How would renewables fair if a return to planned electricity markets was introduced?

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Abstract: For nearly all their history, modern renewables have had to fit into electricity systems that otherwise operate using the model of competitive wholesale markets and retail competition for consumers. Renewables' costs are generally too high for utilities to choose them in preference to other generation technologies. However, there is wide agreement that fossil fuel generation has to be phased out in favour of technologies that produce low levels of greenhouse gas emissions. There have always been question marks about whether the free market model for electricity would be sustainable but doubts are now beginning to emerge from an unexpected quarter and much more influential quarter, the pioneers of liberalised electricity markets, Britain. In December 2010, the British government published a White Paper on its proposed reforms to the electricity market that are widely expected to see foresee a much more interventionist approach. However, the British government also has a strong policy to promote new orders for nuclear generation and concerns have been expressed that the market reforms will be designed to favour nuclear power at the expense of renewables. This paper reviews previous policies in Britain to promote renewables and examines options available in a more planned electricity system.

Keywords: *Electricity liberalisation, renewable obligation, feed-in tariff, carbon market, capacity auction.*

1. Introduction

For nearly all their history, modern renewable generation technologies have had to fit into electricity systems operated using the liberalised model of competitive wholesale markets and retail competition for consumers. Their costs are too high and, for some options, the technologies are not mature enough for utilities to choose them in preference to other generation technologies. However, there is wide agreement that fossil fuel generation has to be phased out in favour of technologies that produce much lower levels of greenhouse gas emissions. As a result, it has been necessary for governments to override the markets in various ways to stimulate investment in renewable.

In Britain, there is now recognition that there are fundamental problems with the electricity market that will require a return to a more planned approach. In December 2010, the British government published a White Paper that set out its initial thoughts on market reforms. The situation in Britain is complicated by the strong policy, supported by all three major parties, to promote nuclear power, overtly as a way to reduce greenhouse gas emissions.

2. Why have electricity markets failed?

In February 2010 when the British government and the energy regulator both reported major problems with competitive electricity markets, they implied there were two main problems: that the market would not build sufficient new renewable capacity; and that the market could not be relied on to ensure there was enough overall capacity to ensure demand would be securely met.

The British Energy Minister, Ed Miliband, told the Times[1]:

[1] The Times 'Labour prepares to tear up 12 years of energy policy' February 1, 2010, p 37

> The Neta system [the British wholesale market], in which electricity is traded via contracts between buyers and sellers or power exchanges, does not give sufficient guarantees to developers of wind turbines and nuclear plants. He said that one alternative would be a return to "capacity payments" - in which power station operators would be paid for the electricity they generate and also for capacity made available. The idea of such payments is to give greater certainty to investors in renewables and nuclear energy.

A day later, Ofgem stated[2]:

> 'The unprecedented combination of the global financial crisis, tough environmental targets, increasing gas import dependency and the closure of ageing power stations has combined to cast reasonable doubt over whether the current energy arrangements will deliver secure and sustainable energy supplies.'

And

> 'There is an increasing consensus that leaving the present system of market arrangements and other incentives unchanged is not an option.'

Neither argument is convincing. The mechanisms to get renewables built inevitably took them out of the main market and if these mechanisms did not work, it was not the fault of the market, it was in the design of these policies, as is argued below. On the more general point of supply security, it is hard to know why this has come up as an issue now. The market model has always relied on the wholesale market price being high enough that sufficient capacity will remain on-line to ensure supply security and that market signals would be seen early enough to stimulate sufficient new capacity to meet demand growth and replace old plant. So far this has proved the case in Britain and supply security has been maintained although it is arguable this has been the result of market imperfections rather than the efficiency of the market [1]. There are a large number of new power plant projects that could be on-line within five years, albeit mostly gas-fired, so there would seem to be no reason as to why doubts on supply security should arise now.

Thomas [1] argues that the faults are more fundamental and would apply even if there was no need to replace fossil fuel plants with low-carbon generation. He argues that: if wholesale markets became truly competitive, investment in new capacity would be intolerably risky; retail competition inevitably disadvantaged small consumers and within small consumers, the poorest consumers; and the costs of competition are bound to outweigh any conceivable benefits.

3. Renewables in competitive markets

In Britain, renewables have been supported through two separate mechanisms, a capacity auction system from 1990-98 financed by the Fossil Fuel Levy (FFL) through the Non-Fossil Fuel Obligation (NFFO) and from 2002 onwards a Renewables Obligation (RO) system. A Feed-In Tariff system was introduced in 2010 but only for much smaller sources than are covered in, for example, Spain and Germany. Each of these mechanisms has had its

[2] Ofgem (2010)'Action needed to ensure Britain's energy supplies remain secure' Press release R5, February 2010.
http://www.ofgem.gov.uk/Media/PressRel/Documents1/Ofgem%20-%20Discovery%20phase%20II%20Draft%20v15.pdf

advantages and disadvantages. In principle, all could be used in a more planned system so it is important to examine their record.

3.1. The NFFO

The NFFO was an accident born of the failure to privatise the nuclear power sector in 1990. The nuclear power plants were placed in a new publicly owned company, Nuclear Electric. The operating costs of the existing nuclear plants were found to be about double the expected market price for electricity so to allow the company to continue trading, a subsidy had to be introduced. 10 per cent of all consumer bills, the Fossil Fuel Levy (FFL) was allocated to this subsidy raising about £1m per year. The European Commission judged this an unfair state aid to nuclear power and required that it be phased out by 1998.

Nearly all of the FFL was paid to Nuclear Electric. For political reasons, a small proportion of this, rising from 0.5 per cent of the subsidy in 1990/91 to 8 per cent in 1994/95 was allocated to renewables and this was disbursed through capacity auctions [2]. A total of five auctions were held. Typically, the auctions would specify the amount of capacity that would receive subsidies and could also be targeted at particular technologies, for example, waste-to-energy. In terms of prices, the results were impressive with the last auction in 1998 producing an average successful bid of £27/MWh compared to £75/MWh in 1990.

However, the completion rate on the successful bids was very poor. This was partly because of difficulties in obtaining finance and planning consents, and problems of equipment supply. The time limit on the FFL imposed by the European Commission meant also that projects could only receive subsidies for a short period of time up to 1998 when the FFL had to be phased out. In 1996, the FFL for nuclear was abolished and remained at a much lower level until 1998 specifically to subsidise renewables. Because subsidies for renewables were allowable under European Union law, it was possible to extend to 15 years the period for which subsidies could be given and this meant that for the final auction, much longer contracts of 15 years could be awarded to successful bidders rather than the contracts up to 1998 that had applied previously.

3.2. The Renewables Obligation

There was a hiatus from 1998 to 2002 while the government considered how to replace the NFFO. In April 2002, the British government announced that a Renewable Obligation (RO) on electricity retailers would be introduced. This effectively requires them to source a given percentage of their electricity from renewable sources. The level was set at 3 per cent in 2003, rising to about 10 per cent in 2010 [3]. Companies that fell short of their target percentage are required to ‘buy out’ their obligation at 3p/kWh (rising annually with inflation). The funds raised are redistributed to the suppliers that complied with the obligation using certificates. The RO was expected to force electricity retail companies to meet their obligation as cheaply as possible to ensure their tariffs remained competitive.

There have been a number of problems with the RO [4]. First, the design of the penalties means that if all the companies fall short of the target, none of them is financially or competitively disadvantaged. The cost of the buy-out may be judged preferable to the risk and extra cost of building new renewable facilities. Given the structure of the British electricity market, under which all the major electricity retailers are owned by the six large generation companies, the RO is also a barrier to entry for new generators. The retail arms of the ‘big six’ companies will generally have a strong incentive to either own or control the resources they contract and will be able to prevent entry by new renewable generation companies.

3.3. Feed-in tariffs

Feed-in tariffs (FITs) have been highly effective, for example, in Spain and Germany, at rapidly expanding renewable capacity and, given the poor rate of installation of renewables in the UK, this has led to pressure to adopt FITs in the UK. In 2008, the UK Energy Act [6] introduced provisions for FITs and in April 2010, FITs were introduced, but only for installations with a capacity of 5MW or less. This scheme can clearly only have a limited impact and seems focused mainly on households. It is too early to assess how successful it will be yet. Elsewhere, experience suggests that the key to successful use of FITs is to set the fixed tariffs at a level that is high enough to stimulate investment but not so high as to lead to wasteful over-investment with larger than necessary public subsidies.

3.4. Review of experience to date

While Britain has probably the best renewable resource base in Europe, at least with current technology, it has one of the poorest rates of installation and costs have been high [4]. The evidence that costs are high is particularly damning given the emphasis with the two main policies, the NFFO and the RO, on market mechanisms as a means to minimise the cost to consumers.

4. The Future

In the next decade, the requirements for installing renewable generation will be massively increased. Under the RO, British electricity retailers are required to source about 10 per cent of their *electricity* from renewables. Under the European Commission's '20-20-20' targets, Member States would need to source 20 per cent of their *energy* from renewable sources. Given that in the UK, electricity makes up less than 20 per cent of final energy consumption, meeting this target would require a massive increase in installation rates. Even if we assume that half of these renewables would not be used for electricity generation (e.g., bio-fuels), this would require that renewable generation capacity would have to increase more than 5-fold in less than a decade.

It would seem that cost-minimisation can no longer be the dominant policy force. Clearly, electricity needs to remain affordable, especially if we are going to require that it substitutes for direct use of fossil fuels, for example, in space-heating and transport, so cost has to remain an important consideration. However, future generations will not be impressed if we fall well short of the '20-20-20' target no matter how cheap the renewables we do build are.

The major unknown is the attitude of the British government to nuclear power. Nuclear proponents claim that nuclear power is the only feasible way to meet such ambitious targets as the '20-20-20' policy. Nuclear is claimed to be a proven, low-carbon, base-load source that can be deployed in large numbers with no resource constraints that cannot be overcome.

Its detractors, apart from the well-rehearsed arguments on safety, proliferation and waste disposal, dispute that it is as low-carbon as it is portrayed and they are concerned about the extent of uranium reserves. The designs now available for order have yet to be demonstrated. They also claim that nuclear's costs are far higher than governments promoting it acknowledge and that rates of installation for nuclear programmes worldwide have almost invariably fallen far short of the rates forecast. To illustrate the two latter points, they note that estimated construction costs of the latest generation of plants has increased from US$1000/kW less than a decade ago to US$6000/kW and if history is a good guide, outturn costs will be even higher. On installation rates, when President Bush launched the US Nuclear

2010 programme in 2002, the assumption was that one or two new reactors would be in service by 2010. It seems likely that the first reactor under this programme will not be finished much before 2020 and many of the utilities that expressed interest in the programme are now dropping out. Nevertheless, the British government is convinced that a rapid expansion of nuclear power will be the main tool for Britain to reduce its fossil fuel usage.

A number of mechanisms have been mooted in Britain to encourage renewables (and nuclear) development.

4.1. Capacity payments

These were mentioned by the Energy Minister in his February 2010 announcement so it seems likely they are in the mind of officials at the energy ministry (now the Department of Energy and Climate Change, DECC). Capacity payments would be paid to generation sources simply for being available to generate and would clearly be an advantage to potentially base-load sources, but would be of little or no value to intermittent sources such as wind, wave or solar. They would be a particular advantage to nuclear power however, which because of its rigid cost structure is vulnerable to market price variations.

However, the logic of capacity payments would seem to be that they should be targeted at peaking capacity. The annual loading of such plant is highly variable depending on weather and demand, and, for several years, a peaking plant whose availability is needed for supply security might earn little or no income from sale of electricity. A capacity payment sufficient to cover its fixed costs would give plant owners a strong incentive to keep such plant on-line. If a base-load source is not earning enough money to cover its costs from sale of electricity this suggests either that there are market defects or that that source is simply uncompetitive.

It should also be noted that from 1990-2002, the British electricity market design included a type of capacity payment. However, this was continually manipulated by the generators to increase, unfairly, the level of payment they received.

4.2. Fixing the Carbon price

The idea of fixing the carbon price came up in the context of the 2008 UK White Paper on nuclear power [5]. According to this, for nuclear power to be economic, using even the government's highly optimistic figures, the carbon price would have to be at least €36/tCO_2. It may have been that this was simply the easiest way for the British government to maintain the illusion that nuclear power was an economic option that companies would choose unprompted if some enabling measures were introduced. A centre piece of the British policy since then has been that no public subsidies would be offered to induce the construction of new nuclear capacity. However, the discussion of the Carbon price was seen by many as an indication that the British government was considering putting a floor on the Carbon price at a level that would make nuclear power economically viable. A Carbon price floor would also provide a more secure income stream for all renewable options, but whether it would be sufficient by itself to ensure that renewable capacity was built is far from clear. The same reservation applies equally to nuclear power.

In practice, the Carbon price is set in the European Union's Emissions Trading Scheme (EU ETS). Britain cannot choose arbitrarily to fix the Carbon price unless it exited the EU ETS and set a floor Carbon price for a new British Carbon market, which does not seem likely to be politically viable. Alternatively the Carbon price could be fixed if the EU ETS was substantially changed to include a floor price for the whole of Europe.

Few would argue that the EU ETS has worked well and the Carbon price has remained low, far below the levels seen by the British government as being necessary to make nuclear power viable. Whether simply giving up on the market entirely to creatively find ways of reducing greenhouse gas emissions by fixing the Carbon price is necessary is far from clear.

4.3. Energy efficiency

Clearly, reducing demand substantially would make the 20 per cent target much easier to achieve. An aggressive programme of energy efficiency measures would also have other policy pay-offs. Britain now has a serious problem of 'energy poverty', a condition under which a household is required to spend more than 10 per cent of their household disposable income on buying energy for the house. This has risen, as energy prices have increased from about 7 per cent of households in 2002 to more than 20 per cent in 2010. A programme of energy efficiency measures targeted at low income households would have major welfare benefits, would be likely to create large numbers of new jobs in the construction sector. It might also allow existing welfare payments, such as the winter fuels allowance under which all pensioners receive a sum of the order of £300 every December as a contribution to their energy bills.

5. Conclusions

5.1. Political considerations

It is arguable that it was always an illusion that a free market for electricity was feasible except in the few years around the turn of the century when fossil fuel markets were over-supplied and the extent of the challenge posed by climate change had not been fully assimilated at the highest policy level. Renewables are, in general, some way, in terms of cost and technological maturity from the position in which it can be left to the market to order them.

If this is the case, the announcements from the British government of concerns about the electricity market should not have been a shock not because of what was said but because Britain is seen as the pioneer, advocate and most successful implementer of electricity markets.

The European Union is in an even more difficult position than the UK. It bought into the rhetoric of electricity markets fully and has spent more than 15 years trying to impose essentially a copy of the 'British Model' on Member States. In the process it irreversibly dismantled structures and companies which, while far from perfect, had delivered reliable affordable electricity for many decades. For the Commission to admit that this effort was all misconceived will be politically difficult. However, the Commission cannot escape the reality that a free market electricity system is not feasible. A likely outcome is that what will emerge is a 'Frankinstein's Monster' of a system with a veneer of competition, but which in reality is subject to strong centralized planning with inadequate regulation.

5.2. Practical options

The capacity auction mechanism under the NFFO, and the Renewables Obligation and the European Union Emissions Trading Scheme have all suffered from serious design issues that meant that none worked as planned. It is hard to say whether, with better design, these could have been effective or whether it is the fate of all market mechanisms, no matter how attractive in principle, to fail in practice, often through manipulation by the companies.

However, if the '20-20-20' targets are a necessary and viable target, we may not have the time for more experiments with market mechanisms. We will also not have the luxury of cherry-picking only cheap renewable options, such as on-shore wind, we will have to pursue more expensive renewable options.

Feed-in tariffs remain the option with the best track-record of bringing large quantities of renewables on-line. They can also be tailored for a variety of sources with different prices on offer for different technologies.

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