The flight path to net zero: making the most of nature based carbon offsetting

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Methodology

To develop our business as usual scenario, we took the Department for Transport (DfT) projections of CO_2 emissions for UK aviation (domestic and international) to 2050 which assume capacity is not constrained. DfT also model scenarios where demand is higher due to low oil prices, low market maturity, high economic growth and low carbon prices, all of which may increase consumer demand for aviation. These sensitivities suggest our business as usual value is likely to be ± 15 per cent of the value presented in the report. However, as these factors could increase or decrease the demand for aviation we kept the central figure. We have given an indication of the uncertainty in total emissions due to demand fluctuations with the shaded areas on the graph.

The DfT's central projections suggest total emissions from aviation to be 43.4 $MtCO_2$ in 2020. The last year with actual emissions data available is 2017 and this showed emissions of 36.5 $MtCO_2$. More recent data are available on aircraft kilometres flown in 2018. This suggests an increase in aircraft km of seven per cent on 2017. Three years at this growth rate would give emissions of 44.7 $MtCO_2$ by 2020. Given that some fleet efficiency improvements are likely to occur in this period it seems an accurate starting point.

In our business as usual scenario we have removed the effect of carbon pricing on demand which is included in the DfT figures (11 per cent reduction in demand by 2050), since this would require new policy to be implemented. We also removed the assumption that sustainable aviation fuels (SAF) would reach five per cent market penetration as this may not happen without government intervention in the market. We kept the assumption that the airline fleets would improve their fuel efficiency at a rate of one per cent per year as this is likely to happen due to market forces without any intervention. This gives a central emissions figure of 45.4 $MtCO_2$ in 2050 in the business as usual scenario, with the caveat market sensitivities may increase or decrease this figure by around 15 per cent.

For our technical solutions scenario, we increased the annual improvement in fleet efficiency to 1.2 per cent and assumed a linear increase in SAF penetration from 2030 to reach ten per cent of fuel demand by 2050. We used the Committee on Climate Change's (CCC) estimate of SAF offering a 50 per cent reduction on lifecycle CO_2 emissions compared to kerosene. It is possible that SAF adoption could be greater than this, however this would require strong policy support. Greater lifecycle emissions savings of SAF have been suggested in the literature, however we use this conservative figure as demand for sustainable biomass is likely to be far greater than supply by 2050, so greater emissions savings are less likely to be realised.

For our demand constraint scenarios, we were agnostic to the method by which this could be achieved (carbon pricing, ticket taxes, capacity constraints etc) but included two plausible scenarios of 40 per cent and zero demand growth based on 2005 levels. For the 40 per cent growth scenario, we capped demand in 2050 at 40 per cent of 2005 levels and lowered the trajectory of demand growth between 2020 and 2050 to fit this. The zero demand growth scenario required an overall decrease in aviation demand as current demand is already above 2005. Although this scenario is less likely, we feel it is still plausible especially considering the possibility of cultural shifts, combined with ambitious government policy.

During the modelling we made a number of assumptions which do not accurately reflect market forces (for example, penetration of SAF into the fuels market is unlikely to be linear). However, we consider that these are acceptable when the goal is to achieve decadal estimates of emissions. Furthermore, given the sensitivities in modelling demand (± 15% according to DfT) the absolute values should be treated with caution whereas the direction and relative speed of change are more important to understand the likelihood of meeting our obligations under the Paris Agreement.