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 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.

## 2016 short-term 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 a part of the process for updating BEIS's analytical projections. The 2016 updated values are shown in Table 1 below and represented graphically in Figure 1 later in this document.

**Table 1: BEIS's updated traded carbon values for modelling purposes, £/tCO2e in real 2016 terms**

| Year | Low | Central | High |
|---|---|---|---|
| 2016 | 0.00 | 4.18 | 4.18 |
| 2017 | 0.00 | 4.22 | 4.22 |
| 2018 | 0.00 | 4.25 | 4.61 |
| 2019 | 0.00 | 4.41 | 7.22 |
| 2020 | 0.00 | 4.58 | 9.14 |
| 2021 | 0.00 | 4.76 | 11.90 |
| 2022 | 0.00 | 4.94 | 15.67 |
| 2023 | 0.00 | 8.21 | 20.31 |
| 2024 | 0.00 | 13.04 | 25.96 |
| 2025 | 2.49 | 16.86 | 32.38 |
| 2026 | 7.17 | 23.52 | 40.51 |
| 2027 | 11.02 | 32.15 | 46.98 |
| 2028 | 16.38 | 38.01 | 53.72 |
| 2029 | 23.42 | 42.34 | 65.00 |
| 2030 | 32.63 | 48.95 | 80.06 |
| 2031 | 32.63 | 48.95 | 80.06 |

| | | | |
|---|---|---|---|
| 2032 | 32.63 | 48.95 | 80.06 |
| 2033 | 32.63 | 48.95 | 80.06 |
| 2034 | 32.63 | 48.95 | 80.06 |
| 2035 | 32.63 | 48.95 | 80.06 |

## Methodology

The 2016 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 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 Intercontinental Exchange (ICE) over 3 months between 1 April 2016 and 30 June 2016.
- Re-estimated impact of the Market Stability Reserve (MSR) on the EU ETS cap.

The 2016 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 extended in line with the projected emissions, abatement costs and the EU ETS emissions target in 2030.

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 2016, 2017 and 2018 vintages, averaged over a period of 3 months. After 2018 prices are extrapolated using the real discount rate of 3.8%;
- a fundamentals-based carbon price trajectory that is modelled through the BEIS Carbon Price Model (BCPM)[4].

[1] Further information on the POLES model can be found here:
http://www.enerdata.net/enerdatauk/solutions/energy-models/poles-model.php
[2] BEIS 2016 fossil fuel price assumptions can be found here:
https://www.gov.uk/government/publications/fossil-fuel-price-assumptions-2016
[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-2016

As a result, until 2023 the central trajectory reflects the current market dynamics that are driven by the prevailing surplus of allowances. Beyond 2023, when 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[5] 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 more abatement is required over a longer time horizon.
- A discount rate of 8% in real terms is used instead of 3.8% in the central trajectory. With a higher discount rate, greater abatement can be achieved in future at the same price (i.e. future costs are more heavily discounted). As a result, carbon values under the 8% discount rate assumption are lower than they would be with 3.8% assumption.

Note that the foresight and discount rate assumptions are consistent with the recommendations made by an external peer reviewer in 2014[6].

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

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

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. This represents a situation of continued oversupply of allowances in the market driven by depressed economic activity.
- No changes are made to the length of perfect foresight or discount rate compared with the central scenario.

## Comparison with 2015 short-term carbon values

Figure 1 below provides a comparison of the 2016 modelling values with those published in 2015.

Central scenario

Modelling values in the central trajectory are produced using the same methodological approach as in 2015. The 2016 updated short-term carbon values for modelling purposes in the central scenario are lower as compared to last year's values until 2027, which is driven by:

- the expectation of increased EUA auction volumes in 2017 in comparison with 2016. EU ETS auction values are affected by the backloading policy that reduced auctions in 2014-2016; as a result auction volumes in 2017 are significantly higher than in 2016. This has affected the EUA futures curve as market participants are now pricing the expectation of higher auction volumes;
- power sector installations have sold some of the allowances that they originally bought for hedging, thus exacerbating oversupply;
- decreased demand for allowances from the power sector in the longer term driven by a greater deployment rate of nuclear power in the EU.

High scenario

Updated carbon values in the high scenario are outputs of the fundamentals-based BCPM and are considerably lower than those from 2015 update. This is largely driven by the assumptions about the foresight (10 years in contrast with 16 years in the 2015 carbon price update) and the discount rate (8% in contrast with 3.8% in the 2015 carbon price

update). Both assumptions lie within the sensitivity range previously recommended by the external peer reviewers (footnote 6) and are chosen to provide a meaningful range around the central trajectory.

The high series represent a state of the world in which strong economic growth and low price of coal relative to gas drive an increase in BAU emissions and a subsequent increase in demand for allowances which drives the ETS price up. Market participants in this state of the world take a longer view on fundamentals (including future emissions reduction targets), which prompts them to undertake early action to abate carbon.

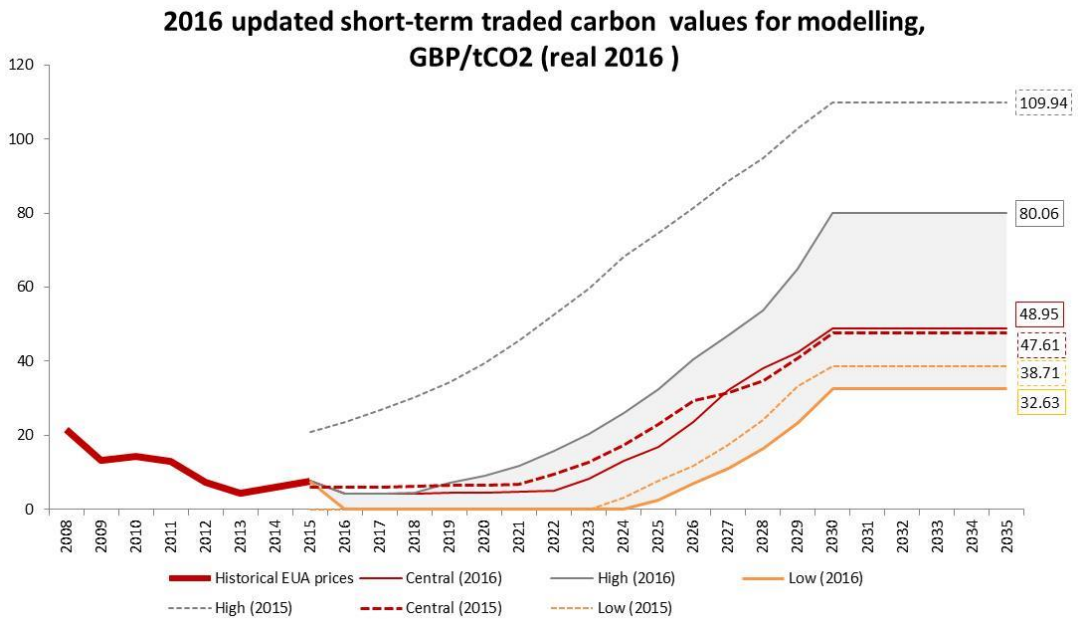
Low scenario

The 2016 short-term traded carbon values in the low scenario are modelling outputs of the BCPM. 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 and consequently a low demand that drives low prices.

After 2024, the 2016 updated values are lower than those modelled in 2015. This is mainly driven by decreased demand for allowances from the power sector in the longer term, which reflects a greater deployment rate of nuclear power in the EU.

Given the uncertainty when projecting carbon prices over a longer time horizon and difficulty with 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 (footnote 2).

**Figure 1: BEIS's updated traded carbon values for modelling purposes, £/tCO2e in real 2016 terms**



## 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 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 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 EU level. In reality, there could be changes to policy design, e.g. through the review of 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.

For advice on sensitivity analysis in respect of the modelling values, please contact BEIS’ appraisal guidance team at GHGappraisal@decc.gsi.gov.uk .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