average)
Wind	11	4.32 (1.6 MW DNC+) 5.29 (under1.6 MW DNC)
Hydro	6.00	4.46
Landfill gas	5.7	3.76
Waste combustion	6.55	3.84
Other combustion	5.9	5.07
Sewage gas	5.9	
Average	7.2	4.35

risk free environment. However, in addition to the time lag between NFFO2 and NFFO3; there were application procedure changes between the Orders and a far greater number of applicants for NFFO3 than expected. Together these factors undermined confidence of nascent renewable developers. Moreover, they were not sure that they would be able to obtain a contract whether for this Order or the next; or whether there would be a similar technology band in the next Order (such as the unexpected exclusion of sewage gas from NFFO3) or even whether the government would continue to support renewable energy in the future given the declining R&D programme and no stated policy beyond NFFO5.

Nevertheless, the procedures of the NFFO3 contracts overcame may of the problems of NFFO1 and NFFO2. The contracts were awarded for 15 years which allows the capital to be repaid over a longer period (therefore reducing the price per kilowatt hour and going some way to destroying the image of renewables as being expensive). The contracts may be taken up within five years of the awarding of the contract which provides ample time to seek planning permission, the renewable levy being in place until 2014. This procedure was particularly helpful for the waste projects which were unsuccessful in the 1991 NFFO. Moreover, it also mitigated the need for particular haste in developing projects and should make it easier for projects to use British equipment. Furthermore, NFFO3 contracts were eligible to new projects only; they include a sub-band for small-scale wind energy projects and biomass gasification was included for the first time.

Nevertheless, NFFO3 highlighted or created a number of new problems for renewable energy development. Despite the uncertainty described above, NFFO3 was heavily over-subscribed: 141 projects were awarded 627 MW DNC of contracts while 380 projects totalling 1870 MW DNC were refused. A large number of applicants therefore wasted time and effort in their application. This led to calls for more certainty concerning the future Order – its size, minimum prices and so on. More importantly, it has led to discussions of alternative or new markets for renewable electricity.

Of crucial importance was the inclusion of two new clauses into the NFFO3 contracts at the behest of the RECs (with the agreement of OFFER who are party to the NFFO contract, but with the opposition of the DTI who are not involved in the contract). The levy out clause stated that if the levy were to cease during the contract the RECs would not be required to make up the shortfall between the pool and premium price. The supply out clause stated that if renewable energy generation exceeded 25% of the RECs supply business, the REC would not have to take the renewable electricity. These two clauses make the NFFO contract extremely uncertain and places the risk of developing the project firmly with the generators. It is too early in the life of the NFFO3 projects to understand the implications of these clauses, for example if they will significantly affect the ability of developers to obtain finance.

Finally, 20 waste to energy projects were awarded 240 MW DNC of contracts, most of which do not have planning permission or their fuel supply guaranteed. Furthermore, competitive bidding means that the technology used is the cheapest, mass burn, which does not generally include combined heat and power (CHP) or recycling. Friends of the Earth have already condemned the contracts, saying that the NFFO should be part of an integrated waste management strategy. Objections can be expected despite stringent emission controls being introduced by HMIP as part of an EC Directive on Incinerator Emissions (Environment Select Committee, House of Commons (1994)).

The NFFO4 announcement

The long awaited statement of the Fourth NFFO (NFFO4) was finally announced in November 1995, having been expected in July. The announcement confirmed government policy of working towards 1500 MW DNC of new capacity by 2000. It explained that the NFFO4 contracts are expected to be awarded in early 1997 with a fifth Order in 1998 for between 400 and 500 MW DNC each, with the expectation that about two-thirds would be commissioned. The selection of projects will continue to be by competitive bids within technology bands with 15-year contracts offered to successful bidders at their bid price. The biggest change was the splitting of support for municipal and industrial waste (M&IW) into two bands, so that a generation plant with CHP attached was also eligible. Thus, the NFFO legislation, originally intended to support electricity was transformed, as a result of new powers gained from the Environment Act, into a mechanism of support for heat and it is believed that it was this transformation which was the cause of the delay.

Overall, the eligible technologies remained more or less similar to NFFO4. Wind energy continued to be divided into two bands, although the split point is to fall below the 1.6 MW DNC used in NFFO3. Hydro power had a 5 MW DNC cap for the first time and landfill gas continued to be supported from sites where tipping was carried out before 22 July. Electricity from energy crops and forestry waste using gasification technologies was supported, while technologies based on steam generation, eligible in NFFO3, were excluded. Electricity from agricultural waste and food processing based on anaerobic digestion had a technology band for the first time.

Thus, on the whole, there were few procedural or technical differences between NFFO3 and NFFO4. However, the NFFO4 announcement, unlike the NFFO3 announcement, omitted to justify the NFFO on environmental and diversity grounds. Mr Page confined his justification to one of economics, stating that the NFFO 'is expected to stimulate further convergence between electricity prices under NFFO and the market price for electricity – bringing electricity from renewables closer to the point where they can compete in the open market against conventional generation'. Although it is too early to draw a definite conclusion from such an omission, it may be a pointer to the intended future policy towards renewables. Since there is no formal policy of support for renewables beyond NFFO5, the government could have used the announcement as an opprtunity to provide some confidence to the renewables industry about its future.

Key lessons to be learnt from the NFFO process

With the benefit of time it is possible to discern the broad outlines of the key events or results of the NFFO process so far. A more detailed account of the NFFO can be found elsewhere (Mitchell, 1994). As had been described above, the NFFO process has had a number of problems. However, it is important to stress that in terms of renewable energy development in the UK, it has created a momentum for development of a wide range of technologies and has led to a rapid increase in installed capacity of renewable electricity. In this sense it has been successful. Furthermore, the NFFO has proved to be a very flexible mechanism allowing alterations to Order arrangements if they have created problems. However, this benefit is double edged, flexibility being achieved at the expense of certainty allowing problems to be removed (ie the 1998 end date) but also allowing potential new problems to develop (ie the levy out clause).

As a result of the NFFO process a number of points concerning renewable energy development have become clear. First, a R&D programme should be coordinated with the market enablement programme. Second, competition as the basis for support of renewables, while bringing prices down rapidly, has a number of disbenefits. Third, the NFFO process has led to the development of a renewable energy industry with a stake in its future. Fourth, the deployment of renewable energy technologies as a result of the NFFO has led to a dawning of an understanding by the renewable energy industry of the key issues that renewable energy has to address and the importance of the attitude of the financial institutions and electricity system to the successful outcome of those issues. Fifth, OFFER developed a *de facto* policy for renewable energy in tandem to its NFFO responsibilities. Finally, the problems of renewable energy deployment as a result of the NFFO has led to the realization of the need for a coordinated planning and renewable support policy.

Limited overlap between R&D and NFFO technologies

When comparing the technologies which received R&D spending to those supported by the NFFO we can see that there is limited overlap. The three NFFOs supported medium-size wind turbines (ie turbines of 300–750 kW), landfill gas, sewage gas, hydro, biomass gasification and waste to energy plants while R&D mainly supported large-scale wind turbines (ie 3 MW), although latterly changed to smaller-scale turbines, landfill gas, hydro, geothermal, wave and tidal. The main overlap was with landfill gas and hydro and smaller-scale wind turbines. Thus, the major proportion of the total RD&D expenditure was on technologies which have, to all intents and purposes, been curtailed (wave and geothermal) or changed tracks, such as the wind programme.

The National Audit Office (NAO) recently investigated the renewable energy R&D programme (NAO, 1994, p 7). Their general conclusions were that the DoEn's methodology of choice of technology support was soundly based. However, they also concluded that 'the earliest influence of the main customers' (ie the CEGB) led to a few projects and programmes receiving a large share of the total budget. The CEGB 'was mostly interested in developments capable of bulk energy generation' such as large wind turbines, tidal power and HDR. Such RD&D programmes were expensive and one-third of the total available funds were consumed by the Severn and Mersey Barrages, large and vertical axis wind turbines and HDR (NAO, 1994, p 13) none of which has come to fruition. This provided a difficult inheritance for the NFFO. In a perfect world, it is to be hoped that a market enablement programme follows on from the R&D programme. The NFFO has had to support technologies into the market place with only minimal previous support.

Competition versus standard payments as a means of supporting renewable electricity

As has been discussed above, the NFFO was developed in the privatized system and is unique within Europe as a method of support for renewable energy. Clearly, a privatized electricity system is not necessary for the support of renewable energy and nor is competition as a means of awarding the contracts. Moreover, the NFFO method is not particularly cheap and is actually extremely expensive in the initial stages (Mitchell, 1995a)

compared to the Danish, Dutch and German support mechanisms. Most European countries have a renewable energy support mechanism in place either in the early stages of development, as in Spain or Greece, or in the later stages, as in Denmark. What they all have in common, with the exception of the UK, is that renewable electricity is paid a standard pre-known payment per kilowatt hour and is not awarded as a result of competition. This is not to say that the mechanisms or methods of awarding contracts are problem free, but in general it can be argued that the mechanisms are much less bureaucratic for the organizing body than the NFFO is for the DTI and OFFER (Mitchell, 1993).

The tranche system has a number of disadvantages centring on the requirement of a tranche to bring together several applicants to allow the competitive process to take place. The time lag between tranches is an unnecessary source of development costs and inefficiencies in development time; it is a bureaucratic process with several application deadlines which create busy periods for those involved (such as OFFER, the RECs) and therefore staffing and time management problems; there is no certainty of success for an application which means the developer runs the risk of wasted development costs. This has particular problems for small or new manufacturing entrants. It creates waves of development which create unnecessary environmental concern and finally there are problems of coordination with the planning process.

Standard payments on the other hand appear to have several benefits, primarily related to its simple non-bureaucratic procedures. It is a simple process with limited vetting/bureaucracy; there is no hurdle rate of return on investment required; the level of payment is known prior to development and generators know they will receive that payment if they apply, which provides certainty; developers can apply at any time, which is an efficient use of development resources and which is easier for those administering the process.

Furthermore, the standard payment mechanism does not exclude any type of developer or resource. The system is therefore inclusive. Competition by its nature is exclusive and small-scale projects, smaller-scale companies and lower resource sites in particular are at a disadvantage in a competitive system. At the beginning of a programme of support for technology development, it could be argued that an inclusive support system allows development of a diversity of sites which may lead to a broader understanding of the impacts of different types of development. From a position of diverse development, a more focused policy suitable for a particular area or region may then emerge.

Nevertheless, standard payments have a clear disbenefit in that there is less pressure to reduce prices, although it is possible to ratchet down payments to ensure price reductions. Furthermore, there was never any likelihood that the renewable energy support mechanism in the UK privatized system would exist in any way other than based on competition. It is only as the NFFO process has reached a point of such oversubscription that new markets or alternative non-competitive means of support are being discussed.

The development of a renewable energy community with a stake in its future

Possibly the most important impact of the NFFO was that its creation was the pivotal point for the development of a renewable industry in the UK. Once in the door, so to speak, the renewable energy industry has maintained a strong pressure on government to open it further. Thus, government policy in 1989 was to work towards 600 MW DNC by 2000 and this had risen by 1994 to 1500 MW DNC by 2000. Furthermore, it has shown that the renewable industry in the UK is able to provide well over the 1500 MW DNC NFFO capacity, as was shown more or less in the oversubscription of NFFO3 alone. Moreover, other countries have also reached a similar stage where demand for support far exceeds that provided by the support mechanism. Thus the level of renewable deployment has been shown to be limited by economic and institutional factors rather than by its physical or personnel resource.

> The NFFO has allowed for the first time a 'competitive' arena in which renewables have existed. This has created a number of knowledgeable actors in fields hitherto uninvolved with renewable energy: lawyers, planners, accountants and bankers. Furthermore, it has allowed the creation of many companies, of differing sizes, hoping to generate renewable electricity. These companies in turn affect other companies, all of which now have a stake in the future of a renewable energy industry. While many of these generating companies have links with the ex-nationalized industries, and therefore are not strictly increasing the level of independent power producers in the ESI, there are also many new incomers (DTI, 1995a).

Moreover, the preparation and deployment of the renewable projects has increased the technical knowledge of renewable integration into the grid and has created a pool of empirical data. Technicians inside and outside of the electricity companies are becoming skilled in these new areas. The benefits of volume manufacture for renewable energy technologies as compared to one off plant manufacture has become apparent, as has the short vintage times of RETs. Moreover the locational benefits of distributed power (and therefore RETs) to the electricity system are increasingly clear. This technical and economic knowledge is based for the first time on empirical data rather than on theoretical estimates. This

empirical data can be used to support arguments previously made with no supportive evidence.

The future of renewable energy support in the UK is by no means certain. Although the NFFO is a market enablement policy, renewable energy deployment has been essentially cushioned from the market place. It is clear that renewable generation would find it hard to survive within the post-privatization electricity market place without any preferential means of support, for example a guaranteed buyer. Currently, there is no stated policy for renewables beyond NFFO5 and a declining R&D budget. Renewable energy has now become delinked from nuclear power and, if renewables are supported, it will be on their own merits.

New markets for renewables

However, as a result of these points (NFFO deployment and the collection of empirical data, the development of a renewable energy industry, and the uncertainty of the future for renewables post NFFO) it has become clear to the renewable energy industry that there were a number of key issues which they need to lobby for if they are to survive. These key issues are centred on the need to create new markets for renewables. It is also clear that the electricity companies and financial institutions are able to heavily influence the extent to which those issues can be used in support of renewables.

The future for renewables falls into four brackets. First, those projects which as a result of the NFFO have reduced their price per kilowatt hour significantly and will be able to contract directly with a buyer in a competitive retail market. Second, those projects which will choose to sell directly to the local REC or a broker, possibly small-scale or community projects. Third, near-market renewable technologies which still require a premium payment similar to that received under the NFFO. And fourth, medium- and long-term renewable technologies which will need continued R&D support.

Developing a market for renewables, partly by changing the methodology of costing power, is central for the first two groups. There are three main areas of discussion: the retail market in 1998; a definition of the convergence price and an obligation on the RECs to pay this for renewable electricity; and establishing cost-reflective pricing as a means of buying and selling power within the electricity system.

A key issue for the first group of renewables is the extent to which renewables can enter a retail market in 1998. RECs will still have a monopoly of their grid system. Renewable generators and buyers will have to negotiate with the RECs for the use of the grid for back up and so on. The extent to which the regulator enforces rulings that provide fair and clear price for use of the system, fair prices for back up and removal of obstacles to attachment to the grid will have a major impact on the type and amount of support renewables need.

The second key issue is to define what is meant by convergence price which the Energy Minister, Mr Egger, stated was the goal for the NFFO technologies. This may be set on a competitive basis or at another higher price which would reflect the benefits of renewable electricity. In other words, a setting of a price would indicate the government's position on renewables. The level at which the convergence price is set is crucial for renewables since that is the price that the second group of renewables could expect to be paid by RECs post NFFO. The convergence price is variously described as the market clearing price through a price which includes a value for pollution benefits, diversity benefits and so on.

Altering the means of costing power is the final but interlinked prong in the renewable energy campaign for new markets. The renewable energy industry argue that the traditional electricity pricing mechanism at the bus-bar is a throw back to the nationalized industry days, when the costs of the different parts of the system were less important, and ignores the costs of fossil fuel and nuclear transmission and distribution and the benefits of distributed power. If the costs of the electricity system become more transparent it is possible to calculate the total cost of both generating and delivering a kilowatt hour to a consumer. This is known as cost reflective pricing and would include all costs and benefits of generating including transmission and distribution losses, use of system charges, reducing reinforcement costs, saved triad payment and so on. Cost reflective pricing therefore illuminates the most economic choice of supply for a particular load centre and this can be supportive to distributed electricity generation in certain locations, which may be helpful to renewables. Cost reflective pricing establishes the value of electricity at any one place and payment of the value of electricity by the REC and PES should be the cost that they would have otherwise paid to deliver the alternative kilowatt hour. Furthermore, cost reflective pricing has the benefit of being the logical outcome of economic purchasing, appears to be supported by OFFER and is easily adapted to include additional debits and credits for electricity generation.

Currently, all NFFO renewable generation is bought whenever it is generated and generators do not have to provide it at peak times or engage with the broader electricity market and in the ways that other electricity generators are obliged to. Renewable electricity therefore exists in a more supportive and less competitive environment than other electricity sources. Notwithstanding this, some means has to be identified which will allow certain renewables, for example photovoltaics, to be subsidized in a way acceptable to OFFER and which will allow financial recovery for RECs, currently established

in Section 33 of the Act, post NFFO5, not to exclude the possibility of NFFO6, NFFO7 and so on.

The importance of the electricity companies to renewable energy development

Most of these points are dependent on the attitudes of the regional electricity companies and the regulator. Without their support, or with their opposition, it is unlikely that these new electricity system payments or pricing mechanisms could be introduced.

The importance of finance to renewable energy development

The importance of finance to renewable energy development became clear as the NFFO1 and NFFO2 projects had difficulty in obtaining finance at a reasonable cost. There is no doubt that larger renewable energy technologies obtain cheaper finance with better terms and conditions of lending than smaller scale renewable energy technologies. Furthermore, larger projects of the same technologies also have cheaper finance. Similarly, larger and more commercially secure developers are able to obtain finance at a cheaper rate than smaller and less commercially secure or known developers. None of this is unusual to the renewable energy industry as opposed to any other industry in the UK. However, when investigating the means of financing renewable energy in the UK it became clear that finance has an independent role in technology development in that the terms and conditions upon which it is available influences and biases technology development. Renewable energy projects pay more for their capital and have more onerous terms and conditions of lending than conventional energy sources which reduces the competitiveness of renewables (Mitchell, 1993).

Capital is generally available at a price for larger projects. Larger projects which are unable to obtain finance at any price are unusual and can be expected to exhibit characteristics completely at odds with the criteria for lending demanded by the financial system. This is not so for smaller projects, which may well have good economics but are unable to fulfil bank criteria of lending. This almost total lack of support for small-scale renewable energy development by local banks in the UK is the main difference with the continent. Support systems whether in the UK, Germany, Holland and Denmark, complement the domestic financial system so that those which are supported by the support system are also able to obtain finance. However, in the UK, the NFFO and the financial system excludes small-scale and independent (ie individual or community) generators although the NFFO3 has tried to overcome this for wind energy by including a sub-band for projects under 1.6 MW DNC. Notwithstanding this, there is a problem of financing renewable energy in the UK which is partly due to the newness of the technology (which will therefore be overcome to some extent through experience) but which is also due to the innate differences or mismatching between the needs of the UK financial system and the characteristics of the RETs. As a result of the latter point, it can be argued that RETs will be viewed with caution by financial institutions even when experience under the NFFO has occurred.

The creation of a de facto *renewable policy in OFFER*

Under section 32 of the Electricity Act, the RECs must satisfy the DGES that they have made arrangements which 'will secure' the capacity required by the NFFO. In order for an applicant to pass or satisfy the 'will secure' test, OFFER, who undertook the scrutiny on behalf of the RECs, had to be reasonably satisfied that the applicant had fulfilled a number of requirements so that they would be able to generate the amount of electricity they had contracted for. Thus, for example concerning the NFFO1 projects, legally the DGES was required to ensure 102 MW DNC of the capacity was commissioned by 1998.

In practice this was not such a heavy burden. The power purchase contracts of NFFO1 and NFFO2 made allowances for problems in attaining generation start dates. For example, existing schemes contracted to generate from October 1990. New or refurbishment schemes contracted for a commissioning date for some time in the future (up to two or three years away for waste generators). There was then provision within the contract for slipping that commissioning date for 12 months. And finally there was another provision, providing the host REC, the generator and the NFPA agree, to slip this date for some months providing it appears that the generator has made their 'best endeavour' to generate. It therefore seems unlikely that a generator would be taken to court by the REC for non-generation providing the generator could show that they used their 'best endeavour' to generate, nor was it likely that the DGES would be held to account if they did not do so. Furthermore, the levy out and supply out clauses negate this problem for OFFER in NFFO3.

Nevertheless, OFFER was faced with an increasing amount of work for each Order, culminating in the large oversubscription of the NFFO3 process. Not only did they have to vet each applicant (521 of which 141 were successful) but also the many projects which did not finally apply. It can be argued that this type of detailed work is neither the best use of OFFER's skills nor commensurate with the renewable projects electricity generation as a proportion of electricity supply. A reduced role more similar to NOVEM in the Netherlands, BMFT in Germany or the DEA in Denmark, all parallel organ-

izations to OFFER in the administration of renewable support mechanisms in those countries, would seem to be an appropriate solution.

OFFER's *de facto* policy towards renewable energy has evolved, as could be expected, from the time of OFFER's creation in 1989 and during the three NFFO Orders. In NFFO2, the importance of the 'will secure' test was made clear in the Notes to Generators. However, OFFER appeared to pass applicants based primarily on the economic test arguing that they should not prejudge projects before the Planning Policy Guidance Note (PPG) for renewable energy was finalized. Nevertheless, because there was so much environmental confrontation over the wind energy projects, OFFER as the visible body in charge of the 'will secure' text, was criticized for having let through the contentious projects. OFFER maintained, it can be argued with justification, that the planning process should take the final decision on planning not the 'will secure' test and this policy was made clear to NFFO3 applicants.

More importantly, during the NFFO3 application process, OFFER moved towards placing renewables within their wider framework for electricity supply. OFFER released advice to the Department of Trade and Industry (DTI) in November 1994 concerning the method used to award NFFO contracts (OFFER, 1994). OFFER put forward two methods: the first to take the cheapest bids and the second to establish a price that renewable energy technologies should meet for each NFFO on a path to meet their convergence goal, current government policy as stated by the Minister of Energy. The former would mean that some wind energy but mainly landfill gas and waste to energy plants would be developed while the latter provided a slightly higher price for NFFO3 and therefore included one or two biomass projects as well. OFFER's advice was provided during the final stages of the Nuclear Review and also just before the DTI was due to announce the successful NFFO3 contracts.

OFFER could argue that it was only concerned to provide 'advice' of how the DTI should meet government policy of the convergence price of NFFO technologies. Alternatively, the advice of taking the cheapest renewables complements economic purchasing arguments. Nevertheless, by providing the advice OFFER has exerted a certain amount of pressure on the government to make clear what the convergence price for renewables is. Furthermore, it has introduced an element of questioning into the appropriateness of the NFFO mechanism, given government policy, in subsidizing a wider range of technologies beyond the cheapest few which are intended to become 'competitive' or converge with other electricity sources at some unspecified time in the future.

Moreover, the NFFO represents a subsidy paid for by a levy and an obligation on the RECs, both of which in principle jars with OFFER's wider policy of competition. Nevertheless, OFFER's wider framework does support independent power as a means to greater competition and its arguments for transparency of prices within the electricity system supports the arguments in favour of embedded generation (Thomas, 1995) and the value of electricity, both favourable to renewables. What OFFER has not yet made clear is the relationship of renewable energy and their secondary obligation to the environment.

OFFER's policy, in addition to those discussed in the previous section, are pushing renewable generation from a subsidised, cushioned environment to the harsher reality of the electricity market place. Renewable electricity sources have to find new markets, but in ways that OFFER will accept.

NFFO and planning coordination

Serious environmental confrontation occurred in 1993–94 between environmentalists concerned with the visual intrusion of wind turbines on the landscape and renewable (primarily wind) energy developers. The coupling of competitive bidding with payment of premium prices until the end of 1998 meant that generators were under pressure to commission their projects as soon as possible and to maximize their revenues by developing a good resource site. This lead to a serious debate, which is documented in detail by the Welsh Affairs Committee Report (House of Commons, SCWA, 1994), about the public implications, particularly in relation to wind energy, of renewable energy development.

The Welsh Affairs Committee came to the conclusion that high windspeed sites could be developed in an acceptable manner provided the development was coordinated with well functioning, locally accountable planning policies. No such coordination occurred in the UK for NFFO1 and NFFO2. A draft planning guidance note (PPG22) was issued in December 1991 and final guidance was published in February 1993 (PPG note 22, 1993). As a result, it was not available even in draft form to give guidance for the 1991 NFFO applicants, planners or any other interested group. Furthermore, PPG22 has been widely criticized by planning officers and others for not giving adequate guidance on such issues as visual (and cumulative) impact, noise and safety once the importance of these issues had become apparent following the development of the NFFO2 sites. Moreover, there are more fundamental criticisms of its lack of guidance concerning the role of planners which PPG22 seems to expect the local planners to play in fulfilling a national energy requirement. No formal guidance was issued for NFFO3 applicants. The House of Commons

Welsh Affairs Committee set up its inquiry into wind energy in Wales and rushed its publication, in part to try and clarify some of the questions of planning prior to the NFFO3 applications and contracts.

ETSU has undertaken a number of area renewable resources studies in parallel to planning studies. However, the ETSU studies are based on electricity regions and although they provide details of renewable resource within certain regions they do not break them down into local authority areas. Since it is the local authorities which have to publish their renewable energy plans, bearing in mind the national energy requirement, the ETSU studies are currently unhelpful to local authorities in drawing up their plans.

The final target of the NFFO is 1500 MW DNC of new renewable capacity by 2000, roughly the equivalent of 2000 MW installed and about 3% of the electricity supply. So far round 325 MW DNC has been commissioned from the three NFFO orders (New Review, 1995). It is clear to most of those involved that if 1500 MW DNC is to be successfully commissioned without another major environmental confrontation, as occurred in 1993–94 concerning wind energy, widely approved planning laws need to be established (Mitchell, 1995b).

Conclusion: the NFFO and mismatching

It is always difficult to set up a support mechanism for a new technology or a group of technologies. With respect to renewable energy technologies and as a result of this overview, the main problems to their development appear to occur when their characteristics mismatch (or do not fit in with) the requirements of the framework structures necessary to develop them. Thus, mismatching occurred when the key characteristics of RETs (small-scale, compared to mainstream power generation power plants, often decentralized, new technologies, high capital costs, often intermittent electricity supply, new planning problems, new regulatory questions) did not fit the standard requirements or expectations of the key agents (bankers, investors, regulators, utilities and sometimes governments) involved in their development.

Thus, the NFFO process provided three important lessons when setting up a support mechanism for any, not just renewable energy, technologies. First, there was a large pool of renewable energy developers waiting to be tapped if the institutional barriers are unlocked. Second, the support mechanism itself must ensure that it is matched with the framework conditions that it will have to work within. Third, it is necessary to recognize the differences between the characteristics of the technology and the framework structures and to establish the support mechanism so that it bridges, or tries to bridge, any mismatched characteristics of the technology.

Renewable energy technologies embody very different characteristics from conventional power plant characteristics. The electricity system and the finance system has therefore become used to dealing with those very different characteristics and it is only to be expected that there would be some barriers and inertia to change from those areas. Nevertheless, while a support mechanism cannot be expected to overcome all barriers on its own, it should at least ensure that it is set up in such a way that it does not add any additional barriers.

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