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Comments on October 2011 Guidance Issued by Treasury on Valuation of Greenhouse Gas Emissions

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Summary

The EU emissions trading system is failing to produce a carbon price that is efficacious in promoting low-carbon investment or a low-carbon economy. Carbon price projections from this scheme are nevertheless incorporated in the formal guidance issued by the UK Treasury to guide government departments in appraising policy initiatives and projects, and in applying cost benefit analysis to a variety of projects and policies. The importance of this issue is that the valuation of carbon emissions, to reflect adequately their long-term social and environmental cost, is a critical component of an effective policy to mitigate climate change.

The Treasury's guidance deals with this issue of the carbon price by trying to maintain a distinction between emissions in what it calls the 'traded sector', i.e. sectors such as power and aviation covered by the EU ETS, and the 'non-traded sector', which includes domestic gas and road transport. This distinction is untenable and has the potential to create serious distortions in policy. This Comment explains how these are likely to arise.

Examples show how this guidance can result in the wrong choices being made in several areas:

- policies moving in opposing directions on the important aviation sector,
- distortions in the choice between different methods of domestic heating,
- postponement of worthwhile investment because valuations fail to reflect the fact that emissions today cause a bigger climate effect, sooner, than those in 10 years time.

Introduction and Background

This paper comments on the valuation of CO_2 emissions given in the October 2011 guidance issued by HM Treasury and DECC.[1] It argues that the guidance has some fundamental weaknesses in the context of UK and global action to mitigate emissions and climate change. The guidance provides a rationale for its approach in the context of compromises over international climate policy, and the desire to keep the UK on a level playing field within the main international emissions trading framework of the EU ETS. The weaknesses identified in the guidance can therefore be interpreted simply as a consequence of a seriously flawed ETS, and our comments as a criticism of flaws in particular features of that cap and trade scheme. Nevertheless it can be shown that, when viewed from a global perspective, these weaknesses violate some of the first principles which should govern effective regulatory action to internalize environmental costs in an efficient way. They are therefore serious flaws at a very fundamental level, and are inconsistent with an effective policy to reduce UK emissions.

The Treasury/DECC position appears to be the following: the UK is part of the European trading system for CO_2 emissions, the EU ETS. Any emissions taking place within the 'trading sector', i.e. that part of the energy economy governed by the EU ETS, will be counted as part of aggregate EU emissions, on which a specific limit has been set in the EU ETS. In consequence, any attempt to value UK emissions of CO_2 at an above-market price would produce additional savings in UK emissions, but would both reduce the market price of CO_2 emissions in the EU as a whole and have a zero net effect at both an EU and a global level. In effect, UK taxpayers and consumers would be subsidizing higher emissions in other EU countries. This point has been made by the House of Commons Energy and Climate Change Select Committee[2] in the context of proposals for a carbon tax or floor price for carbon. But of course it is equally true that the same logical trap may apply to almost ***any*** UK initiative that is differentiated from, or additional to, the EU ETS, including any targets embodied in the UK Government's Climate Change Act 2008. It is argued in this paper, therefore, that a superficially reasonable approach to UK emissions valuations, such as that adopted by the Treasury and DECC, can lead to some highly unsatisfactory policy outcomes.

[1] *Valuation of energy use and greenhouse gas emissions for appraisal and evaluation*, HM Treasury and DECC, October 2011.
[2] *Financial Times*, 26 January 2012.

At the same time, it is evident to everyone concerned that the EU ETS is failing to provide incentives, with a carbon 'market price' insufficient[3] to promote either investment in low-carbon technologies or in 'carbon efficiency'. Whether the blame rests with the recession, the rather short-term nature of the targets, or excessively lax caps lobbied for and negotiated by EU firms and member states, is irrelevant. The traded sector 'market price' is an order of magnitude below more realistic estimates of the damage done by current emissions, or most reasonable estimates of what valuation should be applied to emissions in the non-traded sector, including numbers for the latter given in the Treasury guidance. In consequence, it is inconsistent with a serious emissions reduction policy.

The Treasury has clearly tried to deal with this issue through an attempt at pragmatic compromise, and by employing the pretence that emissions in the traded sector are a different commodity from those in the non-traded sector, which can therefore be priced on a different basis without serious consequences. What will be shown in this Comment is that this distinction is not sustainable as a basis for evaluating policies and projects. Indeed it leads to a variety of inconsistencies and distortions that will ultimately undermine UK policy to reduce emissions.

The problems with the guidance are manifest as:

- The treatment of CO_2 as two separate commodities, depending on whether emissions are deemed to occur in a market or non-market context. In reality the emission of CO_2 is homogenous in terms of its effects and its consequences. Such a treatment therefore creates numerous inconsistencies and the potential for perverse incentives, if project sponsors seek to modify their projects to substitute emissions between markets.

- The fact that the time profile for the valuation of carbon, as set out in Table 3 of the associated Treasury guidelines, is logically inconsistent with 'climate damage'

[3] Most recently noted by the chief executive of E.ON speaking in Brussels recently. *Financial Times*, 8 February 2012.

minimization, dramatically so for the traded sector but also, to a more limited extent, for the non-traded sector.

Both these problems are fundamental in character, and can be shown to violate some of the obvious principles that need to govern attempts to value emissions for policy purposes. How damaging they might prove in practice is harder to calculate. We will argue that both are potentially serious, and are limited only by the number and scale of the decisions to which the guidance will be applied. They are, it is to be hoped, of only marginal significance for some of the central planks of UK emission reduction policy – such as action to decarbonize the power sector, or to promote the technology shift to electric vehicles – since the main drivers for these policies will emphatically not come through the 'at the margin' decisions which this guidance is intended to influence. But they are in our view likely to be of real consequence for major decisions in an important 'second division' of climate policies, for example in relation to more widely based issues such as agriculture, land use planning, energy technology choice, and broader 'lifestyle-influencing' policy choices impacting on individual persons and businesses, and their consumption.

The root cause of these concerns may ultimately take us beyond immediate issues such as the ETS. It may call into question the validity of combining target-driven market approaches, marginal abatement cost estimates linked to quantity targets, simple cost benefit approaches that are only really appropriate to a marginal analysis, and the ignoring of 'non-linearities' and path dependencies. However in this Comment we confine ourselves to describing the nature and potential consequences of these two particular flaws in the Treasury/DECC carbon valuation guidance.

Distinction between CO_2 in Traded and non-Traded Sectors

A basic tenet of regulatory economics is that creating separate markets or rules for the same commodity or resource, or even for different commodities, creates arbitrage possibilities and leakages across the boundaries – this is implicitly and inherently sub-optimal. Great care is usually taken to limit the possibilities for such leakages, and to minimize the possibility of

market or competitive distortions.[4] We should therefore examine what distortions and leakages will occur as result of defining the homogenous gas CO_2 as if it were two different commodities.

In the Treasury's guidance, the separate markets are 'traded sector' and 'non-traded sector' emissions. Traded sector emissions, covered by the EU ETS are, in the short and medium term, valued at much lower levels than non-traded emissions, which can be presumed to bear a closer relationship, if only as an order of magnitude, to the real cost of the climate externality, i.e. the true social cost of emissions. The traded sector is deemed to include electricity, industrial consumption of fossil fuels of all kinds, and, from 2012, the aviation sector. The non-traded sector includes domestic gas consumption, road transport fuel, and 'incidental emissions' associated with agriculture or environmental change.

There are several respects in which this valuation anomaly will alter, in a distorting manner, the choices that are being made. We can set out a number of potential concerns:

The first general concern is relates to the understatement of benefits of emission reduction in the traded sector; this is now particularly pertinent to aviation, as well as to fuel substitution[5] in the power sector because from 2012 aviation is to be included in the traded sector. Ostensibly, a prime motive for this was the recognition that air travel was a fast-growing and potentially problematic source of emissions, so its inclusion within the traded sector would exert a dampening effect on demand. At the same time, airport or other planning policies carried out within a public sector context would, prior to 2012, have applied a much higher and arguably more appropriate carbon penalty to any measures that had the effect of increasing air travel. Policy is therefore moving in two opposite directions at the same time. On the one hand it puts a small penalty on aviation per se, through its inclusion in trading and

[4] Thus, in a regulatory context, a loose analogy can be drawn with the concerns that arise where companies are engaged in both regulated 'monopoly' activities and in competitive markets. This creates two potential distortions, as firms have an incentive to transfer as many costs as possible to their regulated business, in order to justify higher tariffs to the regulator. The first is that consumers in the regulated monopoly sector have to pay a higher regulated price. The second is that the firm has an unfair competitive advantage. Policy is therefore crafted to ensure that firms are never permitted to allow activities and costs to 'leak' from competitive markets into regulated activities.

[5] This is discussed more fully in the next section, in the context of the time profiles for carbon valuations.

the imposition of a 'carbon cost' on air travel. On the other hand it reduces the benefit attributable to measures which reduce air travel, such as rail investment, through lower valuation of aviation's negative environmental impact.

The second general concern arises from the phenomenon of leakage. In monopoly regulation the concern is with allowing costs to 'leak' from competitive into regulated markets, to the benefit of the producer and the detriment of the consumer. In this policy context, the corresponding concern should be with policies, or projects, being distorted to favour options where the fuel and its associated carbon emissions 'leak' into the traded sector rather than the non-traded sector.

A few simple examples of how this might have perverse consequences, resulting in less cost-effective carbon reduction policies, are the following:

1. A scheme to promote the use of biofuel will show a much higher return if it is seen to displace diesel as a road fuel, rather than aviation fuel, even though many commentators might take the view that, prima facie, the opposite outcome was better policy.[6]
2. In the domestic sector, efficiency measures promoting domestic gas saving will tend to have a higher priority compared to measures promoting electricity saving.
3. On the other hand, and as a seeming paradox, the fuel choice bias is reversed in any choice of technology for low-carbon domestic heating at the installation stage, when all-electric heat pump installations will be unduly favoured, because their associated emissions carry a lower valuation than, say, solar power or heat pumps with gas back-up.
4. Generally, in competing for scarce capital resources, higher cost projects with high public sector and non-traded carbon content, may be favoured over more cost-effective interventions which happen to impact on the traded sector. A reforestation project may, for example, falsely appear superior to an infrastructure spend aimed at improving carbon capture and storage.

[6] The reason for this is that, prima facie, there are currently a larger number of options available for substituting low-carbon for fossil fuel in road transport.

Time Profile of Carbon Valuations

A second and even more fundamental principle of regulatory economics is to set targets that conform to the purpose of the policy. Setting the wrong targets produces perverse incentives which can undermine or even damage the main objective itself. This is a familiar principle,[7] and examples of potential distortions, and controversy, are very familiar from debate over public policy issues in health, policing, and other sectors. Unfortunately the numbers provided in the Treasury guidance can be shown to contradict this principle in a potentially very damaging way.

In the context of emissions and climate change, the global objective of emissions policy is to reduce (or rather to limit) the ***cumulative*** emission of CO_2. Since CO_2 is essentially cumulative[8] in the atmosphere, this necessarily implies that, even with a relatively low rate of discounting such as 3.5 per cent, a higher value attaches to current than to future emissions. With cumulative concentration being essentially additive, current emissions create a higher total level of damage than future emissions; current emissions are still present in (say) five years, have a radiative forcing effect for those five years, and then continue to have an equivalent effect to that of the same volume of new emissions. The higher benefits of short-term reductions, in comparison to those achieved later, are not necessarily confined to those that emerge from this simple arithmetical analysis. In the context of strategic decision making, postponing higher concentrations provides additional option value both in relation to mitigation/abatement strategies for emission reduction, and with respect to adaptation. All these arguments are set out in more detail in a recent working paper.[9]

A falling cost of CO_2 emissions is, in consequence, a necessary condition for the internal consistency of any set of year-by-year valuations of CO_2 emissions.[10] It is ***not*** met by the

[7] Targets are said to have been taken to extremes under Soviet planning. A famous cartoon from *Krokodil* shows a crane holding a single multi-tonne nail. The plant manager exclaims: 'Look! This month's output!' – the target for the supply of nails had been set in terms of weight.

[8] Note that this consideration does not apply in the same way to all GHG; methane, for example, has a much higher radiative forcing effect but breaks down within a few years.

[9] 'Cumulative Carbon Emissions And Climate Change: Has The Economics Of Climate Policies Lost Contact With The Physics?', John Rhys, OIES Working Paper EV 57, July 2011. Available at: www.oxfordenergy.org/wpcms/wp-content/uploads/2011/07/EV-571.pdf.

[10] Observation of a falling real cost is accentuated by the effect of discounting, even with rates as low as 3.5%, as these comfortably exceed any estimates of the rate of 'natural' re-absorption of CO_2 – 2% p.a. or less. This is explained in more depth in the OIES paper.

Treasury guidance, the discrepancy being most serious in the traded sector. The scale of the discrepancy again reflects the construction of traded sector prices as estimates of an outcome of the ETS as currently conceived, and with its current caps.

The potential consequences of this major inconsistency are described in more length in the OIES Working Paper.[11] The very simple example given there to demonstrate the adverse consequence of a wrong time profile is what we can refer to as the 'leaking tank' example.

[11] OIES Working Paper EV 57, op. cit.

Leaking Tank Example

Suppose I have a large store containing thousands of tonnes of CO_2, held under pressure in large corroding metal vessels. Technical experts have advised me that there is no means of permanently sealing the vessels, other than at prohibitive cost, but that I can with only modest expense treat the seals of the vessels in a way that will prolong their expected life from six months to 20 or 30 years, at which point there will be a slow leakage into the atmosphere, perhaps over a 10 year period. What should I do, given the objective of minimizing adverse climate impact?

<u>Answer.</u> Working from a measure or price signal – such as a rising carbon price – that suggests later emissions are significantly more damaging, the answer seems obvious. We should be prepared to spend money not on reinforcing the vessels, but on breaking them open immediately, since the social cost will be significantly higher in five years and even more so in 30 years. Moreover, immediate release would additionally make it easier to meet annual emissions targets for future years.

This is clearly absurd if limiting the CO_2 stock is the real target, and if CO_2 emissions are essentially cumulative. Immediate release, using PAGE modelling numbers merely to illustrate the point, should be assumed to be some 20–30 per cent more damaging.

In addition, simple reliance on a PAGE or similar calculus ignores the possibility that a novel low-cost technical solution will be developed for the problem of sealing the corroding tank. There is therefore an additional option value which attaches to not releasing the CO_2, but this value is not captured in a simple social cost of carbon analysis.

The tank is merely a generic example. Even simpler is the converse question, whether to plant a tree now or in five years.[12] With a rising carbon price (after discounting to a common base year), the implied answer is to defer planting indefinitely, which seems absurd. The point of such a simple example, of course, is not to suggest that the real world is full of

[12] To demonstrate the argument precisely, one should add the admittedly somewhat artificial assumption that these are mutually exclusive options and that the land can used once only.

obvious absurdities, but to demonstrate a logical flaw in a methodology. The same weaknesses will be present in much more complex policy appraisals, but will be superficially much less obvious, and therefore of greater concern.

Time Profile: Traded Sector

The carbon valuations given in Table 3 of the Treasury guidelines show carbon prices in the traded sector rising fairly rapidly, at rates between 6 and 11 per cent per annum to 2030, when they are assumed to converge with those in the non-traded sector. Even after using the prescribed discount rate of 3.5 per cent, this represents a quite sharply rising profile of carbon valuations, when discounted back to a common base year. This profile gives a very perverse signal in two potentially very important policy areas within the traded sector.

The first is the whole question of gas-for-coal substitution in the power sector. Recognition of the significantly higher value of early reductions in CO_2 would encourage earlier rather than later substitution of gas for coal in power generation, even if this were to involve earlier exhaustion of gas reserves and some later return to coal. In global terms, this is a significant short-term source of potential CO_2 reduction. Moreover fuel substitution is a relatively low-cost CO_2 abatement option, often with relatively modest investment costs.

The second is in the context of carbon capture and storage. The balance between profiles involving early or later emissions is potentially a major consideration in relation to a number of investment, design, and operating choices both for generating plant and for the storage infrastructure. Obvious examples can be constructed in relation to choice between technologies or modes of operation involving different rates of CO_2 capture, and in relation to the security of storage. If this is so, then there should be a clear benefit to those choices being informed by price and cost signals that reflect the physical realities of CO_2 emissions.

Time Profile: non-Traded Sector

Discounting at 3.5 per cent per annum, the Table 3 numbers provide a profile of emissions damage that does value early emissions more highly, at least up to 2030. After 2030, the

assumed carbon emissions start to rise much faster, at nearly 10 per cent per annum, so the profile becomes inconsistent at that point. No reasoning is given for this development.

It may appear somewhat pedantic to dispute assumed carbon valuation profiles more than 20 years into the future, since most people might assume the impact on actual decisions would be relatively minor. Nevertheless this feature does have the potential to distort relatively near-term decisions. A hypothetical project that delivers a constant stream of emission reductions over 15 years would, on these figures, give a 10 per cent extra carbon benefit if started in 2031 rather than in 2015.[13] The true position, as is demonstrated in the OIES paper, should place the advantage heavily the other way, favouring earlier rather than later execution of the project.

There are potential situations in the non-traded sector, to which this kind of timing decision might be critical. Agriculture provides one type of example. The development of mineral sequestration of carbon through novel building materials, were it to occur, would be another.

Conclusions

We believe that these observations highlight shortcomings in the Treasury and DECC guidance. They stem, in our view, not from any shortcomings in the technical analysis – although others might also wish to question the use of the 3.5 per cent discount rate, or the assumptions underpinning the technical analysis – but from a mistaken choice of objectives.

The guidance elevates a narrow short-term interpretation of UK economic interest, in the context of a flawed EU trading system, making it a major feature of climate policy. In doing so, it risks not merely losing the moral high ground implied by basing policy on a valid global objective, but also the strategic benefit of encouraging early adaptation to the requirements of a low-carbon future. The argument for using the 'market price' valuations of CO_2 emissions, to avoid unintentional subsidy of other EU emissions, could be applied equally as an argument against the adoption of emissions targets under the 2008 Act.

[13] Once again, for the sake of simplicity these are cast as ultra-low or zero-cost policies, but they are mutually exclusive. In other words the project can only be done once, and the only question is one of timing.

This may be short-sighted when the main faults stem essentially from conforming to the dictates of possibly transient features of the trading system; these are in principle remediable through negotiation, and are unlikely to persist through the life of many of the longer-term projects under evaluation. The recent intervention by the CEO of E.ON[14] makes it very clear that major changes to the ETS are required if it is to have any value in promoting a low-carbon future.

It is our view that if the UK wishes to take the active role in climate policy implied by ambitious emission reduction targets, problems such as those implied by an inadequate ETS should be tackled at their source, rather than allowing them to contaminate the UK process of adjustment as a whole. For the EU ETS, this may be a straightforward (in principle) matter of tightening caps to promote higher carbon prices, or of altering other features of the scheme, for example to include a wider coverage of emissions within the cap.

Treasury guidance on carbon valuation should therefore, in our view, be promoting investment and operational decisions that are consistent with a longer-term view of what adjustments need to be made to carbon emissions, and to energy use and production. This must reflect both a consistency across traded and non-traded sectors, and a significantly larger weight on near-term emissions.

[14] *Financial Times*, 8 February 2012, op. cit.