Carbon prices in Phase III of the EU ETS

Michael Grubb,
Chief Economist at the Carbon Trust,
and Faculty of Economics, Cambridge University

Forecasts of environmental control costs, and of energy demand / emissions, have persistently turned out to be too high. This note examines the lessons and their implications for carbon price projections. The EC's Impact Assessment estimates carbon prices rising from €26/tCO2 in 2013 to €39/tCO2 by 2020, and some modelling studies conducted this year have projected higher prices. This note explains why, for the proposed emissions cap, realised prices are likely to be much lower than the models suggest, in the lower part of the range €20-40/tCO2.

Introduction

Future prices in any market are uncertain, so all predictions need to be handled with care. However, history has revealed two patterns of great relevance to carbon price projections:

- The cost of environmental control has been littered with inflated projections, including examples of asbestos, benzene, lead (in petrol), and vinyl chloride. Figure 1 compares the estimated to actual costs for various environmental policies in the UK. Other examples include CFC phase-out – for which realised costs proved to be around a third of the initial estimates - and most famously, sulphur dioxide, where costs in the US trading scheme have been half to a third of initial estimates.
- Of direct relevance to carbon costs and the impact of recent events, energy forecasts from the 1970s were notoriously embarrassing in the degree of their errors; they vastly underestimated the decoupling of energy demand from economic growth and the 'one-way' response to the 1970s energy price shocks that was not reversed as prices fell during the 1980s and 1990s.

This note asks what this experience tells us about carbon price projections.

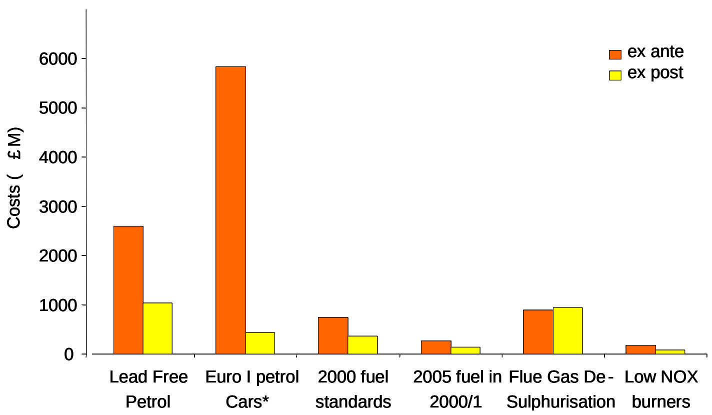

Figure 1: Estimated costs of environmental policies – before and after

Sources for cost data: Harrington, W., R. D. Morgenstern and P. Nelson (2000). "On the Accuracy of Regulatory Cost Estimates " *Journal of Policy Analysis and Management* 19(2): 297-322 and Hammitt, J. K. (2000). "Are the Costs of Proposed Environmental Regulations Overestimated? Evidence from the CFC Phaseout." *Environmental & Resource Economics* 16: 281-301. Chart from K.Neuhoff, *'Tackling carbon: how to price carbon for climate policy'*, www.climatestrategies.org, using data from AEA Technology Environment (2004), "An Evaluation of the Air Quality Strategy", DEFRA.

Energy forecasting.

Have forecasts learnt from history? The most systematic attempt to improve energy forecasting came in the US with the work of the Energy Information Administration. This provides a long series that can be rigorously analysed. A recent study found that a good record of forecasting *aggregate* energy demand concealed a systematic error of about 5% inflation in 5-year forecasts of industrial energy demand – the area most relevant to the EU ETS - that has not improved over the years. A consistent upward bias of far less than 5% in as many years, if sustained post 2012, would imply massive overestimation of the costs and difficulty of achieving the EU cap.

Forecasts are based on economic or sector modelling, which needs to be informed with projections of underlying driving forces (such as economic or sector output growth) and other influential parameters (such as fuel prices), together with estimates of likely responses. Most of these can now be estimated econometrically, hence "using the past" to project the future. However such projections err to the extent either that input assumptions on driving forces prove wrong, or future responses may not be a continuation of past patterns. In addition, economic growth and sector output projections are liable to systematic error, as there are strong pressures towards optimism: no government likes to lay out a gloomy economic future, or project that it will mismanage the economy; no company raises capital, justifies a new project, or energises its workforce, by proclaiming a future of decline. Nothing from the DOE evidence, or projections of carbon prices, suggest that this central lesson has been sufficiently factored in to the Phase III carbon price projections.

The history of CO2 allocations

Evidence from the actual *ex-post* history from cases where governments have sought to negotiate allocations of CO2 emissions is even more striking.

In the UK, a pilot "bid-in" trading scheme early in the decade involved 32 companies that agreed targets to reduce emissions by around 14% by 2006 relative to projected baselines. In practice, trading prices peaked after a few months, and then fell towards zero as it became increasingly clear that the market was in surplus. The official assessment of the scheme studied four of the biggest participants (that accounted for more than 50% of the incentive funding) and reported that emission reductions were nine times that of the baseline with 66% attributable to the scheme. At a bigger scale, the UK Climate Change Agreements established targets for 44 industrial sectors, defined biannually through to 2010. Despite the enormous effort expended in negotiating the original targets, the second target period assessment report found that '.. the assumptions of growth and energy prices on which the original BAU forecasts were made are now outdated and of limited relevance' – this during one of the UK's most sustained and stable periods of economic growth. Excluding the steel sector, in target period 1 (2002) the savings were about 40% greater than the targeted savings relative to base year; for the second period, the savings were more than double the target. Exceedence in the steel sector was much bigger still. As a result, the review process resulted in a tightening of the initially agreed targets in all but four of the sectors.

The biggest test of all was the 2005 verification data on the EU ETS. The most detailed analyses confirm that allowances issued for 2006 exceeded verified emissions by close to 100MtCO2, or about 5% of the total. Within this, deliberate cutbacks in the power sector (notably in the UK) offset much larger surpluses from other sectors, and in all sectors in the Accession countries. The percentage surplus in non-power sectors ranged from 5-30% or higher in some cases – within just a couple of years of the allocations being completed.

It is hard to estimate how much of the surplus was due to abatement as compared to inflated forecasting. Inadequate data at the outset amplified the potential for error. The other factor is abatement itself, given the new incentives. After regulation is in place, industries expend more effort in sourcing the most efficient technologies, unimagined advanced or innovative control measures often emerge and substitutes are often found. Prior estimates either overlook or are unable to include these factors and thus the costs of regulation are often overestimated.

Whatever the balance of these varied causes, the underlying evidence is fully consistent with the historic tendency to overestimate the difficulty of achieving environmental targets. The evidence for inflated 'baseline' forecasts, matched by underestimation of the flexibility of responses, is thus overwhelming, and the causes are identifiable. What might this imply for carbon prices in EU ETS Phase III?

Implications for EU ETS prices after 2012

A recent analysis by the Carbon Trust (2008) has illustrated how the overall EU 20-30% greenhouse gas (GHG) reduction goals compare to the various factors that can build up to give emission projections. Working from underlying economic projections in the Impact Analysis that the EU economy grows by about 40% over 2005-20, the implications for emissions are adjusted by structural changes, capital stock turnover, and the impact of other policies. Explicit programmes to improve energy efficiency, and implementation of the Renewable Energy Directive, will further reduce emissions. The scale of the abatement challenge – and hence carbon prices – depends heavily on all these factors, and also on the degree of access to international crediting.

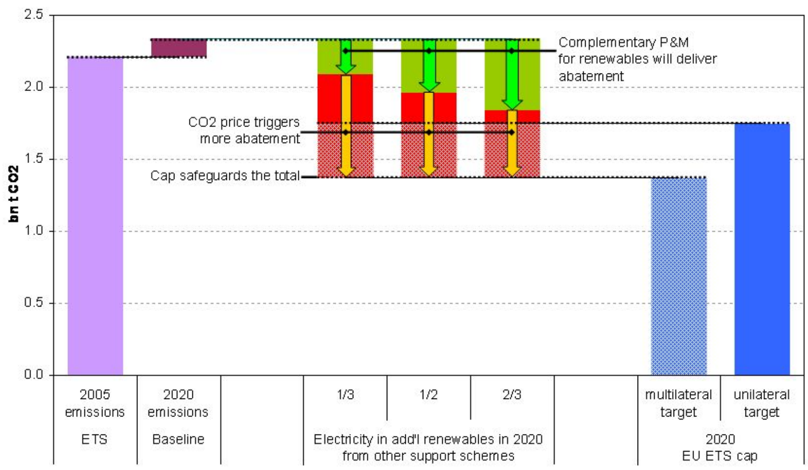

Figure 2: EU ETS emission projections for 2020 and the impact of renewable energy policies.

Sources: F. Matthes, Schleich, J.; Diekmann, J.: Ausgewählte Aspekte zur Cap-Definition für das EU Emissionshandelssystem in der Phase 2013-2020, forthcoming. See also *Carbon Trust (2008), Cutting Carbon in Europe: the 2020 plans and implications for the EU ETS*, for component analysis of overall EU emission projections & targets (www.carbontrust.co.uk).

The importance of the renewable energy contribution in EU ETS sectors is illustrated in Figure 2. The EU Commission scenarios project that the electricity industry will deliver 38–48% of the overall renewable energy requirement (SEC(2008) 85/3, p.82), to which would be added the industrial use of renewables (e.g. biomass in cement kilns).

The difficulties with liquid biofuels in particular suggest that a higher share may have to come from the EU ETS sectors than originally assumed. The Figure shows how the residual requirement for emission reductions that need to be driven by energy efficiency policies and the carbon price declines rapidly as the share of renewable energy increases.

Moreover, *none* of the modelling studies used to predict carbon prices explicitly build in the impact of the EU's third target – to improve energy efficiency by 20% *relative to projections*. As the Carbon Trust analysis indicates, if this were to be achieved, against the baseline projected and the delivery of renewable energy targets, this would actually in itself more than deliver the EU's GHG goals for 2020. This underlines that projections depend on numerous assumptions that determine the 'baseline', and a large part of the overall GHG target may be delivered by implementation of the EU's other policy pillars, on energy efficiency and renewables. The present high energy prices, as indicated below, will both reduce the baseline, and enhance implementation of renewable and energy efficiency policies.

The range of technological options

The biggest single reason for historic overestimation of environmental control costs has been underestimating the technological responses. Tackling CO2 encompasses a huge range of technology options in both supply and demand, and it is impossible for them all to be captured explicitly in modelling. Moreover, as revealed with the US SO2 experience, the essence of an ETS is that it gives flexibility and incentives to pursue new ways of limiting emissions.

If the models assume the EU's ambitious renewables targets are met (and many of the consultant studies do not), this reasonably captures the renewable energy potential to 2020. None of the modelling studies assume the EC's energy efficiency target is met; they tend to model energy efficiency on the basis of past aggregate responses to energy price changes, often the relatively modest price fluctuations in the 25 years preceding 2005. It is in energy efficiency that myriad un-represented possibilities are likely to emerge in response to higher energy prices, strengthened efficiency policies, and carbon-related policies including carbon product labelling. Again, supported by the evidence of past experience, models tend to underestimate the overall response to new incentives. In which case – other things being equal - the carbon prices they predict are likely to be an upper bound, limited by the impossibility of capturing all the possible responses.

The impact of 2007-8

Of course, other things can change – and have. The biggest question is what will be the long term impact of the credit crunch, and of the record energy prices of 2007-8? The EC's forecasts were based mostly on modelling grounded in data from previous years. The events of 2007-8 have changed at least three things of direct relevance to Phase III carbon prices:

- *lower economic growth forecasts* tend to reduce emission projections (though not proportionately);
- the impact of *higher fossil fuel prices* is already evident in behaviour, levels of investment in energy efficiency, and the strengthening of government policies on energy efficiency;
- a widened *gas-coal price differential* could increase the cost of fuel switching in power generation, if high gas prices are sustained through Phase III, which increases the carbon price required to switch away from coal.

The last of these *on its own* would tend drive up carbon prices, but is also associated with higher energy prices generally – which reduces energy demand and carbon prices – and would also accelerate investment in gas supply infrastructure (and storage), which may relieve gas prices in Phase III. Lowered economic growth and energy demand will also relieve pressure on energy prices more generally, and many of the responses being observed now will not reverse. Most of the economic modelling studies (including, the Commission analyses) have assumed sustained economic growth rates above 2%/yr. Near-term projections have recently plummeted, down close to 1%/yr.

The overall direction of impact is clear, and substantial. A prescient detailed study of the German energy system found that an oil shock at $105/bbl would reduce German CO2 emissions in 2015 by about 10%, as compared to the mainstream forecasts based upon much lower fuel price forecasts. The Commission's own analysis did not reflect a transitional oil shock and used a reference oil price starting at $54/bbl and rising slowly; a sensitivity study showed a drop of €5/tCO2 in a high price ($121/bbl) projection. Any reasonable interpretation is that the events of 2007-8 are bound to depress emissions and Phase III carbon prices. The only question is by how much – a question that cannot be answered until the full extent of the global economic turmoil becomes clearer.

The scope for international flexibility
The degree of international flexibility through the Kyoto project mechanisms will also affect the price. The EC proposal limits the use of external credits, to ensure that the majority of efforts remain focused upon reducing the EU's own emissions. This implies that the international credit price is likely to be lower than the EU price. Currently, every month sees new projects submitted into the Clean Development (CDM pipeline) that are projected to save more than 100MtCO2 /yr. The EC's modelling suggests that opening the EU system to completely unlimited flexibility would produce a price collapse to €4/tCO2 (if the EU was the only source of demand). Even with other major factors (such as a US trading scheme), the continuing inflow of projects to the CDM, that will continue generating credits post 2012, will sustain a big price difference.

However, all the pressures and related amendment proposals at present are to open the EU ETS more widely to international crediting, and to open international crediting to new forms of projects (such as Carbon Capture and Storage (CCS) and avoided deforestation). Without taking any view on the desirability of such steps in principle, they would certainly tend to increase supply and lower the carbon price further.

Though this note has concentrated upon the 20% target, in this context it is far from certain how much a move to the 30% reduction target in the context of a global agreement would drive up carbon prices in Europe. A tighter target would be accompanied by a much greater scope of access to international credits – for which the cost even at greatly expanded volumes is likely to be towards the low end of the range considered here. Governments might also try to contain the scale of the international transfers involved by increasing efforts to avoid a high EU ETS price, by further strengthening direct programmes on energy efficiency and lower carbon sources, which could be further facilitated by a context of an enhanced global commitment.

Many studies have suggested that to tackle climate change, more aggressive emission reductions, with much higher carbon prices, will be needed. The IEA's intensive global study of what would be needed to deliver a global 50% greenhouse gas reduction by 2050 finds that carbon prices of several hundred €/tCO2 may ultimately be needed. This may prove to be the case, but only makes sense in the context of a sustained global effort. From this perspective, Europe's 2020 package is a modest offering. The carbon price required to drive investment in some of the major abatement technologies like CCS and offshore wind energy is probably around €50/tCO2. The current proposals are unlikely to deliver that, but they do represent a good next step, and an incentive towards greater energy efficiency and innovation towards more serious carbon controls.

Conclusions
The author's report published as Carbon Trust (2008) concluded that EU ETS prices in Phase III are likely to be in the range €20-50/tCO2. Since making these estimates, the depth of the credit crises has worsened; energy prices peaked (we hope) at even higher levels; European economic forecasts have been downgraded; the inflow of new CDM projects has continued apace; and innumerable amendments have been proposed in the EC package legislation intended to increase the degree of flexibility, with hardly any proposing the opposite. Consequently, the higher levels of carbon prices in the range look increasingly implausible. A reasonable estimate is that in Phase III, under the proposed CO2 cap, carbon prices would be in the range €20-40/tCO2, and more likely in the lower part of this range.

Author and sources. Professor Michael Grubb, Chairman of *Climate Strategies*, is Chief Economist at the UK Carbon Trust and a Senior Research Associate at the Faculty of Economics, Cambridge University. In April 2005, he and academic colleagues authored the only published prediction that EU ETS Phase I prices would first rise and then collapse completely (*Climate Policy*, Vol.5 pp.127-136, 2005 - endnote). This note on future carbon prices combines insights from the Carbon Trust (2008) report *Cutting carbon in Europe: the 2020 package*, with his analyses (with F.Ferrario) of forecasting errors published as *False Confidences: forecasting errors and emission caps in CO2 trading systems* (*Climate Policy*, Vol.6 pp.495-501, 2006).

Acknowledgements and disclaimer. This note was prepared following requests to expand upon comments on carbon prices made at an EU Parliamentary Committee hearing on 26 Aug 2008. Support from the European Climate Foundation, research assistance by Tim Laing, layout by Katherine Robinson and comments by various *Climate Strategies* researchers on drafts, are all gratefully acknowledged. The opinions expressed are those of the athor and should not be otherwise attributed.

About Climate Strategies
Climate Strategies aims to assist governments in solving the collective action problem of climate change. It connects leading applied research on international climate change issues to the policy process and to public debate, raising the quality and coherence of advice provided on policy formation. Its programmes convene international groups of experts to provide rigorous, fact-based and independent assessment on international climate change policy.

Climate Strategies
Managing Director: Jon Price
Climate Strategies
c/o University of Cambridge,
13-14 Trumpington Street
Cambridge, CB2 1QA, UK
Office: +44 (0) 1223 748812
jon.price@climatestrategies.org
www.climatestrategies.org