Further support to the preparation of an Impact Assessment on Revision of the EU Emission Trading System Directive 2003/87/EC concerning aviation

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1 Assessing the economic, social and environmental impacts of the different policy options – COVID19 scenarios

This document is an update to the 2020 impact assessment of potential interactions between the EU ETS and CORSIA[1]. Because the modelling in the initial impact assessment was undertaken in early 2020, it was not possible to include the impact of the COVID19 pandemic. This document contains the aviation sector modelling figures and tables from the original report with an additional demand growth scenario with includes the impact of the COVID19 pandemic. It is intended to be read as a companion document to the initial impact assessment; the discussion in this report only refers to the ways that the pandemic and other recent developments (e.g., increased CORSIA participation) affect the outcomes. Only figures and tables which are affected by the additional scenario are included. Where uncertainty ranges are given for the new scenario, these include the impact of uncertainty in variables other than demand growth scenario only (i.e. oil price, aircraft technology, carbon price, CORSIA participation). The modelled policy options are unchanged (other than that the EU ETS intra-EEA/EFTA aviation cap is adjusted downwards to take account of more recent calculations, as discussed below).

Since the original model runs, a number of updates have been made to the AIM2015 model (including those necessary to model the impact of COVID19). These updates may also have small impacts on the outcomes:

- A more detailed assignment of unscheduled passenger flights and flights on low-demand routes is used; this slightly increases European international flight totals.
- A lag is applied to oil price trends to simulate the impact of fuel price hedging. For smooth oil price trends only small impacts are anticipated. Where there are large fluctuations in oil price the main impact is to extend and smooth out impacts (e.g., improving modelling of the 2015-2018 period which follows a large oil price fall).
- Freight modelling is integrated into the main calculation rather than applied as a postprocessing step. As air freight demand has been less-affected by COVID19 than air passenger demand, freighter flights make up a larger proportion of total demand during the pandemic period.
- The end of production and phasing out of use of the Very Large Aircraft size class (e.g. Boeing 747, Airbus A380) is modelled in more detail. In test runs, this had only a limited impact (<0.3%) on overall long-term CO_2/RPK.
- COVID19-related movement restrictions have been associated with both a decrease in passenger numbers and a decrease in aircraft load factor. Damping factors on domestic and international passenger and freight demand are applied to simulate movement restrictions in the immediate pandemic and recovery period. Using data from IATA (2020)[2], typical observed reductions in load factor for a given reduction in passenger demand are also applied over this period. This means that the number of passenger flights decreases less over this time period than the number of passengers.

Although the same cost curves for biofuel and technology characteristics are used as in the original report, biofuel uptake is generally lower. This is because fossil Jet A prices are lower (due to lower oil price projections), and effective carbon prices are typically lower (because a smaller proportion of emissions are above the EU ETS and CORSIA

[1] EC, 2020. Assessment of ICAO's global market-based measure (CORSIA) pursuant to Article 28b and for studying cost pass-through pursuant to Article 3d of the EU ETS Directive.

[2] E.g. IATA, 2020. Economic Performance of the Airline Industry. https://www.iata.org/en/iata-repository/publications/economic-reports/airline-industry-economic-performance---november-2020---report/

baselines). In many cases the combination of these impacts moves back the point at which biofuel becomes cost-competitive with fossil Jet A to after 2035.

The pandemic has had many impacts on aviation, both on shorter and longer timescales and on a variety of geographic scopes. Future developments are highly uncertain and depend on currently unknown factors (for example, whether COVID19 variants arise for which vaccine adjustments would be needed and whether there are long-term changes in business travel behaviour). Modelling projections are necessarily highly uncertain and in particular outcomes in 2020 and 2021 are subject to high uncertainty.

1.1 Caps for each policy option

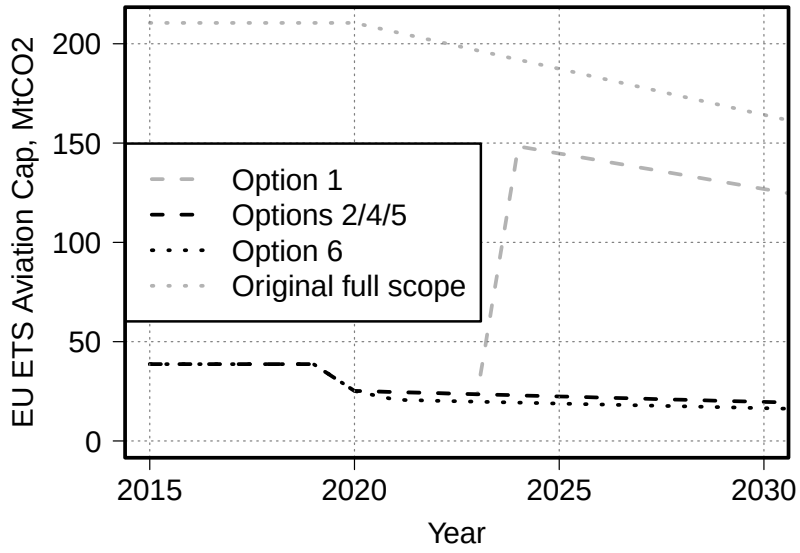

Figure 1. Caps with time to 2030 under different assumed policy options.

Since the original assessment, more recent calculations of the effective intra-EEA/EFTA EU ETS aviation cap once the UK has been removed[3] and Switzerland added have become available (around 25.2 Mt). These are slightly lower than the original estimates used, and the COVID19-adjusted runs use these more recent estimates. The figure above includes these estimates. For policy options 1 and 6 we keep the original cap estimates from the previous report (162.6 Mt, and 21.2 Mt).

1.2 Population, GDP and demand growth

Intra- and extra-EU passenger RPK demand growth rates for the COVID19-adjusted model runs are derived from updated commission projections of aviation demand. For freight demand growth, and demand growth in other world regions, we generate demand projections using an adjusted version of the global GDP and population projections used in the original impact assessment, with the country-level socioeconomic impact of the pandemic included directly via commission projections (for EU27 countries) or estimated from IMF October 2020 projections (for other countries)[4]. In general, during the pandemic period the number of flights, passengers, RPK and FTK have decreased by different amounts, as freight demand is less-affected by movement restrictions and passenger load factors have decreased. There are also some differences

[3] The fact that flights departing from the EEA to the UK would be included in the EU ETS from 1 January 2021 was not known at the time of the definition of the updated model. Whilst this development will increase EU ETS coverage under policy options 2 and 4-6, it is not expected to alter the ranking of the different policy options in terms of global CO_2 reductions.

[4] IMF, 2020. World Economic Outlook, October 2020. https://www.imf.org/en/Publications/WEO/Issues/2020/09/30/world-economic-outlook-october-2020.

between different projections and datasets regarding exactly how much RPK demand in 2020 has reduced below year-2019 values on different geographic scopes. However, these will have relatively little impact on long-term outcomes. Only one COVID19-adjusted demand scenario is used. The figures and tables below show the original model runs with no policy applied and the corresponding COVID19-adjusted model runs[5]. Because different projections use different definitions of Europe, only growth rates are comparable between different European projections. The AIM model runs shown on these plots are on an EEA/EFTA basis excluding the UK.

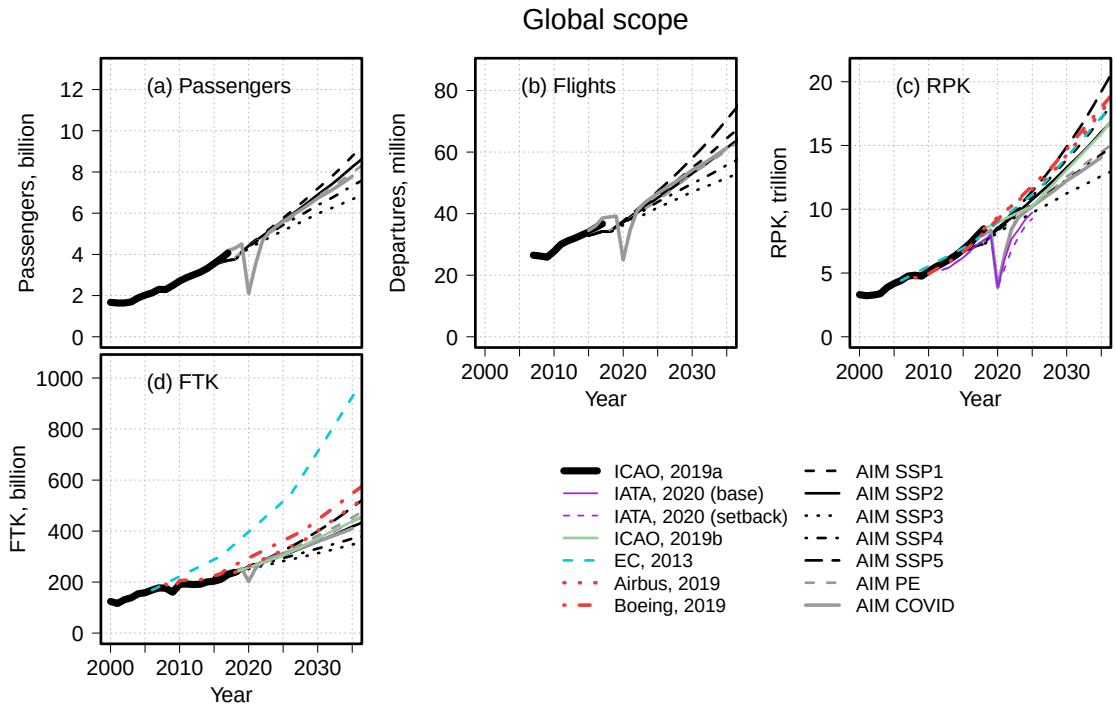

Figure 2. Historical scenarios and future projections on a global scope to 2035, including sample AIM runs.

[5] Note that the COVID19-adjusted model runs also include some changes in modelling the 2015-2019 period which more closely capture the rapid demand growth during this period, as discussed above. This means that COVID19-related demand decreases are from a slightly higher baseline than in the previous model runs. The combined result of this effect and the pandemic is long-term global demand trends which are relatively close to those in the previous impact assessment.

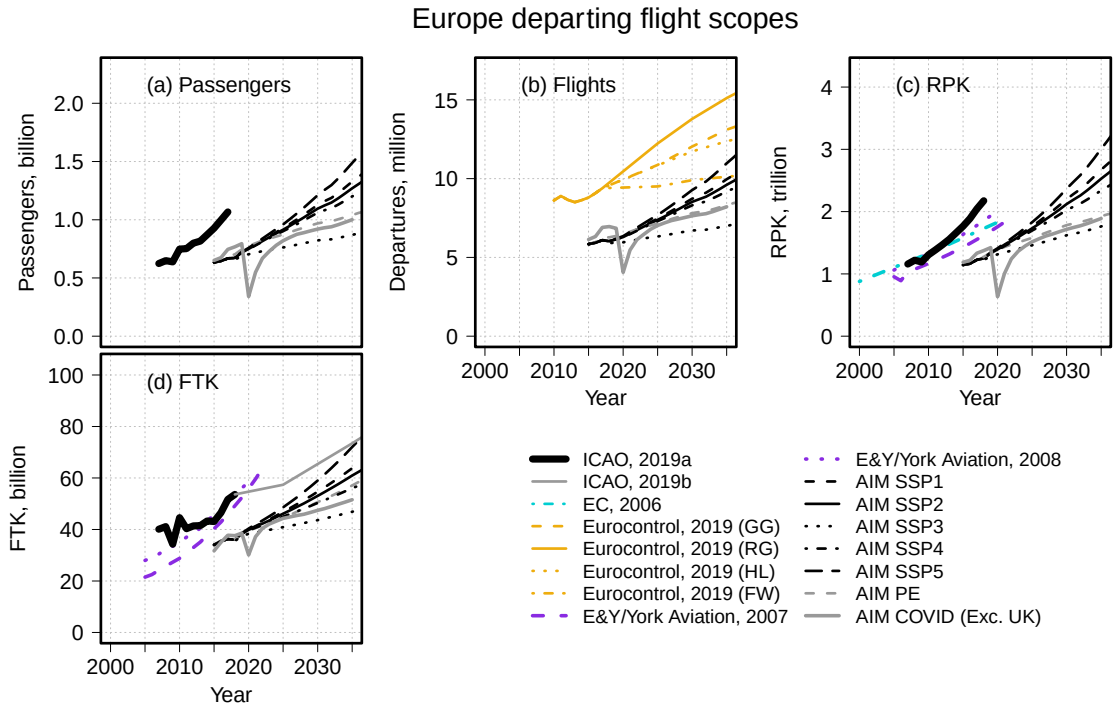

Figure 3. Historical scenario and future projections on extra-Europe (departing flights) scopes. Note that different projections and databases use different definitions of Europe; AIM outputs shown here are on an EEA/EFTA basis excluding the UK.

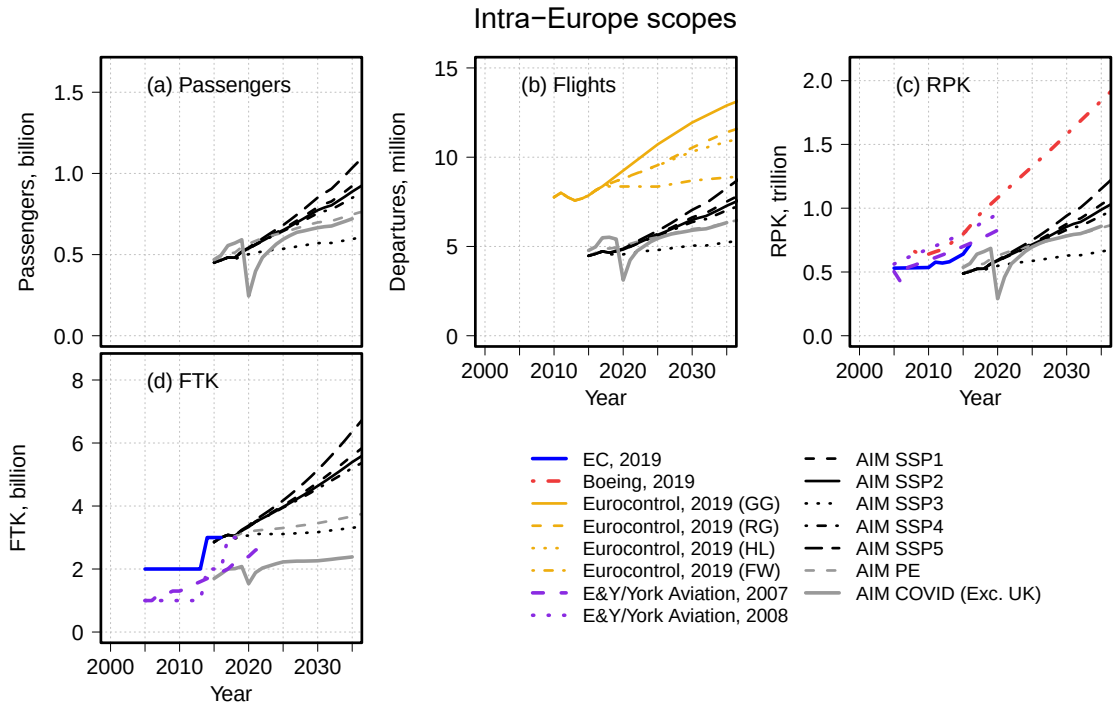

Figure 4. Historical scenario and future projections on intra-Europe scopes. Note that different projections and databases use different definitions of Europe.

A summary of the RTK growth rates and other key metrics for these scenarios is given in Table 1 for the case where no carbon price is applied. These include passenger RPK (at an assumed weight per passenger with luggage of 100kg), hold freight and freight RTK in dedicated freighter aircraft. Because these model runs assume no carbon price, growth rates are slightly higher than those in the Commission-supplied projections they

are based on (which are assumed to be at baseline carbon prices as discussed below). Other uncertain scenario variables are included at COVID19-adjusted nominal values, as discussed below; in particular, this includes lower oil prices than in the previous impact assessment.

Table 1. RTK demand growth by scenario assuming no carbon price and other uncertain scenario variables at nominal values, for global, intra-Europe (EU/EFTA, excluding UK) and extra-European route groups.

Scenario	**Average annual growth rate, 2015-2030, %**			**Average annual growth rate, 2030-2035, %**		
	Global	Extra-EU/EFTA	Intra-EU/EFTA	Global	Extra-EU/EFTA	Intra-EU/EFTA
Number of Passengers						
High (SSP2)	4.5	3.9	3.7	3.6	3.5	2.8
Nominal (PE)	4.4	2.7	2.9	3.2	1.7	1.3
Low (SSP3)	3.6	2.2	1.6	2.3	1.7	0.9
Covid-adjusted	4.1	2.2	2.4	3.0	1.9	1.6
Number of Flights						
High (SSP2)	3.2	2.7	2.5	3.0	2.8	2.3
Nominal (PE)	3.2	2.0	1.9	2.7	1.6	1.2
Low (SSP3)	2.4	1.3	0.8	1.9	1.3	0.7
Covid-adjusted	3.0	1.6	1.4	2.5	1.7	1.4
RPK						
High (SSP2)	4.6	4.5	3.8	3.8	4.0	2.9
Nominal (PE)	4.2	2.8	3.1	2.9	1.6	1.5
Low (SSP3)	3.5	2.7	1.7	2.3	2.1	1.0
Covid-adjusted	3.9	2.4	2.5	2.8	2.0	1.9
FTK						
High (SSP2)	3.4	3.0	3.3	3.1	2.8	3.1
Nominal (PE)	3.8	2.8	1.3	3.4	2.5	1.2
Low (SSP3)	2.5	1.8	0.7	2.1	1.5	0.8
Covid-adjusted	3.8	2.8	1.9	2.6	1.7	1.1
RTK (freight + passenger)						
High (SSP2)	4.3	4.0	3.7	3.7	3.7	2.9
Nominal (PE)	4.1	2.8	3.0	3.0	1.9	1.5
Low (SSP3)	3.2	2.5	1.6	2.3	1.9	1.0
Covid-adjusted	3.9	2.5	2.5	2.8	1.9	1.9

1.3 Oil prices

The tables and figures in this section show the high, nominal and low long-term oil price scenarios assumed in the original report, and updated ones including an estimate of the impact of COVID19. The impact of Covid19 is included via a combination of scenarios supplied via the Commission, and literature estimates of the impact of Covid19 on oil

prices during the pandemic recovery period (e.g. EIA, 2020; IMF, 2020)[6]. The upper and lower oil price scenarios assume the same long-term trends as in the original report, but are adjusted for the impact of Covid19 during the 2020-2025 period.

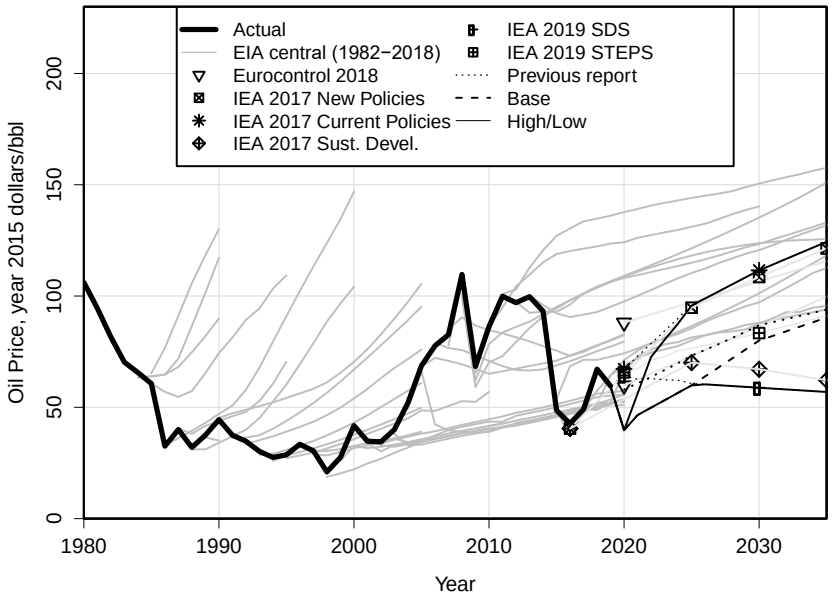

Figure 5. Variation of oil price projections over time, in comparison to actual oil price developments.

The main difference with the previous scenarios used is that oil prices during the pandemic recovery period are lower in all cases, and for the nominal scenario they remain lower than previously projected throughout the entire modelled period to 2035. In the absence of any other changes, this will lower airline fuel costs relative to other cost sources (after an initial period in which these costs are strongly affected by fuel price hedging), and make the uptake of alternative fuels lower and/or later.

Table 2. Assumptions about oil price used for the high, nominal, and low scenarios with covid adjustment. Values in the previous impact assessment are shown in brackets (where different).

Scenario	Oil price, year 2015 US dollars				
	2015	**2020**	**2025**	**2030**	**2035**
Covid-adjusted High	52	40 (67)	96	108	124
Covid-adjusted Nominal	52	40 (58)	60 (73)	80 (87)	90 (94)
Covid-adjusted Low	52	40 (58)	60 (61)	59	57

1.4 Carbon Prices

COVID-19 adjusted assumptions for carbon price, compared to the original project assumptions, are given below. The scenarios Base, Ia, Ib, IIa and IIb were provided by DG CLIMA for the original project.

[6] EIA, 2020. Short-term energy outlook. https://www.eia.gov/outlooks/steo/; IMF, 2020. World Economic Outlook, October 2020. https://www.imf.org/en/Publications/WEO/Issues/2020/09/30/ world-economic-outlook-october-2020.

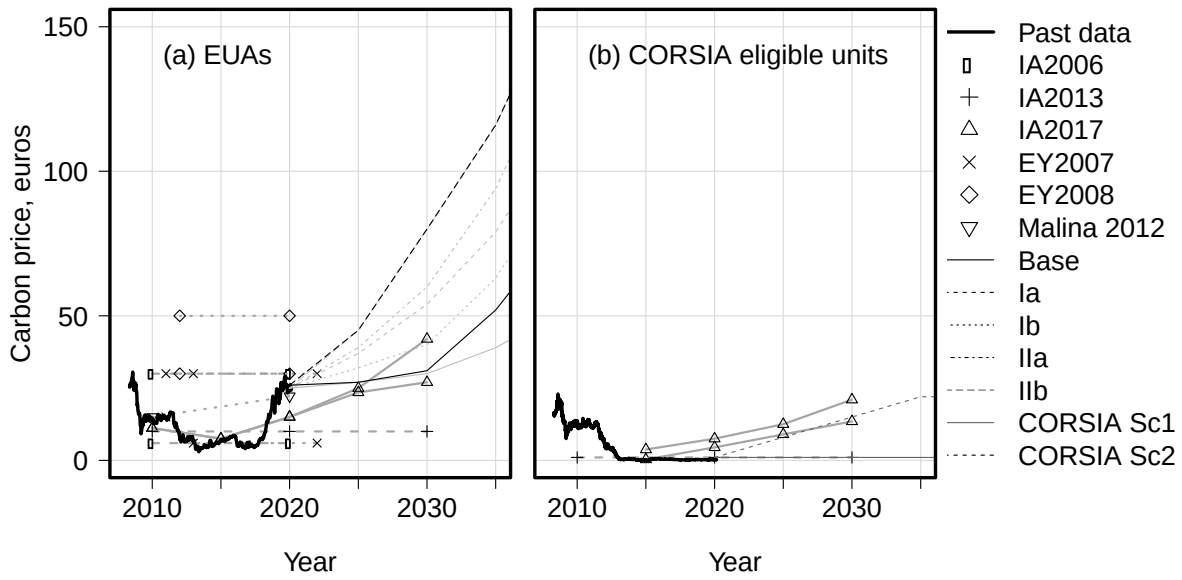

Figure 6. Historical EUA and CER prices, in comparison to assumptions in the literature and past impact assessments. The previous versions of carbon price trends Base, and IIb used in the original impact assessment are shown in grey.

For this project, we use an updated base scenario provided by DG CLIMA. For the upper scenario, we use the IIb scenario as used previously, but slightly adjust the year-2020 carbon price to reflect more recent data. The base and upper scenario values are shown in black, with values from the previous impact assessment shown in grey. CORSIA Sc1 and Sc2 are derived from the analysis in the original impact assessment of likely CORSIA eligible emissions unit prices and remain the same as in that assessment.

The main difference with the previous scenarios is that carbon prices in the nominal case are higher after 2035. The extent to which this affects airline carbon costs will depend on changes in demand, as these costs only apply to aircraft emissions covered by auctioned EUAAs and EUAs purchased from other sectors.

Table 3. Carbon price assumptions by scenario and allowance type.

Scenario	Carbon price, year 2018 euros				
	2015	**2020**	**2025**	**2030**	**2035**
EUA Base (old nominal)	7.7	26	28	31	40
EUA IIb	7.7	26	47	83	120
EUA Base COVID19 (new nominal)	7.7	26	27	31	52
EUA IIb COVID19	7.7	26	47	83	120
CORSIA Sc1 (nominal)	0.2	1	1	1	1
CORSIA Sc2	0.2	1	5	13	22

1.5 Technology assumptions

The same assumptions about technology developments in new aircraft are assumed as in the original project. Because demand growth has changed, the number of new aircraft coming into the fleet has also changed, and this affects how the average CO_2/RPK of the whole fleet evolves. Additionally, during the pandemic, it is assumed that aircraft are

operated at lower load factors (with typical change in load factor taken from IATA estimates of year-2020 values). This temporarily increases CO_2/RPK. An updated figure for CO_2/RPK using the COVID19-adjusted scenario developments is shown below.

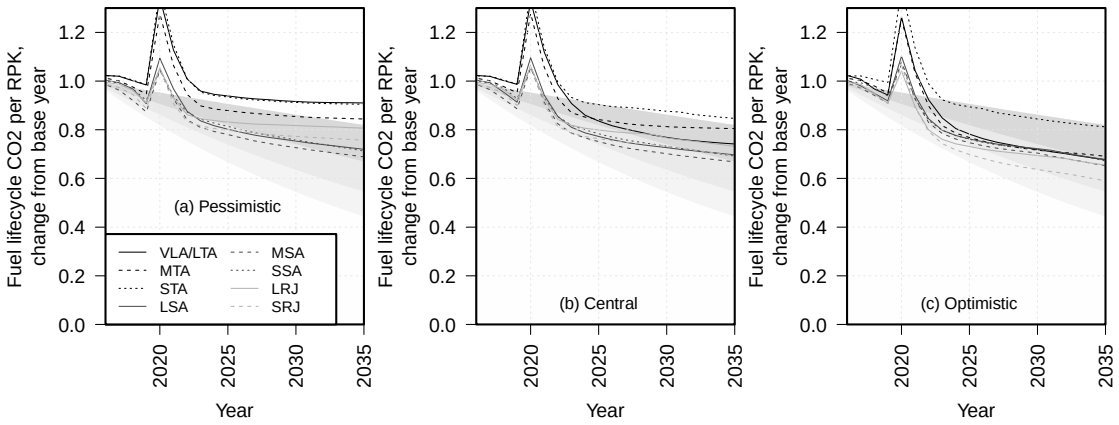

Figure 7. Development of fuel lifecycle CO_2/RPK by technology lens, under nominal assumptions for other parameters. Note that STA (small twin aisle) aircraft have a slower rate of improvement because the base year fleet is already very fuel-efficient. Changes during the pandemic period are approximate and arise from (often significantly) reduced load factors.

1.6 Participation

Participation scenarios have been updated from those used in the original report, using ICAO's most recent list of participating states[7]. At the time of the original report, 81 states had volunteered to participate in the pilot and first stages of CORSIA. In December 2020, at the time of this update, 88 states were listed; the additional 7 states are Afghanistan, Benin, Côte d'Ivoire, Honduras, Kazakhstan, Madagascar and Rwanda. These states account for relatively small fractions of global aviation RPK[8] and their participation is not expected to change outcomes significantly.

- High participation consists of 88 States listed by ICAO on its website by December 2020, plus (from 2027) China, India, Brazil, Russia and Vietnam;
- Initial assumed participation (nominal) participation consists of the 88 States listed by ICAO on its website by December 2020 throughout all CORSIA phases;
- Low participation assumes additionally that the United States will not participate in any phase of CORSIA[9].

1.7 Assumptions for other sensitivity cases

Additional sensitivity runs are carried out using the COVID19-adjusted demand scenarios. These sensitivity runs are the same as those carried out for the original report, i.e.:

- Testing the impact of variants of the main six policy options, as discussed in Annex 1. This includes variant versions of the main policies with different treatment of outermost region routes, and consideration of Option 1 including

[7] ICAO, 2020. CORSIA states for Chapter 3 Pairs. https://www.icao.int/environmental-protection/CORSIA/Documents/CORSIA_States_for_Chapter3_State_Pairs_Jul2020.pdf

[8] For example Kazakhstan, which has the most aviation activity of the additional states, is responsible for under 0.2% of global scheduled RTK according to ICAO's 2018 global aviation statistics on an airline-of-origin basis. However, as discussed in the original report, participation in CORSIA adds all flights between a given country and other participating countries to the scheme's scope, so overall impacts may be above this level.

[9] As discussed in the original report, this would imply a withdrawal from current intentions to participate, assumed motivated by the ongoing non-participation of other large states.

only departing extra-EU/EFTA flights, rather than all extra-EU/EFTA flights, in the EU ETS. Here we test each variant with nominal inputs for all scenario variables against the equivalent main-variant policy.

- For higher environmental integrity credits in CORSIA, we use a range of CER prices between CER scenario 1 and EUA base, as discussed in Annex 1.
- For allowance allocation, we run Options 1, 2, 4, 5 and 6 with the following options for changes in auctioning:
  - Status quo: The current legal situation is perpetuated until 2030, i.e. the 15% auctioning share.
  - Immediate phase-out: 100% auctioning from the entry into force of the revision.
  - Swift phase-out: Full auctioning by 2025, starting with an auctioning share of 60% in 2023, and a share of 80% in 2024.
  - Slow phase-out: A linear increase year-by-year to full auctioning by 2030 starting from 20% in 2023.
  - Slow reduction: A linear increase year-by-year starting with an auctioning share of 20% in 2023 and ending at 55% in 2030.

This is discussed in Section 1.8.11.

1.8 Aviation sector results

1.8.1 Summary of COVID19-adjusted Aviation Sector Modelling Findings

Aviation sector modelling comparing the impact on a range of different metrics of the different policy options is discussed in detail in Sections 1.8.2-1.8.11. This section briefly summarises the outcomes. A comparison of metrics related to airline costs, demand and global direct (i.e. as emitted from aircraft engines) and net (i.e. adjusted for biofuel use, allowances and offsets) CO_2 is given below. Broadly, relative outcomes are similar to those in the non COVID19 case[10]. The lower projected demand growth means that both policies have a smaller impact that previously anticipated, but this is offset to various extents by changes in assumptions about scheme specifications (the change in baseline and increased participation for CORSIA, and slightly reduced cap assumptions for the EU ETS). Lower oil prices also decrease use of alternative fuels, leading to a smaller role for biofuel exemptions.

One effect of COVID19 does need extra explanation, however. CORSIA offset requirements are based on a combination of individual and sectoral offset requirements[11]. Under sectoral offset requirements, all participating airlines offset CO_2 based on the aggregate growth in CO_2 across all CORSIA-eligible routes above the baseline. Under individual offset requirements, an operator offsets their own growth above their own baseline emissions. Offset requirements are 100% Sectoral before 2030 and then are anticipated to transition to 70% Individual by 2035. For example, in the immediate aftermath of the pandemic, because 100% Sectoral offset requirements apply, no airline needs to make offsets whilst global CO_2 on CORSIA-eligible routes remains below the year-2019 baseline. This means that including groups of routes that are slow-growing and/or particularly hard-hit by COVID19 in CORSIA acts to make the

[10] Note that, although intra-EU/EFTA net CO_2 for Option 1 is slightly higher than in the original report, this is balanced out by a larger reduction in extra-EU/EFTA net CO_2 (i.e., the same cap is used as in the initial report but this cap applies to the sum of intra- and extra-EU/EFTA CO_2 and, for these model runs, more of the corresponding reductions in net CO_2 are accounted for on extra-EU/EFTA routes). This arises from slightly different distributions of underlying demand.

[11] E.g. ICAO, 2019; https://www.icao.int/environmental-protection/pages/a39_corsia_faq2.aspx

scheme less effective in 2030, although these effects largely disappear by 2035 due to the transition to Individual requirements and further recovery from the pandemic. For example, the main difference between Policy Options 2 and 4 is that CORSIA covers routes to and from the EU/EFTA region in Option 4, whereas these routes are not covered by either scheme in Option 2. However, because these routes are strongly-affected by COVID19 and are slow-growing, one impact of including them is to reduce global Sectoral offset requirements (i.e. including these flights makes the CORSIA baseline higher and growth above the baseline relatively smaller). The net result is that more CO_2 is offset in CORSIA under nominal scenario conditions under Option 2 than Option 4 until 2032, even though the scope of the scheme is smaller. Similarly, Option 5 introduces another slow-growing group of routes (intra-EU/EFTA international flights) to CORSIA scope, further reducing Sectoral offset requirements. This effect can make 2030 outcomes can seem counter-intuitive, with policy options which have greater CORSIA coverage having fewer offsets, and the different Policy Options may rank differently in terms of global net CO_2 in 2030 and 2035. In this case, 2035 outcomes and ranking are more representative of how the schemes would continue to interact post-2035 (assuming no specification changes).

The distinction between Sectoral and Individual offset requirements also means that, where Sectoral requirements apply, airlines in slow-growing regions have higher CORSIA offset requirements than would be expected based on their own growth, and airlines in fast-growing regions have lower requirements. For example, as intra-EU/EFTA flights are relatively slow-growing, applying CORSIA to them (as in Option 5) with a partly Sectoral offset requirement can lead to lower net intra-EU/EFTA emissions than the case where the EU ETS is applied to those emissions instead (as in Option 4). This difference is made up for by a relatively lower CORSIA requirement elsewhere, i.e. it relates only to accounting applying to global sub-regions.

The table below gives output metrics for model runs carried out with the COVID19-adjusted demand scenario only, i.e. uncertainty ranges are less wide than those in the original report because they refer to uncertainty in non-baseline demand variables only.

Table 4. Comparison of estimated airline costs, ticket prices, RTK demand and direct and net aviation CO_2 by policy option. Values in larger font indicate outputs when all uncertain input variables are set to nominal values. Values in brackets indicate ranges due to changes in uncertain input variables. Direct CO_2 includes all CO_2 emitted by aircraft engines. Net CO_2 totals are adjusted to account for offsets, allowances and alternative fuel use, and assume CORSIA offsets are of high quality. EU/EFTA totals include Switzerland and exclude the UK.

Policy option	Carbon costs as a percentage of airline operating cost, intra-EU/EFTA		Carbon costs as a percentage of airline operating cost, extra-EU/EFTA		Avg. one-way fare, intra-EU/EFTA, €2018		Avg. one-way fare, extra-EU/EFTA, €2018		RTK on intra-EU/EFTA routes, billion	
	2030	**2035**	**2030**	**2035**	**2030**	**2035**	**2030**	**2035**	**2030**	**2035**
Option 1	0.9 (0.8-3.3)	1.6 (1.3-5.1)	1.8 (1.5-6.9)	3.2 (2.4-10.6)	148.0 (143-158)	153.4 (145-164)	332.2 (320-353)	341.8 (324-365)	79.9 (74.2-83.4)	87.1 (80.6-93.1)
Option 2	1.0 (0.9-3.3)	1.6 (1.3-4.8)	0.0 (0.0-0.0)	0.0 (0.0-0.0)	148.1 (143-158)	153.4 (145-164)	330.2 (318-346)	338.0 (320-354)	80.0 (74.6-83.5)	87.4 (81.3-93.4)

Option 3	0.005 (0.0-0.2)	0.004 (0.0-0.2)	0.01 (0.0-0.5)	0.01 (0.0-0.8)	147.1 (142-155)	151.7 (143-159)	330.1 (318-346)	337.9 (320-354)	80.5 (75.8-84.0)	88.3 (83.4-94.3)
Option 4	1.0 (0.9-3.3)	1.6 (1.3-4.8)	0.01 (0.0-0.6)	0.01 (0.0-0.8)	148.1 (143-158)	153.4 (145-164)	330.2 (318-346)	338.0 (320-354)	80.0 (74.5-83.5)	87.4 (81.3-93.4)
Option 5	0.9 (0.7-3.4)	1.5 (1.3-4.6)	0.01 (0.0-0.5)	0.01 (0.0-0.8)	148.1 (143-158)	153.4 (145-164)	330.2 (318-346)	338.0 (320-354)	80.0 (74.5-83.5)	87.4 (81.3-93.4)
Option 6	0.8 (0.7-2.6)	1.3 (1.0-3.8)	0.01 (0.0-0.6)	0.01 (0.0-0.8)	147.8 (142-157)	153.0 (144-162)	330.2 (318-346)	338.0 (320-354)	80.1 (74.8-83.6)	87.6 (81.7-93.6)

Policy option	**RTK on extra-EU/EFTA routes, billion**		**Global direct aviation CO_2 emissions, Mt**		**Global net aviation CO_2 emissions, Mt**		**Intra-EU/EFTA direct aviation CO_2 emissions, Mt**		**Intra-EU/EFTA net aviation CO_2 emissions, Mt**	
	2030	**2035**	**2030**	**2035**	**2030**	**2035**	**2030**	**2035**	**2030**	**2035**
Option 1	273.8 (252-288)	298.1 (271-319)	1077 (965-1206)	1196 (1053-1400)	918 (824-1022)	998 (835-1154)	52.4 (48.5-55.8)	54.0 (49.3-58.8)	29.5 (28.3-30.5)	24.9 (23.7-26.0)
Option 2	276.9 (261-291)	304.3 (286-326)	1079 (969-1209)	1200 (1059-1406)	992 (882-1120)	1099 (913-1288)	52.5 (48.6-55.9)	54.2 (49.5-59.1)	27.0 (26.6-27.7)	24.8 (24.2-25.8)
Option 3	277.0 (261-291)	304.3 (286-326)	1079 (970-1210)	1201 (1061-1407)	1047 (948-1151)	1125 (944-1299)	52.7 (49.3-56.2)	54.7 (50.5-59.7)	49.2 (45.5-49.7)	51.6 (46.9-53.0)
Option 4	276.9 (260-291)	304.2 (285-326)	1079 (969-1209)	1200 (1059-1406)	1003 (905-1108)	1091 (913-1264)	52.5 (48.6-55.9)	54.2 (49.5-59.1)	27.0 (26.6-27.7)	24.8 (24.2-25.8)
Option 5	276.9 (261-291)	304.2 (286-326)	1079 (970-1209)	1200 (1059-1407)	1022 (926-1124)	1097 (920-1269)	52.5 (48.6-55.9)	54.2 (49.5-59.1)	23.9 (18.1-26.7)	23.1 (22.1-24.2)
Option 6	276.9 (260-291)	304.3 (286-326)	1079 (969-1209)	1200 (1060-1407)	1010 (910-1114)	1098 (919-1272)	52.5 (48.8-56.0)	54.3 (49.7-59.2)	32.2 (31.2-33.3)	30.8 (29.0-32.5)

1.8.2 CORSIA coverage

Estimates of CORSIA coverage of global international CO_2 by policy option, for the COVID19-adjusted demand scenario only, are given below. Uncertainty ranges refer to uncertainty in non-demand model inputs (oil price, carbon price, technology characteristics). Factors affecting CORSIA coverage relative to that in the previous impact assessment include decreases in total global demand; differences between route groups in the speed and extent of recovery from the COVID19 pandemic; increased country-level coverage; and the lower (year-2019) baseline. In combination, these factors lead to CORSIA coverage which is similar or slightly higher to that in the original report. However, the amount of CO_2 offset under CORSIA is lower in many cases, particularly where route groups that have been more strongly affected by COVID19 are included.

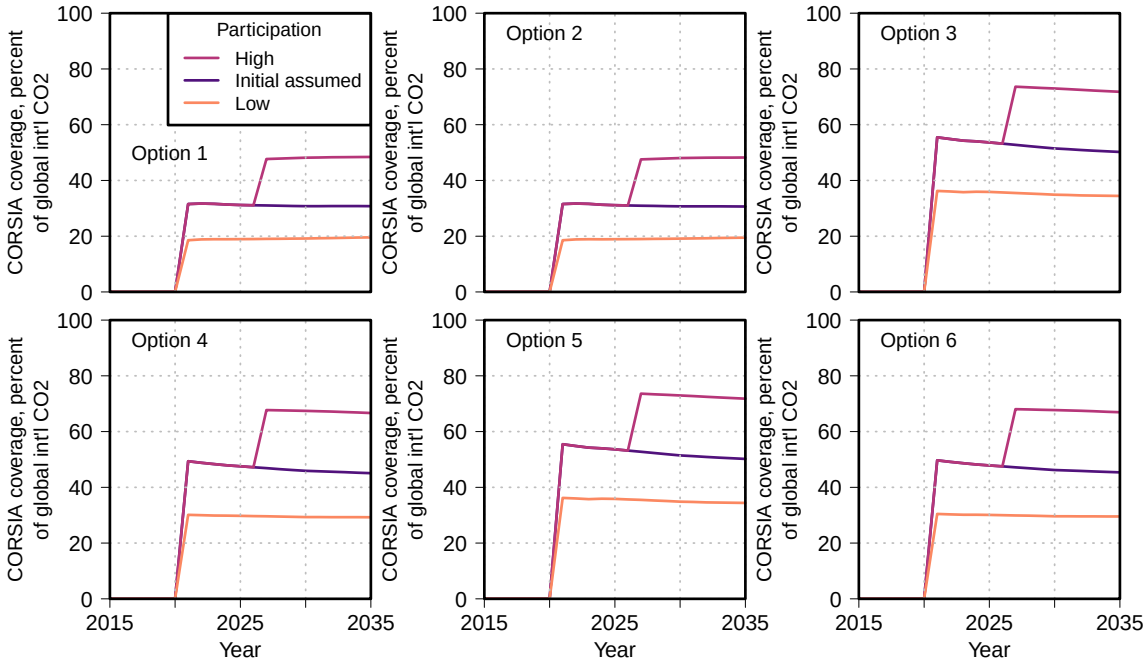

Figure 8. CORSIA coverage of international CO_2 emissions over time, for High, Initial Assumed and Low participation scenarios with all other input values at nominal values (central lines), and background shaded ranges across other values for uncertain variables (not including demand scenario, for which only the COVID19-adjusted case is used; this is why ranges are smaller than in the previous model runs).

Table 5. CORSIA percentage coverage of international aviation CO_2 emissions in 2025, 2030 and 2035, by participation scenario, with the COVID19-adjusted demand scenario and all other input variables set to nominal values. The range of coverage due to variation in other (non-baseline demand) uncertain variables is given in brackets.

Policy option	CORSIA coverage of global international CO_2, Low Participation, %			CORSIA coverage of global international CO_2, Initial Assumed Participation, %			CORSIA coverage of global international CO_2, High Participation, %		
	2025	**2030**	**2035**	**2025**	**2030**	**2035**	**2025**	**2030**	**2035**
Option 1	18.9 (18.6-19.0)	19.2 (18.9-19.4)	19.6 (19.3-19.9)	31.2 (31.0-31.4)	30.8 (30.6-31.2)	30.8 (30.6-31.4)	31.2 (31.0-31.4)	48.2 (47.8-48.8)	48.4 (48.1-49.3)
Option 2	18.9 (18.6-18.9)	19.1 (18.8-19.3)	19.5 (19.2-19.8)	31.1 (30.9-31.2)	30.7 (30.5-31.0)	30.6 (30.5-31.1)	31.1 (30.9-31.2)	48.0 (47.7-48.4)	48.2 (47.9-48.8)
Option 3	35.9 (35.7-36.0)	34.9 (34.4-35.0)	34.4 (33.9-34.7)	53.6 (53.6-54.0)	51.5 (51.2-51.8)	50.2 (49.8-50.6)	53.6 (53.6-54.0)	73.0 (72.8-73.2)	71.8 (71.5-72.0)
Option 4	29.8 (29.7-29.8)	29.3 (29.2-29.4)	29.3 (29.2-29.3)	47.5 (47.5-47.9)	45.9 (45.7-46.2)	45.1 (44.8-45.4)	47.5 (47.5-47.9)	67.4 (67.2-67.7)	66.7 (66.5-67.1)
Option 5	35.9 (35.7-36.0)	34.9 (34.4-35.0)	34.4 (33.8-34.6)	53.6 (53.6-54.0)	51.4 (51.1-51.8)	50.2 (49.7-50.6)	53.6 (53.6-54.0)	73.0 (72.8-73.2)	71.8 (71.5-72.0)

Option 6	30.1 (30.0-30.1)	29.6 (29.5-29.7)	29.5 (29.4-29.6)	47.9 (47.8-48.2)	46.2 (46.0-46.5)	45.4 (45.1-45.7)	47.9 (47.8-48.2)	67.7 (67.5-68.0)	67.0 (66.8-67.3)

1.8.3 EU ETS Coverage

Estimates of EU ETS coverage by policy option, for the COVID19-adjusted demand scenario only, are given below. Uncertainty ranges refer to uncertainty in non-baseline demand model inputs (oil price, carbon price, CORSIA participation, technology characteristics) and so are less wide than those in the original report, which additionally included baseline demand scenarios. Generally, the EU ETS offsets a slightly lower fraction of global aviation CO_2 by 2035 than in the no-COVID19 model runs. This is because smaller fractions of global emissions are above the EU ETS cap (though this is offset by tighter cap assumptions for Options 2, 4 and 5).

Table 6. Modelled direct CO_2 on ETS-covered routes, by policy option at nominal values for uncertain input variables (larger text) and range in values due to variation in non-demand uncertain input variables (values in brackets), 2015, 2025, 2030 and 2035.

Policy option	Direct CO_2 emissions under the EU ETS scope, Mt, for nominal scenario inputs and uncertainty range			
	2015	**2025**	**2030**	**2035**
Option 1	58	213 (195-225)	224 (202-249)	236 (208-269)
Option 2	58	44 (40-45)	45 (42-48)	46 (42-50)
Option 3	58	0 (0-0)	0 (0-0)	0 (0-0)
Option 4	58	44 (40-45)	45 (42-48)	46 (42-50)
Option 5	58	44 (40-45)	45 (42-47)	45 (42-47)
Option 6	58	36 (33-37)	36 (34-38)	37 (34-40)

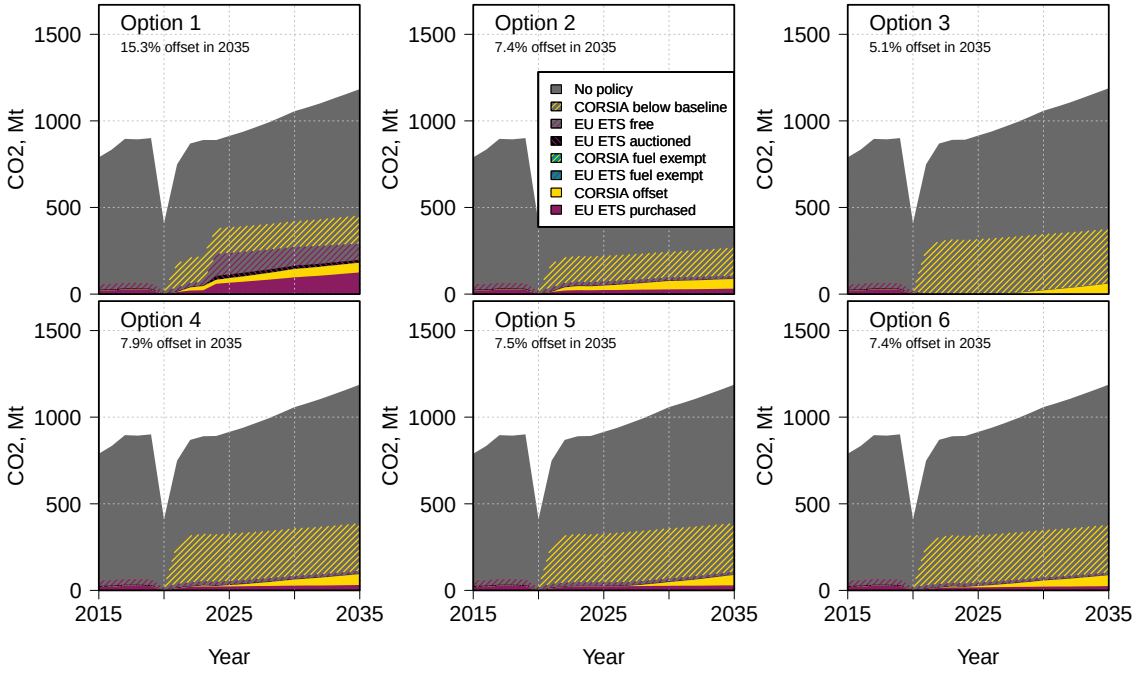

Figure 9. Global aviation CO_2 emission developments to 2035, by type of policy coverage (EU ETS, CORSIA, offset/non-offset, exempt) for all scenario variables at nominal values and Initial Assumed CORSIA participation.

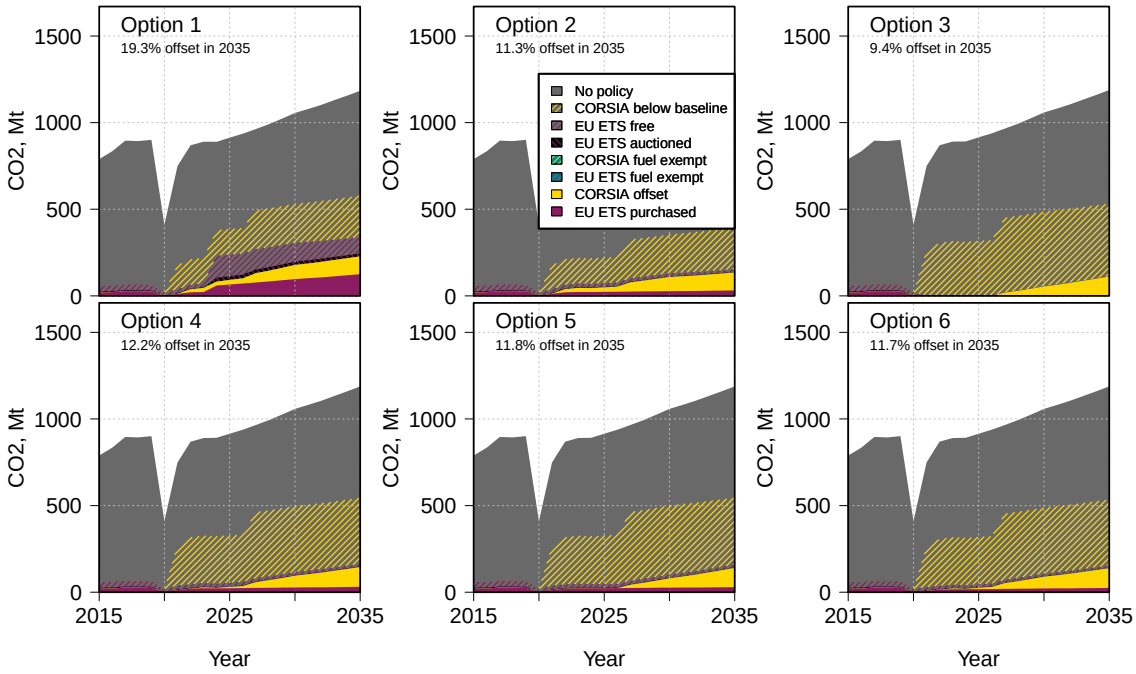

Figure 10. Global aviation CO_2 emission developments to 2035, by type of policy coverage (EU ETS, CORSIA, offset/non-offset, exempt) for all scenario variables at nominal values and High CORSIA participation.

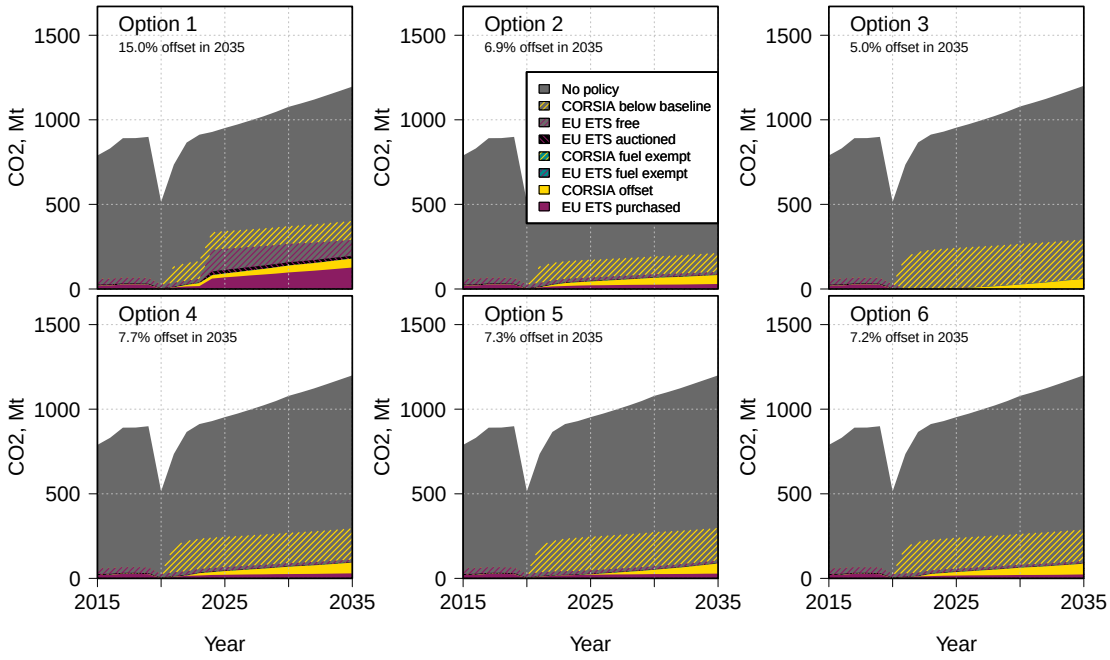

Figure 11. Global aviation CO_2 emission developments to 2035, by type of policy coverage (EU ETS, CORSIA, offset/non-offset, exempt) for all scenario variables at nominal values and Low CORSIA participation.

Because we only run one demand scenario in this update, an updated assessment of CORSIA demand in the High demand scenario is not included.

1.8.4 Demand for CORSIA Offsets

The tables and figures below give demand for CORSIA offsets in the COVID19-adjusted demand scenario, and uncertainty due to variation in other (non-baseline demand) uncertain input variables at Low, Initial Assumed and High participation. As in the original report, offset totals are sensitive to model input assumptions, particularly assumptions about demand growth and technology use.

In general, offset demand is strongly affected by the exact groups of international routes that are included under CORSIA. This applies particularly to the pilot phase. Adding routes that are more strongly affected by COVID19 and/or are slower-growing increases the time period that total emissions on CORSIA routes remain below the baseline and there is no offset requirement. If routes to, from and within the EU/EEA region are included (i.e., Options 3 and 5), average global emissions on CORSIA routes typically do not exceed the CORSIA baseline during the pilot phase, and offset requirements are zero. If routes to and from the EU/EEA region are included (Options 4 and 6), global emissions on CORSIA routes (slightly) exceed the baseline from around 2023, i.e. shortly before the end of the Pilot phase. If only non-EU/EFTA routes are included (Options 1 and 2), there may be non-zero offset requirements from 2022 onwards. Similar effects occur from the different participation scenarios. In particular, as noted above, higher participation during the COVID19 recovery period can lead to lower offset requirements if the increased participation comes from groups of routes that are more strongly affected by COVID19.

Conversely, in some cases (for example, Options 1 and 2 in the Low participation case Pilot phase) projected offset totals are higher than those projected in the non-COVID19 set of model runs; these increases occur where CORSIA participation is dominated by fast-growing aviation systems, and are driven by the slightly lower (2019) baseline and lower oil price assumptions (which both act to increase demand and reduce the amount of CO_2 which is CORSIA-exempt due to biofuel use). Note also that uncertainty ranges for this set of runs also do not include uncertainty in the baseline demand scenario.

Table 7. Demand for CORSIA offsets in the pilot, first and second phases (total demand for full period shown), under nominal scenario assumptions (numbers in larger font) and range due to variations in non-baseline demand uncertain input variables (numbers in brackets).

Policy option	CORSIA offset demand at Low Participation, million			CORSIA offset demand at Initial Assumed Participation, million			CORSIA offset demand at High Participation, million		
	Pilot	**First**	**Second**	**Pilot**	**First**	**Second**	**Pilot**	**First**	**Second**
Nominal scenario assumptions (uncertainty range)									
Option 1	26.5 (9.4-33)	69 (29-93)	378 (213-583)	51 (24-62)	113 (53-155)	547 (303-880)	51 (24-62)	113 (53-155)	941 (546-1450)
Option 2	26.5 (9.4-33)	69 (29-93)	378 (217-583)	51 (24-62)	113 (53-155)	548 (310-882)	51 (24-62)	113 (53-155)	942 (558-1450)
Option 3	0.0 (0.0-0.0)	9.3 (0.0-50)	301 (81-616)	0.0 (0.0-3.4)	9.9 (0.0-76)	375 (79- 867)	0.0 (0.0-3.4)	9.9 (0.0-76)	783 (275-1500)
Option 4	14.8	63	420	12	63	494	12	63	902

Policy option	CORSIA offset demand at Low Participation, million			CORSIA offset demand at Initial Assumed Participation, million			CORSIA offset demand at High Participation, million		
	Pilot	**First**	**Second**	**Pilot**	**First**	**Second**	**Pilot**	**First**	**Second**
	(0.0-26)	(8.3-102)	(202-712)	(0.0-25)	(0.0-127)	(173-962)	(0.0-25)	(0.0-127)	(409-1590)
Option 5	0.0	8.9	299	0.0	9.6	373	0.0	9.6	781
	(0.0-0.0)	(0.0-50)	(78-614)	(0.0-3.1)	(0.0-75)	(78- 865)	(0.0-3.1)	(0.0-75)	(271-1492)
Option 6	13.0	61	416	12	61	491	12	61	898
	(0.0-26)	(6.4-100)	(196-709)	(0.0-23)	(0.0-125)	(168-959)	(0.0-23)	(0.0-125)	(403-1590)

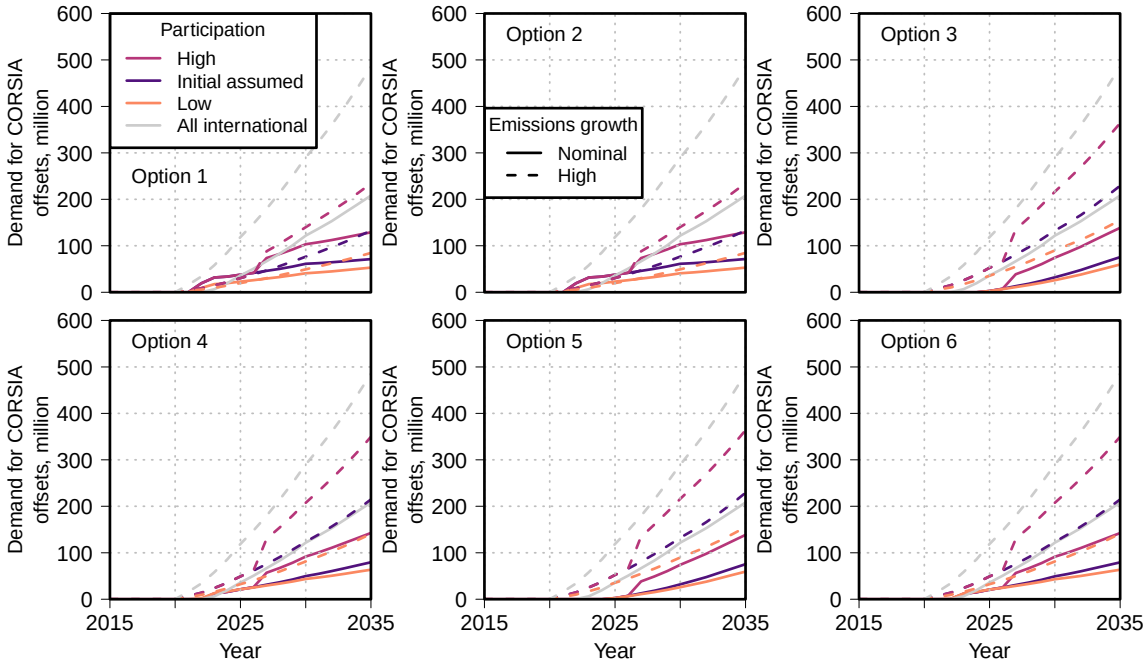

Figure 12. Demand for CORSIA credits by year, policy option and CORSIA participation scenario, for other scenario variables at covid19-adjusted nominal values (solid lines) and at values at the upper end of the uncertainty range for global CO_2 emissions (dashed lines). One credit is equivalent to one tonne of CO_2.

Note here that the unusual circumstances during the pandemic period can mean that there can be a lower offset requirement if participation is 'all international flights' rather than a subset of international flights. This is because the baseline is different for different participation scenarios, and different route groups are projected to come back above the baseline at different times.

1.8.5 Demand for EU ETS allowances

The figures and tables below show demand and revenue for EU ETS allowances in the COVID19-adjusted demand scenario. Note that these totals differ from those in the original report for several reasons: the demand-lowering impact of the COVID19 pandemic; slightly lowered EU ETS aviation cap assumptions; changes in carbon price; and small changes related to model updates. However, in general EUAA-related outcomes are close to those from the original report, reflecting that, provided emissions are over the EU ETS cap, outcomes depend strongly on scheme design assumptions which have not changed substantially. The smaller uncertainty range reflects that only

one baseline demand scenario is run here. EUA-related outcomes mainly reflect lower demand assumptions; for example, Option 5 outcomes are closer to Option 4 than in the previous assessment because a smaller fraction of emissions are above the CORSIA cap. The slightly increased totals for EUA demand for Options 2, 4, and 5 compared to the original report reflect the lower cap EU ETS used, as discussed in Section 1.1.

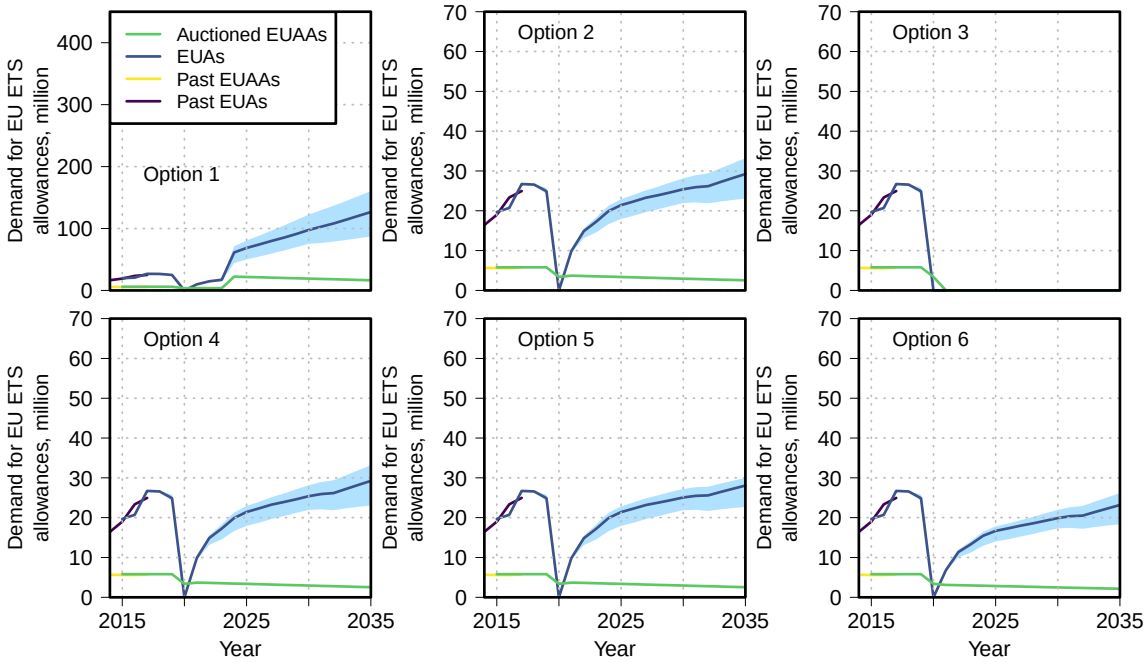

Figure 13. Demand for EUAAs and EUAs purchased by aviation by policy, for uncertain variables set at Coid19-adjusted nominal values (solid lines), and range due to variation in non-baseline demand uncertain input values (background shaded area). NB: A different scale has been used for option 1.

Table 8. Annual demand for auctioned EUAAs from aviation in the EU ETS, and projected revenues, in 2030 and 2035, by policy option at nominal values for uncertain input variables (numbers in larger font) and range due to variations in non-baseline demand uncertain input variables (numbers in brackets)

Policy option	Estimated demand for EUAAs, million			Estimated EUAA auction revenue, million €2018		
	2015	**2030**	**2035**	**2015**	**2030**	**2035**
Option 1	5.8	19.0 (19.0-19.0)	16.3 (16.3-16.3)	36	472 (472-1534)	676 (676-1905)
Option 2	5.8	2.9 (2.9-2.9)	2.5 (2.5-2.5)	36	73 (73-238)	105 (105-295)
Option 3	5.8	0.0 (0-0)	0.0 (0-0)	36	0.0 (0-0)	0.0 (0-0)
Option 4	5.8	2.9 (2.9-2.9)	2.5 (2.5-2.5)	36	73 (73-240)	105 (105-295)
Option 5	5.8	2.9 (2.9-2.9)	2.5 (2.5-2.5)	36	73 (73-240)	105 (105-295)
Option 6	5.8	2.5	2.1	36	62	88

Policy option	Estimated demand for EUAAs, million			Estimated EUAA auction revenue, million €2018		
	2015	**2030**	**2035**	**2015**	**2030**	**2035**
		(2.5-2.5)	(2.1-2.1)		(62-200)	(88-248)

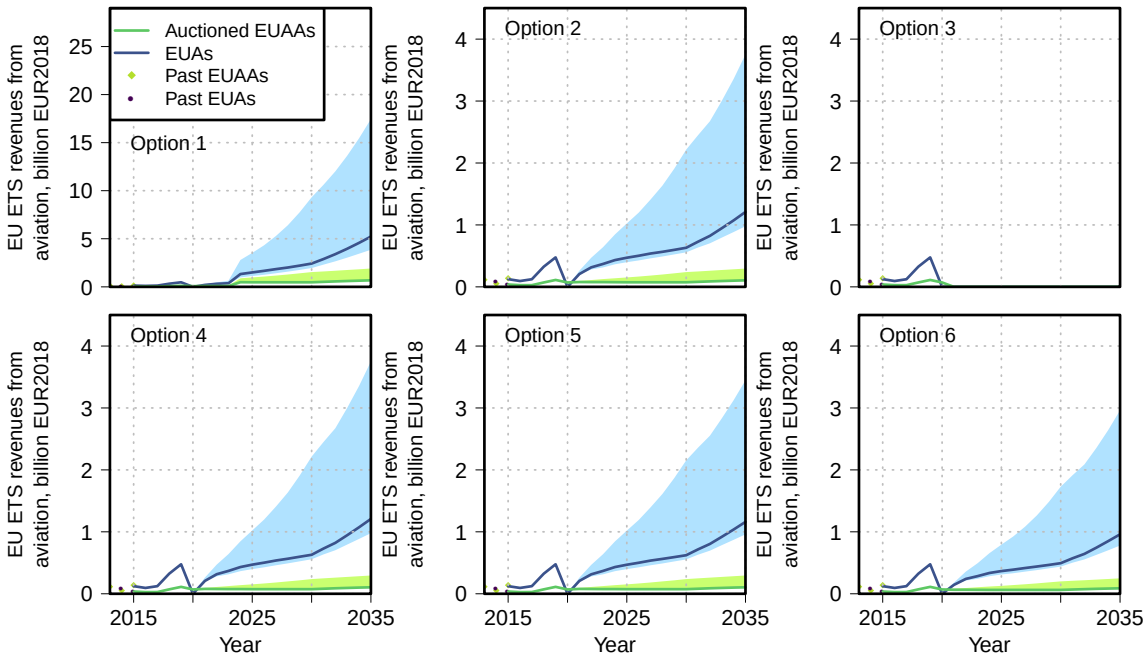

Figure 14. EU ETS auctioning revenue, and revenue to other sectors from aviation purchasing EUAs, by policy, for uncertain variables set at nominal values (solid lines), and range due to variations in non-baseline demand uncertain input variables (shaded areas). NB: A different scale has been used for option 1.

Table 9. Annual demand for EUAs from stationary sectors from aviation in the EU ETS, and projected revenues, in 2030 and 2035, by policy option at nominal values for non-baseline demand uncertain input variables (numbers in larger font) and range due to variations in non-baseline demand uncertain input variables (numbers in brackets). Note that the low and high ends of the EUA demand range and the low and high end of the EUA costs range do not occur in the same model runs.

Policy option	Estimated demand for EUAs by aviation from stationary sectors, million			Estimated amount paid by airlines for EUAs from other sectors, million €2018		
	2015	**2030**	**2035**	**2015**	**2030**	**2035**
Option 1	20	98 (75-122)	127 (87-160)	124	2420 (1960-9310)	5230 (3860-17500)
Option 2	20	25 (22-28)	29 (23-33)	124	630 (557-2220)	1210 (978-3750)
Option 3	20	0 (0-0)	0 (0-0)	124	0 (0-0)	0 (0-0)
Option 4	20	25	29	124	630	1210

Policy option	Estimated demand for EUAs by aviation from stationary sectors, million			Estimated amount paid by airlines for EUAs from other sectors, million €2018		
	2015	**2030**	**2035**	**2015**	**2030**	**2035**
		(22-28)	(23-33)		(557-2220)	(978-3750)
Option 5	20	25	28	124	622	1160
		(22-27)	(23-30)		(554-2150)	(959-3450)
Option 6	20	20	23	124	493	959
		(17-22)	(18-26)		(438-1730)	(778-2960)

1.8.6 Airline Costs

Airline cost impacts by policy in the COVID19-adjusted scenarios are given below. Although amounts of CO_2 emitted above the EU ETS cap and CORSIA baseline are smaller than in the corresponding model runs without COVID19, EU ETS carbon prices in the 2030-2035 period are higher. The net result is that total airline carbon costs are similar to the previous set of runs by 2035, although their geographical distribution is not necessarily the same.

Several factors affect how airline costs have changed compared to the previous set of runs. First, fuel prices are lower and carbon prices higher, particularly after 2030. These act to make carbon price a higher fraction of costs. Second, demand is lower, which acts to reduce carbon costs. In general the balance of these two effects is that carbon costs are a slightly higher fraction of costs than they were in the previous assessment. Additionally, fuel costs in 2015 are slightly higher in this set of model runs as they now take account of fuel price hedging, which led to some airlines paying (higher) year-2014 fuel prices in 2015.

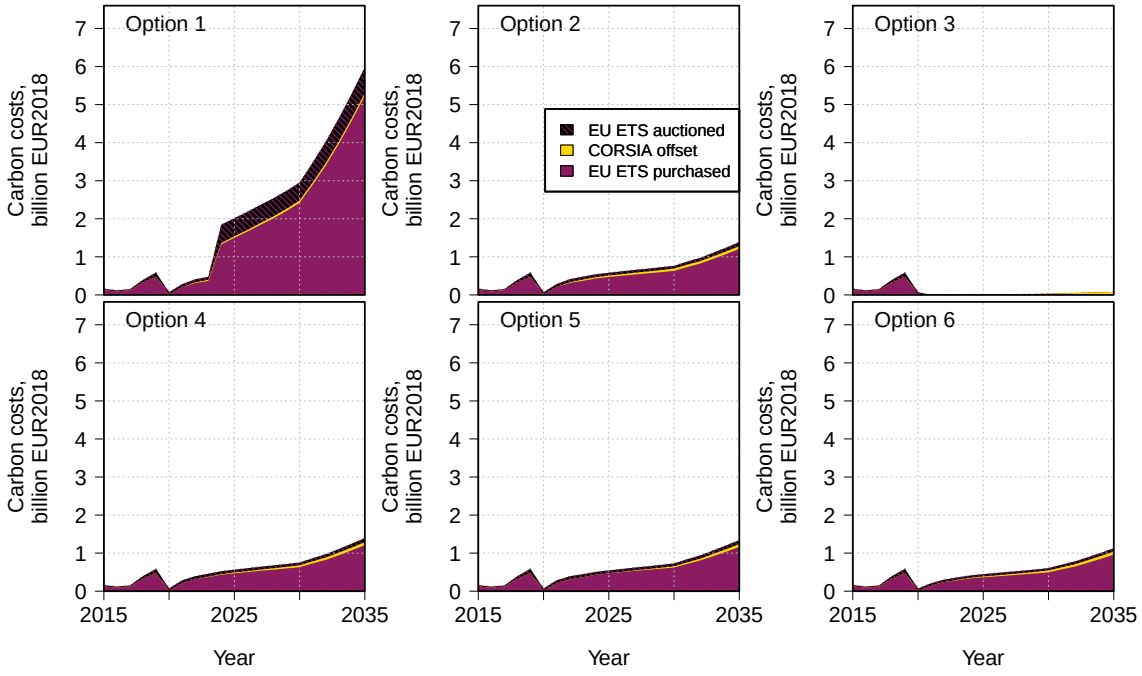

Figure 15. Total global airline carbon costs by policy option, cost type and year, under COVID19-adjusted nominal scenario conditions.

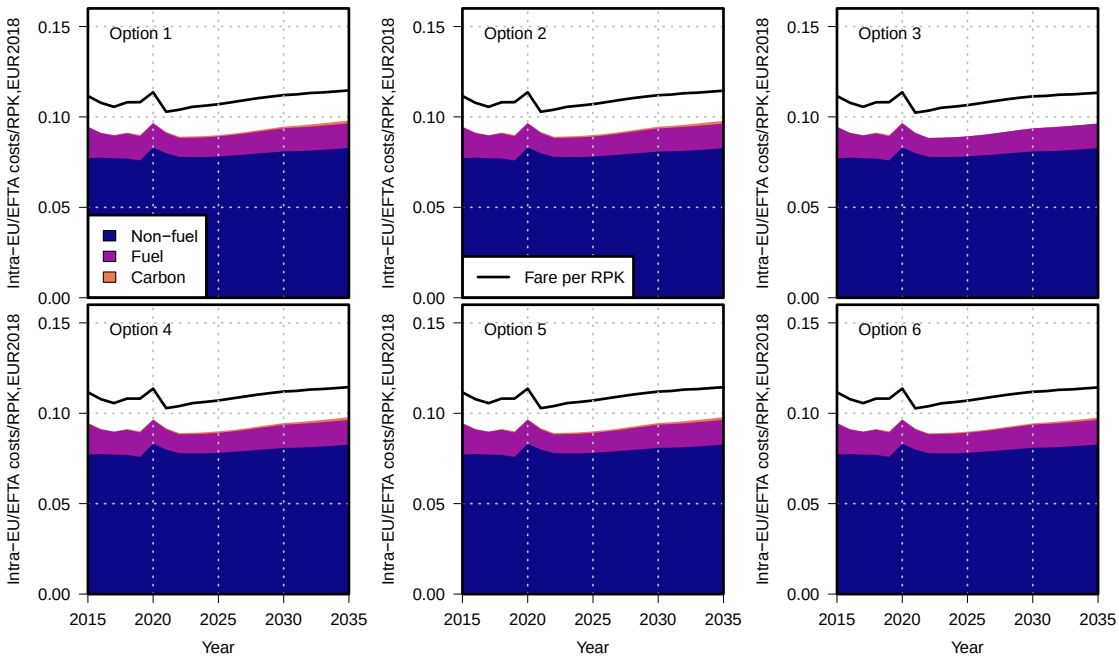

Figure 16. Intra-EU/EFTA Airline costs per RPK over time for each of the six main policy options at COVID19-adjusted nominal scenario values. Note that not all factors affecting cost and fare in 2020 are modelled.

Table 10. Estimated intra-EU/EFTA carbon costs when all scenario variables are at covid19-adjusted nominal values (numbers in larger font) and range due to variation in non-baseline demand uncertain scenario variables (numbers in brackets), as a percentage of fuel costs, total operating costs, and operating margin by policy option, 2015, 2030 and 2035.

Policy option	Carbon costs as % of fuel costs (exc. carbon)			Carbon costs as % of total operating costs			Total carbon costs as % of estimated operating margin if no costs are passed through onto ticket prices		
	2015	2030	2035	2015	2030	2035	2015	2030	2035
Option 1	1.2	6.8	11.7	0.2	0.9	1.6	2.8	12	28.2
	(1.2-1.2)	(4.6-29.0)	(7.6-49.7)	(0.2-0.2)	(0.8-3.3)	(1.3-5.1)	(2.8-2.8)	(12.0-44.8)	(25.5-94.1)
Option 2	1.2	7	11.3	0.2	1	1.6	2.8	12.6	27.8
	(1.2-1.2)	(5.0-28.8)	(7.7-46.2)	(0.2-0.2)	(0.9-3.3)	(1.3-4.8)	(2.8-2.8)	(12.3-51.0)	(25.9-91.7)

As discussed in the subsequent section, we anticipate around 70-80% of these costs will be passed through onto ticket prices; i.e. non-passed through costs as a percentage of operating margin in 2035 will be 5% or less under nominal scenario conditions and under 40% even at the top of the option 1 uncertainty range.

Policy option	Carbon costs as % of fuel costs (exc. carbon)			Carbon costs as % of total operating costs			Total carbon costs as % of estimated operating margin if no costs are passed through onto ticket prices		
	2015	2030	2035	2015	2030	2035	2015	2030	2035
Option 3	1.2	0.04	0.03	0.2	0.005	0.004	2.8	0.06	0.06
	(1.2-1.2)	(0.0-1.8)	(0.0-3.0)	(0.2-0.2)	(0.0-0.2)	(0.001-0.2)	(2.8-2.8)	(0.0-2.5)	(0.0-2.7)
Option 4	1.2	7	11.3	0.2	1	1.6	2.8	12.6	27.8
	(1.2-1.2)	(5.0-28.8)	(7.7-46.2)	(0.2-0.2)	(0.9-3.3)	(1.3-4.8)	(2.8-2.8)	(12.3-51.0)	(25.9-91.7)
Option 5	1.2	7	10.9	0.2	0.9	1.5	2.8	12.5	26.7
	(1.2-1.2)	(5.0-29.9)	(7.5-44.7)	(0.2-0.2)	(0.7-3.4)	(1.3-4.6)	(2.8-2.8)	(12.2-51.6)	(24.7-89.2)
Option 6	1.2	5.6	9	0.2	0.8	1.3	2.8	9.8	21.7
	(1.2-1.2)	(4.0-22.7)	(6.1-36.6)	(0.2-0.2)	(0.7-2.6)	(1.0-3.8)	(2.8-2.8)	(9.6-39.2)	(20.6-73.4)

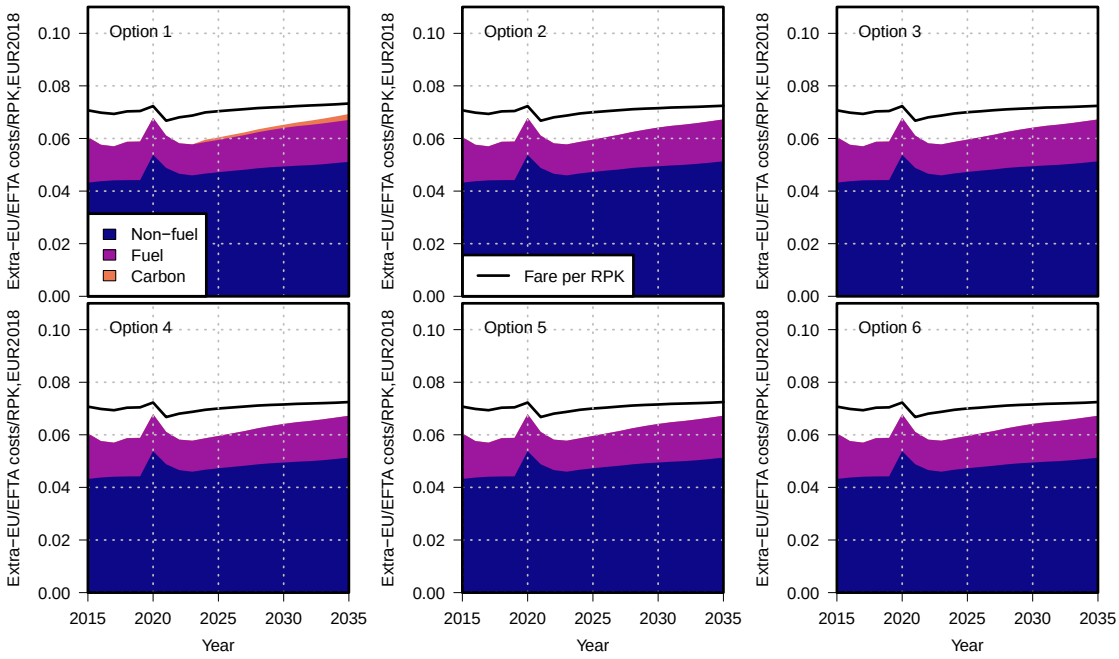

Figure 17. Fuel, non-fuel and carbon costs per RPK for extra-EU/EFTA flights under COVID19-adjusted nominal conditions for uncertain input variables. Note that not all factors affecting costs are fare in 2020 are modelled.

Table 11. Estimated extra-EU/EFTA carbon costs when all scenario variables are at COVID19-adjusted nominal values (numbers in larger font), and range due to variations in non-baseline demand uncertain input variables (numbers in brackets) as a percentage of fuel costs, total operating costs, and operating margin by policy option, 2015, 2030 and 203512.

Policy option	Carbon costs as % of fuel costs			Carbon costs as % of total operating costs			Carbon costs as % of estimated operating margin if no carbon costs are passed through onto ticket prices[Error! Bookmark not defined.]		
	2015	**2030**	**2035**	**2015**	**2030**	**2035**	**2015**	**2030**	**2035**
Option 1	0.2 (0.2-0.2)	8.1 (5.5-35.0)	14.1 (9.0-59.6)	0.04 (0.0-0.0)	1.8 (1.5-6.9)	3.2 (2.4-10.6)	0.2 (0.2-0.2)	13.0 (11-79)	34.6 (24.3-187)
Option 2	0.2 (0.2-0.2)	0.0 (0.0-0.0)	0.0 (0.0-0.0)	0.04 (0.04-0.04)	0.0 (0.0-0.0)	0.0 (0.0-0.0)	0.2 (0.2-0.2)	0.0 (0.0-0.0)	0.0 (0.0-0.0)
Option 3	0.2 (0.2-0.2)	0.04 (0.0-2.4)	0.05 (0.01-4.1)	0.04 (0.04-0.04)	0.01 (0.0-0.5)	0.01 (0.003-0.8)	0.2 (0.2-0.2)	0.09 (0.0-2.9)	0.10 (0.03-6.4)
Option 4	0.2 (0.2-0.2)	0.06 (0.02-2.8)	0.05 (0.02-4.3)	0.04 (0.04-0.04)	0.01 (0.005-0.6)	0.01 (0.005-0.8)	0.2 (0.2-0.2)	0.09 (0.04-3.4)	0.11 (0.05-6.7)
Option 5	0.2 (0.2-0.2)	0.04 (0.0-2.4)	0.05 (0.01-4.1)	0.04 (0.04-0.04)	0.01 (0.0-0.5)	0.01 (0.003-0.8)	0.2 (0.2-0.2)	0.05 (0.0-2.9)	0.10 (0.03-6.1)
Option 6	0.2 (0.2-0.2)	0.06 (0.02-2.8)	0.05 (0.02-4.3)	0.04 (0.04-0.04)	0.01 (0.005-0.6)	0.01 (0.005-0.8)	0.2 (0.2-0.2)	0.09 (0.04-3.3)	0.11 (0.05-6.7)

1.8.7 Changes in ticket prices

The impact of the different policy options on ticket prices for the COVID19-adjusted scenarios is given below. Changes from the non-COVID19 model runs in fares largely arise from changes in fuel prices and segment-level demand, as well as model edits relating to fuel cost hedging and the location of unscheduled flights[13]. As with the previous set of model runs, differences between fare between the different policy options are small, with the largest differences still only around 1%.

[12] Note carbon costs are non-zero in 2015 as routes to/from the UK are included in extra-EU/EFTA throughout.

[13] note also that in the previous report fare was reported on a current EU/EFTA membership basis so, e.g. year-2015 intra EU/EFTA fares included the UK; the tables and figures below refer to year-2020 EU/EFTA membership throughout.

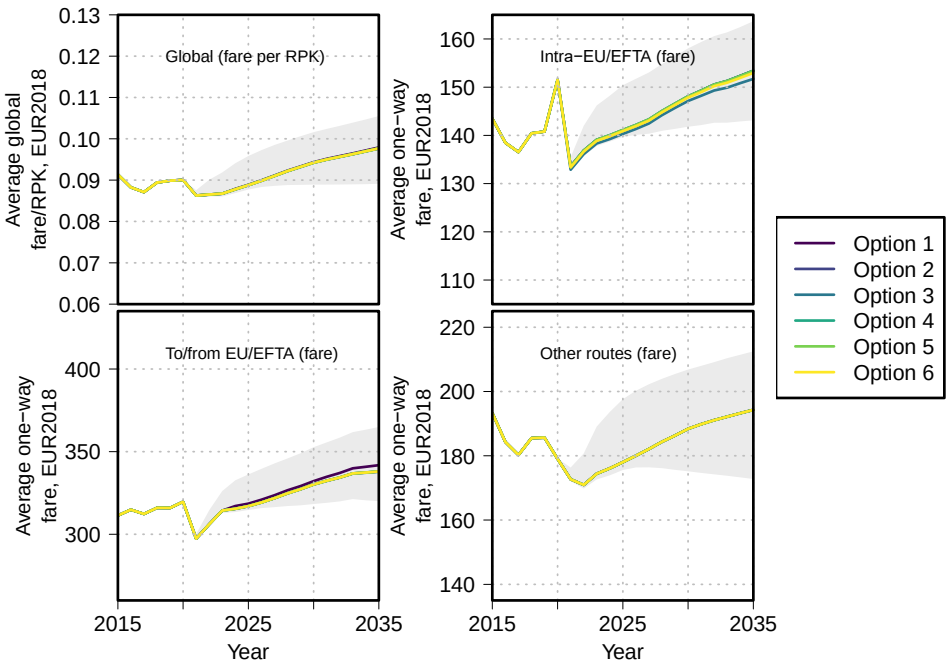

Figure 18. Average fare by main policy option with all uncertain scenario variables at COVID19-adjusted nominal values (solid lines), for intra-EU/EFTA, extra-EU/EFTA and other routes. Background ranges show the range of variation due to changing other non-baseline demand uncertain variables.

Table 12. Average fare in 2030 and 2035 by region and policy option, for all uncertain scenario values set to COVID19-adjusted nominal values (numbers in larger font), and range across all non-baseline demand uncertain variables (numbers in brackets).

Policy option	Avg. one-way fare, intra-EU/EFTA, €2018			Avg. one-way fare, extra-EU/EFTA, €2018			Avg. one-way fare, other routes, €2018		
	2015	**2030**	**2035**	**2015**	**2030**	**2035**	**2015**	**2030**	**2035**
Option 1	143.47	148.00 (143-158)	153.37 (145-164)	311.41	332.17 (320-353)	341.79 (324-365)	193.31	188.39 (175-207)	194.39 (173-212)
Option 2	143.47	148.10 (143-158)	153.41 (145-164)	311.41	330.16 (318-346)	338.00 (320-354)	193.31	188.38 (175-207)	194.28 (173-212)
Option 3	143.47	147.14 (142-155)	151.71 (143-159)	311.41	330.07 (318-346)	337.85 (320-354)	193.31	188.38 (175-207)	194.29 (173-212)
Option 4	143.47	148.10 (143-158)	153.41 (145-164)	311.41	330.19 (318-346)	338.02 (320-354)	193.31	188.38 (175-207)	194.28 (173-212)
Option 5	143.47	148.10 (143-158)	153.36 (145-164)	311.41	330.18 (318-346)	338.02 (320-354)	193.31	188.38 (175-207)	194.28 (173-212)
Option 6	143.47	147.84 (142-157)	152.95 (144-162)	311.41	330.17 (318-346)	337.99 (320-354)	193.31	188.38 (175-207)	194.28 (173-212)

1.8.8 Demand

The impact of the different policy options on demand for the COVID19-adjusted scenarios is given below. The low and high demand growth scenarios from the original report are also shown for comparison. In general, applying COVID19-related adjustments reduces extra-EU/EFTA RTK demand to a level that is close to that in the initially-envisaged Low demand scenario. Intra-EU/EFTA RTK is also reduced, but remains above the initial Low demand scenario and in some cases decreases are offset by greater growth during the 2015-2018 period than in the original model runs. As in the previous set of model runs, demand differences between the different policy options are small (for example, less than 1.5% in in intra-EU/EFTA RTK between different options in 2035 at nominal COVID19-adjusted values for uncertain scenario variables, and up to 2.1% for extra-EU/EFTA RTK under the same conditions).

Table 13. Estimated intra-EU/EFTA and extra-EU/EFTA RTK in 2030 and 2035, by policy and demand growth scenario, with all other uncertain variables set at nominal values (numbers in larger font) and range across variation in other uncertain variables (numbers in brackets).

Policy option	Annual RTK (low demand growth, not adjusted for COVID19), billion		Annual RTK (COVID19-adjusted nominal demand growth), billion		Annual RTK (high demand growth, not adjusted for COVID19), billion	
	2030	**2035**	**2030**	**2035**	**2030**	**2035**
Intra-EU/EFTA (including OMRs, excluding UK)						
Option 1	65.3 (61.3-69.5)	68.4 (63.3-74.0)	79.9 (74.2-83.4)	87.1 (80.6-93.1)	89.0 (83.5-94.8)	102.5 (94.7-111.0)
Option 2	65.6 (62.1-69.8)	68.8 (64.6-74.4)	80.0 (74.6-83.5)	87.4 (81.3-93.4)	89.5 (84.5-95.2)	103.2 (96.6-111.6)
Option 3	66.0 (63.0-70.3)	69.3 (65.9-75.1)	80.5 (75.8-84.0)	88.3 (83.4-94.3)	90.1 (85.9-96.0)	104.2 (98.9-112.8)
Option 4	65.6 (62.1-69.8)	68.8 (64.6-74.4)	80.0 (74.5-83.5)	87.4 (81.3-93.4)	89.5 (84.5-95.2)	103.2 (96.5-111.6)
Option 5	65.6 (62.0-69.8)	68.8 (64.6-74.4)	80.0 (74.5-83.5)	87.4 (81.3-93.4)	89.6 (84.7-95.4)	103.5 (97.2-112.0)
Option 6	65.6 (62.2-69.9)	68.9 (64.7-74.5)	80.1 (74.8-83.6)	87.6 (81.7-93.6)	89.6 (84.7-95.3)	103.3 (97.0-111.8)
To/from EU/EFTA						
Option 1	275.6 (262-287)	301.6 (283-317)	273.8 (252-288)	298.1 (271-319)	344.3 (327-359)	409.9 (382-432)
Option 2	279.3 (272-292)	307.5 (298-324)	276.9 (261-291)	304.3 (286-326)	349.9 (340-365)	418.7 (406-442)

Policy option	Annual RTK (low demand growth, not adjusted for COVID19), billion		Annual RTK (COVID19-adjusted nominal demand growth), billion		Annual RTK (high demand growth, not adjusted for COVID19), billion	
	2030	**2035**	**2030**	**2035**	**2030**	**2035**
Option 3	279.4 (272-292)	307.5 (297-324)	277.0 (261-291)	304.3 (286-326)	349.9 (339-365)	419.1 (404-442)
Option 4	279.3 (271-292)	307.4 (297-324)	276.9 (260-291)	304.2 (285-326)	349.9 (339-365)	418.6 (404-442)
Option 5	279.3 (271-292)	307.4 (297-324)	276.9 (261-291)	304.2 (286-326)	349.9 (339-365)	418.7 (404-442)
Option 6	279.3 (271-292)	307.4 (297-324)	276.9 (260-291)	304.3 (286-326)	349.9 (339-365)	418.6 (404-442)

Table 14. Estimated global, extra-EU/EFTA and intra-EU/EFTA RPK and FTK by policy option, for all uncertain input variables at COVID19-adjusted nominal values (numbers in larger font) and range due to variation in non-baseline demand uncertain input variables (numbers in brackets).

Policy option	Estimated global annual RPK, trillion			Estimated global annual FTK, billion		
	2015	**2030**	**2035**	**2015**	**2030**	**2035**
Option 1	6.88	12.22 (11.33-12.95)	14.04 (13.00-15.35)	204	358.2 (313.7-392.2)	406.1 (354.3-460.8)
Option 2	6.88	12.24 (11.39-12.97)	14.07 (13.09-15.38)	204	360.0 (318.2-394.3)	409.6 (361.6-465.2)
Option 3	6.88	12.24 (11.41-12.97)	14.08 (13.12-15.39)	204	360.1 (318.6-394.4)	409.7 (361.4-465.3)
Option 4	6.88	12.24 (11.39-12.97)	14.07 (13.09-15.38)	204	360.0 (318.2-394.3)	409.6 (361.4-465.2)
Option 5	6.88	12.24 (11.39-12.97)	14.07 (13.09-15.38)	204	360.1 (318.4-394.4)	409.6 (361.5-465.2)
Option 6	6.88	12.24 (11.39-12.97)	14.07 (13.10-15.39)	204	360.0 (318.3-394.3)	409.6 (361.4-465.2)
	Estimated extra-EU/EFTA annual RPK, trillion			**Estimated extra-EU/EFTA annual FTK, billion**		

	2015	2030	2035	2015	2030	2035
Option 1	1.30	1.85 (1.77-1.90)	2.03 (1.92-2.10)	60.0	88.5 (74.6-97.9)	94.8 (78.9-109.0)
Option 2	1.30	1.87 (1.82-1.91)	2.06 (2.00-2.13)	60.0	90.3 (79.1-100.0)	98.3 (86.1-113.5)
Option 3	1.30	1.87 (1.82-1.91)	2.06 (2.00-2.13)	60.0	90.3 (79.0-100.0)	98.3 (85.7-113.4)
Option 4	1.30	1.87 (1.82-1.91)	2.06 (2.00-2.13)	60.0	90.3 (78.9-100.0)	98.3 (85.8-113.4)
Option 5	1.30	1.87 (1.82-1.91)	2.06 (2.00-2.13)	60.0	90.3 (78.9-100.0)	98.3 (85.8-113.4)
Option 6	1.30	1.87 (1.82-1.91)	2.06 (2.00-2.13)	60.0	90.3 (78.9-100.0)	98.3 (85.8-113.4)

	Estimated intra-EU/EFTA annual RPK, trillion			Estimated intra-EU/EFTA annual FTK, billion		
	2015	**2030**	**2035**	**2015**	**2030**	**2035**
Option 1	0.54	0.78 (0.72-0.81)	0.85 (0.78-0.91)	1.70	2.23 (2.04-2.33)	2.34 (2.12-2.48)
Option 2	0.54	0.78 (0.73-0.81)	0.85 (0.79-0.91)	1.70	2.23 (2.03-2.33)	2.34 (2.12-2.48)
Option 3	0.54	0.78 (0.74-0.82)	0.86 (0.81-0.92)	1.70	2.26 (2.11-2.36)	2.39 (2.23-2.53)
Option 4	0.54	0.78 (0.73-0.81)	0.85 (0.79-0.91)	1.70	2.23 (2.03-2.33)	2.34 (2.12-2.48)
Option 5	0.54	0.78 (0.72-0.81)	0.85 (0.79-0.91)	1.70	2.23 (2.03-2.33)	2.34 (2.12-2.48)
Option 6	0.54	0.78 (0.73-0.81)	0.85 (0.80-0.91)	1.70	2.23 (2.04-2.33)	2.34 (2.12-2.48)

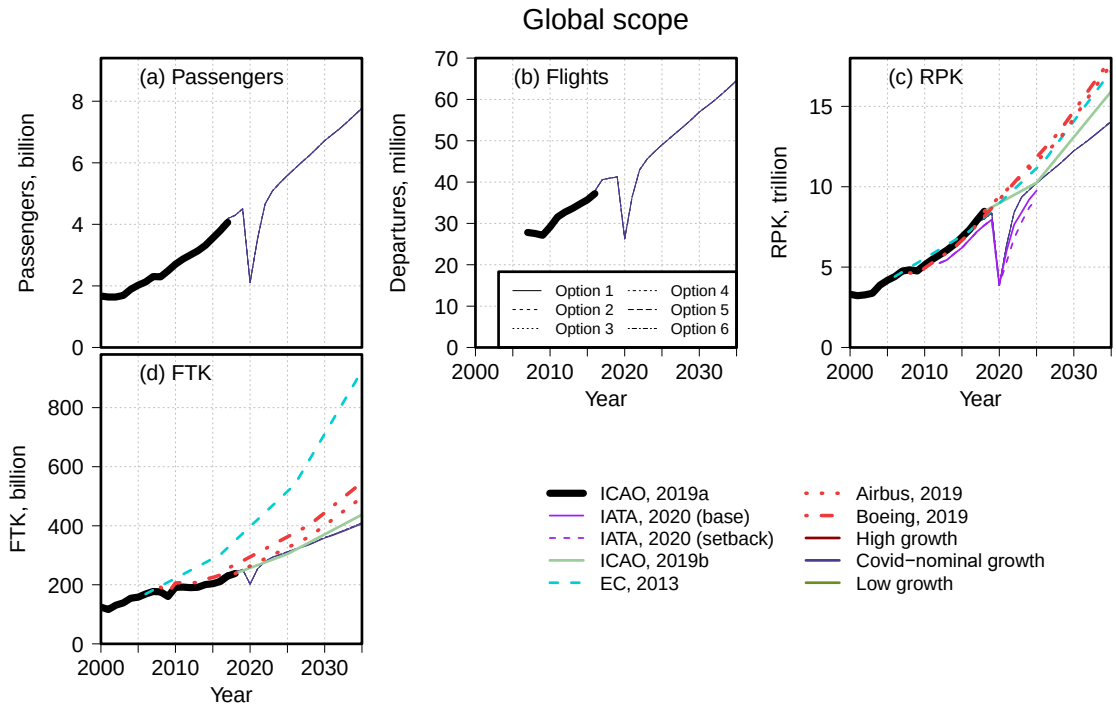

Figure 19. Global demand metrics (passengers, flights, RPK, FTK and direct CO_2) showing uncertainty ranges in outputs for the COVID19-adjusted demand growth scenario and main policy options.

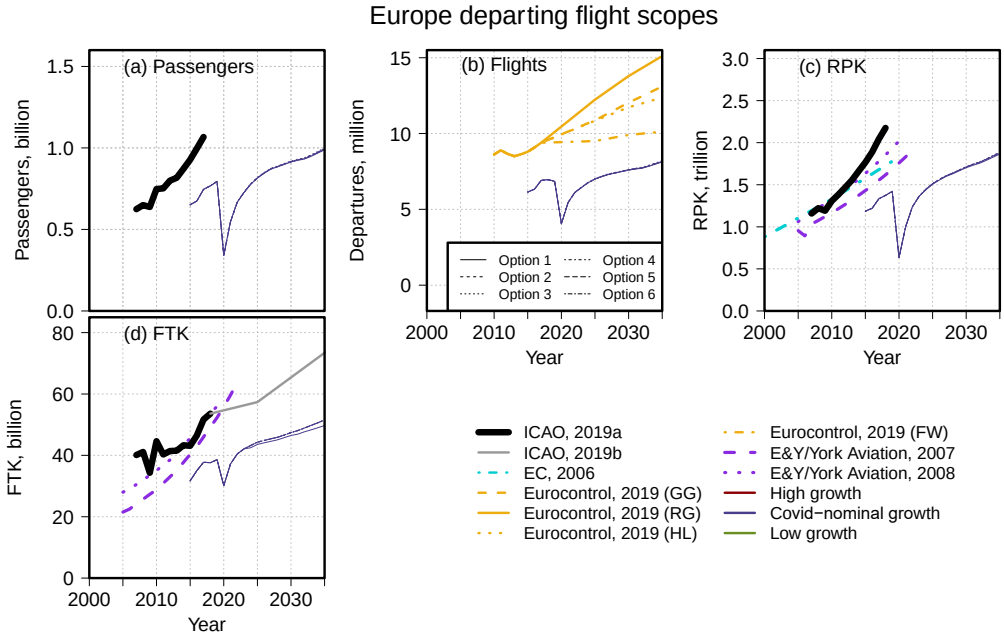

Figure 20. Demand metrics (passengers, flights, RPK, FTK and direct CO_2) on an EU/EFTA departing flights scope, showing uncertainty ranges in outputs for the COVID19-adjusted demand growth scenario and main policy option. Note that alternative projections use multiple different definitions of 'Europe' and are included for comparisons of growth rate only. The AIM numbers shown exclude the UK throughout the plotted time period.

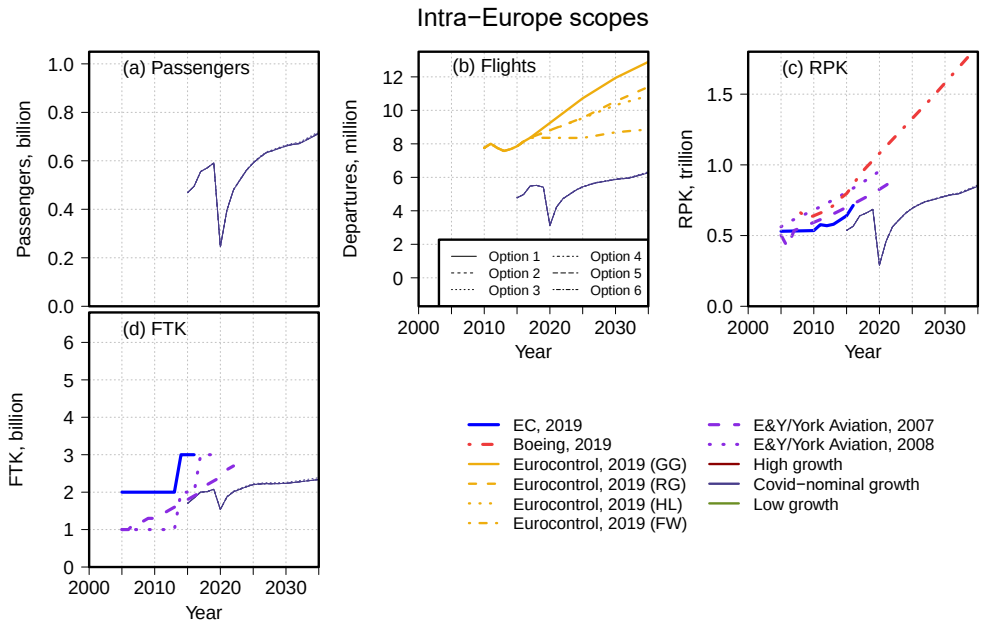

Figure 21. Demand metrics (passengers, flights, RPK, FTK and direct CO_2) on an intra-Europe scope, showing uncertainty ranges in outputs for the COVID19-adjusted demand growth scenario by main policy option. Note that alternative projections use multiple different definitions of 'Europe' and are included for comparisons of growth rate only. The AIM numbers shown exclude the UK throughout the plotted time period.

Table 15. Direct comparison of intra-EU/EFTA and extra-EU/EFTA RTK at different carbon price assumptions, under COVID19-adjusted nominal scenario inputs for all other uncertain variables, by policy option.

Policy option	Intra-EU/EFTA annual RTK, billion				Extra-EU/EFTA annual RTK, billion			
	COVID19-adjusted nominal scenario inputs		**COVID19-adjusted nominal scenario inputs + higher carbon price**		**COVID19-adjusted nominal scenario inputs**		**COVID19-adjusted nominal scenario inputs + higher carbon price**	
	2030	**2035**	**2030**	**2035**	**2030**	**2035**	**2030**	**2035**
Option 1	79.9	87.1	78.7	85.2	273.8	298.1	266.7	287.5
Option 2	80.0	87.4	79.0	86.0	276.9	304.3	276.8	304.1
Option 3	80.5	88.3	80.4	88.2	277.0	304.3	276.8	303.9
Option 4	80.0	87.4	79.0	86.0	276.9	304.2	276.5	303.6
Option 5	80.0	87.4	79.0	86.0	276.9	304.2	276.6	303.7
Option 6	80.1	87.9	79.3	86.4	276.9	304.3	276.5	303.7

1.8.9 Net aviation CO_2 emissions and climate impact

As in the previous report, differences in direct aviation CO_2 emissions between policies are small. These arise from the small demand differences between the different policy options discussed in the previous section. Direct CO_2 is lower than in the non COVID19-affected model runs due to lower demand; however, as lower demand growth leads to slower fleet turnover, per-RPK emissions are typically slightly higher than in the previous set of model runs.

Once the effect of EU ETS allowances purchased from other sectors and CORSIA offsets are added in, differences from the previous set of model runs arise from the changes in scheme specification assumed here, i.e., the year-2019 CORSIA baseline, greater nominal case participation, and slightly lower EU ETS cap assumptions. Lower nominal case demand additionally means that more routes may be below the CORSIA baseline. As discussed above, Sectoral CORSIA offset requirements mean that fewer offsets can be required on a global level if greater numbers of slow-growing routes are included in the scheme, because they increase the baseline and reduce average growth above the baseline. COVID19-related demand decreases exacerbate this effect. For 2030 in particular, this interaction can mean that fewer CORSIA offsets are required for policy options that include routes to, from and/or within EU/EFTA countries, increasing net CO_2 for those options. Relatedly, where CORSIA Sectoral offset requirements are applied, all eligible airlines on participating routes have an offset requirement based on global CO_2 emissions growth above the baseline; this means that airlines on routes to, from and/or within EU/EFTA countries can have a larger offset requirement than would be calculated based on their individual emissions growth (which is balanced out by a lower offset requirement for airlines on more rapidly-growing route groups).

Despite these changes, the relative impacts of the different policy options remain similar to those in the original report, i.e. Option 1 has the lowest global net CO_2, Option 3 the highest, and the impacts of Options 2, 4, 5 and 6 are similar to each other and have net CO_2 outcomes intermediate between those of Option 1 and Option 3.

Table 16. Year-2030 and 2035 net aviation CO_2 after offsets and EU ETS allowances are subtracted, for different levels of CORSIA offset additionality. Central values shown are for all scenario variables at COVID19-adjusted nominal values, including demand growth. Ranges include variation arising from changes in other non-baseline demand uncertain input variables.

Policy option	Direct annual CO_2 emissions, Mt		Net annual CO_2 emissions, Mt (0% additional CORSIA offsets)		Net annual CO_2 emissions, Mt (100% additional CORSIA offsets)	
	2030	**2035**	**2030**	**2035**	**2030**	**2035**
Global						
Option 1	1077 (965-1206)	1196 (1053-1400)	979 (889-1084)	1069 (909-1240)	918 (824-1022)	998 (835-1154)
Option 2	1079 (969-1209)	1200 (1059-1406)	1053 (947-1181)	1171 (989-1373)	992 (882-1120)	1099 (913-1288)
Option 3	1079 (970-1210)	1201 (1061-1407)	1079 (970-1210)	1201 (1013-1407)	1047 (948-1151)	1125 (944-1299)
Option 4	1079 (969-1209)	1200 (1059-1406)	1053 (947-1181)	1171 (989-1373)	1003 (905-1108)	1091 (913-1264)

Policy option	Direct annual CO_2 emissions, Mt		Net annual CO_2 emissions, Mt (0% additional CORSIA offsets)		Net annual CO_2 emissions, Mt (100% additional CORSIA offsets)	
	2030	**2035**	**2030**	**2035**	**2030**	**2035**
Option 5	1079 (970-1209)	1200 (1059-1407)	1054 (948-1182)	1172 (989-1377)	1022 (926-1124)	1097 (920-1269)
Option 6	1079 (969-1209)	1200 (1060-1407)	1059 (952-1187)	1177 (994-1380)	1010 (910-1114)	1098 (919-1272)
Extra-Europe (to/from EU/EFTA, excluding UK, including OMRs)						
Option 1	172 (154-193)	182 (159-210)	94 (93-95)	80 (79-83)	94 (79-83)	80 (79-83)
Option 2	174 (158-196)	185 (165-216)	170 (155-192)	181 (156-211)	170 (155-192)	181 (156-211)
Option 3	174 (158-196)	185 (165-216)	170 (155-192)	181 (156-211)	161 (147-175)	166 (146-186)
Option 4	174 (158-196)	185 (165-216)	170 (155-192)	181 (156-211)	154 (140-167)	164 (144-183)
Option 5	174 (158-196)	185 (165-216)	170 (155-192)	181 (156-211)	161 (147-175)	166 (146-186)
Option 6	174 (158-196)	185 (165-216)	170 (155-192)	204 (156-211)	154 (141-167)	164 (144-184)
Intra-Europe (EU/EFTA, excluding UK, including OMRs)						
Option 1	52.4 (48.5-55.8)	54.0 (49.3-58.8)	29.5 (28.3-30.5)	24.9 (23.7-26.0)	29.5 (28.3-30.5)	24.9 (23.7-26.0)
Option 2	52.5 (48.6-55.9)	54.2 (49.5-59.1)	27.0 (26.6-27.7)	24.8 (24.2-25.8)	27.0 (26.6-27.7)	24.8 (24.2-25.8)
Option 3	52.7 (49.3-56.2)	54.7 (50.5-59.7)	52.6 (49.2-56.1)	54.6 (48.1-59.6)	49.2 (45.5-49.7)	51.6 (46.9-53.0)
Option 4	52.5 (48.6-55.9)	54.2 (49.5-59.1)	27.0 (26.6-27.7)	24.8 (24.2-25.8)	27.0 (26.6-27.7)	24.8 (24.2-25.8)
Option 5	52.5 (48.6-55.9)	54.2 (49.5-59.1)	27.3 (26.7-28.6)	26.0 (24.6-29.1)	23.9 (18.1-26.7)	23.1 (22.1-24.2)
Option 6	52.5 (48.8-56.0)	54.3 (49.7-59.2)	32.5 (31.4-33.9)	31.0 (29.1-32.9)	32.2 (31.2-33.3)	30.8 (29.0-32.5)

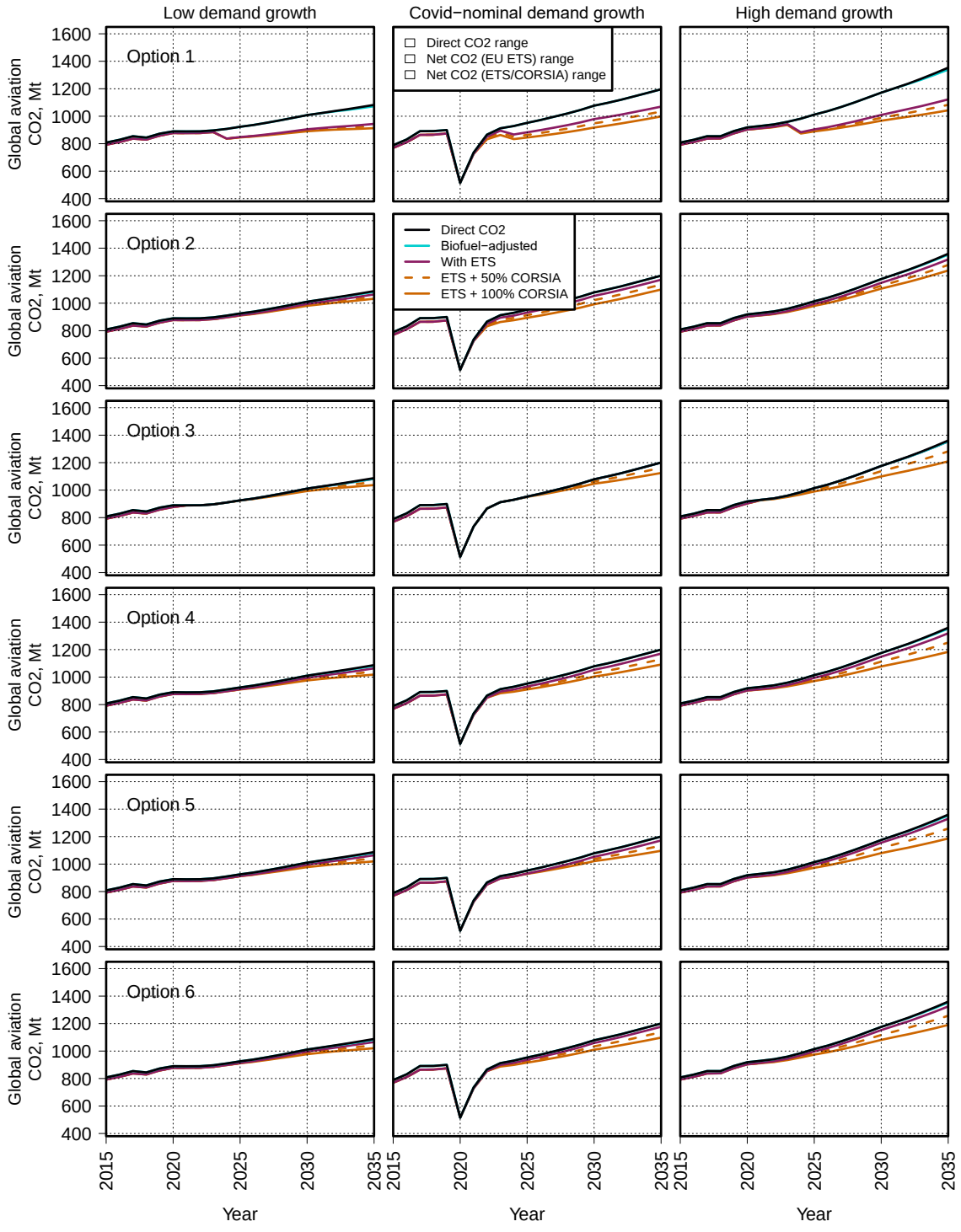

Figure 22. Global net aviation CO_2 emissions by policy option and demand growth scenario, including the impact of EUAs purchased from other sectors and CORSIA offsets at different levels of effectiveness. Background ranges show variation across all combinations of uncertain variables. Note that the high and low scenarios shown are the ones from the original report without the impact of COVID19.

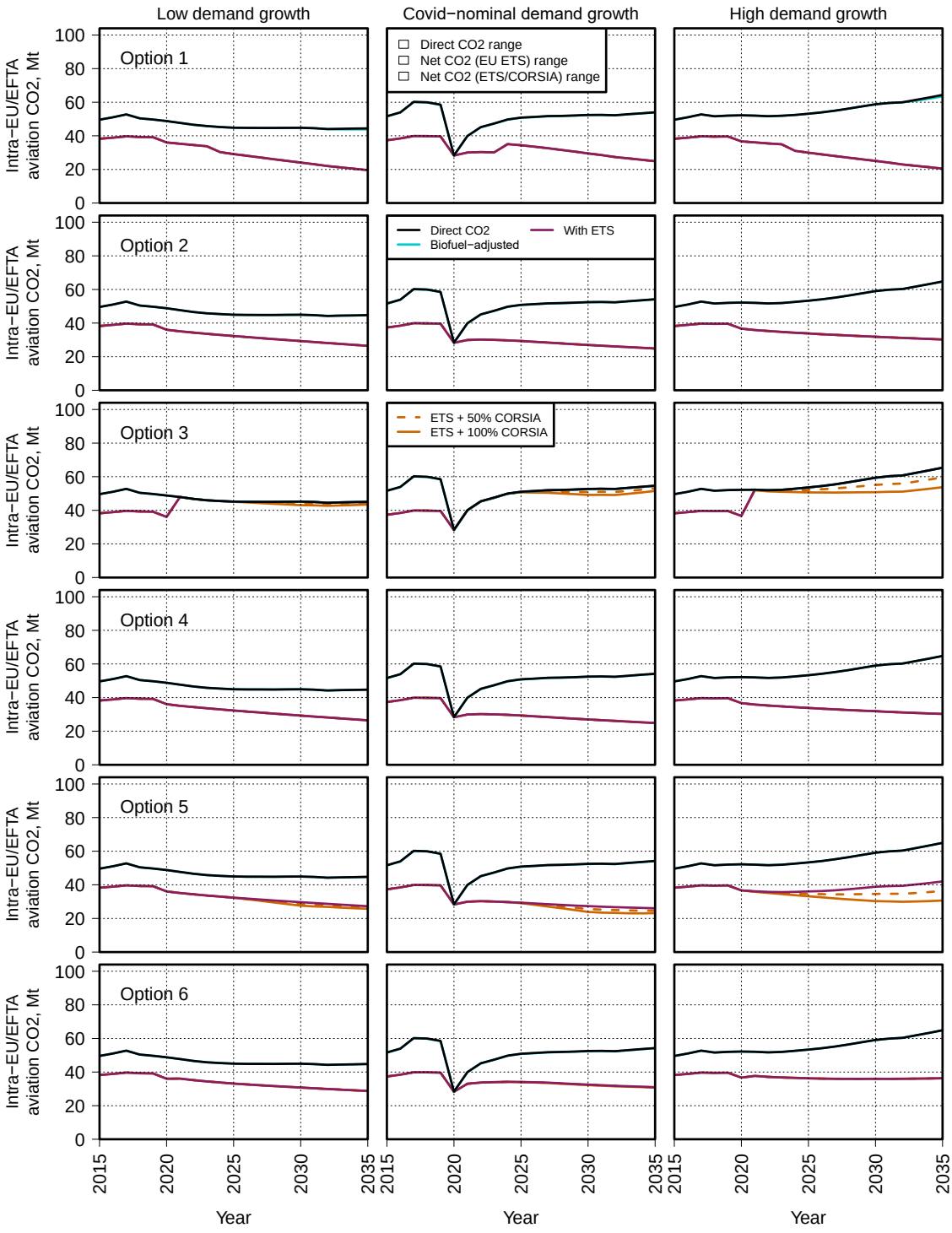

Figure 23. Intra-European (EU27 + Norway, Switzerland, Iceland, not including the UK) net aviation CO_2 emissions by policy option and demand growth scenario, including the impact of EUAs purchased from other sectors and CORSIA offsets at different levels of effectiveness. Background ranges show variation across all combinations of uncertain variables. Note that the high and low demand scenarios shown are from the original report and are not adjusted for the impact of COVID19.

1.8.10 Aviation Externalities

The impacts of the different policy options on aviation externalities in the COVID19-adjusted demand scenario are shown below. The relative externality impacts of the different policy options are similar to those in the original report, and primarily reflect small differences in demand between the different options.

Table 17. Metrics used to calculate annual externalities (passenger and flight movements, local NOx and local PM2.5), 2030 and 2035. Numbers in larger font show values at COVID19-adjusted nominal inputs for uncertain scenario variables. Numbers in brackets show the range due to variation in uncertain non-baseline demand scenario variables.

Policy option	EU/EFTA airport passenger movements, Mppa		EU/EFTA airport LTO cycles, million		EU/EFTA airport local NOx, thousand tonnes		EU/EFTA airport local PM2.5, tonnes	
	2030	**2035**	**2030**	**2035**	**2030**	**2035**	**2030**	**2035**
Option 1	1760 (1640-1830)	1900 (1760-2030)	6.86 (6.26-7.33)	7.35 (6.68-8.02)	48.6 (42.2-55.2)	50.2 (43.3-58.3)	279 (235-327)	251 (209-299)
Option 2	1760 (1650-1840)	1910 (1790-2040)	6.87 (6.29-7.34)	7.37 (6.74-8.04)	48.7 (42.5-55.4)	50.6 (43.8-59.0)	279 (236-328)	252 (212-300)
Option 3	1770 (1670-1840)	1920 (1820-2050)	6.90 (6.37-7.37)	7.43 (6.87-8.10)	48.9 (42.9-55.6)	50.9 (44.4-59.4)	280 (238-329)	254 (214-302)
Option 4	1760 (1650-1840)	1910 (1780-2040)	6.87 (6.29-7.34)	7.37 (6.74-8.04)	48.7 (42.5-55.4)	50.6 (43.8-59.0)	279 (236-328)	252 (212-300)
Option 5	1760 (1650-1840)	1910 (1790-2040)	6.87 (6.29-7.34)	7.37 (6.74-8.04)	48.7 (42.5-55.4)	50.6 (43.8-59.1)	279 (236-328)	252 (212-300)
Option 6	1760 (1660-1840)	1910 (1800-2040)	6.88 (6.32-7.35)	7.39 (6.78-8.06)	48.8 (42.6-55.5)	50.7 (44.0-59.2)	279 (237-328)	253 (213-301)

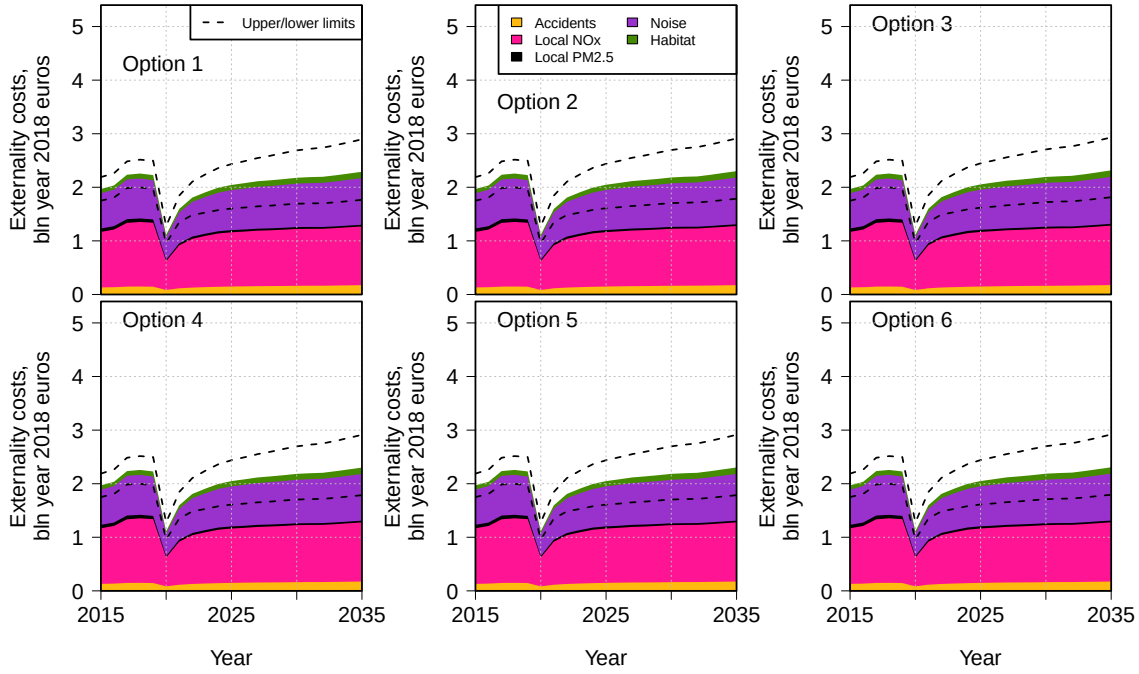

Figure 24. Estimated externality costs from European airports (EU/EFTA), COVID19-adjusted nominal scenario, by policy option and externality type, excluding climate impacts. Note that the upper/lower limits include uncertainty from only non-baseline demand uncertain variables, so the uncertainty range is less wide than in the previous set of model runs.

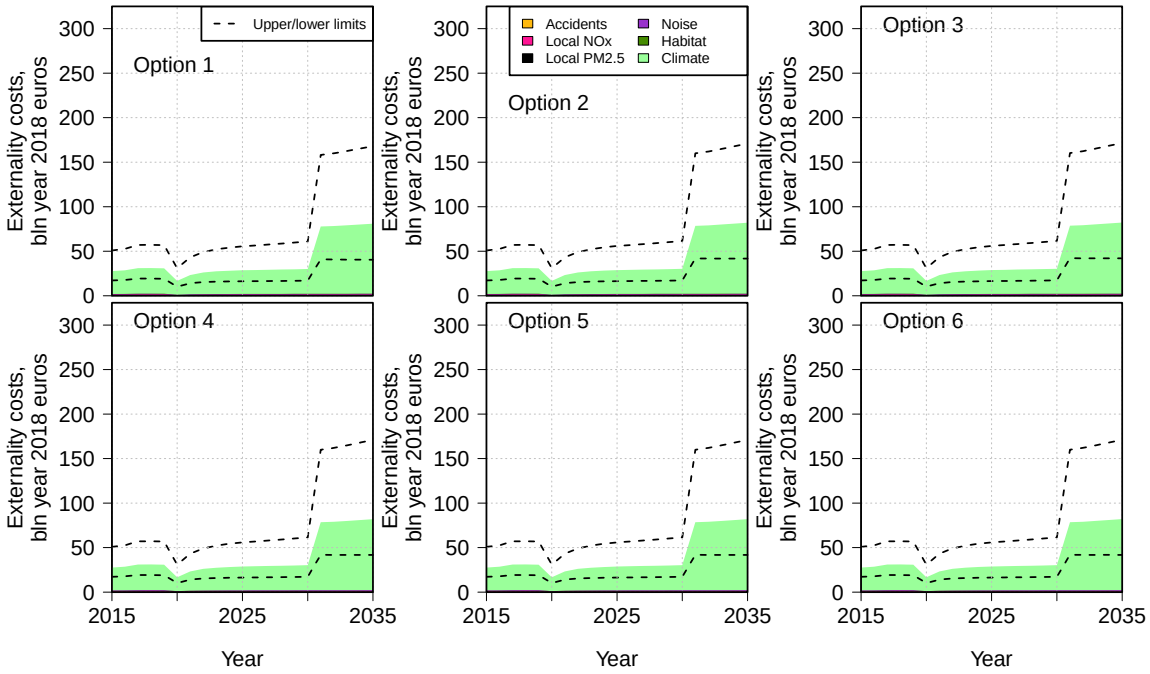

Figure 25. Estimated externality costs from European airports (EU/EFTA), COVID19-adjusted nominal scenario, by policy option and externality type, including climate impacts. Note different recommended per-kg costs for CO_2 before and after 2030.The upper/lower limits include uncertainty from only non-demand uncertain variables, so the uncertainty range is less wide than in the previous set of model runs.

Table 18. Total estimated EU/EFTA aviation externality costs by category, 2021-2035. Numbers in larger text give values at COVID19-adjusted nominal values for all uncertain scenario variables. Numbers in brackets give the range of variation across different values for non-baseline demand uncertain scenario variables.

Policy option	Accident costs, billion €2018	NOx costs, billion €2018	PM2.5 costs, billion €2018	Noise costs, billion €2018	Habitat destr'n costs, billion €2018	Climate costs, billion €2018	Total, billion €2018
Option 1	2.236 (2.050-2.366)	14.90 (13.09-16.60)	0.535 (0.457-0.616)	11.25 (6.88-15.88)	1.490 (1.397-1.539)	631.9 (331.3-1291)	662.3 (355.2-1328)
Option 2	2.239 (2.060-2.369)	14.94 (13.17-16.68)	0.536 (0.459-0.617)	11.27 (6.911-15.90)	1.494 (1.406-1.542)	637.0 (338.2-1306)	667.5 (362.2-1343)
Option 3	2.250 (2.083-2.381)	15.00 (13.28-16.75)	0.537 (0.462-0.620)	11.32 (6.989-15.97)	1.501 (1.423-1.550)	638.6 (340.0-1309)	669.2 (364.3-1347)
Option 4	2.239 (2.059-2.369)	14.94 (13.17-16.68)	0.536 (0.459-0.617)	11.27 (6.909-15.90)	1.494 (1.406-1.542)	637.0 (338.1-1306)	667.5 (362.1-1343)
Option 5	2.239 (2.059-2.370)	14.94 (13.17-16.68)	0.536 (0.459-0.617)	11.27 (6.909-15.90)	1.494 (1.406-1.542)	637.0 (338.1-1306)	667.5 (362.1-1343)
Option 6	2.242 (2.067-2.373)	14.96 (13.20-16.70)	0.536 (0.460-0.618)	11.29 (6.934-15.92)	1.496 (1.411-1.544)	637.3 (338.4-1306)	667.8 (362.5-1344)

1.8.11 Impacts of Changes in Auctioning

As in the original report, we test five options for changing the auctioning percentage to 2030. These options are:

0) Status quo: The current legal situation is perpetuated until 2030, i.e. a 15% auctioning share.

1) Immediate phase-out: 100% auctioning from the entry into force of the revision.

2) Swift phase-out: Full auctioning by 2025, starting with an auctioning share of 60% in 2023, and a share of 80% in 2024.

3) Slow phase-out: A linear increase year-by-year to full auctioning by 2030 starting from 20% in 2023.

4) Slow reduction: A linear increase year-by-year starting with an auctioning share of 20% in 2023 and ending at 55% in 2030

For the 2030-2035 period we assume for each of the cases above that the auctioning share remains constant at its year-2030 value (so, for example, in the Slow Reduction

case the auctioning share remains at 55% between 2030 and 2035). Outcomes for the COVID19-adjusted nominal scenario are shown below.

In general, the relative impact of each policy/auctioning option is similar to that in the no-COVID19 case. However, this variation is now around a baseline of lower demand than in the case without COVID19. As an example of impact, the highest-impact case for scenario inputs at nominal COVID19-adjusted values is likely to be Policy Option 1 with immediate phase-out of auctioning in 2024 on extra-EU/EFTA routes. In these circumstances, carbon prices are 3.6% of airline operating costs in 2024 and 3.5% in 2030. This is still below the level of variability that airlines experienced from fluctuations in fuel costs at the levels seen over the 2010-2020 period, which may exceed 10% of total operating cost.

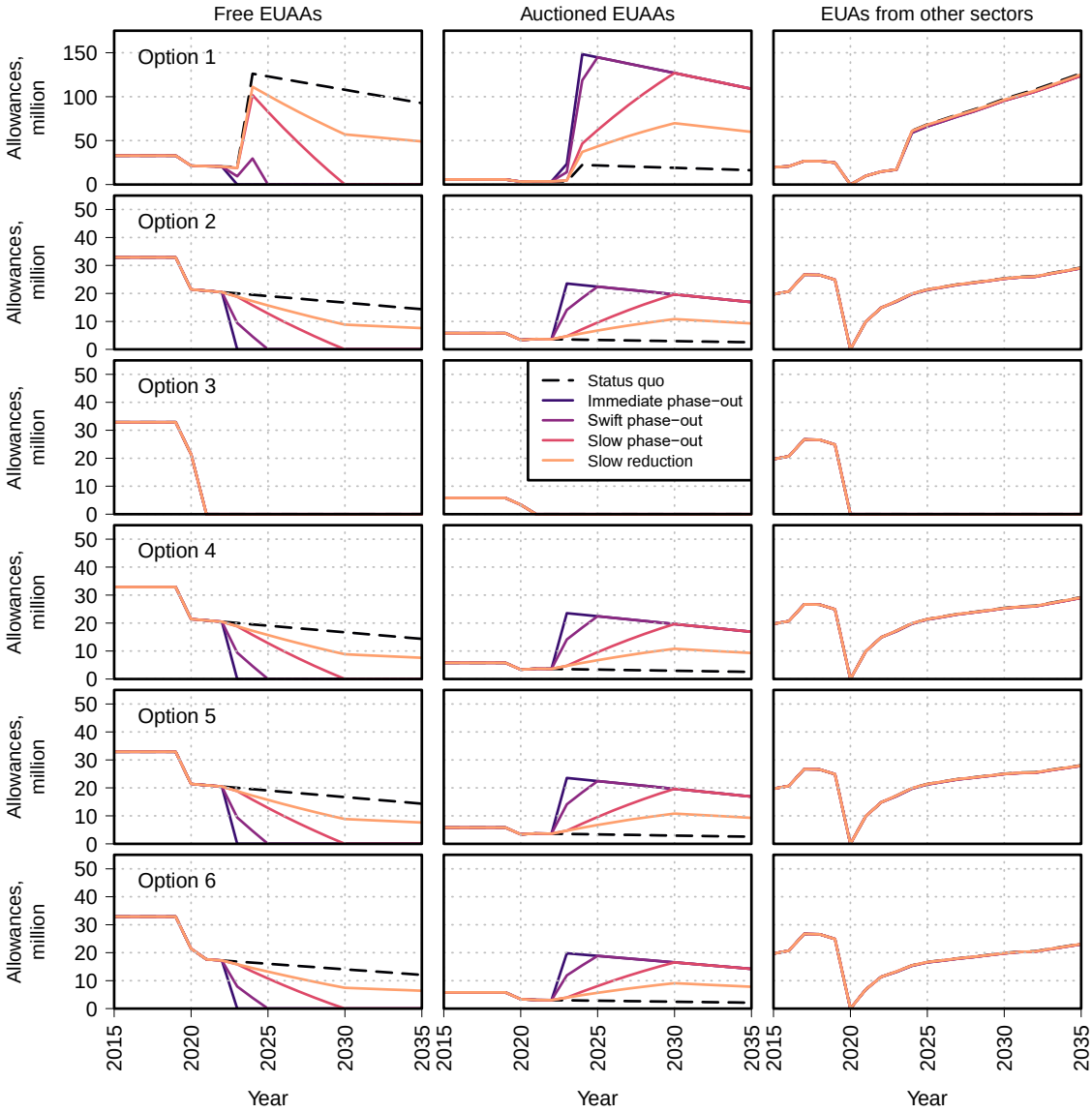

Figure 26. Free and auctioned EUAAs and EUAs purchased from other sectors, for the six different policy options and five different options for auctioning percentage over time, with uncertain scenario variables at COVID19-adjusted nominal values. A different scale has been used for Option 1.

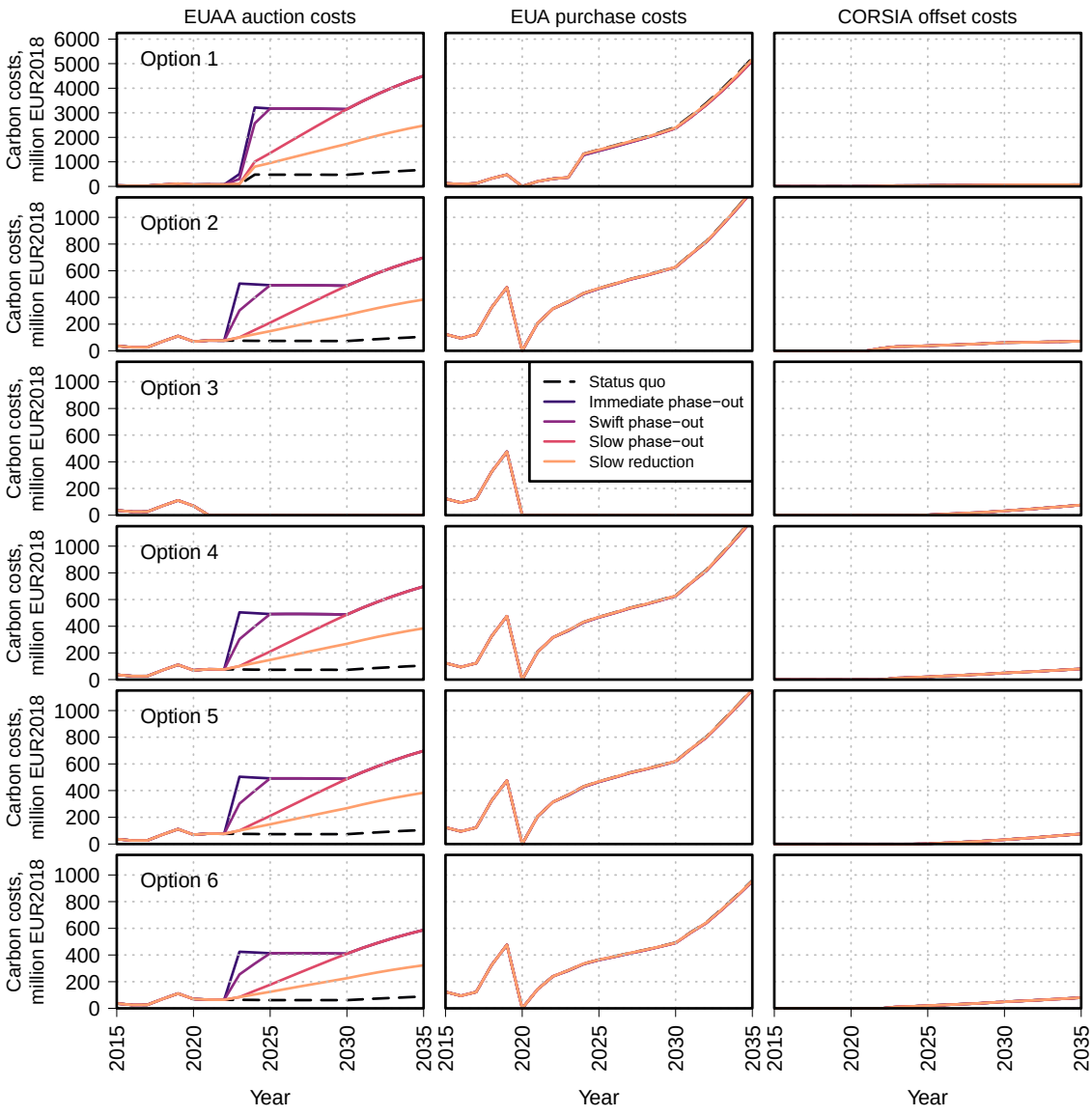

Figure 27. Global auctioned EUAA costs, costs from EUAs purchased from other sectors, and CORSIA costs, for the six different policy options and five different options for auctioning percentage over time, with uncertain scenario variables at COVID19-adjusted nominal values. A different scale has been used for Option 1.

Table 19. Total year 2023-2030 auctioning revenue and amount paid by aviation to other sectors for EUAs, by ETS/CORSIA policy and auctioning option, with all other scenario variables set to COVID19-adjusted nominal values.

	Status quo	Immediate phase-out	Swift phase-out	Slow phase-out	Slow reduction
Total EUAA auctioning revenue 2023-2030, million €$_{2018}$					
Option 1	3410	22700	21900	14700	9000
Option 2	592	3950	3640	2360	1480
Option 3	0	0	0	0	0
Option 4	592	3950	3640	2360	1480
Option 5	592	3950	3640	2360	1480
Option 6	500	3320	3070	1980	1240
Total amount paid for EUAs from other sectors, 2023-2030, million €$_{2018}$					
Option 1	13300	13000	13000	13100	13200
Option 2	4100	4070	4070	4080	4100
Option 3	0	0	0	0	0
Option 4	4100	4070	4070	4090	4090
Option 5	4080	4050	4050	4070	4070
Option 6	3190	3160	3160	3170	3180

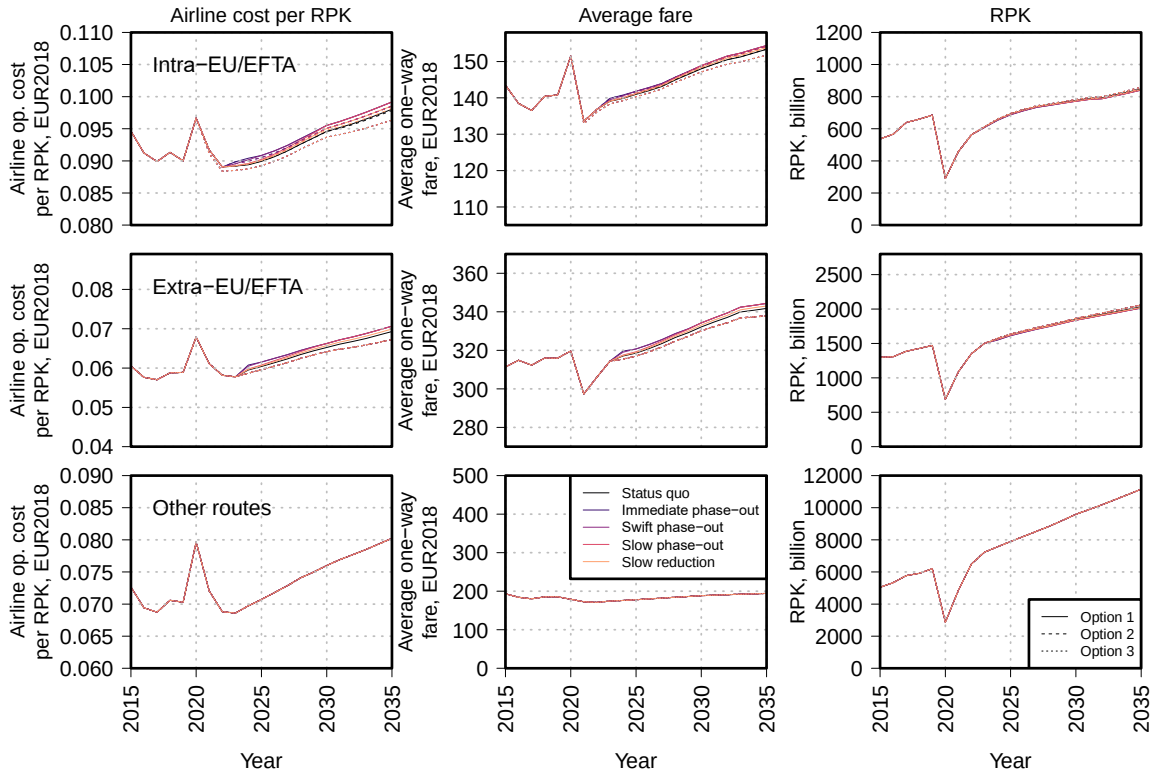

Figure 28. Airline cost per RPK, average one-way ticket price and RPK by combination of CORSIA/ETS and auctioning policy option, for all uncertain scenario variables set to COVID19-adjusted nominal values and intra-EU/EFTA, extra-EU/EFTA and other route scopes. Only policy options 1, 2 and 3 are plotted as outcomes for options 4, 5 and 6 are close to option 2.

Table 20. Year-2030 impact on one-way intra-EU/EFTA ticket prices and intra-EU/EFTA RPK by combination of CORSIA/ETS policy and auctioning option, with uncertain scenario variables set to COVID19-adjusted nominal values.

	Status quo	Immediate phase-out	Swift phase-out	Slow phase-out	Slow reduction
Intra-EU/EFTA average one-way ticket price, year 2030, €2018					
Option 1	148.0	148.9	148.9	148.9	148.4
Option 2	148.1	148.7	148.7	148.7	148.4
Option 3	147.1	147.1	147.1	147.1	147.1
Option 4	148.1	148.7	148.7	148.7	148.4
Option 5	148.1	148.6	148.6	148.7	148.3
Option 6	147.8	148.2	148.2	148.2	148.0
Intra-EU/EFTA RPK, year 2030, billion					
Option 1	777	772	772	772	774
Option 2	778	775	775	775	777
Option 3	782	782	782	782	782
Option 4	778	775	775	775	777
Option 5	778	775	775	775	777
Option 6	779	777	777	776	778

1.9 Impacts on Outermost Regions

The impacts of the different policy options on EU outermost regions in the COVID19-adjusted demand scenario are shown below. In general, only Policy Option 1 has non-negligible impacts on OMRs. For Option 1, carbon costs on routes to and from OMRs are smaller than in the previous set of runs in 2030, but slightly larger in 2035; the main factor here is the increase in nominal assumed year-2035 carbon price. Changes in assumptions about the number and location of unscheduled flights also affect some baseline totals for the Canary Islands.

Table 21. Projected carbon costs and numbers of flights on routes to and from outermost regions, 2030 and 2035. Numbers in larger font show outcomes when all uncertain variables are at COVID19-adjusted nominal values. Numbers in brackets show range across all values for non-baseline demand uncertain input variables.

Policy option	Projected carbon costs as a percentage of total segment operating cost on routes to/from/within outermost regions		Projected number of flights to/from/within outermost regions, thousand	
	2030	**2035**	**2030**	**2035**
Option 1	1.45 (1.22-5.29)	2.52 (1.94-8.04)	458 (419-488)	522 (473-569)
Option 2	0.05 (0.05-0.24)	0.10 (0.08-0.33)	461 (426-491)	527 (486-575)
Option 3	0.005 (0.0-0.23)	0.006 (0.002-0.24)	462 (429-492)	529 (490-576)
Option 4	0.07 (0.05-0.33)	0.10 (0.08-0.46)	461 (426-491)	527 (486-575)
Option 5	0.07 (0.05-0.45)	0.10 (0.08-0.54)	461 (426-491)	527 (486-575)
Option 6	0.004 (0.002-0.11)	0.005 (0.003-0.14)	462 (428-492)	528 (489-576)

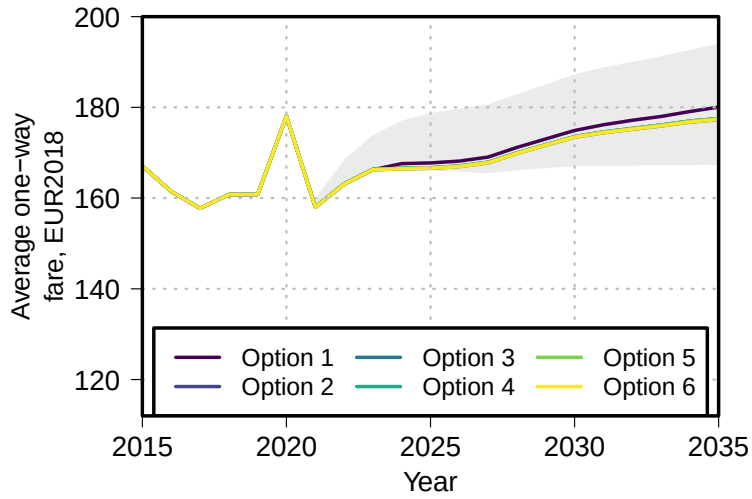

Figure 29. Average one-way fare on routes to, from and within EU outermost regions, by policy option at COVID19-adjusted nominal values for uncertain input variables (solid lines). Grey shaded areas show the range of uncertainty across all non-baseline demand uncertain variables.

Table 22. Average one-way fare for routes to/from/within EU outermost regions by policy option, 2015, 2030 and 2035, for all uncertain variables set to COVID19-adjusted nominal values (numbers in larger font) and range due to variation in non-baseline demand uncertain input variables (numbers in brackets).

Policy option	Avg. one-way fare, to/from/within OMRs, €2018		
	2015	**2030**	**2035**
Option 1	167.10	174.91 (169-187)	180.05 (170-194)
Option 2	167.10	173.55 (167-183)	177.53 (168-187)
Option 3	167.10	173.42 (167-183)	177.30 (167-186)
Option 4	167.10	173.56 (167-183)	177.54 (168-187)
Option 5	167.10	173.56 (167-183)	177.53 (168-187)
Option 6	167.10	173.44 (167-183)	177.35 (167-186)

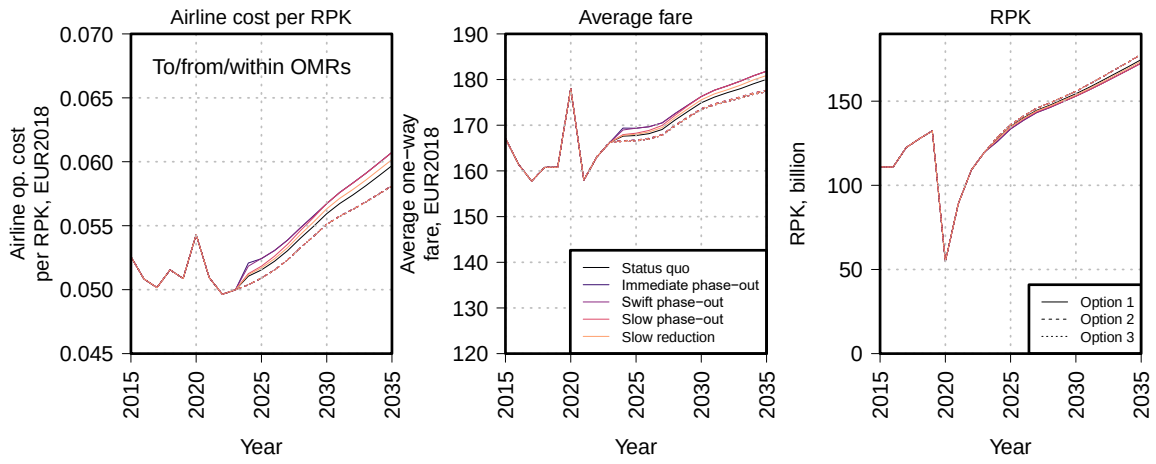

Figure 30. Impacts on airline cost per RPK, average fare, and RPK travelled, for routes to, from and within OMRs, by policy option and future allowance auctioning option at COVID19-adjusted nominal values for uncertain input variables.

2 Impacts of specific policy variants

2.1 Option 1 applying to outgoing flights only

The impacts of applying Option 1 to outgoing flights only under the COVID19-adjusted demand scenario are shown below.

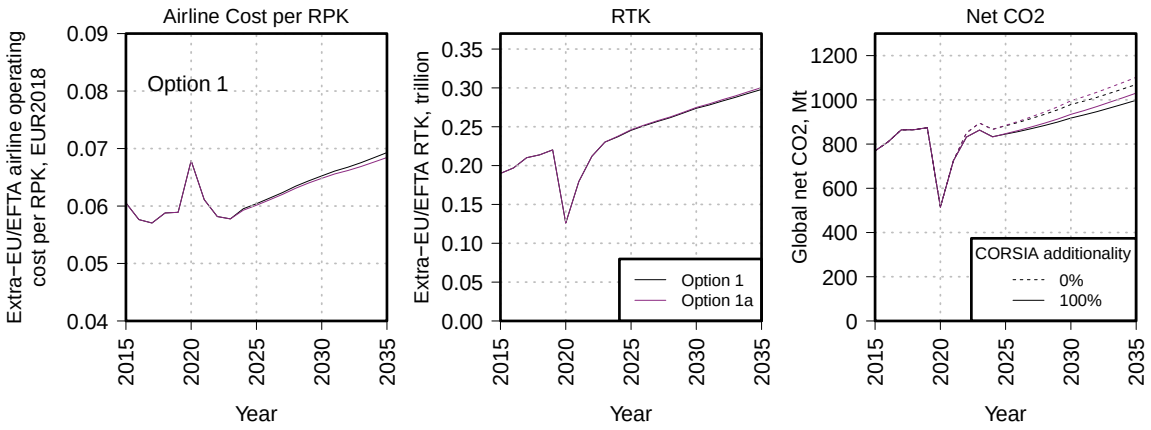

Figure 31. Impact of option 1 on extra-EEA departing flights only, in comparison to option 1 on all extra-EEA flights: extra-European airline cost per RPK, RTK and global net CO_2.

2.2 Options 4, 5 and 6 including outermost regions

The impact in the COVID19-adjusted demand scenario of running options 4, 5 and 6 with intra-EU/EFTA flights to and from outermost regions included in the EU ETS (referred to as Options 4a, 5a and 6a) are shown below. Additionally Option 4 is applied with international intra-EU/EFTA flights to and from outermost regions included in CORSIA (referred to as Option 4b). Metrics assessing the inclusion of outermost regions in policy options 4, 5 and 6. CO_2 totals assume that CORSIA offsets are fully additional. In general, including COVID19 has only a small impact on the relative effect of each policy, though it has a larger impact on metrics across all policies (e.g., airline cost per RPK is lower due to lower oil price, and demand is lower due to lower GDP growth, but these affect all policy options roughly equally). As discussed in Section 1.8.1, additional reductions in CORSIA offset requirements arise in 2030 from including route groups that are slow-growing and/or particularly affected by COVID19 in CORSIA. Adding these route groups to the scheme acts to increase the baseline and make average growth above the baseline smaller, so that under Sectoral offset requirements the scheme makes fewer offsets even though its scope is larger. By 2035 this effect is much reduced via the transition to mainly Individual offset requirements.

Policy option	EUAA auctioning revenue, million €2018		Airline cost per RPK, flights to/from OMRs, €2018		RTK to/from OMRs, billion		Global net aviation CO_2, Mt	
	2030	2035	2030	2035	2030	2035	2030	2035
Option 4	73	105	0.053	0.056	15.8	18.0	1003	1091
Option 4a	78	111	0.054	0.058	15.6	17.7	997	1084
Option 4b	73	104	0.053	0.056	15.8	18.0	1005	1092
Option 5	73	105	0.053	0.056	15.8	18.0	1022	1097
Option 5a	78	111	0.054	0.058	15.6	17.8	1015	1090
Option 6	62	88	0.053	0.056	15.8	18.0	1010	1098
Option 6a	63	91	0.054	0.057	15.7	17.9	1006	1094

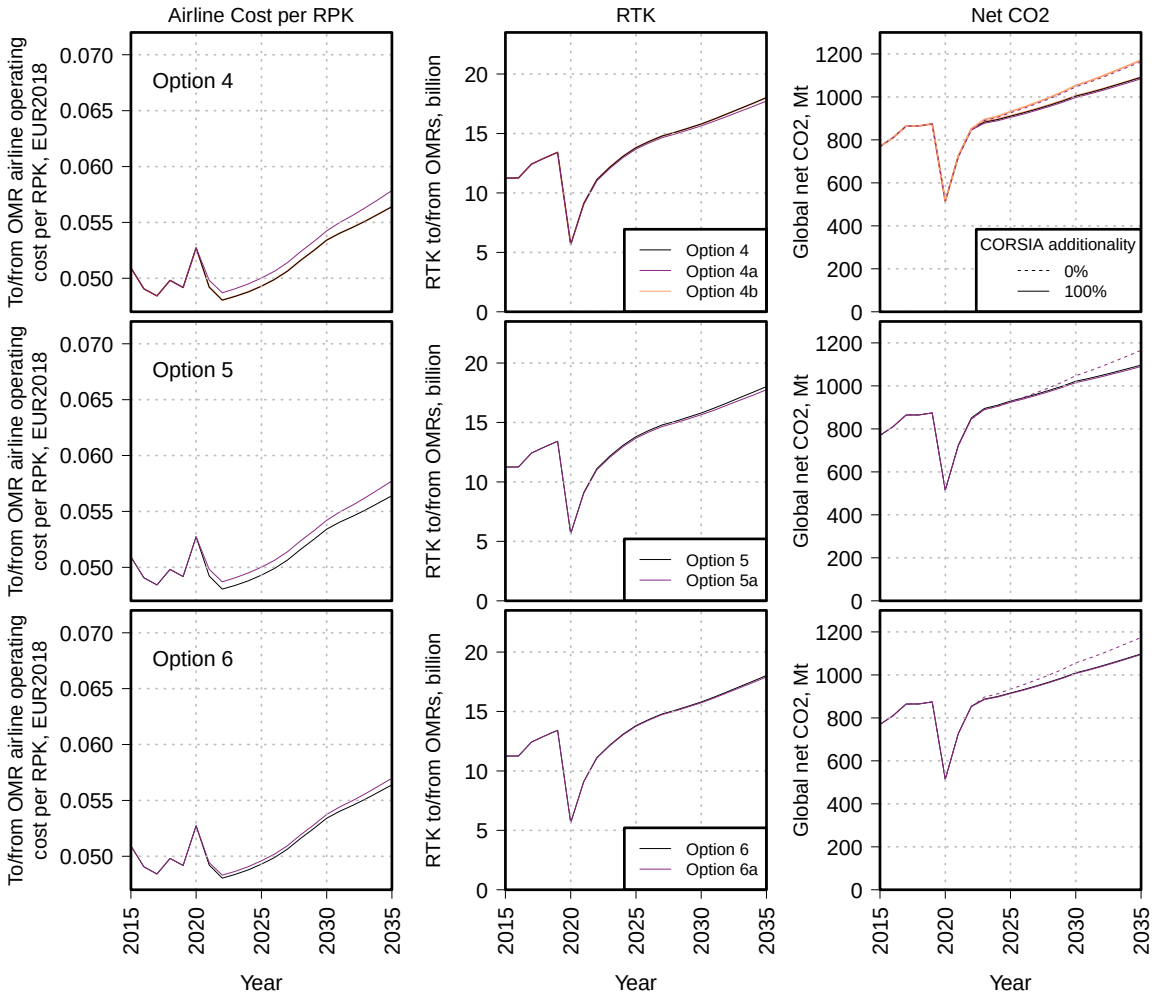

Figure 32. The impact of including flights to and from outermost regions in the EU ETS in policy options 4, 5 and 6: airline cost per RPK to and from OMRs, RTK to and from OMRs, and global net aviation CO_2. The COVID19-adjusted nominal scenario is used as a baseline.

Changes in CORSIA offset requirements

This section shows outcomes from the COVID19-updated analysis of the impact of imposing additional requirements on CORSIA credits for routes to and from or within the EU/EFTA (as assessed by evaluating the impact of higher CORSIA credit prices). Outcomes are very close to the case without COVID19; the main difference is that baseline net CO_2, RTK and RPK are lower, but the relative impact on these values of changing CORSIA credit prices remains similar.

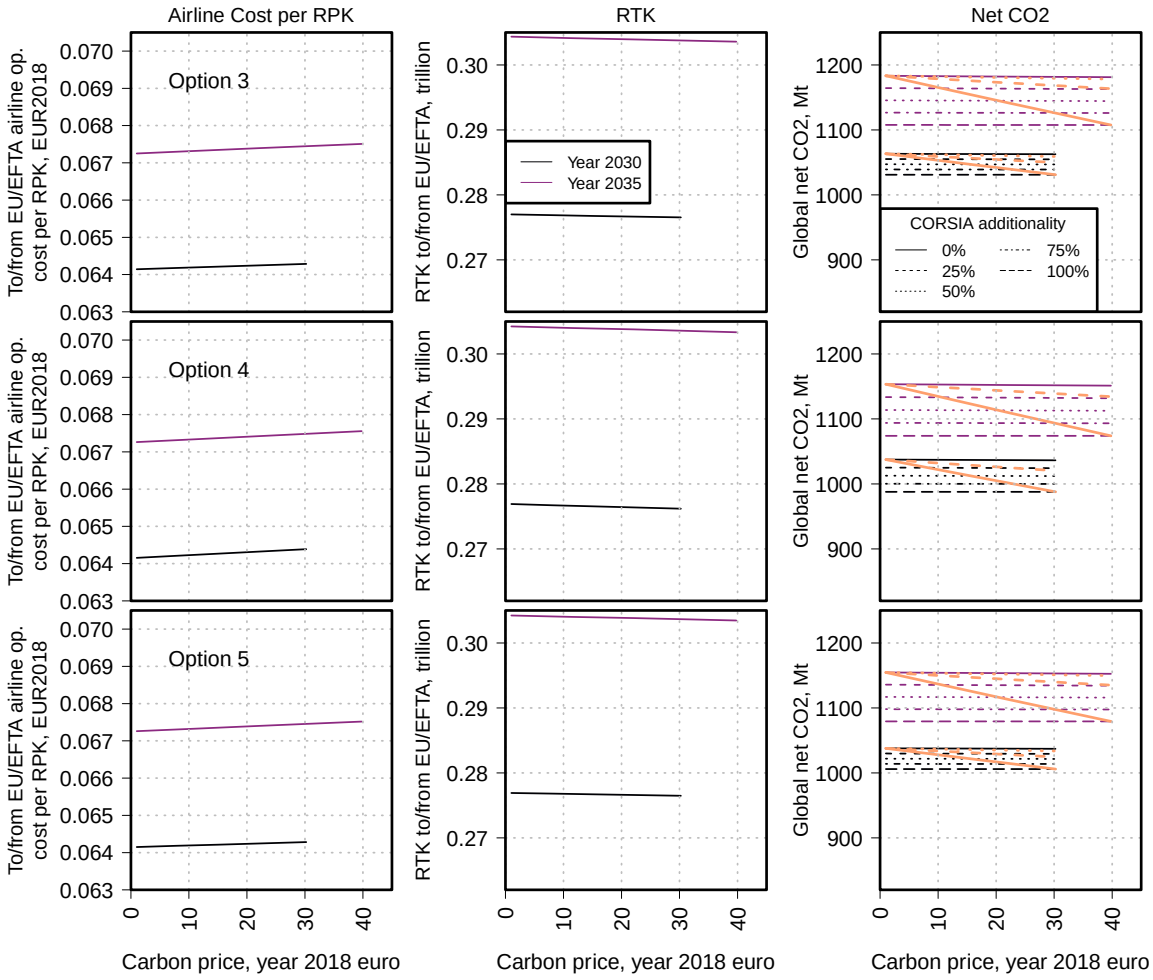

Figure 33. Impact on intra-EU/EFTA flights and global net CO_2 of changing CORSIA offset costs and additionality, simulating offsets of different quality levels. Orange lines show schematic relationships in the case that offset additionality varies linearly with carbon price, for higher-price offsets applied globally (solid orange line) and for flights to/from and within Europe (dashed orange line) and only for CORSIA-covered flights within Europe (dotted line). These model runs include the impact of COVID19.

Option 5 with EU ETS on domestic flights above the CORSIA baseline

This section shows outcomes from applying the EU ETS in Option 5 to intra-EU/EFTA flights above the CORSIA baseline as well as below, for the COVID19-adjusted demand scenario. As in the previous impact assessment, results are almost identical to Option 5 without this adjustment. This is because domestic flights in many EU/EFTA countries are decreasing, so domestic flight CO_2 typically remains below the CORSIA baseline.

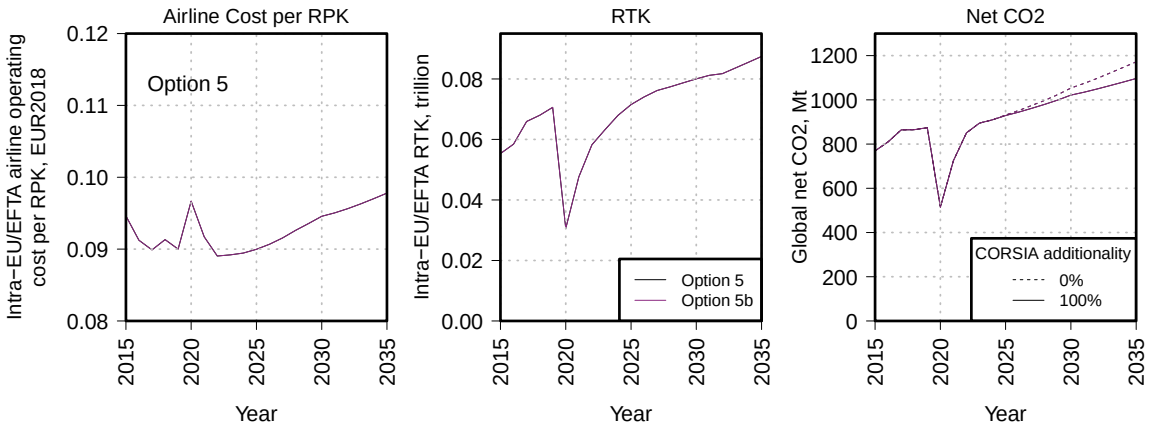

Figure 34. Impacts on intra-EU/EFTA airline costs, RTK and global Net CO_2 of adjusting Option 5 to fully include EU/EFTA domestic flights in the EU ETS in the COVID19-adjusted demand scenario.

3 Supplementary tables and figures from the aviation modelling

Table 23. Yearly Demand (tkm), direct CO_2, and net CO_2 adjusted for allowances and offsets, by policy for COVID19-adjusted nominal scenario conditions

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Aviation tonne-km, billion, global																					
Option 1	893	946	1021	1042	1088	587	895	1120	1228	1280	1331	1380	1427	1473	1526	1580	1622	1666	1713	1761	1810
Option 2	893	946	1021	1042	1088	587	895	1120	1228	1282	1335	1382	1430	1476	1529	1584	1626	1671	1719	1767	1816
Option 3	893	946	1021	1042	1088	587	895	1120	1229	1283	1335	1383	1430	1477	1530	1584	1627	1672	1719	1768	1817
Option 4	893	946	1021	1042	1088	587	895	1120	1228	1282	1335	1382	1430	1476	1529	1584	1626	1671	1719	1767	1816
Option 5	893	946	1021	1042	1088	587	895	1120	1228	1282	1335	1382	1430	1476	1529	1584	1626	1671	1719	1767	1816
Option 6	893	946	1021	1042	1088	587	895	1120	1228	1283	1335	1382	1430	1476	1529	1584	1626	1671	1719	1767	1817
Aviation tonne-km, billion, routes to and from Europe (EU/EFTA, excluding UK)																					
Option 1	190	197	210	214	220	126	180	212	230	237	245	251	257	262	268	274	278	283	288	293	298
Option 2	190	197	210	214	220	126	180	212	230	240	248	254	259	265	271	277	282	288	293	299	304
Option 3	190	197	210	214	220	126	180	212	230	240	248	254	259	265	271	277	282	288	293	299	304
Option 4	190	197	210	214	220	126	180	212	230	240	248	254	259	265	271	277	282	288	293	299	304
Option 5	190	197	210	214	220	126	180	212	230	240	248	254	259	265	271	277	282	288	293	299	304
Option 6	190	197	210	214	220	126	180	212	230	240	248	254	259	265	271	277	282	288	293	299	304
Aviation tonne-km, billion, routes within Europe (EU/EFTA, excluding UK)																					
Option 1	55	58	66	68	71	31	48	58	63	68	71	74	76	77	79	80	81	82	83	85	87
Option 2	55	58	66	68	71	31	48	58	63	68	72	74	76	77	79	80	81	82	84	85	87

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Option 3	55	58	66	68	71	31	48	59	63	68	72	74	77	78	79	80	82	82	84	86	88
Option 4	55	58	66	68	71	31	48	58	63	68	72	74	76	77	79	80	81	82	84	85	87
Option 5	55	58	66	68	71	31	48	58	63	68	72	74	76	77	79	80	81	82	84	86	87
Option 6	55	58	66	68	71	31	48	58	63	68	72	74	76	77	79	80	81	82	84	86	88
Aviation direct CO_2, Mt, global																					
Option 1	789	831	891	892	899	515	735	866	912	928	951	973	996	1020	1046	1077	1097	1120	1145	1170	1196
Option 2	789	831	891	892	899	515	735	866	912	930	953	974	998	1022	1048	1079	1100	1123	1148	1174	1200
Option 3	789	831	891	892	899	515	735	866	912	930	953	974	998	1022	1049	1079	1100	1123	1148	1174	1201
Option 4	789	831	891	892	899	515	735	866	912	930	953	974	998	1022	1048	1079	1100	1123	1148	1174	1200
Option 5	789	831	891	892	899	515	735	866	912	930	953	974	998	1022	1048	1079	1100	1123	1148	1174	1200
Option 6	789	831	891	892	899	515	735	866	912	930	953	974	998	1022	1048	1079	1100	1123	1148	1274	1200

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Aviation direct CO_2, Mt, routes to and from Europe (EU/EFTA, excluding UK)																					
Option 1	151	156	165	166	166	99	136	152	159	160	162	164	166	167	169	172	174	176	177	179	182
Option 2	151	156	165	166	166	99	136	152	159	161	164	165	167	169	171	174	176	178	180	183	185
Option 3	151	156	165	166	166	99	136	152	159	161	164	165	167	169	171	174	176	178	180	183	185

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Option 4	151	156	165	166	166	99	136	152	159	161	164	165	167	169	171	174	176	178	180	183	185
Option 5	151	156	165	166	166	99	136	152	159	161	164	165	167	169	171	174	176	178	180	183	185
Option 6	151	156	165	166	166	99	136	152	159	161	164	165	167	169	171	174	176	178	180	183	185
Aviation direct CO_2, Mt, routes within Europe (EU/EFTA, excluding UK)																					
Option 1	52	54	60	60	59	28	40	45	47	50	51	51	52	52	52	52	52	52	53	53	54
Option 2	52	54	60	60	59	28	40	45	47	50	51	51	52	52	52	52	53	52	53	54	54
Option 3	52	54	60	60	59	28	40	45	47	50	51	52	52	52	52	53	53	53	53	54	55
Option 4	52	54	60	60	59	28	40	45	47	50	51	51	52	52	52	52	53	52	53	54	54
Option 5	52	54	60	60	59	28	40	45	47	50	51	51	52	52	52	52	53	52	53	54	54
Option 6	52	54	60	60	59	28	40	45	47	50	51	51	52	52	52	53	53	52	53	54	54
Aviation net CO_2 adjusted for offsets and allowances, Mt, global, assuming 100% additional offsets																					
Option 1	769	810	864	865	874	515	725	832	863	833	845	857	870	884	900	918	932	947	964	981	998
Option 2	769	810	864	865	874	515	725	832	863	876	894	910	928	947	968	992	1011	1032	1054	1076	1099
Option 3	769	810	864	865	874	515	735	866	912	930	951	967	985	1004	1024	1047	1060	1075	1091	1108	1125
Option 4	769	810	864	865	874	515	725	851	883	894	910	926	943	962	981	1003	1019	1036	1054	1073	1091
Option 5	769	810	864	865	874	515	725	851	895	929	945	971	962	980	999	1022	1035	1049	1065	1080	1097
Option 6	769	810	864	865	874	515	728	854	887	899	916	932	949	968	987	1010	1025	1042	1060	1079	1098
Aviation net CO_2 adj. for offsets and allowances, Mt, routes to/from Europe (EU/EFTA, exc. UK), assuming 100% additional offsets																					
Option 1	144	148	156	157	158	96	132	148	155	110	107	104	101	99	96	94	91	89	86	83	80

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Option 2	144	148	156	157	158	96	132	148	155	158	160	162	164	165	168	170	172	174	177	179	181
Option 3	144	148	156	157	158	96	132	148	155	158	159	160	160	160	160	161	162	163	164	165	166
Option 4	144	148	156	157	158	96	132	148	151	152	153	153	153	153	153	154	155	157	159	162	164
Option 5	144	148	156	157	158	96	132	148	155	158	160	160	160	160	160	161	162	163	164	165	166
Option 6	144	148	156	157	158	96	132	148	151	152	153	153	153	153	154	154	156	158	159	162	164

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Aviation net CO_2 adj. for offsets and allowances, Mt, routes within Europe (EU/EFTA, exc. UK), assuming 100% additional offsets																					
Option 1	37	38	40	40	40	28	30	30	30	35	34	34	33	32	31	30	29	27	27	26	25
Option 2	37	38	40	40	40	28	30	30	30	30	29	29	28	28	27	27	27	26	26	25	25
Option 3	37	38	40	40	40	28	40	45	47	50	51	51	50	50	50	49	49	49	50	51	52
Option 4	37	38	40	40	40	28	30	30	30	30	29	29	28	28	27	27	27	26	26	25	25
Option 5	37	38	40	40	40	28	30	30	30	30	29	28	27	26	25	24	23	23	23	23	23
Option 6	37	38	40	40	40	28	33	34	34	34	24	34	34	33	33	32	32	32	31	31	31

4 Comparison of direct CO_2 emissions covered by the EU ETS and CORSIA, by policy option and participation

This annex includes COVID19-adjusted supplementary data from the sections on CORSIA and EU ETS coverage. This includes estimates of total EU ETS allowance demand from aviation in comparison to the projected total number of allowances, and direct comparisons of CO_2 covered under the EU ETS and CORSIA in absolute and percentage terms.

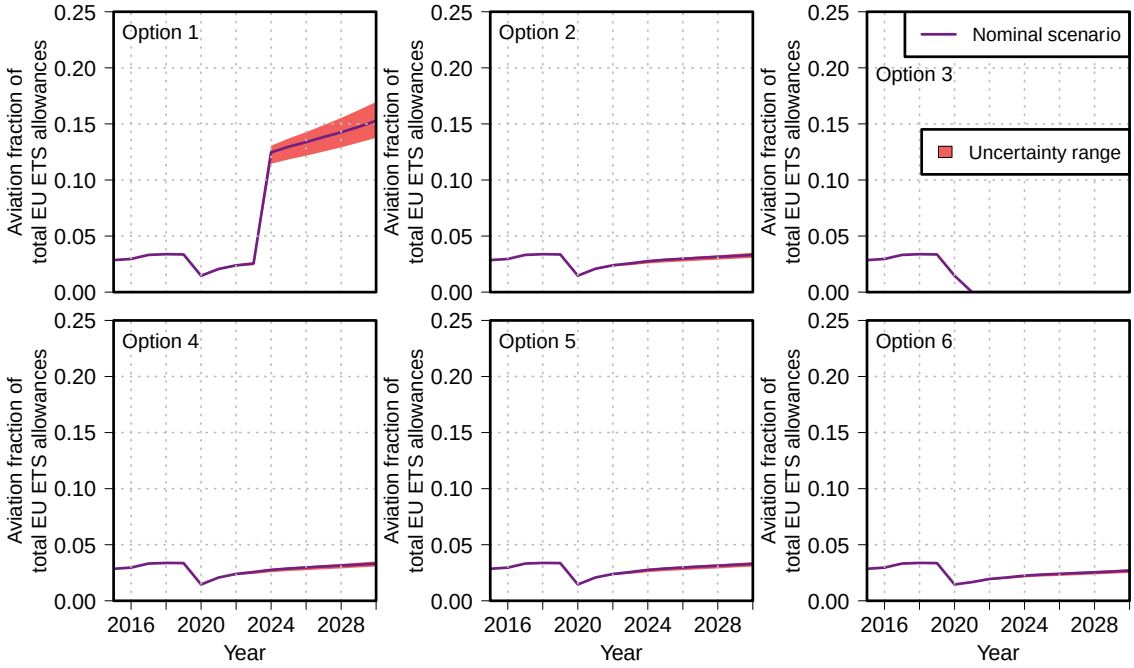

Figure 35. *Fraction of total EU ETS (EUA + EUAA) allowances purchased by aircraft operators, to 2030, by policy option. Solid lines show outcomes with all uncertain scenario variables set to COVID19-adjusted nominal values. Shaded ranges show the range of outcomes across all values for non-baseline demand uncertain scenario variables; because demand growth was a major component of uncertainty in the original (pre COVID19) comparison, this means uncertainty ranges are smaller.*

Table 24. CORSIA and EU ETS total coverage, and CO_2 offset, as a percentage of global direct aviation CO_2. Figures in larger font show outcomes with all scenario variables set to COVID19-adjusted nominal values. Figures in brackets show the range of variation due to variation in non-baseline demand uncertain scenario variables.

Policy option	Direct CO_2 covered by CORSIA, % of total		Direct CO_2 offset under CORSIA, % of total		Direct CO_2 covered by EU ETS, % of total		Direct CO_2 offset under EU ETS, % of total	
	2030	2035	2030	2035	2030	2035	2030	2035
Initial Assumed CORSIA Participation								
Option 1	21.6 (21.4-22.1)	21.6 (21.5-22.2)	5.7 (3.9-7.9)	6.0 (3.6-8.8)	20.8 (20.1-21.4)	19.7 (18.6-20.2)	9.1 (7.8-10.1)	10.6 (8.3-11.4)
Option 2	21.6 (21.4-22.0)	21.5 (21.3-22.1)	5.7 (3.9-7.9)	6.0 (3.6-8.8)	4.2 (3.9-4.3)	3.8 (3.5-4.0)	2.4 (2.3-2.4)	2.4 (2.2-2.5)
Option 3	36.2 (35.8-36.6)	35.3 (34.7-35.8)	3.0 (0.0-6.9)	6.3 (2.8-10.6)	0.0 (0.0-0.0)	0.0 (0.0-0.0)	0.0 (0.0-0.0)	0.0 (0.0-0.0)
Option 4	32.3 (31.8-32.8)	31.7 (31.1-32.4)	4.6 (1.8-8.1)	6.6 (3.4-10.7)	4.2 (3.9-4.3)	3.8 (3.5-4.0)	2.4 (2.3-2.4)	2.4 (2.2-2.5)
Option 5	36.1 (35.7-36.6)	35.3 (34.7-35.8)	3.0 (0.0-6.9)	6.3 (2.8-10.6)	4.1 (3.8-4.3)	3.7 (3.3-4.0)	2.3 (2.2-2.4)	2.3 (2.1-2.4)
Option 6	32.5 (32.0-33.0)	31.9 (31.3-32.6)	4.6 (1.7-8.1)	6.6 (3.4-10.7)	3.4 (3.1-3.5)	3.1 (2.8-3.3)	1.8 (1.8-1.9)	1.9 (1.7-2.0)
High CORSIA Participation								
Option 1	33.8 (33.5-34.5)	34.0 (33.7-34.8)	9.6 (6.7-12.9)	10.8 (7.0-14.9)	20.8 (20.1-21.4)	19.7 (18.6-20.2)	9.1 (7.8-10.1)	10.6 (8.3-11.4)
Option 2	33.7 (33.4-34.3)	33.9 (33.6-34.6)	9.6 (6.7-12.9)	10.8 (7.1-14.9)	4.2 (3.9-4.3)	3.8 (3.5-4.0)	2.4 (2.3-2.4)	2.4 (2.2-2.5)
Option 3	51.3 (50.8-51.9)	50.5 (49.8-51.2)	6.9 (2.3-12.3)	11.6 (6.5-17.6)	0.0 (0.0-0.0)	0.0 (0.0-0.0)	0.0 (0.0-0.0)	0.0 (0.0-0.0)
Option 4	47.4 (46.8-48.2)	46.9 (46.1-47.8)	8.5 (4.4-13.5)	11.9 (7.1-17.6)	4.2 (3.9-4.3)	3.8 (3.5-4.0)	2.4 (2.3-2.4)	2.4 (2.2-2.5)
Option 5	51.3 (50.7-51.9)	50.5 (49.7-51.2)	6.9 (2.2-12.3)	11.5 (6.5-17.5)	4.1 (3.8-4.3)	3.7 (3.3-4.0)	2.3 (2.2-2.4)	2.3 (2.1-2.4)
Option 6	47.6 (47.0-48.4)	47.1 (46.3-48.0)	8.5 (4.3-13.5)	11.9 (7.1-17.7)	3.4 (3.1-3.5)	3.1 (2.8-3.3)	1.8 (1.8-1.9)	1.9 (1.7-2.0)

Policy option	Direct CO_2 covered by CORSIA, % of total		Direct CO_2 offset under CORSIA, % of total		Direct CO_2 covered by EU ETS, % of total		Direct CO_2 offset under EU ETS, % of total	
	2030	2035	2030	2035	2030	2035	2030	2035
Low CORSIA Participation								
Option 1	13.4 (13.2-13.7)	13.7 (13.5-14.1)	3.8 (2.6-5.1)	4.4 (2.8-6.1)	20.8 (20.1-21.4)	19.7 (18.5-20.2)	9.1 (7.8-10.1)	10.6 (8.3-11.4)
Option 2	13.4 (13.2-13.6)	13.7 (13.5-14.0)	3.8 (2.6-5.1)	4.4 (2.9-6.1)	4.2 (3.9-4.3)	3.8 (3.5-4.0)	2.4 (2.3-2.4)	2.4 (2.2-2.5)
Option 3	24.5 (24.3-24.7)	24.2 (23.9-24.4)	2.4 (0.1-4.9)	5.0 (2.6-7.7)	0.0 (0.0-0.0)	0.0 (0.0-0.0)	0.0 (0.0-0.0)	0.0 (0.0-0.0)
Option 4	20.6 (20.4-20.9)	20.6 (20.3-20.9)	4.0 (2.3-6.1)	5.3 (3.1-7.7)	4.2 (3.9-4.3)	3.8 (3.5-4.0)	2.4 (2.3-2.4)	2.4 (2.2-2.5)
Option 5	24.5 (24.3-24.7)	24.2 (23.8-24.4)	2.4 (0.1-4.9)	5.0 (2.5-7.6)	4.1 (3.8-4.3)	3.7 (3.3-4.0)	2.3 (2.2-2.4)	2.3 (2.1-2.4)
Option 6	20.8 (20.6-21.1)	20.8 (20.5-21.1)	4.0 (2.2-6.0)	5.3 (3.1-7.7)	3.4 (3.1-3.5)	3.1 (2.8-3.3)	1.9 (1.8-1.9)	1.9 (1.7-2.0)

Table 25. CORSIA and EU ETS total coverage, and CO_2 offset, absolute values. Figures in larger font show outcomes with all scenario variables set to COVID19-adjusted nominal values. Figures in brackets show the range of variation due to variation in non-baseline demand uncertain scenario variables.

Policy option	Direct CO_2 covered by CORSIA, Mt		Direct CO_2 offset under CORSIA, Mt		Direct CO_2 covered by EU ETS, Mt			Direct CO_2 offset under EU ETS, Mt		
	2030	2035	2030	2035	2015	2030	2035	2015	2030	2035
Initial Assumed CORSIA Participation										
Option 1	233 (207-266)	258 (226-310)	61 (38-95)	71 (38-123)	58	224 (202-249)	236 (208-269)	20	98 (75-122)	127 (87-160)
Option 2	233 (207-266)	259 (227-310)	61 (38-95)	71 (39-124)	58	45 (42-48)	46 (42-50)	20	25 (22-28)	29 (23-33)
Option 3	390 (352-439)	424 (376-498)	32 (0-84)	76 (30-149)	58	0 (0-0)	0 (0-0)	20	0 (0-0)	0 (0-0)
Option 4	348 (313-395)	380 (336-451)	50 (17-98)	79 (36-150)	58	45 (42-48)	46 (42-50)	20	25 (22-28)	29 (23-33)
Option 5	390	424	32	75	58	45	45	20	25	28

Policy option	Direct CO_2 covered by CORSIA, Mt		Direct CO_2 offset under CORSIA, Mt		Direct CO_2 covered by EU ETS, Mt			Direct CO_2 offset under EU ETS, Mt		
	2030	2035	2030	2035	2015	2030	2035	2015	2030	2035
	(352-439)	(375-498)	(0-83)	(30-149)		(42-47)	(42-47)		(22-27)	(23-30)
Option 6	350 (315-397)	383 (338-454)	49 (17-98)	79 (36-151)	58	36 (34-38)	37 (43-40)	20	20 (17-22)	23 (18-26)
High CORSIA Participation										
Option 1	364 (324-415)	407 (356-486)	103 (65-155)	129 (74-209)	58	224 (202-249)	236 (208-269)	20	98 (75-122)	127 (87-160)
Option 2	364 (324-415)	407 (356-486)	103 (65-155)	129 (75-209)	58	45 (42-48)	46 (42-50)	20	25 (22-28)	29 (23-33)
Option 3	553 (498-625)	606 (536-715)	74 (22-149)	139 (69-247)	58	0 (0-0)	0 (0-0)	20	0 (0-0)	0 (0-0)
Option 4	511 (458-580)	563 (495-668)	92 (43-163)	143 (75-248)	58	45 (42-48)	46 (42-50)	20	25 (22-28)	29 (23-33)
Option 5	553 (497-625)	606 (535-715)	74 (21-148)	138 (69-247)	58	45 (42-47)	45 (42-47)	20	25 (22-27)	28 (23-30)
Option 6	513 (460-583)	565 (497-670)	91 (42-163)	142 (75-248)	58	36 (34-38)	37 (34-40)	20	20 (17-22)	23 (18-26)
Low CORSIA Participation										
Option 1	145 (128-165)	164 (143-197)	41 (25-62)	53 (30-86)	58	224 (202-249)	236 (208-269)	20	98 (75-122)	127 (87-160)
Option 2	145 (128-165)	164 (143-197)	41 (25-62)	53 (30-86)	58	45 (42-48)	46 (42-50)	20	25 (22-28)	29 (23-33)
Option 3	264 (239-296)	291 (258-339)	26 (1-59)	60 (27-108)	58	0 (0-0)	0 (0-0)	20	0 (0-0)	0 (0-0)
Option 4	222 (199-251)	247 (217-292)	44 (22-74)	64 (33-109)	58	45 (42-48)	46 (42-50)	20	25 (22-28)	29 (23-33)
Option 5	264 (238-296)	290 (257-339)	26 (1-59)	59 (27-107)	58	45 (42-47)	45 (42-47)	20	25 (22-27)	28 (23-30)
Option 6	225 (201-254)	249 (219-295)	43 (21-73)	63 (33-109)	58	36 (34-38)	37 (34-40)	20	20 (17-22)	23 (18-26)

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