REF

RENEWABLE ENERGY FOUNDATION

2005–2006 REVIEW OF THE RENEWABLES OBLIGATION

28 October 2004

2005–2006 Review of the Renewables Obligation

"…we need access to a wide range of energy sources and technologies and a robust infrastructure to bring the energy to where we want to use it."
Tony Blair, preface to *Our Energy Future*

Introduction

This response to the DTI's consultation has been prepared by Hugh Sharman of Incoteco (Denmark) ApS, and The Renewable Energy Foundation, working in collaboration.

Hugh Sharman is an energy consultant, based in Denmark. Most of Incoteco's work is done for and with large energy companies seeking innovative environmental solutions to practical problems. An example is its leading role in the formulation and development of the "CO_2 for EOR in the North Sea" (CENS) project during 2001. During 2004, Incoteco (Denmark) ApS completed a wind-energy related study for the Danish Energy Agency that was also supported by a number of important Scandinavian energy companies. Its purpose was to find more effective uses for the large wind power surplus that is generated in West Denmark. For further information about Incoteco see **www.incoteco.com**.

The Renewable Energy Foundation is a newly created foundation which has arisen from widespread and growing public concern that the current renewables energy policy is in itself unbalanced, and causing subsequent imbalances in the rest of the energy sector. REF encourages the development of renewable energy and energy conservation whilst safeguarding the landscapes of the United Kingdom from unsustainable industrialisation. In pursuit of this goal, REF highlights the need for an overall energy policy that is balanced, ecologically sensitive and effective.

The Renewable Energy Foundation is currently commissioning research and commentary from leading consultants and industry experts in order foster a full and informed debate. For further information see **www.ref.org.uk**.

General Comments

We note that the Renewable Obligation Certificate (ROC) system is a proven and effective instrument for promoting and incentivising the construction of new electricity generating plant within the framework of the Government's requirements and aims. We believe that the Government's aims are not being fully met by the way in which the ROC process is working, so we are pleased that this statutory review is being undertaken and are glad to offer suggestions for improvements.

The primary purpose of introducing the Renewable Obligation was to encourage investment in new generating capacity that, taken together with other measures, would fulfil the Government's overall energy objectives, which are to:

1. reduce carbon dioxide emissions by 60% by 2050
2. maintain security of supply
3. ensure competitive energy markets
4. ensure every home is adequately and affordably heated

The Obligation has been in force for over two years and we perceive some over-riding characteristics in the way the legislation is working. In particular, we note that ROCs reward

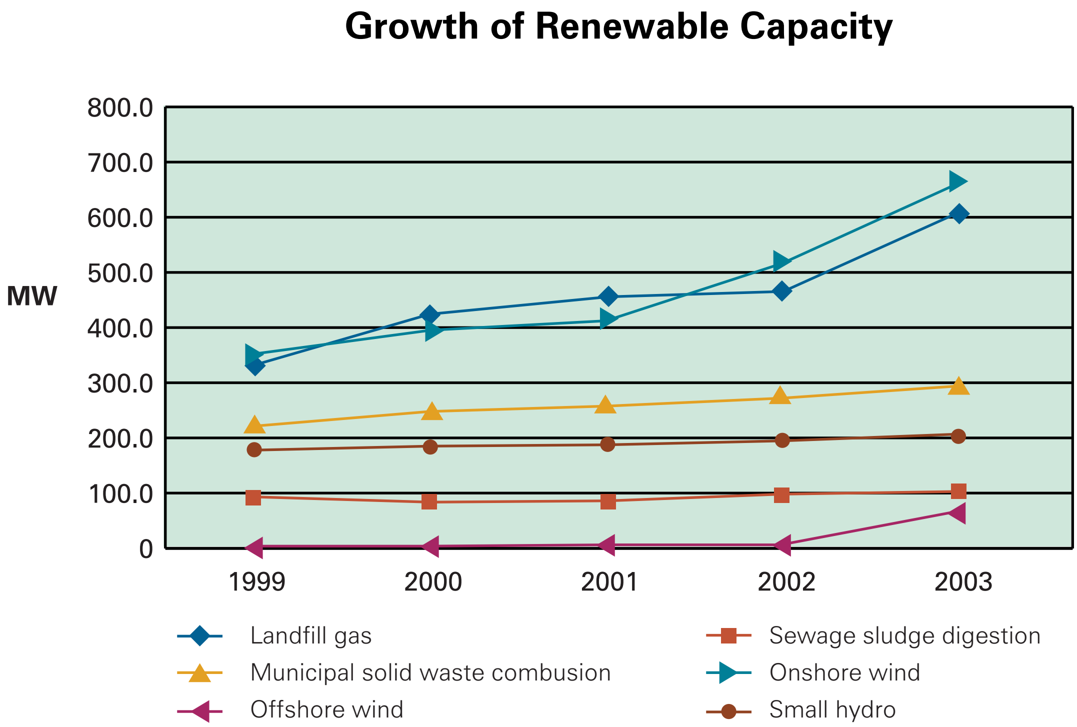
- Any and all qualified MWh irrespective of **when** these are supplied or **whether** they supply any firm capacity.
- Only least cost, nearest market, technical solutions, with the consequence that **only** these have been financed.
- Developers of any qualified renewable energy capacity, irrespective of their overall success in meeting the Government's targets. When a shortfall in the statutory supply takes place the penalty paid by the electricity suppliers is entirely transferred to the energy consumers and remains fixed, so that each qualifying MWh has a higher monetary value, simply as a result of the shortfall in supply.

We do not believe that this was the way that the Government intended the legislation to work. We specifically note that ROCs do not reward

- Energy savings which would save both energy (thus, probably, CO_2 emissions) and reduce the risk of investing in excessive capacity.
- The construction of firm capacity in any way that differentiates such capacity from capacity that is only intermittently or randomly intermittently available.
- Innovations in new generation technologies, based on a full and diverse range of renewable energy sources.
- Developments, such as energy storage, that might improve the true value and usefulness of intermittent energy sources.
- CHP, which typically uses up to 92% of the input (fossil or bio fuel) energy.
- Any generation not connect to the grid.

As a consequence, it appears that generating capacity that is being built under the ROC programme is not capacity that can fulfil the objectives listed in *Our Energy Future* adequately or in a balanced way. We are concerned that the Government does not recognise, in any official publications, the wide-ranging issue of the United Kingdom's, particular and extreme vulnerability to World peak hydrocarbon production, a phenomenon which will negatively affect the whole economy in ways that can only dimly be recognised.

Results so far



The foregoing chart represents the renewable capacity construction trends.[1] We note that of all the qualifying categories of renewables, only landfill gas and onshore wind power are enjoying strong capacity growth. Of these, only landfill gas provides any firm capacity, but such projects have a relatively short life, and under current EU legislations there will be no new landfill sites. We note that "Stranded and Orphan Gas" technology for exploiting current land-fill sites is under-encouraged, and that much gas is still flared.

Growth in small hydro will be limited by topography, while growth in MSW combustion will be limited by the legislation that favours other technology and government policy objectives for waste, the treatment of which leaves the UK at a material disadvantage.

During the last year, a number of approvals have been given for the construction of offshore wind power stations, but we also note that some of these qualify for capital grants. It may be that the very existence of capital grants might inhibit the financial completion of some of these, indicating that the undoubtedly more challenging environment for offshore wind investments might eventually justify a favourable differential in the value of the ROC for qualifying offshore wind, compared with onshore wind.

The looming capacity crunch

By 2020, 70 to 80% of the firm generation capacity that provides a high degree of reliability in the UK today will be or should be retired.

1 DTI, *Digest of United Kingdom Energy Statistics 2004*, Table 7_4.

1 Only 1 GW of nuclear will be still functioning, 11 GW having been de-commissioned as obsolete. The lives of these plants cannot be significantly prolonged. By 2020, even Sizewell B will be near the end of its 30+ years of useful life.

2 If any of the remaining 34 GW of the CEGB's coal and oil stations, on-line today, are still running, the newest of these will be 50 years old, and their boiler tubes will be coming to the end of their creep life. Most other major mechanical and electrical components will be in need of replacement. Repair and refurbishment will become increasingly expensive and wasteful, since the average thermal efficiency of the overall plants is only 37%.

3 A significant fraction of the UK's CCGTs will ageing by 2020, and even the newest of these will be subject to fuelling by foreign suppliers of gas, whole continents away, at a time when global gas depletion will be a fully recognised threat, just as it is recognized that in 2004, the high prices for oil are caused by physical and geological, not political considerations. [2]

Thus, by 2020, during the period of only 15 years from this consultation, 11 GW of nuclear and 34 GW of CEGB steam plant, plus anything up to 10 GW of CCGTs must have been de-commissioned and replaced by 55-65 GW of new, non-polluting but firm generating capacity at a cost of some £60 billion. Given global hydrocarbon depletion, it is unthinkable that most of this will be replaced by gas-fired capacity. So a strategy for supplying firm capacity still needs to be identified, planned for, publicly accepted and approved before it can be designed, financed, constructed and commissioned. The extreme gravity of this impending shortfall has not been recognised by the Government.

What is most striking about the development of power projects funded so far by the ROCS process is that, up to the end of 2003, so little firm, reliable capacity has been added. Wind power, without commensurate amounts of energy storage, cannot supply any realistic firm capacity. *E.ON Netz* has recently prominently noted that "shadow" power stations to the level of 80% of installed capacity must be maintained in the portfolio, leading them to conclude that " **due to their limited availability, wind power plants cannot replace the usual power stations capacities to a significant degree, but can basically only save on fuel."**[3]

The experience of large wind carpets from Germany and Western Denmark shows beyond doubt that while small amounts of wind capacity can be accommodated within large electricity systems, large amounts of wind capacity need almost equally large,

2 Article search for "peak oil" at the *Oil and Gas Journal* web site, **http://ogj.pennnet.com/search/search.cfm**, returned 1,000 results on 18 October, 2004. See also, "Multicyclic Hubbert model shows global conventional gas output peaking in 2019", *Oil and Gas Journal*, 16 August, 2004; and Matthew R. Simmons, "The Peak Oil debate, Crisis or Comedy", presentation to the SPE Annual Technical Conference September 27, 2004 Houston, Texas, available at **http://www.simmonsco-intl.com/files/SPE%202004%20Annual%20Conference.pdf**.

3 E.ON Netz GmbH, *Wind Report 2004* (E.ON Netz: Bayreuth, 2004), 7. Available from http://www.eon-netz.com/.

predictably reliable and controllable generating plant running in parallel, in order to maintain system balance and reliability. [4]

In the *EON Netz*, control area of Germany, where the peak demand is about 20 GW, the wind capacity is 6,500 MW. At this level, wind power is already causing well-documented, large technical and economic problems. In particular there is a need to have firm capacity of at least 60% of the wind capacity in constant reserve for upward and downward regulation. [5]

Because this reserve capacity is operated sub-optimally, wind-power is delivering disappointing CO_2 savings.

Recommendations

1. Limit the number of ROCS available for randomly intermittent capacity

To avoid needlessly running into the problems documented by*E.ON Netz*, research must be commissioned on the ability of the UK system to absorb randomly intermittent power, without excessively wasteful and expensive balancing operations by fossil plant. Beyond this calculated limit, no stochastically intermittent generating capacity should be accredited for the issue of ROCs. This limit would only be lifted if the generator can ensure, through energy storage or by some other technical solution, that the power can be delivered according to demand, in a market-friendly and predictable manner.

It should be noted in relation to the foregoing argument that the continental power systems are heavily inter-connected with neighbouring systems. Germany, for example has 13 GW of connections, in excess of 15% of peak demand, and the E.ON Netz area is particularly well interconnected. By contrast, the UK's power system is, to all intents and purposes, an island, having a single 2,000 MW connector with France. This point, which will make the problem of grid balancing much more challenging in UK than even E.ON has found it, should not be neglected in any analysis.

2. Introduce two new classes of "firm" ROC

We propose that all renewable generation systems that are able to provide firm capacity, should be rewarded by a "firm" ROC (fROC).

Tidal streams, tidal mills (such the Severn Barrage), or the recently proposed tidal lagoon[6] provide intermittent but predictably available capacity. This capacity, while less useful than the capacity that a fossil unit can provide, is of higher value than randomly available capacity. This should be reflected in the support available through the RO system.

Of even greater value would be renewable capacity that is not intermittent at all. Hydropower falls into this category, when rainfall and sound management allow, and we

---

4 See the E.ON Netz *Wind Report 2004*, p. 11, and also Hugh Sharman, "The UK's Dash for Wind", October 2004, report for the *Renewable Energy Foundation*.
5 See *Wind Report 2004*, p. 3, and pp. 8–9.
6 http://www.foe.co.uk/resource/briefings/severn_barrage_lagoons.pdf

recommend that it should be included in the RO system both for its own sake and also to establish a benchmark of quality.

Other qualifying systems might include those which deliver power (or compressed air or pumped water) to a storage device (compressed air cavern, offshore lagoon, battery) will allow the renewable energy to be delivered according to demand. Such power has a comparable "quality" to that from fossil plant. In its nature, it is likely to be more expensive than either intermittent power sources, and it is right that the ROCs needed to finance such capacity should reflect this premium aspect.

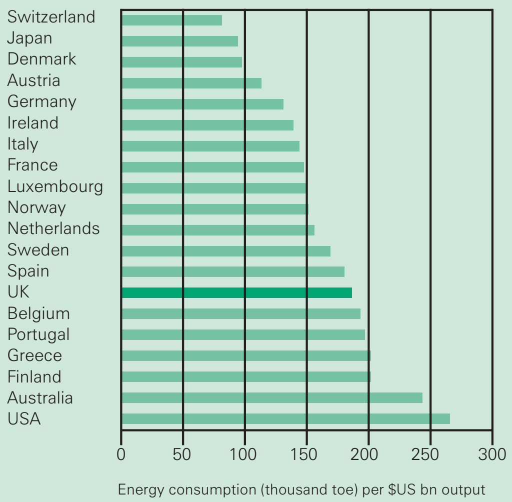
We propose to dub this type of ROC the Premium ROC, or pROC, and recommend its consideration and early adoption.

This value can be enhanced either by a separate component for fRocs and pROCs, with a higher buy-out price, *or* by requiring that a percentage of the RO be met by any combination of fROCs, pROCs, where 1 ROC = an appropriate fraction of an fROC and a smaller fraction of a pROC.

3. Reward Energy Saving

The UK uses energy very wastefully compared with other leading industrial countries, such as Japan and Germany.

Energy intensity ratio in "top 20" OECD countries, 2000



The differences between the best and worst energy utilisation shown in this table from the Government's own *Our Energy Future* are huge. The UK's energy intensity is three times greater than Switzerland and more than double that of Japan.

It is axiomatic that the cheapest MWh is the one that does not need to be generated at all. The fewer MWh that are required to maintain a satisfactory supply to the economy, the better.

There are self-evident rewards, of course, for saving energy. Individuals or companies save energy reduce costs.

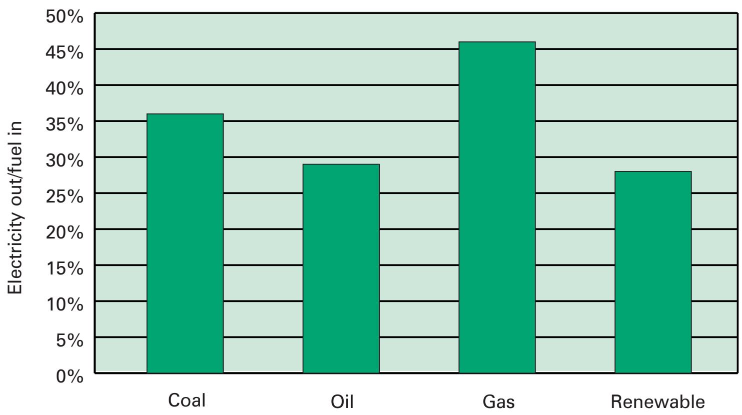
The energy effectiveness of the UK is so low and the coming capacity crunch is so large that the Government ought to make the saving of energy its top priority.

When reviewing the incentivisation of the construction of new energy capacity, the Government should set an even higher priority on cutting energy waste, rather than simply tracking an ever-increasing demand curve.

Whether it is feasible to devise a "savings" ROC that will not effectively penalize individuals and companies that have already invested heavily in energy savings and reward "energy laggards" is open to the ingenuity of the designers of such measures, which we believe deserve public debate.

4. ROCs for Combined Heat & Power (CHP)

Efficiency of fuel used in power generation, 2003



(from Dukes Table 5.1, 2004)

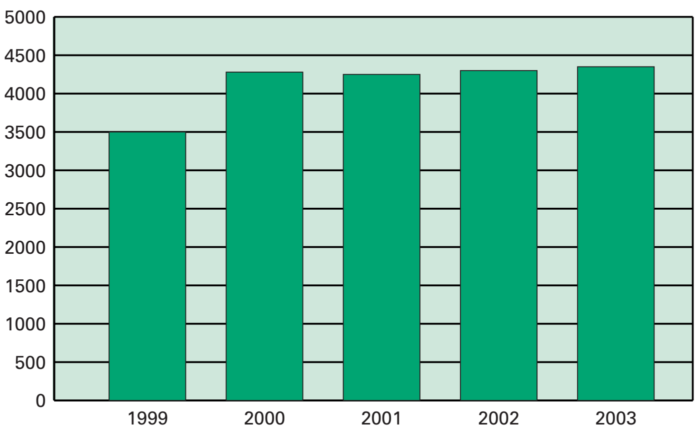
As can be seen in the accompanying chart, the typical, average, fuel utilization of power plants in the UK, whether fuelled by fossil or bio-fuels, is lamentable.

The low efficiency of fuel utilization is made worse by the NETA trading system that often requires inefficient operation patterns. This is confirmed by anecdotal evidence from generators interviewed by the authors of this paper. By contrast, the average efficiency of CHPs is usually more than 85% or in the case of district heating nearly 95%.

Even the UK's most efficient power stations, its large fleet of modern CCGTs, had an average energy utilization during 2003 of just 46%, no better than it was in 2000. **So over 50% of the energy consumed is wasted, energy which could otherwise be used productively, thus saving both fuel and CO_2 emissions.**

It might be noted that Denmark, where energy intensity is half that in the UK, virtually all thermal power plants, large and small, fuelled by fossil and renewable fuels alike, are CHP plants.

CHP Capacity in UK, MW



Yet, considering its importance, CHP forms a tiny fraction of UK energy capacity. It is instructive to note that since the introduction of NETA, growth in CHP capacity in the UK has stalled. Anecdotal evidence confirms that NETA is largely to blame for the lack of progress in building new CHP.

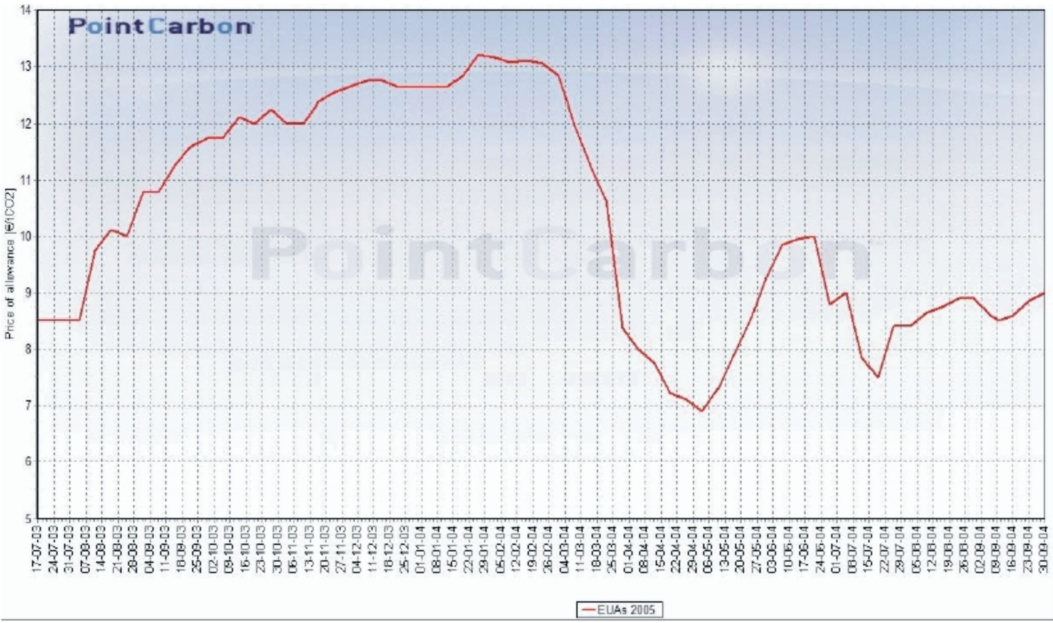
The publications of the CHP Association give evidence of the many "initiatives" to promote new CHP building through grants and other forms of capital assistance.[7] In view of this it is very striking that so little progress has been made in an area which is so successful elsewhere in Europe, for example in Denmark and Germany.

7 See **http://www.chpa.co.uk/**

Although CHP is not strictly a "renewable" technology we recommend that the ROCs programme be extended to cover CHP, so that it can survive and prosper without the requirement for capital assistance.

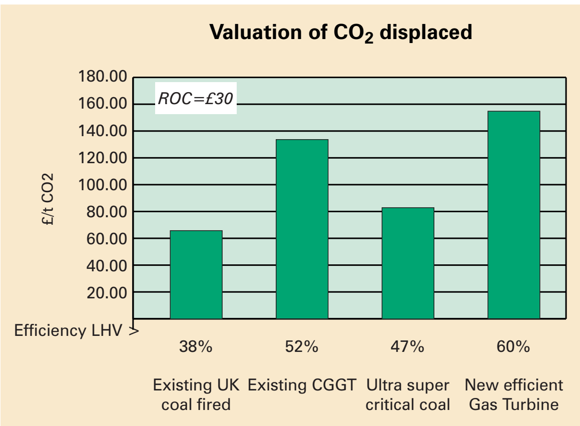
We also suggest that the effect of NETA on CO_2 emissions be analysed with a view to making changes in the way NETA works to ensure that all thermal plants are run in the most "energy economic" mode.

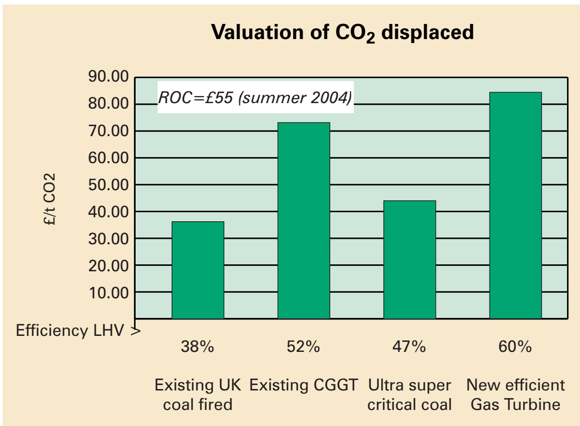
5. Harmonize the monetary value of emissions reductions with ROCs



The European CO_2 emissions trading system (ETS) that commences officially in January 2005, is already working in CO_2 "futures". The present value (early October, 2004) of 2005 CO_2 emission reductions, as shown in the chart, is between €7–10 per ton.[8]

The market is rather sophisticated, so it is foreseen that the value of traded CO_2 in the period up to 2007-8 will stay in or near this band.





8 PointCarbon: www.pointcarbon.com

In contrast, it can be seen that the value of CO_2 displaced by a ROC-generated MWh is much greater than that judged in the coming ETS. The ETS judges the cost of reducing CO_2 emissions, according to the EU's overall timetable for all other measures. This seems to indicate that the ROC is distorting the market and causing UK electricity consumers to use money on ROCs-supported generation capacity that could be spent more efficiently on other CO_2 emission reduction measures.

Financial Considerations

The ROC system, as currently designed, is creating a perverse effect in the financing of higher quality, sustainable and secure renewable energy. Funding from commercial sources will always flow first and fastest to the solution that generates the earliest returns at least risk. As there is currently no differential in money terms between the categories of energy generation which produce ROCs it follows that banks will finance the route that provides fastest and safest access to ROCs. Thus wind power stations, although producing power of the least value and use, as they can be brought into production quickly and are technologically mature, attract easy funding. The banks do not need to concern themselves about the relative effectiveness of the sites, or the technology, because the artificial ROC trading and fine mechanism provides a guaranteed, high quality, zero risk cash flow. All other technologies, no matter their quality, or their value will, because they require more funding prior to the production, either fail to attract funds, or pay a premium. This is a grave distortion and is causing funding and development to paw into the least useful technology.

In its defence, the primary purpose of the ROC is to encourage investment in the building of new generation capacity that will not produce any CO_2 emissions. In view of the imminent peaks in oil and gas production, renewable energy can also provide a measure of protection against worldwide fuel scarcity. So the extra cost of a ROC to the general consumer is not just a straightforward emission reduction measure. Nevertheless it is troubling that such a large gulf exists, so close to the full-scale introduction of the ETS, between market estimates for the cost of CO_2 emission reduction and the extra costs that consumers must pay through their power bills for capacity that delivers CO_2-free power.

Conclusions

We believe that the foregoing analysis is sound and that the recommendations proposed are helpful in formulating revisions to the way the ROCs programme works. If implemented, the measures proposed will help shape a better balanced, more diversely sourced, environmentally friendly, and economic power generation portfolio that fulfils all the aims of the Government, as stated in the White Paper, *Our Energy Future.*