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Energy Conservation and Electricity Sector Liberalisation: towards a Green and Competitive Electricity Supply?

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6. United Kingdom

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In this article, the development of cogeneration, wind energy and demand-side management in the United Kingdom and the Netherlands are compared. It is examined to what extent these developments are determined by liberalisation of the electricity sector in both countries. The analysis suggests that unbundling of generation and distribution, rather than privatisation or introduction of competition in generation or supply, gives a boost to the construction of new power plants. What kind of generation capacity is constructed - mainly electricity producing combined cycle gas turbines in the United Kingdom, almost exclusively cogeneration plants in the Netherlands - depends on fine-tuning of the additional regulation. Furthermore, it is argued that neither the development of wind energy, nor that of demand-side management in either country is very much dependent on electricity sector liberalisation. Some recommendations for policy makers in other countries wishing to reconcile energy conservation with liberalisation are given.

At the 1997 Kyoto climate change summit, CO₂ emission targets for the industrialised countries have finally been agreed on. Since the electricity industry is one of the most important contributors to CO₂ emissions in industrialised countries, on ratification of these targets energy conservation in electricity supply will become even more important in the future than it has been up to now. A very important question therefore is how energy conservation can be reconciled with the present trend of liberalisation of the electricity supply system in many countries.

In this article, energy conservation developments in the United Kingdom and the Netherlands are compared, and their link to liberalisation is analysed. In the final section it is discussed what lessons can be drawn from this comparison for other countries planning to liberalise their electricity sector and wishing to stimulate energy conservation developments.

'Energy conservation' here is defined as *all measures that contribute to a reduction in the use of fossil fuels and nuclear energy as primary-energy sources for electricity supply*. With this definition, three key areas of energy conservation in the electricity sector can be identified:

1. Reduction of end-user demand;
2. Use of renewables as a primary-energy source; and
3. Use of more efficient fossil fuel generation technologies¹.

Each of these three broad areas of energy conservation in electricity supply consists of a whole range of individual options. In this article three case-studies, one for each field of energy conservation identified, will be examined in detail: the development of demand-side management as a way in which utilities are involved in influencing end-user demand and improving energy efficiency, the development of wind energy as an example of a renewable energy technology, and cogeneration as a very efficient fossil fuel generation technology.

The process which is commonly referred to as 'liberalisation' in electricity supply in fact consists of three separate steps:

- A change in *vertical structure* of the electricity supply system, in its most drastic form a complete organisational unbundling of generation, transmission, distribution and end-user supply of electricity;
- A change in *market structure*, specifically the introduction of competition in electricity generation and end-user supply; and
- A change in *ownership* of utilities, in practice often a privatisation of formerly public organisations.

The actual implementation of these three steps is to a large extent dependent on the existing situation prior to liberalisation, and varies considerably per country. Before analysing the relevance of these three variables for each case-study therefore a general introduction to the

¹ An increased use of nuclear energy is a way to reduce CO₂ emissions which is promoted by some. However, as it is heavily contested by others with reference to the waste problems and danger of accidents it is chosen to exclude nuclear energy from the energy conservation options discussed here.

liberalisation process in the United Kingdom and the Netherlands will be given.

Electricity Sector Liberalisation in the Netherlands and the United Kingdom

In this section some key features of the Dutch and British electricity supply system will be outlined as a background to the case-studies. Obviously, it is not possible to give a full account of all recent developments in Dutch and British electricity supply here.

Netherlands

Since the 1980s, the electricity supply system in the Netherlands is in a process of rapid change. Many changes that had already taken place were given a formal basis by the 1989 Electricity Act, but the legal arrangement itself gave rise to new developments.

Historically, Dutch electricity supply developed as a system in which a great variety of unbundled and integrated utilities of very different scales were active. In the eighties, it was considered that the functioning of this system was not optimal, and unbundling of generation and distribution utilities was thought to improve cost effectiveness of electricity supply. This unbundling became a fact in 1988. Five power producers were formed, which in 1990 merged into four public electricity generators. The distributors were turned into public limited companies with their former owners, provincial and municipal authorities, as shareholders. The process of strategic mergers on the distribution level then rapidly gained momentum, reducing the number of companies from more than seventy at the beginning of the eighties to thirty-one in 1995.

The 1989 Electricity Act introduced competition in power generation under strictly limited conditions, whilst a monopoly of distribution companies in supply to end-users was retained. Though the arrangements did not lead to substantial competition between the four so-called 'central' power producers, nor to imports by large end-users, they invoked an unexpected boom in 'decentral', distributor- or end-user owned generation capacity. This will be worked out in the first case-study.

In 1995, a policy document was published in which the future organisation of electricity supply in the Netherlands was outlined. In this document a new Electricity Act was announced, which presumably will

be introduced in 1999. According to the plans, the four central power producers have to merge into one organisation, and distribution companies have to separate their distribution activities from end-user supply. A step-by-step introduction of competition in electricity supply is planned, starting with large consumers. Full competition in power generation will be introduced as soon as the new Electricity Act becomes operational. Privatisation has not been worked out yet, but is likely to be considered after competition in supply has become effective.

United Kingdom

The British electricity system consists of three separate parts: England and Wales, Scotland and Northern Ireland. The England & Wales system comprises by far the largest part of British electricity consumption: 88% in 1990, compared to Scotland 10% and Northern Ireland 2%. The England & Wales model is often characterised as the UK model. Therefore, in this article no specific reference will be made to developments in Scotland and Northern Ireland.

In the past, the nationalised industry in England & Wales was dominated by one large generation and transmission company, the Central Electricity Generating Board (CEGB). The CEGB sold electricity in bulk to twelve area distribution boards, each of which served a closed supply area. A co-ordinating body, the Electricity Council, dealt with overall policy matters.

The 1989 Electricity Act laid the legislative foundations for introduction of competition in generation and supply of electricity, as well as for privatisation of generation and distribution companies. The former CEGB was split into a nuclear generation company, which remained publicly owned, and two large fossil-fired generation companies, the shares of which were floated on the market. The twelve area distribution companies were transformed into privately owned regional electricity companies (RECs). Transmission and distribution remained monopoly activities, regulated by a newly created body, the 'Office of Electricity Regulation' (OFFER).

Competition in power generation in England & Wales was introduced on the first of April 1990. From the same date on, a group of large industrial end-users could choose their electricity supplier. As of April 1994, supply competition was introduced for a second group of consumers, whilst from April 1998 on all end-users will be free in their choice of supplier.

Developments in British electricity supply since 1990 include the privatisation of part of the nuclear generation capacity, the sale of almost

all RECs to foreign investors and the entrance of a large number of 'independent power producers' (IPPs) - in most of which RECs have an important share - into the power generation market. Furthermore a substantial shift in primary-energy sources for electricity generation occurred, which will be discussed in the first case-study.

Efficient Fossil Fuel Generation Technologies: Cogeneration

Netherlands

Cogeneration of heat and power (CHP) in the Netherlands is booming since the beginning of the nineties. By far the largest part of the newly installed cogeneration capacity in the Netherlands, and indeed the largest part of totally installed capacity in recent years, is decentral, mainly industrial CHP set up as a joint-venture between industry and distribution companies. At the end of the eighties, after having been almost constant for many years at a level of around 1,500 MW, installed decentral cogeneration capacity started to increase sharply to around 4,600 MW in 1997 (PW/K, 1997). In this way, the share of decentral power plants in total generation capacity in the Netherlands rose from 13% in 1990 to almost a quarter (23%) in 1996 (See Figure 6.1).

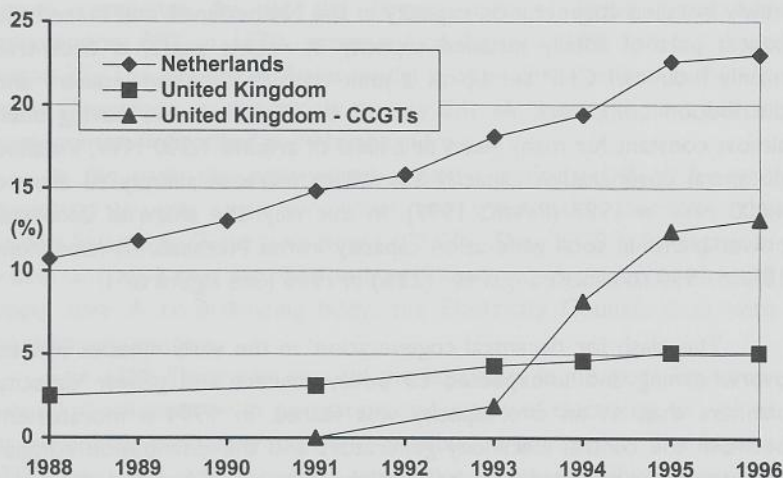
The 'dash for decentral cogeneration' in the early nineties was so overwhelming and unexpected to policy makers and power capacity planners that, as an overcapacity was feared, in 1994 a moratorium between the central electricity generators and the distribution companies was agreed in order to temper the growth of installed decentral cogeneration capacity (Sep, 1994).

Reasons for the dash for decentral CHP in the Netherlands have been examined by several authors. They point to various factors that have been important:

Firstly, unbundling of distribution and generation gave the distribution utilities a business interest in stimulating cogeneration. It was a way for them to become less dependent on the power generation companies (Boonekamp & van Hilten, 1995). The 1989 Electricity Act, in which the unbundling was proclaimed, legally restricted the generation capacity of distributors to plants smaller than 25 MW. Whilst the entrance of new companies into public electricity generation was effectively prohibited by setting a minimum requirement of 2500 MW capacity, the size of power plants constructed by end-users for their own demand was not limited. Hence, by setting up joint-ventures with industrial end-users distributors

could become involved in plants substantially larger than 25 MW. A simultaneous horizontal integration of distributors, which increasingly became involved in supplying gas as well as electricity, also might have contributed to the appeal of cogeneration to distributors. In this way, they could supply gas to industrial cogeneration plants and contractually receive the electricity in excess of that needed on the industrial site (Huygen, 1995).

Figure 6.1 Share of cogeneration in totally installed generation capacity in the Netherlands and the United Kingdom, 1988-96. (Sources: DTI, 1997; PW/K, 1997; CBS, 1997)^{1,2,3}



Notes

1. For comparison, the share of combined cycle gas turbines in the UK is also given;
2. UK figures refer to March of each year. In December 1996, the share of CCGTs had risen to 16.8%;
3. Dutch CHP is exclusive central generation capacity, which amounted to around 1000 MW in 1996.

Secondly, to industrial end-users as the other party in the joint-ventures, cogeneration became attractive as a result of investment subsidies provided by policy makers, reduced gas tariffs due to world market developments and a special agreement with the Dutch gas supplier Gasunie, as well as higher tariffs for electricity delivered to the grid as a result of the contracts with distributors (Blok & Farla, 1996).

Thirdly, environmental considerations played a role for various actors in the development of cogeneration. Policy makers specifically stimulated cogeneration for environmental reasons. The founding of the 'Projektbureau Warmte/Kracht' as an organisation which had to act as a broker of cogeneration capacity between distribution companies and industrial end-users is regarded as a particularly successful policy instrument applied (Moor & Boels, 1995). Furthermore, environmental non-governmental organisations and various other parties lobbied in favour of cogeneration. Distribution companies could list the CO₂ emission reductions achieved by their cogeneration activities as an important contribution to the targets they set in their 'Environmental Action Plan', an emission reduction and energy conservation agreement with Government. So could the industries in their 'Energy Efficiency Plans' agreed with Government.

United Kingdom

It is not so much the development of cogeneration capacity itself on which much of the debate on consequences of liberalisation in the United Kingdom has focused. Rather it has been the generally unexpected, very prosperous application of combined cycle gas turbines (CCGTs) as a generation technology since the early nineties. This has become known as the 'dash for gas' in the UK, as it was linked to the rise of gas as a primary-energy source in electricity supply.

In fact, almost all new generation capacity since liberalisation has been of the combined cycle type. These plants can be used in a cogeneration mode - producing heat as well as electricity - or in an electricity producing mode. The latter application has been by far dominant. In 1989, there were no combined-cycle plants operating, but the large number of orders in the early nineties resulted in an installed capacity of 9,185 MW in March 1996 - a growth from zero to 13.1% of total installed capacity in only five years time (DTI, 1997; Figure 6.1).

Compared to that boom, the rise in cogeneration capacity in the UK has been quite modest, but nevertheless significant: after the installed cogeneration capacity had reached its lowest point of around 1,800 MW in 1988, there has been a turnaround in CHP's fortunes: in nine years time installed capacity grew to 3,500 MW, or from 2.5% of to 5% of total electricity generation capacity (Figure 6.1).

According to various analyses, the development and improvement of the combined-cycle turbine has been one precondition for this dash. It provided a relatively easy-to-deal-with and cheap technology with a short construction time, which could be constructed largely off-site, delivered

turn-key and supposedly operated comparatively error-free (Bantock and Longhurst, 1995).

Another precondition was that gas as a primary-energy source for the combined-cycle plants became very attractive due to substantial price reductions since the late eighties, which were caused by world-market developments and UK gas market liberalisation. The change in attitude of the European Union and UK Government to allow gas use in power generation, the availability of domestic gas reserves and the existing extensive gas supply network also played a facilitating role (Manners, 1996).

These factors made that the newly unbundled RECs in the early nineties saw combined cycle turbines as a relatively risk-free investment, by which some independence from the two main generators could be obtained. Formally 'Independent Power Producers' mostly were the owners of these plants, but RECs as the main shareholders assured through long-term contracts that the electricity generated by these plants would be available for supply to their - up to 1998 still partly captive - end-users. In order to protect their market share, the generators also began to build their own combined-cycle plants. An additional benefit to them was that in this way they could close part of their existing older coal plants and avoid having to retrofit these with expensive flue-gas desulphurisation to make it comply with new, EU instigated stricter emission reduction obligations (Parker, 1996). It has also been suggested that the Conservative Government had an interest in allowing the dash for gas to continue in order to reduce the power of the coal-mining trade unions (Watson, 1997).

Sorrell (1996) focuses on factors that have determined cogeneration development in the United Kingdom. He argues that the development of new generation technologies, in particular the combined-cycle gas turbine and the gas-fired spark ignition engine, as well as lower gas prices as a result of gas market liberalisation have been important preconditions for the revival of cogeneration. Also, a number of specific barriers have been removed by the regulator in recent years: in particular conditions for obtaining generation and supply licenses, as well as terms for top-up and stand-by electricity contracts were changed in favour of cogeneration.

Electricity market liberalisation, in his view, has had mixed effects: on one hand, higher electricity prices for a few very large industries as a result of the removal of subsidies after liberalisation have contributed to the attractiveness of cogeneration. On the other hand, the lower electricity prices for smaller industrial end-users due to the vigorous com-

petition that arose after liberalisation have undermined the economics of self-generation. According to Sorrell's analysis, environmental policy has played a relatively minor role in the development of cogeneration in the UK: the Governmental target set could be seen as largely a continuation of existing trends, only supported by a number of voluntary and information programmes.

Discussion: Electricity Sector Liberalisation and Cogeneration Development

When comparing the developments in both countries and the analyses of underlying factors, some interesting observations can be made.

Firstly, in the Netherlands as well as in the UK there has been a 'dash for new generation capacity' at the beginning of the nineties, the extent of which was not anticipated by most parties. In both countries, the reduction of gas prices and the development of new generation technologies, particularly that of the combined-cycle gas turbine, appear to have been important facilitating factors for the sharp rise in generation capacity commissioned, though the latter aspect is not given much attention in the Dutch analyses. Nevertheless, decentral cogeneration plants in the Netherlands in the period 1990-95 were almost exclusively CCGTs, gas motors and gas turbines. Whilst these technologies had not existed or played any role of importance in power generation before the middle of the eighties, in 1995 they had a share of respectively 30, 20 and 21% in total decentral generation capacity (Sep, 1996b).

Secondly, independent power producers and the parties set up as joint-ventures between distributors and industry formally have been the main investors in new generation capacity in both countries. In fact, however, it seems that RECs in Great-Britain, and correspondingly distribution companies in the Netherlands, have been the main driving force behind this dash. They had an interest to become less dependent on the large power generators by stimulating the construction of new plant.

Thirdly, it is important to notice here that the dash for new generation capacity in the Netherlands came about without privatisation, without competition in electricity supply, and under very restricted conditions for competition in power generation. Nevertheless, competition between decentral and central power plants emerged, quite unintentionally, on a much larger scale than had been anticipated. It was even decided to restrict this competition, as soon as its extent was realised. This strongly suggests that, out of the three liberalisation steps identified, unbundling rather than privatisation or introduction of compe-

tition in power generation and supply is a key driving force that stimulates the construction of new generation capacity.

A fourth observation is that the unexpected rise of new generation capacity in the Netherlands in the early nineties emerged as a dash for cogeneration, whereas in the UK it became rather a dash for electricity producing CCGTs. The developments in the UK suggest that if distribution companies can freely choose how to reduce dependency on central power generation, they are likely to opt predominantly for electricity producing CCGTs as a relatively uncomplicated, not site-specific, fast to build capacity with a short pay-back period. In that case industrial- and small-scale residential cogeneration show to be attractive enough only to conquer a small, but nevertheless substantial niche in the generation market.

Apparently it needs more specific regulation to turn the 'dash for new power plant' after unbundling into a 'dash for cogeneration'. In the Dutch assessments, the installation of an organisation which acted as a broker of cogeneration capacity between distributors and industry is regarded as an instrument that has been important. Nevertheless, the existence of a similar organisation in the UK could not bring about an equivalent boom in cogeneration capacity.

A difference in environmental policy might be partly responsible for the dash for CHP in the Netherlands. Whereas in Great-Britain support is merely limited to information and voluntary programmes, in the Netherlands cogeneration has been initially stimulated by substantial investment subsidies. CHP plants could also be listed as a contribution to the - though equally voluntary - emission reduction targets set by distributors and industry. However, although all parties frequently employ environmental benefits of cogeneration as a rhetorical justification for investment, it seems quite unlikely that development of cogeneration had boomed if it would not have been attractive otherwise.

Here an important difference between the Dutch and British situation shows. Phased introduction of liberalisation in the Netherlands, particularly unbundling prior to introduction of full competition in generation, made it possible to take a regulatory influence on the kind of capacity constructed in the dash after unbundling. In the absence of third-parties, the newly unbundled distributors could only choose between buying all electricity from central power producers, or to stimulate cogeneration development. The factual developments show that the latter option has been a very attractive one.

Renewables: Wind Energy

Netherlands

Wind energy is the second largest renewable primary-energy source in the Netherlands, though it is by far outweighed by energy from biofuels². In 1995, with 257 MW installed capacity 1.141 PJ of energy were produced, which equals 3.2% of the total renewable energy production in that year (See Figure 6.2). Distribution companies were involved in, or initiated almost three-quarter (70%) of the wind energy projects, partly in co-operation with third parties (van Beek and Kohlmann, 1996). By 1997, the total installed capacity of wind turbines had grown to 297 MW (LBW, 1997).

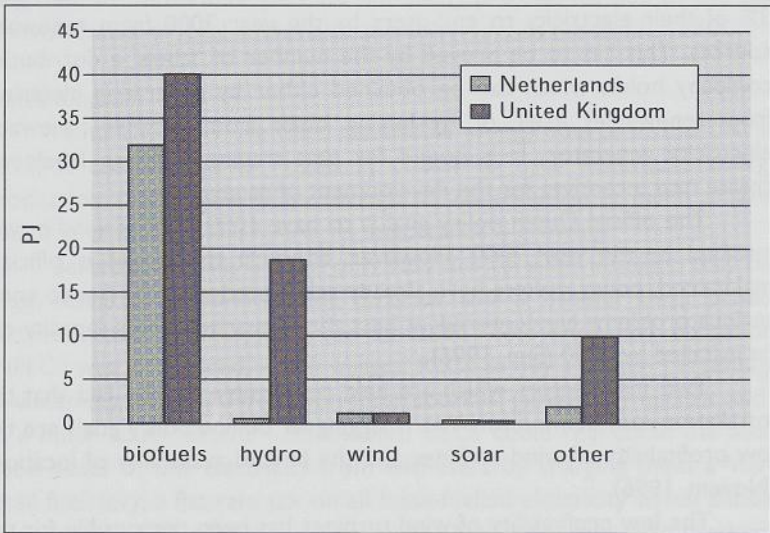


Figure 6.2 Renewable Energy Utilisation in the Netherlands and the United Kingdom in 1995 (Sources: DTI, 1997 and CBS, 1997)

² The definition of 'renewables' is controversial. Whereas the official statistics in the Netherlands as well as the United Kingdom include energy from waste incineration as an important category, many would dispute if this is indeed a 'renewable' source of energy.

The development of wind power in the Netherlands was stimulated by policy makers with direct investment subsidies since the eighties. In 1996, these subsidies were replaced by specific tax reductions for investors in wind energy projects. Since 1990, investments in wind energy by the distribution companies are also partly financed by the 'MAP levy', a levy charged to end-users by the distributors which has to be spent by these utilities on energy efficiency and renewables projects.

End-users can also voluntarily stimulate the development of renewables by buying 'green electricity': in that case they are charged an additional amount by their distribution company which has to be spent on renewables. In 1996, some 16,000 households and a few companies bought in total 0.122 PJ (34 GWh) of green electricity (EnergieNed, 1997). Furthermore, a system of tradable 'green electricity labels' will be introduced in 1998. In this system, distribution companies have to supply 3% of their electricity to end-users by the year 2000 from renewable sources. This has to be proved by the number of 'labels' a distribution company holds, which can be obtained either by generating electricity from renewables itself, or by buying labels from another renewable electricity generator. It is hoped for that trading of these labels will create new incentives for the development of renewables.

The official Dutch policy goal is to have 1000 MW of wind power installed by the year 2000. However, although this target is officially maintained, policy makers have already acknowledged that, due to some serious problems encountered, at best three-quarter of this capacity can be installed by 2000 (Sep, 1996).

Two main factors which are held responsible for the fact that the installation rate of wind turbines is lagging far behind policy goals are the low profitability of wind turbines and the limited availability of locations (Novem, 1996).

The low profitability of wind turbines has been responsible for the fact that projects in the past have only been realised as far as investment subsidies were available (Novem, 1996). On top of that, the recent change to tax reductions as an instrument has led to considerable uncertainty with investors, which might be responsible for the particularly low installation rates in 1997: until October only 20 MW had been installed, which is one of the worst results in many years (Janse, 1997).

The lacking financial attractiveness of wind turbine investments is also a result of the low remuneration for electricity delivered to the grid compared to countries as Germany and Denmark, since there is no legal minimum other than 'avoided costs' set and distribution companies did

not have any particular incentive to raise these tariffs. It is hoped for that the obligation to supply 3% of all electricity from renewables by the year 2000, in combination with the tradable green electricity labels, will provide such an incentive and hence increase profitability of wind energy. A positive signal is that one distribution company voluntarily has set a target of 5% renewables by 2000, and is offering contracts with a relatively high remuneration to green electricity generators (Janse, 1997b).

Problems with finding suitable locations are compounded by a lack of integration between national policy and local policies. When the 1000 MW goal was set, an agreement was signed between central Government and seven Provinces in which turbines had to be installed. However, apparently it was not realised that local councils in the end had to issue permits for installation of turbines. In practice it takes a very long time to obtain such permits, and many projects fail due to the lack of involvement of local authorities and communities (Wolsink, 1996).

United Kingdom

Wind energy is the third renewable energy source in the UK. In 1995, it contributed for 1.288 PJ (1.8%) to total renewable energy production (See Figure 6.2). Though its contribution is much smaller than that of biofuels and hydro, its importance is growing.

Before 1990, there were only very few turbines installed: only ten large research & development turbines and a handful small private turbines. After privatisation, the so-called 'non fossil fuel obligation' (NFFO) was introduced, which obliged RECs to buy a certain percentage of electricity produced from non-fossil sources, particularly nuclear and - to a much lesser extent - renewables. RECs could reimburse the additional costs of this electricity from end-users by charging them a 'non-fossil fuel' levy, a flat-rate tax on all fossil-fuelled electricity which initially amounted to 10% of the end-user tariffs (Mitchell, 1996). The predominant part (over 90%) of this levy has been spent on nuclear power, which - quite contrary to Governmental plans - could not be privatised in 1990. The remainder, however, is spent on the development of renewables, including wind energy.

The official policy goal is to finance the development of 1500 MW 'declared net capacity' (DNC)³ by the year 2000, which amounts to about 3% of UK electricity supply. Regarding wind power no specific goal is formulated, but the British Wind Energy Association claims that 'it is likely that wind energy will make up almost a third of this, roughly equivalent to 1000 MW of total installed wind capacity' (BWEA, 1997).

The funds for renewables generated by the non-fossil fuel levy are assigned to projects via a competitive bidding process. In five different bidding rounds or 'tranches' in the period from 1990 to 1998, developers of renewable energy projects can bid for these 'premium price' funds. Projects with the lowest bid price within different categories of renewables are awarded a contract. Aim of this system is to bring the price of renewables closer to that of conventional electricity generating technologies. By the end of 1996, three bidding rounds had been completed and some 1,250 MW renewable DNC had been contracted, of which 262 MW DNC wind projects (DTI, 1997). Investors were subsidiaries of the generation companies and distributors as well as third parties. A fourth tranche was on the way in 1997.

So far, the NFFO system has given rise to some difficulties. Some of these problems have already been solved by adapting the original regulation, some still have to be solved. For instance, initially the NFFO subsidies were limited to 1998. The very short pay-back time that resulted made prices that had to be paid in NFFO1 to make projects economically viable exceptionally high. A solution to this problem came in 1993, when the European Commission allowed the renewables subsidies to continue after 1998. Presently, it is planned to continue charging the levy for renewables until the year 2018 (Littlechild, 1995). Also, the initial concentration on the most economic renewables was somewhat reduced by introducing 'technology bands' in the bidding system, so that a project only had to compete with other renewable energy projects of the same kind (Mitchell, 1995).

A problem of the NFFO system that has not been solved yet is the lack of co-ordination with local planning policy. Only a small percentage

³ Declared net capacity or DNC stands for a factor in which the operational time ('load factor') of the renewable energy technology is related to that for conventional plant. For example, for wind energy the DNC factor is 0.43, which is calculated by dividing the load factor for wind (0.3) through that for conventional plant (0.7). This means that a certain figure for declared net capacity relates to a much larger figure for total installed capacity.

of the projects that get a NFFO contract is actually commissioned due to problems to obtain local permission to install turbines. For wind power this has meant that out of the 262 MW of turbines contracted in the first three NFFO tranches, by the end of 1996 only 73 MW was actually operating (DTI, 1997). As wind turbines are most economic in some windy areas, projects in these areas ran into substantial local opposition (SCWA, 1994).

Nevertheless, the NFFO system has been successful in that it has initiated the development of quite a variety of renewable energy projects which sometimes, like in the case of wind energy, virtually started from scratch. Another success of the NFFO system is that, although the price level of renewables is still substantially higher than that of other primary-energy sources, it has contributed to an increased economic viability of renewables as expressed in reduced premium prices that had to be paid over the bidding rounds completed so far (Littlechild, 1995).

A recent development separate from the NFFO system is the emergence of green electricity schemes. By 1997, two companies had been set up to trade green power to a couple of commercial and industrial customers. Particularly landfill gas and hydro projects - as the cheapest renewables - are used for green power, though wind energy is expected to play a role here in future as well. However, the potential size of this market so far is very uncertain (ENDS, 1997).

Discussion: Electricity Sector Liberalisation and Wind Energy Development

From the wind energy developments in the Netherlands and the United Kingdom some points for discussion emerge.

Firstly, the comparison shows that wind energy development in both countries is still almost completely dependent on the regulatory support system set up for renewables. Neither wind energy, nor most other renewable primary-energy sources for electricity generation can compete yet with fossil fuels without additional support from policy makers.

The question is whether this support system is in any sense influenced by liberalisation, or is functioning merely apart from the liberalisation process. Taking the three steps of liberalisation identified previously, the role of unbundling and privatisation in wind energy development is most difficult to assess. There is no evidence that these play a role in influencing the functioning of the support system, nor in overall wind energy development.

Neither does the introduction of competition in generation and supply seem to have a substantial influence. Comparison of both coun-

tries shows that, whereas in the Netherlands the support system is operating in a situation which is only about to be formally opened to competition, in the United Kingdom it is working in a market which is already to an important extent competitive. Nevertheless in the UK a 'level playing field' is provided, as the non-fossil fuel levy in the UK has to be paid by captive and non-captive customers alike. It is furthermore already planned to continue this levy after the market has been opened to all customers in 1998.

In both countries the support system in itself, however, bears a competitive element. In the UK, investors in renewable energy have to compete for the NFFO funds. In the Netherlands, distributors will have to compete for the tradable green electricity labels in order to fulfil their 3% target. Though this might contribute to economic efficiency of projects, it is not clear from the comparison made here if such a system works better in stimulating wind energy and other renewables than a regulatory prescribed tariff for electricity delivered to the grid. The latter instrument is used in for instance Denmark and Germany, where installation rates are much higher than in the Netherlands or the United Kingdom (Slingerland, 1997).

The comparison of wind energy developments in both countries furthermore shows that both regulatory support systems share an important problem: a disregard of the need for co-ordination with planning on a local scale. In the Netherlands as well as in the United Kingdom, lacking support of locals and local authorities for wind energy has been a main reason for substantial delays and failures of projects. Hence, assuring support on this level is likely to be much more important for wind energy development than any influence of the liberalisation process.

Even more so as the role of green electricity schemes, which can be interpreted as a market based and supply competition dependent way of stimulating renewables, is still marginal. In the Netherlands, where green electricity is already more widespread than in Great-Britain, it accounted only for 0.122 PJ in 1995 - 11% of the wind energy production, and a mere 0.3% of total renewable energy utilisation in that year. It therefore seems very improbable that the marketing of green electricity in the near future in any sense could replace the regulatory support renewables have received so far.

Reduction of End-User Demand: Demand-Side Management

Netherlands

Demand-side management activities directed at improving energy efficiency in the Netherlands are carried out by the distribution companies. They include measures to further energy-efficient lighting and household appliances, loft insulation and more efficient heating as well as information campaigns aiming to influence the behaviour of end-users.

The activities of the Dutch distribution companies are financed by the 'MAP levy', a levy of at maximum 2,5% of a captive end-user's bill. The funds generated by this levy can also be used by distributors to finance renewables projects, as the goal of the levy refers to CO₂ reduction rather than to energy efficiency: according to a voluntary agreement between the distributors and Government, the overall target is to save 17 million tonnes of CO₂ over the period 1990 to the year 2000 (EnergieNed, 1994). Each individual distribution company has to contribute to the target set in this national 'Environmental Action Plan', which is the sum of the Environmental Action Plans made by all the individual distribution companies for their franchise areas. The activities are co-ordinated on a national scale by the umbrella organisation of the distributors, 'EnergieNed'.

There have been some discussions in the past about the way funds generated by the MAP levy were spent (Kuys *et al.*, 1996). As this is largely at the discretion of individual distribution companies, funds were not always considered to be spent most efficiently. Also, some groups of end-users, in particular small-scale commerce and business, complained that the extent of energy efficiency improvements in their sector was not in line with their share in total levy payments. Furthermore, it was noticed that the financing of some energy efficiency activities from MAP levy funds could be interpreted as unfair competition, particularly where distribution companies were entering non-traditional electricity markets like the waste market. The new Energy Distribution Act introduced in 1997 has provided some alleviation here, as it laid down some guidelines and obliged distributors to provide a detailed account of the spending (EK, 1996).

Up to 1996, the activities of distributors had resulted in total in a reduction of 11 million tonnes of carbon-dioxide emissions (EnergieNed, 1997), roughly on schedule for attaining the goal of 17 million tonnes set for the year 2000. However, despite the activities of the distributors in light of the Environmental Action Plan, electricity demand in the Netherlands is still growing rapidly: 18% over the period 1990-96 (Sep, 1997).

Commercial energy services in the Netherlands develop very slowly. In 1994, there were only a few commercial energy services companies active, mostly engineering- and installation firms. Low energy prices, lack of capital needed for energy efficiency investments and the high risks involved were seen as main obstacles for potential providers of energy services (Moor *et al.*, 1994).

United Kingdom

In the UK, the involvement of RECs in demand-side management activities aiming at energy efficiency is regulatory prescribed via the so-called 'Standards of Performance'. These standards, which were set by OFFER in 1994, include arrangements for a secure and efficient supply of electricity to customers. The standards require the companies to undertake projects designed to save over 6,000 GWh of electricity over the period 1994-1998. Schemes include for instance efficient domestic lighting and communal lighting, energy efficient refrigerators, improved heating and insulation (OFFER, 1994).

These activities are backed up by some direct Governmental subsidies as well as an allowance of £1 per customer until 1998. Co-ordination of the activities on a national level is the responsibility of the 'Energy Saving Trust', an organisation founded in 1992 as a joint partnership between Government, British Gas, the RECs and the Scottish power companies (Jones, 1995).

There has been a discussion in Britain about the 'volume incentive' to the RECs. Due to the specific price regulation, which directly linked the price for distribution and supply services to the volume of electricity sold, RECs had a strong incentive to maximise their sales (IEA, 1996). In the supply and distribution price reviews carried out by OFFER in 1993 and 1994 respectively, this incentive was somewhat reduced by linking a larger part of the revenues to fixed charges, in particular to the number of customers.

Up to 1997, OFFER and the Energy Saving Trust had approved 390 schemes under the standards of performance. These were set to achieve accredited lifetime energy savings of some 5,400 GWh. Over hundred of these schemes had been officially completed in 1997, with forecast accredited lifetime energy savings of 1,200 GWh - 20% of the overall target (EST, 1997). In addition, in recent years some pilot projects have been carried out on a limited scale by several regional electricity companies (Collier, 1995). Nevertheless, electricity demand in the United Kingdom has grown by some 6% since the standards of performance were introduced in 1994 (DTI, 1997b).

Prospects for commercial energy services in the UK in 1997 were considered to be slim. Due to low energy prices and expectations that prices would fall further, the energy service market was thought to remain fragile in the view of consumers, energy suppliers and energy services companies (EST, 1997b).

Discussion: Electricity Sector Liberalisation and Demand-Side Management

The development of demand-side management and energy efficiency as energy services in both countries appears still mainly dependent on the regulatory support provided. Despite the different stages in the liberalisation process in the Netherlands and Great-Britain, the organisational similarity of both regulatory support systems is striking: a target on the national level has been set, there is one organisation responsible for co-ordination of activities and support on a national level, individual distribution companies, respectively RECs, are responsible for implementing most projects in practice, and projects are financed by levy charged to captive customers.

Differences can be found particularly in what targets are set, the way the levy is charged, and in the period in which the overall target should be achieved. In the Netherlands, the overall goal is to reduce CO₂ emissions by 17 million tonnes over ten years, representing a 3% reduction of projected emissions for the year 2000. In the United Kingdom, a goal has been set in terms of electricity to be saved: 6,000 GWh over a period of four years (which equals some 2% of total electricity demand in 1996). The levy there is charged as a fixed amount per customer, whereas in the Netherlands it is related to the energy demand of a customer.

A link of this support for demand-side management and energy efficiency to either competition, unbundling or privatisation is not evident. Though the end-date of the standards of performance set in the UK is coupled to the liberalisation process, there do not seem to be any organisational obstacles to continue a regulatory support system in a liberalised situation. It appears that continuation of support for demand-side management and energy efficiency in the UK after 1998, and in the Netherlands after 2000, is predominantly a question of political will. Although there will be no captive customers anymore after liberalisation, there is no principal obstacle to charging a levy to all customers in order to finance energy efficiency and demand-side management.

On the other hand, the development of demand-side management and energy efficiency as commercial energy services is likely to be strongly dependent on the liberalisation process, and more specifically

on the price development after the introduction of competition in supply. As it is generally expected that prices will drop after liberalisation, the demand for energy efficiency is likely to decrease: an electricity end-user that can get substantially lower tariffs by simply changing supplier, presumably will be less in need of services that will save money by reducing the overall electricity bill.

The link of commercial energy services to unbundling and privatisation is more difficult to establish. There are no signs that these play a significant role in the development of commercially offered energy efficiency and demand-side management. What can be concluded from the developments in the Netherlands and the United Kingdom, however, is that the role of commercial energy services so far is fairly limited. If electricity prices indeed decrease by liberalisation, its prospects are more likely to deteriorate rather than to improve.

Discussion and Conclusions: Lessons for other Countries?

As has been stated before, in every country there are specific variables - such as geographical position, overall industry structure and availability of primary-energy sources - which to a substantial extent set the borders for the organisational development of a national electricity supply system. Wider cultural and political factors, which are difficult to trace within the limited context of a study focusing on electricity sectors, also play a role. Therefore care should be taken when trying to extrapolate from developments in one or two countries. Nevertheless, it is held here that the comparison of development of three energy conservation options in the Netherlands and the United Kingdom does reveal some underlying patterns that could be relevant to policy makers in other countries as well when trying to reconcile energy conservation and liberalisation.

In the cogeneration case, it has been argued that liberalisation gives rise to a 'dash for new generation capacity'. From the comparison, it appears that unbundling of generation and distribution, rather than privatisation or introduction of competition in power generation and supply *per se*, is the main factor responsible for this dash. Apparently unbundling alone can create a strong incentive for distribution companies to stimulate the construction of new power plant. The developments in Britain show that, if unbundling and full competition in power generation are introduced simultaneously, gas-fired combined cycle turbines are presently likely to become the dominant generation capacity chosen by

investors. cogeneration in that case could be expected to become a minor, but nevertheless significant niche market.

From an environmental point of view this can be regarded as a positive development, which comes more or less 'free' to policy makers at liberalisation. Not only is gas a cleaner fuel than for instance coal in terms of CO₂ and SO₂ emissions (though not in terms of NO_x emissions), the new combined cycle turbines have also a substantially higher conversion efficiency compared to older plants - and thus contribute to energy conservation.

However, since plants operated in a cogeneration mode often have an even higher conversion efficiency than electricity producing combined cycle plants, it would be even more beneficial to energy conservation if investors would set up predominantly cogeneration capacity. Developments in the Netherlands suggest that this can be achieved by an unbundling prior to introduction of full competition in power generation. An initial strict limiting of the size of power plants to be constructed by distributors themselves, whilst - prior to introduction of full competition - preventing third parties from entering the market appears to be a very successful strategy here.

In the second case-study, wind energy development in the Netherlands and Britain showed to be presently almost completely dependent on the regulatory support provided. The regulatory support systems in both countries were concluded to differ widely: whereas 'competitive bidding' would be a heading applicable in Britain, the present Dutch system could be marked as 'tradable labels'.

The support systems for wind energy showed to be nevertheless similar in that they were both set up internally as competitive systems, and in that neither of these support systems seemed to be very much influenced by unbundling, privatisation and introduction of competition in supply and demand. Another feature both systems shared was their limited attention to co-ordination with planning and creating support on a local scale.

Finally, it was noticed that 'green electricity' in both countries is emerging as a way of stimulating wind energy and other renewables which could be seen as supply competition dependent. In both countries, however, its role so far was concluded to be marginal.

For policy makers wishing to support the development of wind energy and other renewables as an energy conservation option, the comparison gives rise to the conclusion that wind energy development, and presumably development of other renewables as well, can go quite well together with liberalisation. However, here no windfall benefits

from liberalisation are to be expected. Rather, a carefully designed regulatory support system apart from the liberalisation process has to be set up. 'Green electricity' for the moment could not be expected in any sense to be able to replace such a support system, though it might show a significant potential for the future.

Whether 'competitive bidding' would be more or less efficient than 'tradable labels' cannot be concluded from the comparison, as the latter system in the Netherlands is only in its initial stages. Given the much larger installation rates for wind energy in countries where a fixed, regulatory prescribed rate has to be paid for electricity from wind turbines delivered to the grid, it might very well be that the latter instrument is preferable to the systems in either the Netherlands or Great-Britain. However, the comparison suggests that any support system applied should pay attention to co-ordination with planning and creating support on a local level.

Demand-side management and energy efficiency measures were compared in the third case-study. It was concluded that, similar to wind energy, the development of this energy conservation option is presently predominantly dependent on the regulatory support provided. The support systems in the Netherlands and the United Kingdom were seen to be remarkably similar organisationally. In both countries, essential elements are a national overall target, an organisation responsible for co-ordination of activities on a national level, giving individual distribution companies the responsibility for implementing projects in practice and financing these projects by charging a levy to end-users.

Furthermore, it was discussed that the support system for energy efficiency could be maintained independently from the liberalisation process. Charging an energy efficiency levy to all customers alike would not be expected to lead to market distortions. Liberalisation, however, was argued to presumably negatively influence the development of commercial energy services. Though these services might become a marketing instrument and part of package deals to attract customers, end-user demand for these services would be expected to decrease if electricity prices would drop after liberalisation. Therefore prospects for these services, which were shown to be presently already at a low level in both countries, were expected to deteriorate.

To policy makers wishing to stimulate energy efficiency and demand-side management activities in a liberalised market the comparison could show some key elements of a regulatory support system for energy efficiency and demand-side management which could be applied in a liberalised market. It can be concluded from the comparison

that application of such a system is likely to be needed in order to obtain a substantial level of energy efficiency activities. The development of commercial energy services alone for the moment does not seem to provide an equivalent alternative to regulatory induced energy efficiency and demand-side management.

Finally, the comparison of three energy conservation options in the Netherlands and the United Kingdom has shown that energy conservation and liberalisation can very well be reconciled. Particularly in electricity generation positive effects of liberalisation on energy conservation can be expected. Nevertheless, care should be taken not to misinterpret liberalisation as deregulation. Without regulatory support, renewables and demand-side management are not likely to flourish in a liberalised situation. Rather, liberalisation should be seen as a re-regulation, which - if properly fine-tuned and based on a sound understanding of the effects - can be used as an instrument to stimulate energy conservation as well. After all, enlarging the playing field is a question of moving the fences, rather than of removing them.

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