

Peer Review

DECC 2012 Carbon Values Update

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1. Terms of Reference

DECC is required to provide annually revised carbon values as evaluation inputs into policies which involve or influence carbon emissions. The terms of reference for this Review relate to the modelling and estimations for the traded sector (as covered by the EU-ETS) up to 2020. This document identifies an initial perspective, some observations on the modelling process, and comments on the proposals by DECC for the updated short-term traded carbon values for 2012.

2. Sources and Engagement

I have been informed by presentations and discussions at five meetings held at DECC, a conference call with Enerdata, as well as previously published reports on carbon values and Enerdata's project proposal. I have been provided with a copy of DECC's original spreadsheet model, but without any documentation; nor have I seen any detailed documentation of the POLES estimated equations and algorithms as used by Enerdata. My focus is therefore upon the principles of the overall modelling approach, rather than the parametric assumptions involved.

Prior to this report, I provided a note on the way in which DECC's spreadsheet model aggregated individual yearly Marginal Abatement Cost Curves (MACCs), its incompatibility with the Enerdata estimation process, and I suggested a way forward. That correction has now been implemented. Through subsequent email iterations, I advised on the alternative approaches of using market data and reporting ranges.

Finally, I have seen a version of the report, *DECC's Updated Short-term Traded Carbon Values, 2012*, as drafted on 14 August 2012.

3. Modelling Issues

Enerdata were contracted to provide the MACCs for the 2012 update using their POLES model. The key points of this approach are

- A Business-as-Usual (BAU) trajectory is developed from 2011, consistent with DECC's own working assumptions, and assuming zero carbon prices. I have a concern about the difficulty of re-creating counterfactual, recent historical data, as if there had been no carbon prices influencing the market participants. However, I have been re-assured by a member of the steering group familiar with the use of Enerdata's Poles in DECC's global modelling that this potential source of bias is being dealt with properly.
- Whilst the POLES model is a large-scale, global energy-economy model, in which several key variables are endogenous, e.g. oil prices, the price of carbon is set exogenously. This allows exogenous carbon price trajectories to be specified and the resulting year by year abatement, compared to BAU, thereby estimated. The carbon trajectory that achieves particular abatement targets over time can then be identified. In the initial runs of the model, these trajectories were linear. I suggested they should be weakly exponential to be consistent with the discounting that DECC might wish to assume in the forward curve for traded carbon prices, allowing for banking. In the relevant conference call, it was suggested to me that this may not make much difference, but, in general, it would seem that consistency is better.
- Going forward, if Enerdata are contracted to use POLES again, they could be requested to provide alternative carbon price trajectories to achieve specified total cumulative abatements by, say, 2020 and 2030. This would mean less post-processing at DECC and the possibility of having more subtle functional forms for the trajectories.
- The Enerdata model steps forward, without any foresight, making investment decisions based upon fundamentals and some adaptive empirical estimates for several behavioural parameters. This is a valid approach, in keeping with some of DECC's observations on myopia. Evidently, the lack of agent anticipations in the model could lead to bias, and, at a time when the market is oversupplied, will produce lower carbon prices and later abatement than market participants may indicate if considerations of future market tightening were to be taken seriously. DECC could benefit, in my opinion, on a clearer summary of the investment heuristics and behavioural assumptions being used in the POLES model, as these are ingredients that policies are often seeking to influence.

4. Expediency

A fundamental analysis, such as the one coming out of POLES for 2012, is suggesting that the EU-ETS is over-supplied with allowances and that the short-term traded prices should be zero. The most plausible reason why we are seeing the market prices trading above zero is the option value of potential surprises, or in the expectation of future shortages. As such, since optionality and forward looking in general are not in the fundamental model, there

is a dilemma whether DECC should be guided more by the market in the production of updated 2012 carbon values, than, as originally envisaged, by the fundamental resource cost modelling. In looking at alternative sources for market information on the real costs to participants, there are two main sources, forward prices and analyst forecasts.

Forward prices have some appeal in the near term, where there is sufficient traded volume and it is well known that hedging decisions in the power sector are active for up to three years out. Whenever power generators sell forward, risk management will require them to hedge the carbon price as well. This suggests that for up to three years, at least, the forward prices do reflect real activity in the economy. Forward prices, being traded daily, will have some short-term volatility, influenced by sentiment and transient market factors. Thus, it would clearly make sense to take an average over a period of time, and in the absence of further analysis, quarterly averaging would appear to be sensible.

The forward curve will also embed a forward risk premium. This will mainly reflect insurance against spot price volatility, as the opportunity cost to market participants of not trading forward is to take spot risk. It will also embed some policy risk premium, in addition to the underlying time value of money (net of transaction costs, margin calls, etc). To the extent that DECC would not wish to be pricing the risk of their own policies, as perceived by the market, into the forward prices, some analysis may have to be done to correct for this, if it is thought to be material.

Since the market is only substantially liquid for about 3 years forward, projecting a longer term structure is speculative. In general, the functional form of the carbon forward curve will be a complicated and transient manifestation of market expectations and risk premia. Given that EUAs have been driven to varying degrees at various times by the price of oil, and that the oil forward curves vary stochastically from contango to backwardation, it would be an oversimplification to presume simple rules should apply to the carbon forward curve.

Nevertheless, one defensible baseline might be to use the average yearly spreads in early years as a basis for compounding the later ones, in the absence of any explicit reason for the term structure of risk in these forward positions to be changing year on year, at least over the next ten years. In other words, the average discount rate in early years (where trading volumes are high) could be used for extrapolating futures prices over the reference period for this report.

Analysts forecasts will often be a mixture of fundamentals, market information and assumptions, and are useful in reflecting the various opinions in the sector. Sometimes, they may not even be forecasts, however, in the sense of best, central estimates, but may be a scenario related to specific assumptions. Analysts are inclined to take a more fundamental forward view of potential market tightening than the forward market prices, but these will involve policy scenarios that may or may not be consistent with DECC's, and there is sometimes a concern that in some organisations, carbon analysts may be compromised by the objectives of developing their companies' own carbon finance business. Unless a reasonably detailed commentary on the assumptions can be provided for each forecast, it is too casual to simply average a convenience sample of analysts' forecasts, and for a Government policy document, this may lack credibility. On the other hand there is plenty of evidence that analyst averages have been widely used in practice for company earnings and macro variables.

An ideal compromise might be to create an interpolation of market forward curves in the short term and a fundamental model in the longer term. The fundamental model should, however, have been calibrated to be consistent with the shorter term carbon price trajectories,

as discussed in the previous Modelling Issues section. Also, a credible way to take some, or all, of the policy risk premium out of the forward market curve should be devised.

From a pragmatic view, there is reason to believe that the POLES based carbon values may be biased down, because it is a myopic feed-forward model, and the forward curve based upwards, because it embeds risk premia and illiquidity in the longer term. These could be treated as high and low bands for these reasons. If DECC were tempted to interpolate, it could be through mid-points, or, better, as a smooth transition between greater weight to the market in the short term and greater weight on the model in the longer term.

To the extent that explicit high and low scenarios are required alongside central carbon values, there are many ways these could be produced and so it is important that some principles should be followed. Firstly, the High, Central and Low economic scenarios should be consistent with the widely adopted values used in Government. These have presumably already been given to Enerdata for alternative model-based projections. Secondly, since DECC is minded to move away from the Enerdata model based central estimates to market prices, and if the reasoning is that market participants attach an extra option value over current market fundamentals, we might be tempted to attach this same option value, for consistency, to the model-based High and Low scenarios. However, if the “option value” interpretation is correct, then this reflects current market participants already making some assessment of the high and low scenarios in pricing EUAs above model-based fundamentals

In the context of using a market based approach, the standard deviation of historical prices is a coherent way forward to assess price risk. If market prices are used to estimate the high and low values, there is a choice between basing these on the historical volatility (i.e. standard deviations) for the forward curve, or using the historical ex post error volatility between the forward curve and the actual spots, for up to about 3 years. The latter indicates something about the forward premium and the expectation error, whereas the former mainly indicates the variance in expectations. Both positions can be defended, although my inclination is that trying to take out the forward premium and working with expectations is preferable.

The clearer approach, in keeping with the model-based DECC motivation, is to retain the fundamentals-only method for the Low and High scenarios, with the High taking in perhaps a 30% tightening and maybe other policy assumptions, whilst retaining the market based “central” estimates on the basis that these central estimates also incorporate some market sentiment and optionality views on the future ranges. In this case, the H and L scenarios would be providing, in a sense, some supporting evidence to the central market based estimate being above a fundamental level, rather than alternative trajectories for the market forward curve prices themselves.

5. Final Comments on the Proposed Values

DECC appears to have taken the expedient approach. It is appropriate to use the market prices in the short-term, since they are the real costs to market participants. I am less comfortable with using forecasts from market analysts as their underlying assumptions may be unclear or inappropriate, and averaging them is too casual. As for the ranges, it is more meaningful to use explicit fundamental assumptions for the ranges, as DECC has done, than the volatility of forwards or analyst ranges. Overall, given the economic situation, and the EU caps, the 2012 updated carbon values represent a sensible and practical basis for policy. Going forward, perhaps the modelling exercise next year should recognise, from the outset,

that a coherent, rather than expedient, synthesis of market and fundamental variables will be needed.