Department of Energy & Climate Change

Updated short-term traded carbon values used for UK public policy appraisal

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Background

DECC's short-term traded carbon values for UK public policy appraisal are used for valuing the impact of government policies on emissions in the traded sector, i.e. those sectors covered by the EU Emissions Trading System (EU ETS). Short-term values quoted in this paper correspond to the period up to 2030 and long-term values correspond to the period post-2030.

In 2009, DECC set out a methodology for producing traded sector carbon values to 2050 in the paper 'Carbon Valuation in UK Public Policy Appraisal: A Revised Approach'[1] (July 2009). The paper advocated moving from a damage cost approach for valuing carbon to a target consistent resource-cost approach.

In 2012, DECC's methodology for producing short-term traded carbon values was updated. The hybrid methodology adopted in 2012 involved using a market-based approach based on futures prices to produce short-term traded carbon values in the central scenario with fundamentals-based high and low scenarios used for sensitivity purposes.[2]

DECC's short-term traded carbon values were last updated in summer 2013 and are being revised again as part of the annual process for updating DECC's analytical projections. Table 1 below shows the 2014 updated short-term traded carbon values for use in government appraisal.

Methodology

The 2014 update is based on the same hybrid methodology as used in 2012 and 2013, but uses revised inputs and assumptions, which include:

- Revised Business As Usual (BAU) emissions projections and corresponding Marginal Abatement Cost Curves (MACCs). These were commissioned from consultants Enerdata and produced using their POLES model, a top-down global sectoral model for the world

[1] Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/41798/1_20090715105804_e___carbonvaluationinukpolicyappraisal.pdf

[2] Further information on the 2012 short-term traded carbon values update can be found here: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/245385/6667-update-short-term-traded-carbon-values-for-uk-publ.pdf

energy system[3]. These BAU emissions projections and MACCs are consistent with DECC's 2014 fossil fuel price projections and underlying economic growth assumptions.[4]

- Updated market prices of EUA futures contracts. This includes data on daily settlement prices of EUA futures contracts with maturities up to 2017 traded on the InterContinental Exchange (ICE) over 3 months between 1 April 2014 and 30 June 2014.
- Revised assumptions on length of perfect foresight and discount rate in the DECC Carbon Price Model (see Annex 1).

Short-term traded carbon values for the period up to 2020 under all three scenarios (central, high and low) have been linearly extended beyond 2020 to reach DECC's long-term carbon values for the period beyond 2030.[5] These long-term carbon values reflect the costs required to achieve the internationally agreed UNFCCC long term goal of limiting global temperature increases to 2 degrees centigrade above pre-industrial levels.

Central scenario

Short-term traded values in the central scenario are estimated using a market-based approach which involves averaging daily settlement prices of end year EUA futures contracts of different vintages over a period of 3 months.

The volume of traded futures contracts decreases rapidly with contracts' settlement dates. For instance, over the period April to June 2014 there were over 860,000 traded lots (1 lot = 1,000 tCO_2) with the settlement date December 2014 and less than 1,000 lots with the settlement date December 2020. In light of this limited liquidity in the futures market beyond a few years, prices are averaged for those futures with settlement dates up to 2017, where there are still a reasonable number of futures contracts, and then extrapolated to 2020 using a discount rate (see Annex 1).

High scenario

Short-term traded carbon values under this scenario have been derived using the DECC Carbon Price Model (DCPM), a fundamentals-based model for estimating carbon prices. The DCPM estimates EUA prices in any given year based on the equilibrium between demand for and supply of abatement over a chosen number of years into the future (the foresight window of the model), which can be set to be between 1 year (i.e. no foresight) to 38 years (i.e. perfect foresight to 2050). Demand for abatement depends on the gap between Business As Usual (BAU) emissions and the EU ETS cap, while supply depends on marginal abatement costs (MACs).

The high scenario is based on assumptions of higher economic growth, low prices of coal relative to gas and a tighter EU ETS cap. It is assumed that there is one-off cancellation of 2 billion surplus allowances over 2015 and 2016 and a tightening of the EU ETS cap trajectory

[3] Further information on the POLES model can be found here: http://www.enerdata.net/enerdatauk/solutions/energy-models/poles-model.php

[4] DECC's 2014 fossil fuel price projections can be found here: https://www.gov.uk/government/publications/fossil-fuel-price-projections-2014

[5] These can be found at Annex 2 here: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48108/1_20100120165619_e_carbonvaluesbeyond2050.pdf

post-2020 to deliver the EU ETS's share of a 40% 2030 EU GHG emissions reduction target. Note that these assumptions about the EU ETS cap trajectory have been used for producing appraisal values in a high scenario for the purpose of sensitivity analysis. This does not necessarily reflect or prejudice the UK's policy position on structural reform of the EU ETS or climate and energy targets for 2030 which are currently subject to ongoing negotiations.

Low scenario

Short-term traded carbon values under this scenario are also derived using the DCPM. The low scenario is based on assumptions of slower economic growth, high prices of coal relative to gas and no tightening of the current EU ETS cap trajectory. As with the high scenario, this is produced for the purpose of sensitivity analysis.

2014 updated short-term traded carbon values

DECC's 2014 updated short-term traded values are shown below. Further detail on the underlying assumptions and an explanation of the reasons for the differences with the 2013 values is provided in the subsequent section.

Table 1: DECC's updated short-term traded sector carbon values for policy appraisal in real 2014 terms, £/tCO2e

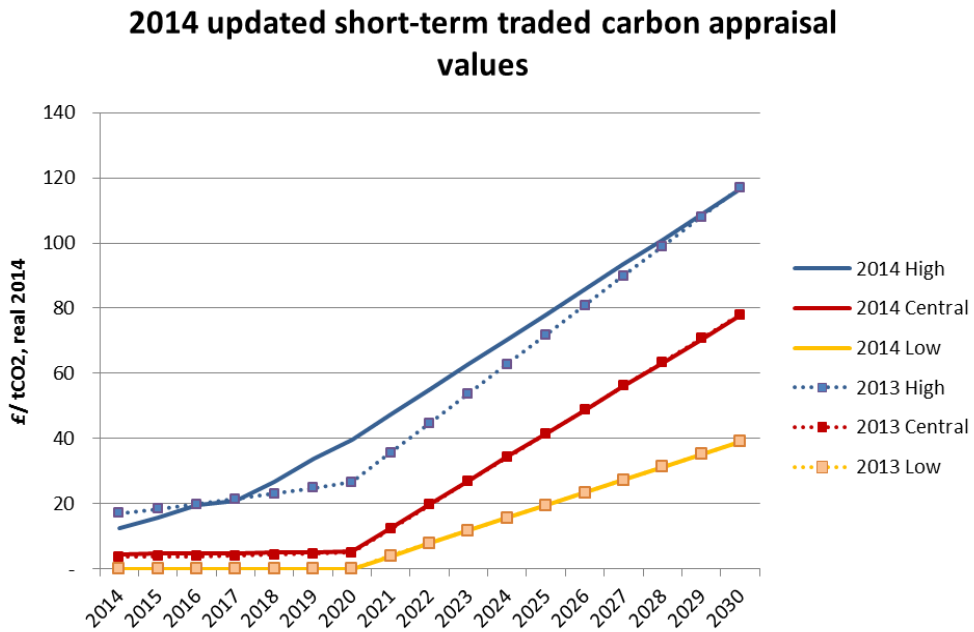
	Low	Central	High
2014	0.00	4.48	12.38
2015	0.00	4.56	15.78
2016	0.00	4.66	19.66
2017	0.00	4.78	20.89
2018	0.00	4.97	26.72
2019	0.00	5.16	33.76
2020	0.00	5.35	39.66
2021	3.88	12.58	47.34
2022	7.77	19.81	55.03
2023	11.65	27.04	62.71
2024	15.53	34.27	70.39
2025	19.42	41.51	78.08
2026	23.30	48.74	85.76
2027	27.18	55.97	93.44

2028	31.07	63.20	101.13
2029	34.95	70.43	108.81
2030	38.83	77.66	116.50

Please note that these values are based on a specific set of assumptions with respect to the move from the end of Phase III of the EU ETS (ending in 2020) to a fully functioning and comprehensive global carbon market in 2030. Consequently these values should not be considered as "forecasts" of future prices and DECC accepts no responsibility for any liability arising from the use of these figures.

Comparison with 2013 short-term traded carbon values

The chart below provides a comparison of the 2014 values with those published in 2013. The reasons for the differences between each scenario are explained in the following paragraphs. The differences between the 2014 values and 2013 values are most significant under the high scenario.



Central scenario

Updated 2014 carbon values in the central scenario, estimated using a market-based approach based on futures prices, are slightly higher as compared with last year's values. This is on account of a slight increase in the market price of EUAs as compared with last year, possibly driven by a reduction in the supply of allowances owing to back-loading and expectations regarding agreement on a 2030 EU Climate and Energy package in the coming months. However, there have been no fundamental changes in the market since last year and it continues to suffer from an oversupply of allowances.

Low scenario

Updated carbon values in the low scenario are the same as those from last year. This represents a scenario with continued chronic oversupply of allowances in the carbon market as a result of which the carbon price up to 2020 is zero. This scenario is presented for the purpose of undertaking sensitivity analysis and does not reflect a view from Government that the market price is likely to reach zero in reality.

High scenario

Updated 2014 carbon values in the high scenario up to 2020 and based on fundamentals-based modelling using the DCPM, are with the exception of the early years, higher than those from last year.

The changes to the high series as compared with last year are primarily driven by:

- *Changes in the underlying BAU emissions projections*

  For years up to 2020, updated BAU emissions projections are lower than last year's. This is because of realised emissions and historic growth being weaker than projected as part of the 2013 update.

  For the period after 2020, updated BAU emissions projections are higher than last year's because of enhancements to the way policies can be calibrated in the POLES model. It is now possible to undertake more detailed calibration of the 2020 renewables and energy efficiency targets than was previously possible in the POLES. This is undertaken by using information from Member States' National Renewable Energy Action Plans (NREAPs) and National Energy Efficiency Action Plans (NEEAPs). This more detailed calibration means that it now possible to separate more accurately than was previously possible, the effort driven by the EU ETS from that of the 2020 renewables and energy efficiency targets, and exclude it from BAU emissions projections.

  Over the entire model horizon 2014 to 2050, BAU emissions are higher than in the 2013 update which, for a given GHG emissions reduction target, tends to increase the effort required to meet the cap and as a consequence, the modelled carbon price.

- *Longer horizon and revised foresight window in the DCPM*

  The high series for DECC's 2013 values was derived using a model with a horizon to 2030 and perfect foresight over this period, whereas the 2014 values are based on a model with a horizon that extends to 2050 and a rolling 16 year perfect foresight window within this period. The effect is that for the period up to 2017, modelled prices are lower than last year's because of lower projected BAU emissions up to 2020 coupled with limited perfect foresight in the DCPM. After 2017, modelled prices are higher than last year's because market participants now have sight of the tightening EU ETS cap post-2030, which they did not have for last year's values given a 2030 model horizon.

Annex 1: Revised assumptions on length of perfect foresight and discount rate in the DECC Carbon Price Model

As part of the 2014 short-term traded carbon values update DECC invited two external peer reviewers, Dr William Blyth and Dr Luca Taschini, to advise on two assumptions used in the DCPM for undertaking modelling analysis to support policy development. Their peer review reports have been published alongside DECC's 2014 updated short-term traded carbon values.[6]

Length of perfect foresight

This is the length of time over which the market can view all the relevant information needed for forming a view on future carbon prices. Since the EU ETS cap tightens over time and the marginal costs of abatement rise, market participants with a reasonably long perfect foresight window, know the extent to which they need to abate to meet tighter caps in the future. This has the effect of increasing demand for allowances in the near term, pushing up current prices and lowering future prices, thus producing a flatter price profile over time than under a more limited foresight window.

Having taken the peer reviewers' views into consideration, a perfect foresight window of 6 years is used in the central case, with a longer foresight window as appropriate for sensitivity analysis. The rationale for this is set out below:

- In the current state of the market, the price of allowances is determined to a greater extent by short- to medium-term compliance behaviour of market participants, rather than by their views about long-term investment. This is supported by evidence which suggests a number of carbon market participants are not long sighted in so far as factoring in future levels of the carbon price into their decisions is concerned.

- Liquidity in the EUA futures market declines considerably in future years with virtually no trading at all beyond 6 years. Although this is not in itself sufficient to rule out long foresight, does suggest that the market focuses more on earlier years.

- However, the available evidence on foresight is not conclusive and it is plausible that a longer foresight assumption is valid. It is also plausible that foresight may change over time. To address this uncertainty, sensitivity analysis that uses a longer perfect foresight window will be undertaken.

Discount rate

The discount rate affects the rate of increase in modelled prices over time. With a large discount rate, market participants place less weight on information relating to future years (where greater abatement would be needed to meet tightening caps), as a result of which current prices are lower but rise more steeply over time.

[6] Peer review reports can be found here: https://www.gov.uk/government/publications/updated-short-term-traded-carbon-values-used-for-uk-policy-appraisal-2014

Note however that the discount rate is closely linked with the assumed length of perfect foresight in the DCPM. Under limited perfect foresight, the profile of carbon prices is driven to a greater degree by the change in available information as the horizon moves forward with a rolling foresight window rather than by the assumed discount rate. Having assumed limited foresight, the discount rate is therefore of secondary importance.

Having taken the peer reviewers' views into consideration, a discount rate of 6% (in nominal terms) is used in the central case, with a higher discount rate of 10% for sensitivity purposes. The rationale for this is set out below:

- A discount rate of 6% is consistent with the relationship between observed EUA spot and futures prices, and therefore based on empirical evidence. Although this implied discount rate does not include any inherent price risk, there is no readily available data that would allow us to infer an appropriate level of risk premium for EUAs.

- In order to attempt to capture a risk premium in the discount rate used in the DCPM, a higher discount rate of 10% (as recommended by our peer reviewers) would be used for sensitivity purposes.

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