Department for
Business, Energy
& Industrial Strategy

UPDATED SHORT-TERM TRADED CARBON VALUES

Used for modelling purposes

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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.

2018 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 2018 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 2018)

Year	Low	Central	High
2018	2.33	12.76	25.51
2019	0.00	13.15	26.30
2020	0.00	13.84	27.69
2021	0.00	14.56	29.11
2022	0.00	15.11	30.22
2023	0.00	15.68	31.37
2024	0.00	16.28	32.56
2025	2.21	17.70	35.41
2026	2.95	23.95	43.26
2027	5.11	27.59	52.08
2028	8.48	30.76	60.98
2029	12.84	35.60	72.10
2030	18.67	42.66	84.61
2031	18.67	42.66	84.61
2032	18.67	42.66	84.61
2033	18.67	42.66	84.61
2034	18.67	42.66	84.61
2035	18.67	42.66	84.61

Methodology

The 2018 updated short-term traded carbon values are based on the same hybrid methodology as previous years, with the exception of the high series (see below) and 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 use 2018 BEIS fossil fuel price assumptions and underlying economic growth projections[2], with the exception of the high series, which is constructed differently in order to reflect a meaningful range of uncertainty for policy development (see overleaf).

[1] Further information on the POLES model can be found here:
http://www.enerdata.net/enerdatauk/solutions/energy-models/poles-model.php
[2] The final BEIS 2018 fossil fuel price assumptions differ in terms of short-term market changes for all three fuels. These can be found here:
https://www.gov.uk/government/publications/fossil-fuel-price-assumptions-2018

- Updated market prices of EUA futures contracts. This includes data on daily settlement prices of EUA futures contracts with maturities up to 2019 traded on the Intercontinental Exchange (ICE) over three months between 1 April 2018 and 30 June 2018.

The 2018 carbon values are identical to those used for appraisal purposes up to 2020[3]. Beyond 2020, short-term traded carbon values for modelling purposes are estimated in line with the trend in futures prices, 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 and future economic partnership discussions 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 uses both EUA futures contracts prices and a fundamental approach. For the first two years, the carbon price trajectory is based on the daily settlement prices of end of year EUA futures contracts of 2018 and 2019 vintages, averaged over a period of three months. From 2020 onwards, this involves taking the maximum of two trajectories:

- Prices of EUA futures contracts are extrapolated from those in 2019 using the real discount rate of 3.8%.

[3] 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-2018

- A fundamentals-based carbon price trajectory that is modelled through the BEIS Carbon Price Model (BCPM) which assumes six years perfect foresight[4].

As a result of the hybrid methodology, 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 Market Stability Reserve (MSR)[5] 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

Replicating the hybrid approach of previous years, this year of market data to 2025 in the central scenario and a fundamental methodology for the high scenario, led to the central and high scenarios being very close together for early years. This is due to recent, significantly increasing EUA futures prices. Consequently, such a high scenario would not capture the uncertainty that one can infer from observing historical short-term volatility and uncertainty that the fundamental approach reflects in the longer term (many factors of which will also be uncertain in the shorter term). Therefore, this year we have chosen to set the high scenario until 2025 as double the central series in order to better reflect recent market uncertainty and provide a meaningful range for sensitivity testing purposes.

From 2026 onwards, short-term traded carbon values in the high scenario are entirely fundamentals-based and have been derived using the BCPM under a 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, higher emissions and consequently, a greater demand for allowances.

[4] 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.

[5] The MSR controls the surplus of allowances in the market, removing or adding allowances from/to the market as the surplus increases and decreases. Further information on the MSR can be found here: https://ec.europa.eu/clima/policies/ets/reform_en

- A length of perfect foresight[6] of ten years is chosen, as opposed to six 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 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 BEIS Carbon Price Model under a 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, lower emissions and consequently, lower demand for allowances.

- Carbon prices are entirely driven by market fundamentals, i.e. the cost of abatement needed to meet the cap. There is a small value in the first year, then it is zero for early years up to and including 2024. 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.

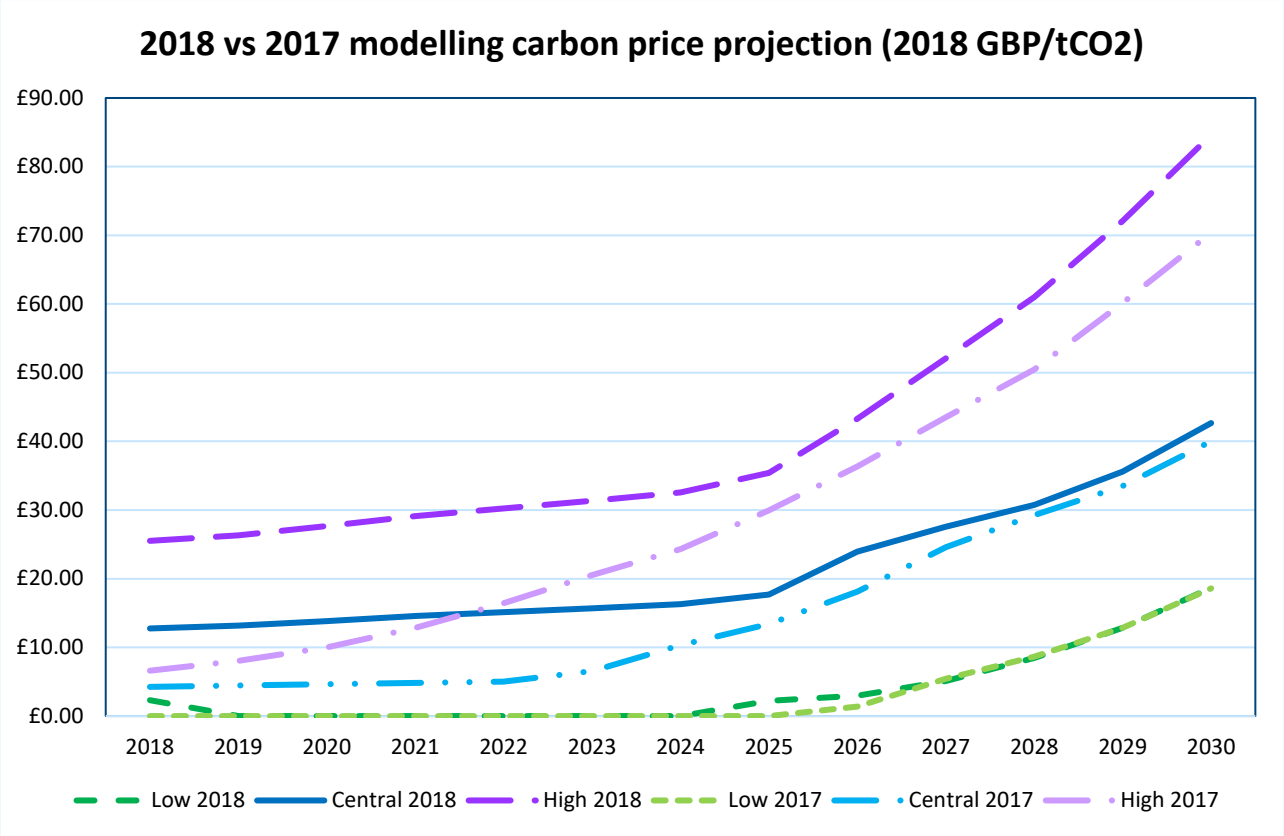
[6] Foresight is the number of years into the future over which market participants can assess the degree of scarcity in the market with perfect clarity.

[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

Comparison with 2017 short-term carbon values

Figure 1 overleaf provides a comparison of the 2018 modelling values with those produced in 2017.

Figure 1: BEIS's updated short term traded carbon values for modelling purposes, £/tCO2e in real 2018 terms



Central scenario

Modelling values in the central trajectory are produced using the same methodological approach as in 2017. The 2018 updated short-term traded carbon values for modelling purposes in the central scenario are higher compared to last year's values, driven by:

1. Higher futures prices - In the 2017 update, average futures price for 2018 delivery was £4.19/t (£4.25/t when adjusted to 2018 values). In this year's update, the average futures price for end 2018 delivery has risen to £12.76/t.

2. Upwards revision in historical emissions data - The 2017 update incorporated historical emissions data up to 2016, whereas the 2018 update includes historical data up to 2017. This has shown that actual emissions were above what was previously projected for 2017 resulting in an increased demand for allowances.

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 scenario carbon values produces higher values than those projected in 2017 for the 2018-2025 period because of the rise in average EUA futures prices used in the central scenario and the approach adopted for the high scenario as described in the previous section. For the remainder of the period, the scenario is very similar to last year although starting from a higher point. This is because the inputs have changed little since last year.

Low scenario

The 2018 short-term traded carbon values in the low scenario are modelling outputs of the BCPM. Other than the first year, the price of allowances up to 2024 is zero in this scenario. This represents a pessimistic view of the future with continued chronic oversupply of allowances in the carbon market relative to demand that drives low carbon prices.

After 2024, the 2018 updated values are very similar than those modelled in 2017. This is because the inputs have changed little since last year for the period 2025 to 2030.

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 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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