

Meeting the challenge of renewable energy

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The White Paper published by the UK Government this month entitled “Our energy future – creating a low carbon economy” makes interesting reading, if nothing else for its bold objective of decreasing CO2 emissions by 60 per cent by 2050. By 2050 most of us will no longer be electricity practitioners, however the objectives of generating 10 per cent of electricity from renewable sources by 2010 and 20 per cent by 2020, are more relevant and will effect all of our lives, or more specifically our purse.

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According to the White Paper, to achieve these targets will require 10,000MW of additional “green” capacity, my own calculations are nearer to 11,000MW however I will assume the published estimate to be correct.

This article discusses some of the obstacles that will need to be surmounted to achieve the stated objectives and makes some tentative predictions regarding the UK renewable industry up to 2010.

Renewable Technologies

What are the technologies that are likely to be used in the UK to build the required 10,000MW up to 2010 (approximately 1,500MW of new yearly capacity).

Waves and tides By the White Paper own admission, it is unlikely that these energy sources will be commercially available before 2005-06, both technologies are currently at the demonstration stage. Assuming that all goes according to plan, we can optimistically expect 10-15MW in operation by 2006, thereafter we can assume some sort of exponential growth fuelled by new projects.

The commercialisation and take-up of new technologies is extremely slow, this coupled with long project development lead times makes it extremely unlikely that wave and tidal power will make a meaningful contribution by 2010, my personal optimistic expectation is that less than 100MW will be in operation by then.

Biomass Biomass could potentially provide over 500MW of additional capacity, the boiler technology is in place and the cultivation of energy crops could provide badly needed revenue for the farming community, the Cinergy 30MW straw fired plant has now been in successful operation for several years, an other 10MW plant has been constructed but suffers from technical problems.

Until the UK can create a new business sector dedicated solely to the production, collection and delivery of biomass to power plants, it is unlikely that any significant progress will take place; therefore the above prediction of 500MW is at least optimistic by a factor of two.

Photovoltaic To date PV panels is primarily envisaged to power buildings, project size in terms of MWs, is extremely

small, capital costs remain high and British weather is everything but helpful, therefore PV will not be making a significant contributions to electricity generation.

HydrogenThe energy released from this fuel is about equivalent to the energy necessary to produce it, current wisdom therefore indicates that hydrogen will be used for transportation and possibly as a form of energy storage, in either cases it will not contribute directly to future generation.

WindThis is the only mature technology that has reached the commercialisation stage, with almost 40GW of installed capacity worldwide and annual growth in excess of 30%. Some technical challenges still lie ahead: the size of individual machines is currently increasing from 1MW to 5MW at breathtaking speed, hence it is reasonable to assume that sooner or later designs faults will appear (as we have seen with gas turbines in the mid 90s), in addition operations offshore are not as yet fully demonstrated and some question marks remain on the ability to maintain equipment effectively throughout the year.

Notwithstanding such challenges, the UK has the greatest wind resource in Europe, it is therefore safe to assume that both onshore and offshore wind will be the primary energy source to meet the White Paper electricity targets.

The Renewable energy mix

To predict the exact contribution of each of the above mentioned technologies to the 10,000MW of planned new generation is impossible, however we should remember that the power sector, because of the high capital costs, is and will remain cautious and extremely slow when it comes to innovation. Wind for example has taken over twenty years to come of age and only recently 1MW machines have become commercially available.

If we take the wind sector as a model to forecast the growth of other renewable energy sources, it is safe to assume that their contribution by 2010 will almost be nil. However there are important differences: firstly for many years wind energy was not taken seriously as industry players focused on the construction of large thermal plants, this obviously hampered the commercialisation of wind, secondly no financial support (in the way of preferential tariffs) was provided.

The situation has now changed, renewable energy has become sexy and the UK is prepared to heavily subsidise "green" electricity, we can therefore expect the development of emerging technologies (wave and tidal power in particular) to be much faster, however there remains a question mark regarding commercialisation. Why should developers and banks invest in risky new technologies when they can obtain the same (if not better) economic benefits from the development of wind farms? Competing technologies will only flourishing once they become economically competitive (on a risk adjusted basis) with wind and/or once sites for wind farms become exhausted.

My forecast from this short analysis is that by 2010 the 10,000MW (if built) will be made up by at least 9,000-9,500MW from wind and the rest by biomass and a small component from tidal and waves.

This prediction represents over 1,400MW of new wind farms constructed per year (a tall order given that to date no more than 80MW have been commissioned in any one year).

The industry currently forecasts 3,000-4,000MW of new build during the period under consideration, in addition to the existing 1,400MW under development. Assuming a total of 5,000MW installed offshore, a further 4,000MW is required onshore. Between now and 2010 the UK will need to construct a total of 400 onshore wind farms (10MW per site) and 50 offshore wind farms (100MW per site).

Barriers to achieve the target

In order to build 9,000MW of wind farms the following is need:

1. Availability of land (or sea)
2. Approval from local authorities and local residents
3. Increases in turbines manufacturing capacity
4. Availability of grid connections
5. A large number of developers willing and capable of undertaking the development work
6. Sources of finances

PlanningThe White Paper recognises that planning permission are going to be a problem, however it does not clearly specify how such problems are going to be resolved. The DTI is proposing for planners in future to be required to take into consideration the environmental benefits of each scheme and a quota of renewable energy production for each region. While these developments are to be applauded, there appear to be no timetable for such innovations, nor can we expect attitudes of planners to change overnight. More importantly the attitude of local people will not change from one day to the next, the “not in my backyard” syndrome will continue even for people who support wind power. Interestingly the White Paper discusses at some lengths issues like economic signals to the market and consultations with planning authorities, but consistently fails to recognise the need to address public opinion. The Government has earmarked many millions of pounds for institutions like the Carbon Trust, committees and programs, but has neglected a simple issue like the education of its own people through for example publicity campaigns.

GridWith regards to grid connections, consultations are taking place with distributions companies, however it is still unclear who will pay for the connections and more importantly grid improvement necessary to maintain grid stability and channel the electricity from remote locations to the centres of consumption.

Recently the Government has proposed a 400MW underwater link between Scotland and Wales at the cost of several hundred millions pounds, many more links will be required for all the wind energy to be fed through the grid. What sort of incentives can be provided to stimulate the undertaking of such a large program of investments? Without financial incentives, it is unlikely that any such investment will make economic sense for the private sector.

Where is the money going to come from? An obvious source of funds would be to channel some of the present subsidies to the renewable sector for grid reinforcement. Such an initiative could be justified on the basis that the current market price per tome of CO2 is approximately £3-4, well below the present price of ROCs, however the Government is committed to maintaining the present ROCs pricing mechanism in place until 2027, therefore the money will have to come from elsewhere, most probably the consumers.

Development companiesFor the industry to thrive it require a large number of players entering the market. Currently the market is fragmented and indigenous with many small players lacking sufficient funds and resources.

Because of the above, most people forecast a consolidation in the industry, however assuming that all bottlenecks in project development can be removed, and assuming that electricity prices remain as high as they are now (between €8-10/kWh) it will make the industry a very attractive place to be, this will attract new players into the market, the question is whether it will attract the right players. A proliferation of incompetent players will increase the number of projects under development but will not contribute in any way to projects successfully reaching financial closure and will cause considerable harm to the industry.

To sustain the high level of development required to meet the Government target, it will require a substantial increase in resources for the indigenous established players, both utilities and wind developers. Both groups of developers are, for different reasons, not cash rich at this moment: utilities are suffering economically due to low electricity prices, while wind developers are attempting to grow organically and therefore find it difficult from a small economic base to fund substantial expansion. Foreign inward investment will also be required, unfortunately most utilities in Europe are currently consolidating their balance sheets following a period of aggressive acquisitions (not necessarily successful), the American utilities have retrenched in their home market, European wind developers are entering the market, however the process is slow since it is difficult for such foreign companies to establish a clear differential advantage outside their home territories; local geographical and regulatory knowledge are significant barriers to entry.

While the self perception in the UK is one of a stable country with many favourable attributes to attract inward foreign investment, this may not be the case with regards to the electricity sector. Over the last 13 years this sector has seen unprecedented changes and experimentation; while this is only to be expected as the market makes its transition from a monopoly to the competitive environment, two changes have had a disastrous impact for foreign investors: the gas moratorium when the Labour Government came to power, effectively halting all new developments of gas fired plants, and the introduction of NETA in 2001, resulting in a reduction in generation prices by 40%. American and German companies are currently counting the costs of such changes and in many cases are going back home.

While people’s memory is short and to date such changes have had no adverse impact on the renewable industry, it is probably safe to state that UK regulatory risk is high, this does not bode well for future foreign investment.

Some of the problems faced by current market players have created a window of opportunity for new participants to enter the market, most notably financial institutions. Financial finds, venture capitalists and banks have all shown a keen interest in the sector and we can expect for them to play an important role in providing financial support (in the form of equity) to existing players.

Regulatory riskIt is impossible to guess what are likely to be the regulatory risks in the renewable sector up to 2010, however the regulations determining the price of electricity must be a prime suspect.

Currently the price of electricity produced from renewable sources is made up of three components:1. The pool price UK£15/MWh approximately2. Fuel levy exemption UK£4.3/MWh3. Carbon credit (ROCs) UK£30/MWh (trading between £40-50/MWh)

In the present environment the price is approximately £65/MWh, this is approximately twice the price in the Republic of Ireland, although it should be remembered that if distribution companies are capable of meeting their Renewable Obligation (as capacity expands) the price of electricity will drop to around £50/MWh.

Current thinking suggest that thermal electricity prices will increase over the next few years, fuelled by increases in gas prices and decreases in reserve margins; theoretically we should expect that by 2010 electricity prises will reach the long term marginal cost of new combined cycle plants (around £30/MWh). Any such increases will feed directly in the tariff paid for renewable energy thus offsetting any potential decreases in the market price of ROCs.

The White Paper recognises that current initiatives will result in electricity price increases for consumers, estimated by 2020 to be between 5-15% for households and 10-25% for industrial users. Such increases, coupled with potential increases in prices for thermal electricity and the cost of grid improvements, could result in government rethinking the present subsidies provided to the renewable sector.

A second, but equally important regulatory risk, is the potential changes in regulations. The Government has already announced the proposed replacement of NETA with BETTA, in addition the EU is working towards an harmonized set of rules for the trading of CO2 and other harmful emissions, this may well have a direct impact on the UK ROCs.

The above analysis goes to illustrate what we have all learnt at Business Schools: first mover advantage is important (Enron being the obvious exception), today we know what the rules are, tomorrow it might be a different story, despite the government commitment to maintaining ROCs until 2027.

FinancesThe next issue to consider is the amount of money necessary to build 9,000-9,500MW of additional capacity, assuming a capital cost of €0.9m/MW onshore and €1.5m/MW offshore, the total bill is over €11bn of which €2.3bn will be in the form of equity (assuming an 80/20 gearing).

To funds such levels of investment, it is likely that inward foreign investment in the form of equity will be required, on the debt side there are positive indications that banks, although currently struggling with bad debts associated with thermal power plants, remain keen to fund projects in the renewable sector. What is not as yet known is the level of gearing and debt service cover ratios they will demand; the good old days of 90:10 gearing have probably gone, also the bank’s perception of risks regarding offshore projects remain untested.

Developments to date

The rate of development of the wind sector has been slow, the table below shows the capacity installed during the last few years:

Year	Installed capacity (MW)	Number of projects	Average size of projects (MW)
1991	4	1	4
1992	17.7	5	3.5

1993	87.7	9	9.7
1994	23.3	4	5.8
1995	45.1	7	6.4
1996	70.8	6	11.8
1997	50.9	7	7.3
1998	14.2	4	3.5
1999	20.1	5	4
2000	63	12	5
2001	64.4	7	9.2
2002	87.7	10	8.7
2003	5.3	3	2.6

The above figures only relate to onshore projects, only one offshore 4MW project has been commissioned.

The new electricity tariffs introduced in 2002 have resulted in a step change in the rate of development of projects, although such activities will not be visible for approximately another year as projects take approximately two years to complete. In 2002 a total of 637MW worth of projects received consents and in March 2003 consent was received for three offshore projects for a total of 397MWs.

Although it is unrealistic to assume that all these projects will reach financial closure and will be built, the figures look encouraging.

Future Developments

To be able to predict the rate of growth in the sector is extremely difficult even if issues of planning and grid connections can be successfully navigated, such issues will probably take several years before the situation improves.

For the onshore sector I predict approximately 150MW of new capacity this year increasing to a yearly build of 500-600MW by 2010. For offshore my predictions are for 100MW to be constructed by the end of 2004, thereafter increasing rapidly to about 700-800MW by 2010.

Total new build for the period under consideration should amount to approximately 5,500-6,500MW. This is a tall order considering that the current build rate is less than 100MW per year, however we should not underestimate the resourcefulness of people when they perceive the opportunity of making money, for example investors managed to completely revolutionise the UK electricity mix in just ten years.

Even if the sector is booming, my own predictions are that the government will not meet its target by approximately 30 per cent, this is partly due to the low base from which the sector is starting and the difficulties that many players and banks are currently experiencing in the electricity sector, however increases in turbine sizes will make a substantial contribution, particularly towards the end of the decade.

Assuming that there are no significant changes in the power market after 2010, the present goal of obtaining 20% of energy from renewable sources should be more easily achievable than the 10% by 2010, by then it is hoped that public opinion will be favourable to a landscape dotted with turbines and the size of machines will be increased, although progressively grid restrictions will make developments more difficult and additional thermal capacity will be needed as standby.IJ

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