Department for
Business, Energy
& Industrial Strategy

UPDATED SHORT-TERM TRADED CARBON VALUES

Used for Modelling Purposes

January 2018

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Background

BEIS's short-term traded carbon values for modelling purposes are used to demonstrate the financial cost of purchasing allowances under the European Union 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.

2017 short-term modelling carbon values

The following estimates for EU Allowance (EUA) prices have been used in the latest update to BEIS's Energy and Emissions projections and will be used in other models of electricity generation and investment across Government. These values are revised annually as part of the process for updating BEIS's analytical projections. The 2017 updated values are shown in Table 1 overleaf and represented graphically in Figure 1 later in this document.

Table 1: BEIS's updated traded carbon values for modelling purposes, £/tCO2e (real 2017)

Year	Low	Central	High
2017	0.00	4.13	4.79
2018	0.00	4.19	6.51
2019	0.00	4.37	7.92
2020	0.00	4.56	9.83
2021	0.00	4.76	12.67
2022	0.00	4.94	16.21
2023	0.00	6.44	20.23
2024	0.00	10.18	23.95
2025	0.00	13.21	29.49
2026	1.37	17.83	35.77
2027	5.34	24.20	42.86
2028	8.50	28.82	49.72
2029	12.65	32.98	59.26
2030	18.31	39.41	69.33
2031	18.31	39.41	69.33
2032	18.31	39.41	69.33
2033	18.31	39.41	69.33
2034	18.31	39.41	69.33
2035	18.31	39.41	69.33

Methodology

The 2017 updated short-term carbon values are based on the same hybrid methodology as previous years, but use updated inputs and assumptions:

- Revised Business As Usual (BAU) emissions projections and corresponding Marginal Abatement Cost Curves (MACCs). These have been commissioned from consultants Enerdata and produced using the POLES model, a top-down global sectoral model of the world energy system[1]. These BAU emissions projections and MACCs are consistent with the latest 2017 BEIS fossil fuel price assumptions and underlying economic growth projections[2].

- Updated market prices of EUA futures contracts. This includes data on daily settlement prices of EUA futures contracts with maturities up to 2018 traded on the

[1] Further information on the POLES model can be found here:
http://www.enerdata.net/enerdatauk/solutions/energy-models/poles-model.php
[2] BEIS 2017 fossil fuel price assumptions can be found here:
https://www.gov.uk/government/publications/fossil-fuel-price-assumptions-2017

Intercontinental Exchange (ICE) over 3 months between 1 April 2017 and 30 June 2017.

- Re-estimated impact of the Market Stability Reserve[3] (MSR) on the EU ETS cap based on the assumption of an increase in the withdrawal rate from 12% to 24% in the years 2019-23.

The 2017 carbon values are identical to those used for appraisal purposes up to 2020[4]. Beyond 2020, short-term traded carbon values for modelling purposes are estimated in line with the projected emissions, abatement costs and the EU ETS emissions target in 2030.

NOTE: On 23 June 2016, the EU referendum took place and the people of the United Kingdom voted to leave the European Union. Until the date of exit, the UK remains a full member of the European Union and all the rights and obligations of EU membership remain in force. While exit negotiations remain in progress, the update to the short term traded carbon values are produced on that basis and consequently, include no explicit assumptions about post EU exit impacts on emissions projections and demand for EUAs.

Consequently, care should be taken in considering whether these values are appropriate for use in analysis.

Central scenario

Carbon values in the central scenario are estimated using a hybrid approach that involves taking the maximum of two trajectories:

- A carbon price trajectory based on the daily settlement prices of end of year EUA futures contracts of 2017 and 2018 vintages, averaged over a period of 3 months. After 2018, prices are extrapolated using the real discount rate of 3.8%.

[3] The Market Stability Reserve (MSR) is a carbon market reform aimed at providing price stability for installations covered under the EU ETS scheme. The MSR will work by reducing new supply entering the market, via government auctions, until the calculated surplus falls below an upper threshold, and will be returned to the market once the calculated surplus falls below a lower boundary.
[4] BEIS short-term traded carbon values for appraisal purposes: https://www.gov.uk/government/publications/updated-short-term-traded-carbon-values-used-for-uk-policy-appraisal-2017

- A fundamentals-based carbon price trajectory that is modelled through the BEIS Carbon Price Model (BCPM) which assumes 6 years perfect foresight[5].

As a result, until 2025 the central trajectory reflects the current market dynamics that are driven by the prevailing surplus of allowances. Beyond 2025, on the assumption that the historical surplus has been addressed by the MSR and abatement is required to meet the EU ETS cap, the central trajectory reflects the cost of abatement needed to achieve the 2030 EU ETS target.

High and low carbon price trajectories are produced for sensitivity analysis to reflect uncertainties around future fossil fuel prices and economic growth. Assumptions that are used in modelling the high and low trajectories are chosen to provide a meaningful range around the central trajectory of carbon values.

High scenario

Short-term traded carbon values in the high scenario are entirely fundamentals-based and have been derived using the BCPM under a certain set of assumptions that produce high prices. For instance:

- BAU emissions projections and corresponding MACCs that are produced using assumptions about (a) high economic growth and (b) low prices of coal relative to gas, which lead to greater demand for coal and higher emissions.

- A length of perfect foresight[6] of 10 years is chosen, as opposed to 6 years' foresight that was used for the central trajectory. With longer perfect foresight, market participants have a longer view of the market, including future caps and the abatement needed to reduce emissions. This increases the carbon price as market participants foresee more abatement is required over a longer time horizon.

- The discount rate reflects the expected annual increase in carbon prices over time. A discount rate of 8% in real terms is used instead of 3.8% in the central trajectory. The rationale behind the use of the 8% discount rate is to capture a risk premium which is not included in a 3.8% rate (as in the central scenario) and this higher rate

[5] BCPM is an in-house fundamentals-based model for estimating carbon prices. The BCPM estimates EUA prices in any given year based on the equilibrium between demand for and supply of abatement over a chosen number of future years (the perfect foresight of the model), which can be set to be between 1 year (i.e. no foresight) to 33 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 of abatement is given by the marginal abatement cost curves.

[6] Foresight is the number of years into the future over which market participants assess the degree of scarcity in the market

assumes that market participants take long-term information into account in the current pricing.

Note that the foresight and discount rate assumptions are consistent with the recommendations made by an external peer reviewer in 2014[7].

Low scenario

Short-term traded carbon values under this scenario are also fundamentals-based and have been derived using the BCPM Carbon Price Model under a certain set of assumptions that produce low prices. For instance:

- BAU emissions projections and corresponding MACCs are produced using assumptions about (a) low economic growth and (b) high prices of coal relative to gas, which lead to lower demand for coal and lower emissions.

- Carbon prices are entirely driven by market fundamentals, i.e. the cost of abatement needed to meet the cap, which is zero for early years up to and including 2025. This reflects a situation of continued oversupply of allowances in the market driven by depressed economic activity in recent years.

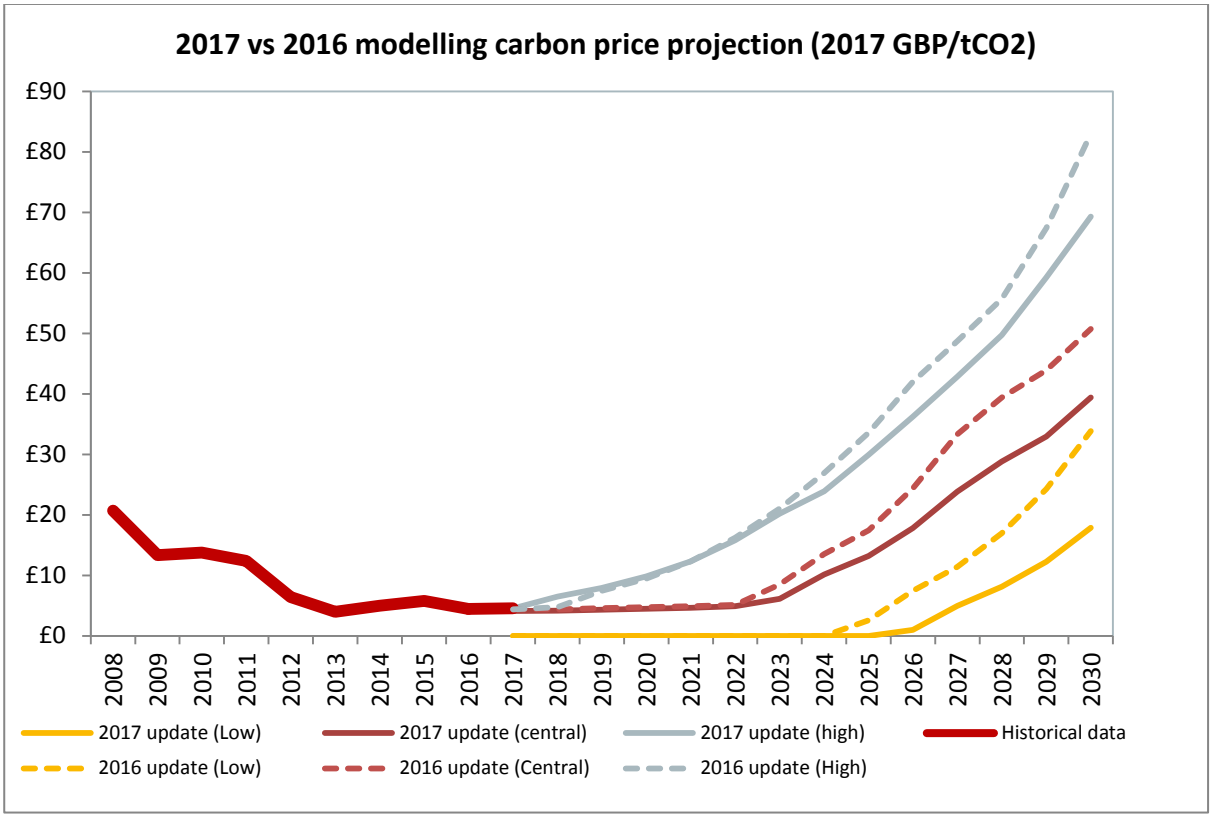
- No changes were made to the length of perfect foresight or discount rate compared with the central scenario.

Comparison with 2016 short-term carbon values

Figure 1 overleaf provides a comparison of the 2017 modelling values with those published in 2016.

[7] Foresight and Cost of Carry assumptions in the BCPM: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/359708/Peer_review_William_Blyth.pdf

Figure 1: BEIS's updated traded carbon values for modelling purposes, £/tCO2e in real 2017 terms



Central scenario

Modelling values in the central trajectory are produced using the same methodological approach as in 2016. The 2017 updated short-term traded carbon values for modelling purposes in the central scenario are lower compared to last year's values, driven by:

1. Higher fossil fuel price assumptions - BEIS's 2017 fossil fuel prices projections over the period 2017 – 2030 have been revised upwards since the 2016 update as a result of a worldwide fall in coal production, particularly in China.

2. Downwards revision in historical emissions data - The 2016 update incorporated historical emissions data up to 2014, whereas the 2017 update includes historical data up to 2016. This new updated data has shown that actual emissions fell below what was projected for 2015-2016 in the 2016 update, leading to reduced demand for allowances.

3. EU 2030 Energy Package - In the 2017 update, the POLES model has been calibrated to take into account the 2030 renewables and energy efficiency targets of 27%, which is in line with the June/July 2017 European Council conclusions on the

2030 Climate and Energy Package. This assumption was not included in the 2016 carbon price update. The inclusion of these energy efficiency and renewables targets reduces the expected volume of emissions even in absence of an EU ETS carbon price.

Given the uncertainty around projecting carbon prices over a longer time horizon and the difficulty of identifying the policy mix in the distant future, carbon prices are flat-lined after 2030. This approach is consistent with the methodology for the BEIS fossil fuel price assumptions.

High scenario

Current modelling of high carbon values are lower than those projected in 2016 for the period 2017-2020 due to the fall in average EUA futures prices. Average futures settlement prices for delivery in 2017-2020 have been revised down from €5.92 (nominal EUR) in the 2016 update to €4.90 this year. This reflects the reduced expectations from market traders that the surplus will be tackled sufficiently in the Phase IV negotiations.

After 2022, projected carbon prices in the high trajectory are lower than last year's. This is largely driven by the downwards revision in BAU emissions projections this year (as described in the central scenario; all other things being equal, there is less demand for EUAs).

Low scenario

The 2017 short-term traded carbon values in the low scenario are modelling outputs of the BCPM. The price of allowances up to 2025 is zero in this scenario. This represents a pessimistic view of the future with continued chronic oversupply of allowances in the carbon market and consequently a low demand that drives low carbon prices.

After 2025, the 2017 updated values are lower than those modelled in 2016. This is largely driven by the downwards revision in BAU emissions projections this year (as described in the central scenario; as all other things being equal, there is less demand for EUAs).

Caveats and limitations

Please note these values are based on a specific set of assumptions with respect to the policy mix post-2020, cost of fuels, level of emissions etc. Consequently these values should not be considered as "forecasts" of future prices and BEIS accepts no responsibility for any outcomes arising from the use of these figures.

Modelled prices under the three trajectories reflect “what if” scenarios based on specific sets of assumptions that are chosen to produce a plausible and meaningful range for sensitivity analysis. As such, they are not meant to depict a likely outcome in terms of the level of prices.

These sets of assumptions do not include any policy instruments to drive emissions down other than the EU ETS. As a result, we assume that the EU ETS incentivises all the abatement required to achieve future emissions reductions. Modelled carbon prices in later years are therefore significantly greater than those observed in the nearer term. In reality there may be other policy measures in place in future that would incentivise carbon abatement, reducing the effort required from the EU ETS and lowering the carbon price. Policy instruments such as the Market Stability Reserve that are included in the modelling are assumed to run over the entire modelling period as currently agreed at the EU level. In reality, there could be changes to policy design, e.g. through the review of the MSR (scheduled to happen within three years of the start of the operation of the reserve and at five year intervals thereafter).

Fundamentals-based prices are also subject to numerous modelling assumptions in the BCPM (including perfect foresight and discount rate) and in the POLES model (including cost of abatement technologies, deployment rates etc.) that attempt to simulate market participants’ behaviour in future states of the world and as a result are subject to considerable uncertainty.

Finally, as stated earlier, the update to the short term traded carbon values are produced on the basis of the UK currently being a full member of the EU and all the associated rights and obligations. Consequently, they include no explicit assumptions about post EU exit impacts on emissions projections and demand for EUAs.

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