TAKS
TRANSPORT ANALYSIS AND KNOWLEDGE SYSTEMS

Environmental and economic impacts of EU ETS and CORSIA policy scenarios for European aviation

Report prepared by TAKS for Transport and Environment (T&E) and Carbon Market Watch (CMW)
Report nr: 22-11

André van Velzen (TAKS)

April 2022

Utrecht - the Netherlands, TAKS, April 2022

Title: Environmental and economic impacts of EU ETS and CORSIA policy scenarios for European aviation
Author: André van Velzen (TAKS)
Report nr: 22-11
Prepared for: Transport and Environment (T&E) and Carbon Market Watch (CMW)

Disclaimer

The European Aviation Safety Agency (EASA) has made available the AERO-MS model for this research on a complimentary basis. The content of this report does not reflect the official opinion of EASA or of the European Union. Responsibility for the information and views expressed lies entirely with the authors.

Contents

List of tables

List of figures

List of acronyms and units

AERO-MS	Aviation Emissions and Evaluation of Reduction Options - Modelling System
CER	Certified Emission Reduction
CH	Switzerland
CMW	Carbon Market Watch
CNG2020	Carbon Neutral Growth 2020
CO_2	Carbon dioxide
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
COVID-19	Coronavirus Disease 2019
EASA	European Aviation Safety Agency
EC	European Commission
EEA	European Economic Area (EU27, Norway, Iceland, Liechtenstein)
EEA incoming flights	Flights arriving in EEA Member States which departed from non-EEA countries
EEA outgoing flights	Flights departing from EEA Members States with the destination in non-EEA countries
ETD	Energy Tax Directive
ETS	Emissions Trading System
EU	European Union
EU27	27 Member States of the European Union
EUA	European Union Allowance for one tonne of CO_2
EUAA	European Union Aviation Allowance for one tonne of CO_2
FF55	Fit-for-55 legislative package to implement the EU climate target
GHG	Greenhouse Gas
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
Intra EEA flight	Flight with both the airport of departure and airport of arrival in one of the EEA Member States
IPR	Intellectual Property Rights
LRF	Linear Reduction Factor
MBM	Market Based Measure
Mt	Megatonne, million tonne
RED	Renewable Energy Directive
RTK	Revenue Tonne Km
SAFs	Sustainable Aviation Fuels
T&E	Transport and Environment
UK	United Kingdom of Great Britain and Northern Ireland

1. Introduction

In July 2021, the European Commission presented the Fit-for-55 (FF55)[1] legislative package which is designed to implement the enhanced EU climate target of at least a net 55% greenhouse gas emission reduction in 2030, relative to 1990 emission levels. The FF55 package includes four proposals that directly affect the aviation sector:

- the revision of the EU Emission Trading System (EU ETS) for aviation, including the introduction of the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) for European aviation;
- the ReFuel EU aviation regulation for a blending mandate of Sustainable Aviation Fuels (SAFs);
- the revision of the Renewable Energy Directive (RED); and
- the recast of the Energy Tax Directive (ETD).

This study relates to the revision of the EU ETS for aviation also taking into account CORSIA.

Aviation was brought into the EU ETS in 2012. Originally the EU ETS covered all flights to and from airports in Member States of the European Economic Area (EEA). A number of countries from outside the EEA strongly disagreed that aircraft operators which are not based in the EEA were also subject to the EU ETS for the flights between non-EEA and EEA Member States. In 2013 the scope of flights subject to the EU ETS was temporarily reduced to only flights between and within EEA Member States (referred to as 'intra EEA flights'). The European Court of Justice stipulating that the EU was in its right to apply the EU ETS to flights outside the EU[2]. The reduction of scope was also adopted in order to provide time to ICAO to agree on a global Market Based Measure.

During the ICAO Assembly in October 2016 a resolution[3] was adopted to implement a global Market Based Measure, called the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), which aims to stabilise net emissions of international aviation at 2020 levels. This is referred to as carbon neutral growth 2020 (CNG2020). CORSIA requires airlines to offset their emissions on international routes above the baseline level. The baseline was initially based on an average of 2019-2020 emissions, but because of COVID-19 was reduced to 2019 levels for the pilot phase. CORSIA's pilot phase started in 2021 and ICAO Member States can voluntarily participate until 2027. From 2027 onwards CORSIA is supposed to be mandatory for all ICAO Member States, except for Least Developed Countries, Small Island Developing States and Landlocked Developing Countries and states that have a share of international aviation activities in Revenue Tonne Km (RTK) below 0.5% of total RTKs. CORSIA applies to all international flights between participating ICAO Member States. All EEA Member States indicated their intention to join CORSIA during the pilot phase but without prejudice to the legislative talks to modify the EU ETS[4].

[1] Delivering the European Green Deal | European Commission (europa.eu)
[2] https://curia.europa.eu/juris/liste.jsf?language=en&num=C-366/10
[3] https://www.icao.int/environmental-protection/Documents/Resolution_A39_3.pdf
[4] https://data.consilium.europa.eu/doc/document/ST-8758-2020-INIT/en/pdf

As part of the FF55 package the EC has proposed to retain the EU ETS for intra EEA flights and that CORSIA will apply to flights between the EEA and ICAO Member States outside the EEA which have also signed up to CORSIA or have to join CORSIA in the mandatory phase from 2027 onwards.

This study will assess the environmental and economic impacts of two alternative policy scenarios for the EC proposal, whereby these impacts are compared with the impacts of the EC proposal. For the study use is made of the AERO-MS[5].

In chapter 2 the two policy scenarios are defined and described. Chapter 3 describes the forecast of aviation emissions for the period 2021-2035 taking into account the impacts of COVID-19 for the aviation industry. Projections regarding future prices of EU ETS allowances and CORSIA international credits are presented in chapter 4. Chapter 5 describes the impacts of the 2 policy scenarios and the EC proposal in terms of the demand for EU ETS allowances and CORSIA international credits and the related costs for European aviation. Finally, a summary of the main conclusions from the study is provided in chapter 6.

2. EU ETS and CORSIA policy scenarios

In relation to the EU ETS and CORSIA the EC has proposed the following:

- EU ETS will be retained for intra EEA flights. This includes both domestic and international flights which both depart from and arrive at an airport in one of the EEA Member States. Moreover the EC has proposed that, opposite to the current situation, flights between outermost regions like the Canary Islands, Madeira and Azores and the EEA Member States will be subject to the EU ETS (with the exception of flights connecting outermost regions with the mother country).
- Following linkages with the CH ETS and the UK ETS, flights departing from EEA Member States and arriving Switzerland or the UK will become subject to the EU ETS.
- A Linear Reduction Factor (LRF) for the cap of 4.2% from 2024 onwards.
- Currently 82% of the annual EUAAs are free allocation. The allocation of EUAAs is amended to zero in 2027. A transition period applies from 2024, with the amount of allowances that is freely allocated is decreasing linearly towards full auctioning in 2027. In this study we have also looked at the situation where full auctioning is directly implemented from 2024 onwards.
- CORSIA will apply to EEA incoming and outgoing flights. EEA outgoing flights are flights departing from EEA Member States to non-EEA countries, except UK and CH. EEA incoming flights are flights departing from non-EEA countries to EEA Member States, except UK and CH.

Regarding CORSIA the current situation is that:

[5] The IPR of the AERO-MS is with EASA. For more information on the AERO-MS see: Impact assessment tools | EASA (europa.eu)

- 107 ICAO Members States have indicated to participate in CORSIA from the start[6].
- Based on 2018 RTK data for the mandatory phase (from 2027 onwards) another 5 major aviation countries are assumed to participate in CORSIA. These are: Brazil, China, India, Russia and Vietnam. Even though for these 5 countries it is mandatory to join CORSIA from 2027 onwards, it is not sure whether these countries will actually do so given they have not indicated they will participate in the pilot phase. Therefore the situation, where these 5 countries would not join CORSIA is also analysed.
- For the CORSIA pilot phase (2021-2023) it has been decided that the baseline will be 2019. For the period 2024-2035 two alternative baselines are presently discussed: 2019 and average 2019-2020. According to its proposal to revise the EU ETS, the EC is in favour of the average 2019-2020 emissions as the baseline for the period 2024-2035, and this is adopted as the default assumption in the analysis. However the situation where the baseline remains 2019 for the entire CORSIA period of 2021-2035 is also analysed in this study.

The two alternative policy scenarios considered in this study are:

1. EU ETS covering all intra EEA flights + all EEA outgoing flights. CORSIA covering all flights other than intra EEA with monetary compensation for international credits purchased to cover outgoing flights from EEA Member States
2. EU ETS covering all intra EEA flights + all EEA outgoing and EEA incoming flights. CORSIA covering all flights other than intra EEA with monetary compensation for international credits purchased to cover outgoing and incoming flights from/to EEA Member States.

A complete overview of the assumptions underlying both scenarios is provided in table 1.

Both the EU ETS and CORSIA assume that Sustainable Aviation Fuels (SAFs) have zero CO_2 emissions. The FF55 package has set blending mandates for SAFs of 2%, 5% and 32% for respectively 2025, 2030 and 2040 for all flights departing from an airport in EEA Member States. In the analysis it is assumed these blending mandates will be implemented affecting the demand for allowances and international credits from respectively the EU ETS and CORSIA.

[6] CORSIA_States_for_Chapter3_State_Pairs_Sept2020.pdf (icao.int)

Table 1. Alternative EU ETS and CORSIA policy scenarios.

	Policy Scenario 1. EU ETS covering all intra EEA flights + all outgoing flights	Policy Scenario 2. EU ETS covering all intra EEA flights + all outgoing and incoming flights
EU ETS		
Coverage of flights	Intra EEA flights plus flights departing from EEA Members States to non-EEA countries	Intra EEA flights plus flights departing from EEA Members States to non-EEA countries and vice versa
Aviation cap (EUAAs)	Cap which is relatively as strict as the cap for the EC proposal covering only intra EEA flights[7] LRF of 4.2% from 2024 onwards	Cap which is relatively as strict as the cap for the EC proposal covering only intra EEA flights LRF of 4.2% from 2024 onwards
Auctioning of EUAAs	Phase out of free allocation from 82% in 2024 with a linear decrease to zero in 2027. Hence from 2027 onwards full auctioning of EUAAs	Phase out of free allocation from 82% in 2024 with a linear decrease to zero in 2027. Hence from 2027 onwards full auctioning of EUAAs
CORSIA		
Coverage of EEA related flights	Intra EEA flights not subject to CORSIA. Flights between EEA Member States and non-EEA countries subject to CORSIA in so far as the non-EEA countries join CORSIA	Intra EEA flights not subject to CORSIA. Flights between EEA Member States and non-EEA countries subject to CORSIA in so far as the non-EEA countries join CORSIA
Baseline	Average of 2019-2020 baseline emission level	Average of 2019-2020 baseline emission level
Monetary compensation	Monetary compensation for international credits purchased to cover EEA outgoing flights	Monetary compensation for international credits purchased to cover EEA outgoing and incoming flights

3. Aviation emissions baseline until 2035

The impact of the COVID-19 pandemic on international aviation has been significant. Moreover, the recovery path of the aviation industry is still uncertain. In developing the aviation emissions baseline scenario three main questions have been considered:

1. What has been the reduction of aviation emissions in 2020 relative to 2019;
2. What will be the recovery path of aviation emissions to rebound to 2019 levels;
3. What is the long-term growth of aviation emissions after the rebound to 2019 levels.

[7] In 2019 the cap for aviation for intra EEA traffic only was 35.7 Mt. Verified emissions in 2019 were 68.2 Mt. Hence the cap reflected about 52% of verified emissions. For the two alternative policy scenarios, the cap is relatively as strict which means that the cap also reflects 52% of the 2019 emissions on the flights covered by the scenarios.

(1) Aviation emissions in 2020 relative to 2019

As part of CORSIA there are requirements for airlines to monitor CO_2 emissions related to international aviation. ICAO has published total CO_2 emissions for international aviation for both 2019 and 2020[8]. The data show CO_2 emissions of global international aviation in 2020 were 56% lower compared to 2019.

According to EU ETS data, aviation related CO_2 emission covered by the EU ETS in 2020 were about 63% lower compared to 2019 (i.e. 68.18 Mt verified emissions for aviation in 2019 versus 24.92 Mt in 2020)[9]. It is noted that in both 2019 and 2020 CO_2 emissions on flights between the UK and the EEA and emissions from UK domestic flights were still subject to the EU ETS.

(2) Recovery path of aviation emissions to rebound to 2019 levels

Over the last years both ICAO and IATA have made estimations when aviation emissions will rebound to the pre-COVID level of CO_2 emissions in 2019. The most recent expectation of IATA is that over the coming years international aviation is expected to gradually recover, and that by 2025 international air travel and related aviation emissions are back to the level of 2019. For domestic air travel, an earlier recovery is expected with domestic air travel and related aviation emissions to be to the level of 2019 by 2023[10].

(3) Long-term growth of aviation emissions after the rebound to 2019 levels

The most recent long term forecast of air travel and related emissions is a pre-COVID analysis of ICAO from 2018[11]. Also in the calculation of CO_2 emissions the SAF blending mandate which becomes higher after 2030 has been taken into account. Hereby it is assumed that, in line with the EU ETS and CORSIA proposals, the CO_2 emission factor for SAFs is 0.

Aviation CO_2 emissions in 2021-2035 according to the baseline scenario

Figure 1 shows the global trend of international aviation emissions according to the baseline scenario, whereby the baseline scenario reflects the reference situation against which the impacts of the alternative policy options are assessed. The figure shows the very significant impact of COVID-19 in 2020. By 2025 the CO_2 emissions are assumed to be recovered to the level of 2019 and for the period after 2025 the growth is in line with the ICAO traffic forecast. The emissions on the State pairs covered by CORSIA show a jump in 2027 when 5 major aviation countries (Brazil, China, India, Russia and Vietnam) are supposed to join the mandatory CORSIA phase (2027-2035).

[8] CCR Information and Data for Transparency - Part II (icao.int)

[9] EU Emissions Trading System (ETS) data viewer — European Environment Agency (europa.eu)

[10] IATA - Air Passenger Numbers to Recover in 2024

[11] LTF_Charts-Results_2018edition.pdf (icao.int)

Figure 1. Global international aviation CO_2 emissions for baseline scenario.

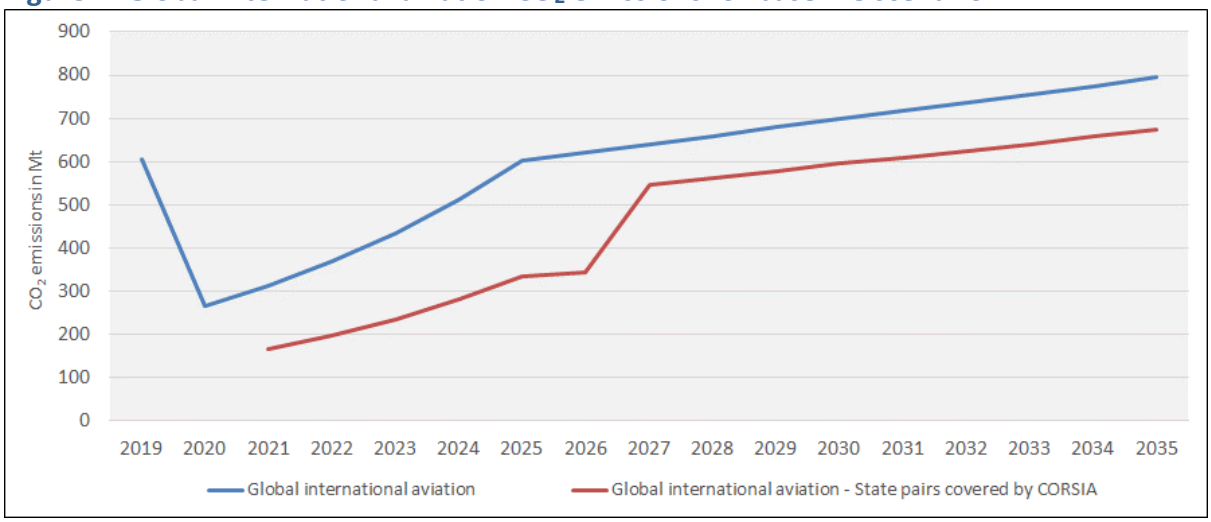
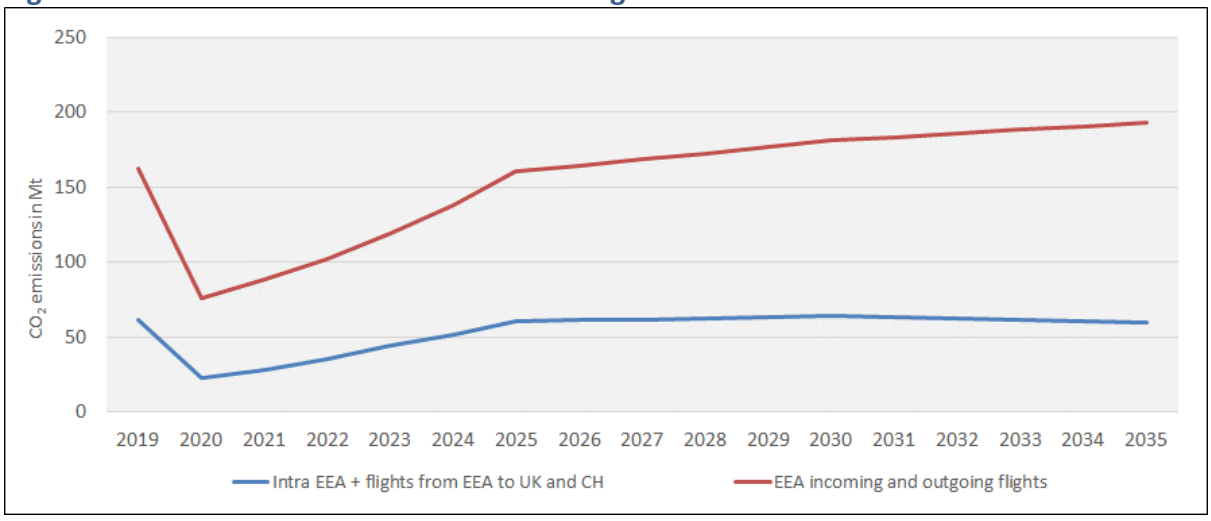


Figure 2 shows the development of CO_2 emissions for flights related to EEA Member States. The blue line represents intra EEA CO_2 emissions which include emissions on flights from the EEA to the UK and CH, as these flights will be subject to the EU ETS following linkages with the CH ETS and the UK ETS. The figure shows that at the end of the period the emissions slightly decrease. This is related to the blending mandate for SAFs which according to the EC proposal increases from 2% in 2025 to 5% in 2030 and 20% in 2035. The red line represents the emissions on flights departing from EEA Member States to non-EEA countries and flights arriving in EEA Member States which departed from non-EEA countries. Clearly these emissions are higher compared to the emissions on intra EEA flights. Emissions on EEA incoming and outgoing flights are expected to increase faster compared to emissions on intra EEA flights once the airline industry has recovered from COVID-19. Also EEA incoming flights are not subject to the EC blending mandate for SAFs.

Figure 2. Aviation emissions on EEA related flights.



4. Prices EU ETS allowances and CORSIA international credits

In order to compute the costs for European airlines to purchase EU ETS allowances and CORSIA international credits, use is made of projected future prices for allowances and international credits.

Since aviation was included in the EU ETS in 2013 up to early 2018 the EU ETS allowance price varied between 5€ and 10€ per tonne of CO_2. From 2018 onwards the allowance price has gone up, and in 2019 and early 2020 the price varied between 20€ and 30€. From 2020 onwards the price has further increased significantly and in 2021 the average EU ETS allowance price was around 54€. In the first month of 2022 the price further increased and in the first 2.5 months of 2022 the average price was 84€.

Allowances prices are projected to further increase to 100 € per tonne of CO_2 in 2030 and 200 € per tonne of CO_2 in 2050[12]. Based on this in this study it is assumed that for 2035 the allowances price will be 125€ per tonne of CO_2.

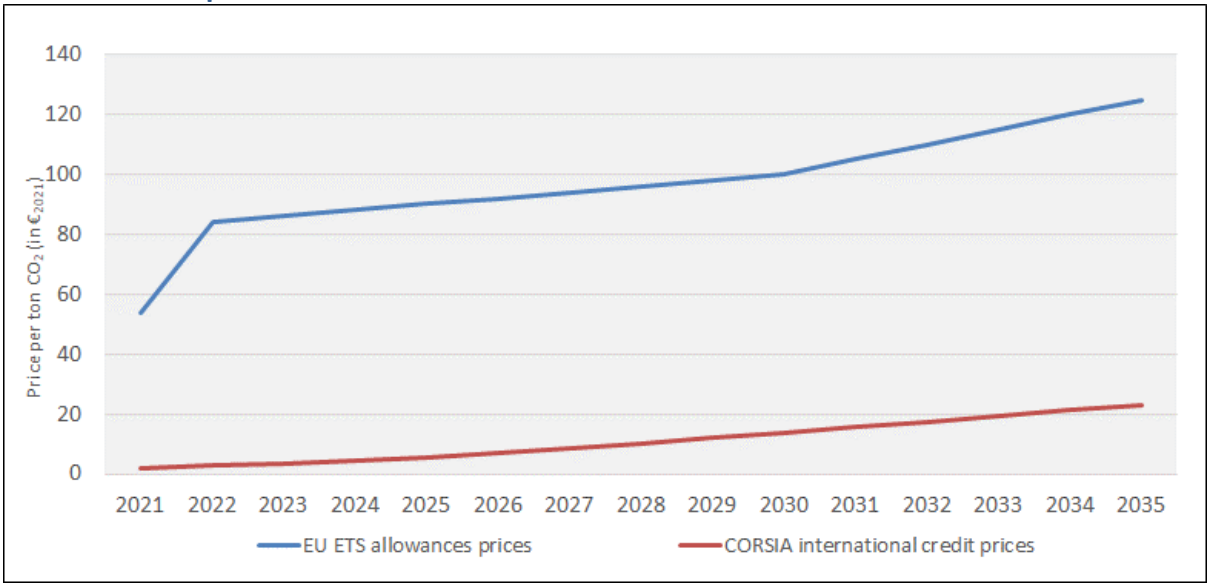
Regarding CORSIA related international credit prices for this study we have adopted projected carbon prices which have also been assumed in the impact assessment study for the EC regarding potential interactions between the EU ETS and CORSIA[13]. In the EC impact assessment study two price scenarios for CORSIA carbon prices have been considered, whereby for this study the higher price scenario is adopted. In this price scenario CORSIA international credit prices go up from 1 $€_{2018}$ per tonne of CO_2 in 2020 to 22 $€_{2018}$ per tonne of CO_2 in 2035. These prices are derived from the analysis of unit prices of emission reduction projects which are likely to generate international credits which are eligible for CORSIA.

Figure 3 shows the carbon prices for both the EU ETS allowances and CORSIA international credits for the period 2021-2035. Prices in figure 3 are expressed in $€_{2021}$.

[12] T&E aviation decarbonisation roadmap - DRAFT - clean copy Proofread.docx (transportenvironment.org)

[13] Further support to the preparation of an impact assessment on revision of the EU Emission Trading System Directive 2003/87/EC concerning aviation - Publications Office of the EU (europa.eu)

Figure 3. Projected EU ETS allowance prices and CORSIA international credit prices for the period 2021-2035.



5. Demand for EU ETS allowances and CORSIA international credits and related costs

Emission reduction resulting from EU ETS or CORSIA will take place in two ways. The first is a reduction within the aviation sector. This in-sector emission reduction follows from: i) reduced demand; and ii) improving efficiency earlier than in the baseline. The second way by which emissions are reduced is related to the aviation sector purchasing EUAs (in case of EU ETS) or international credits (in case of CORSIA) to cover the remaining emissions above the cap or baseline. It is assumed that EUAs and international credits reflect equal emission reductions in other economic sectors. A discussion on the actual quality of EUAs or international credits towards emission reduction within the aviation sector is out of the scope of this study, despite research suggesting emissions reduction between EUAs and international credits are of a very different nature[14].

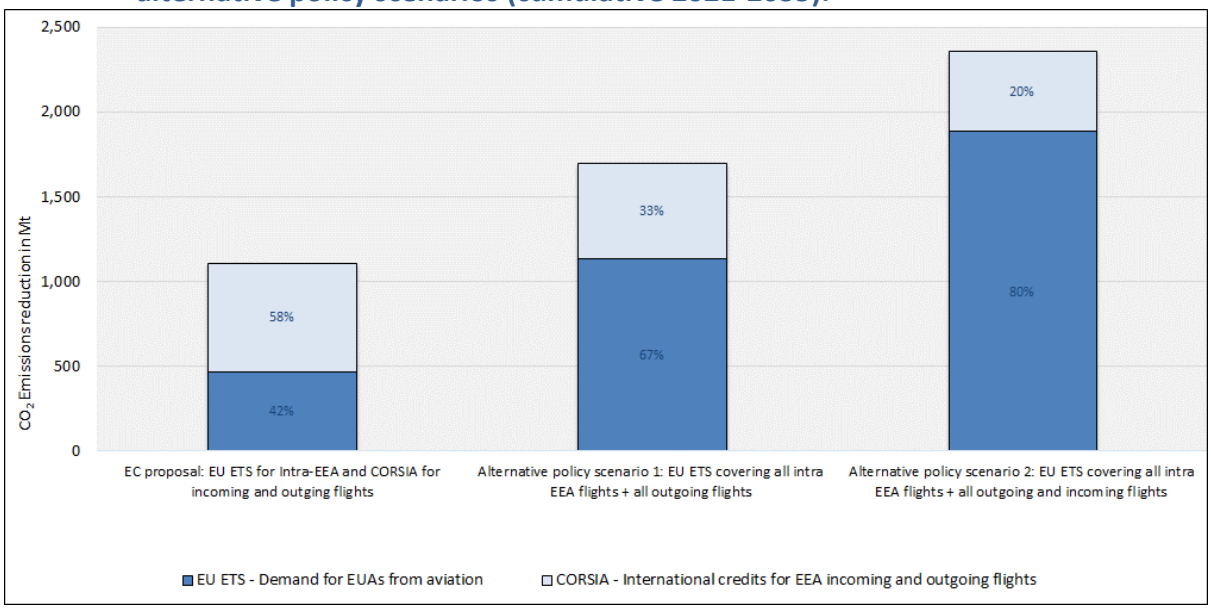
Total emission reduction which is accounted to the aviation sector is reflected by a summation of the in-sector reduction and the demand for EUAs from the aviation sector. A larger in-sector reduction implies that less EUAs need to be bought by the aviation sector to reach the aviation cap (which is assumed to be unchanged).

For the EC proposal and the 2 alternative policy scenarios the emission reduction is computed using the AERO-MS model. Emission reductions are reflected by demand for EUAs from the aviation sector, demand for CORSIA international credits and reductions within the aviation sector. The cumulative emission reduction on intra EEA flights and EEA outgoing and incoming flights for the period 2021-2035 is presented in figure 4 below. The annual emission

[14]https://op.europa.eu/en/publication-detail/-/publication/471ca3b9-7cca-11ec-8c40-01aa75ed71a1/language-en

reductions for the EC proposal and the 2 alternative policy scenarios are presented in figures 6 through 8 Annex A.

Figure 4. Emissions reduction from demand for EUAs and international credits on intra EEA flights and EEA outgoing and incoming flights for EC proposal and 2 alternative policy scenarios (cumulative 2021-2035).



Source: AERO-MS

Figure 4 shows that overall emission reduction for policy scenario 1 is 1.693 Mt (53% higher compared to the EC proposal). For policy scenario 2 the emission reduction is 2.358 Mt[15] (113% higher compared to the EC proposal). The additional emission reduction is due to additional demand for EUAs following from the increased scope of the EU ETS for the 2 alternative policy scenarios. Also the figure shows that relative to the EC proposal the demand for international credits in case of the 2 policy scenario is somewhat lower. This is due to the increased aviation in-sector reduction for the 2 alternative policy scenarios. The increased in-sector reduction results from higher costs for the aviation sector following from the larger geographical scope of the EU ETS for aviation in the 2 alternative policy scenarios. Still though, for the 2 alternative policy scenarios, the reduction within the aviation sector is around 10%, and hence the vast majority of the emission reduction is related to purchasing EUAs and international credits reflecting emission reductions in other economic sectors.

In relation to the number of CORSIA related international credits, there are a number of uncertainties. The first is that it has not yet been decided what the baseline for the period 2024-2035 will be. The default assumption is that, in line with the EC preference, the average 2019-2020 emissions will be adopted as the baseline. However the option of 2019 to be the baseline could also still be considered as an option in the international arena. Clearly 2019 would be a much higher baseline (i.e. no impact of COVID-19) and hence the offset requirements for CORSIA would be smaller. It is computed that for the EC proposal the

[15] Total aviation emissions on Intra EEA flights and EEA outgoing and incoming flights for the period 2021-2035 in the baseline scenario are 3.251 Mt. Hence in case of policy option 2, about 72.5% of these emissions are subject to in-sector reductions or compensated by EU allowances and international credits.

demand for international credits on incoming and outgoing flights will be reduced by 63% if 2019 would remain the baseline for the period 2024-2035 (i.e. for EC proposal demand for international credits would go down from 633 Mt - see figure 4 – to 231 Mt).

A second uncertainty is whether the 5 major aviation countries (China, Russia, India, Brazil and Vietnam) will actually join the second CORSIA phase from 2027. In case these countries will not join CORSIA the demand for international credits on incoming and outgoing flights will be reduced by 25% (i.e. for the EC proposal the demand for international credits would go down from 633 Mt to 475 Mt).

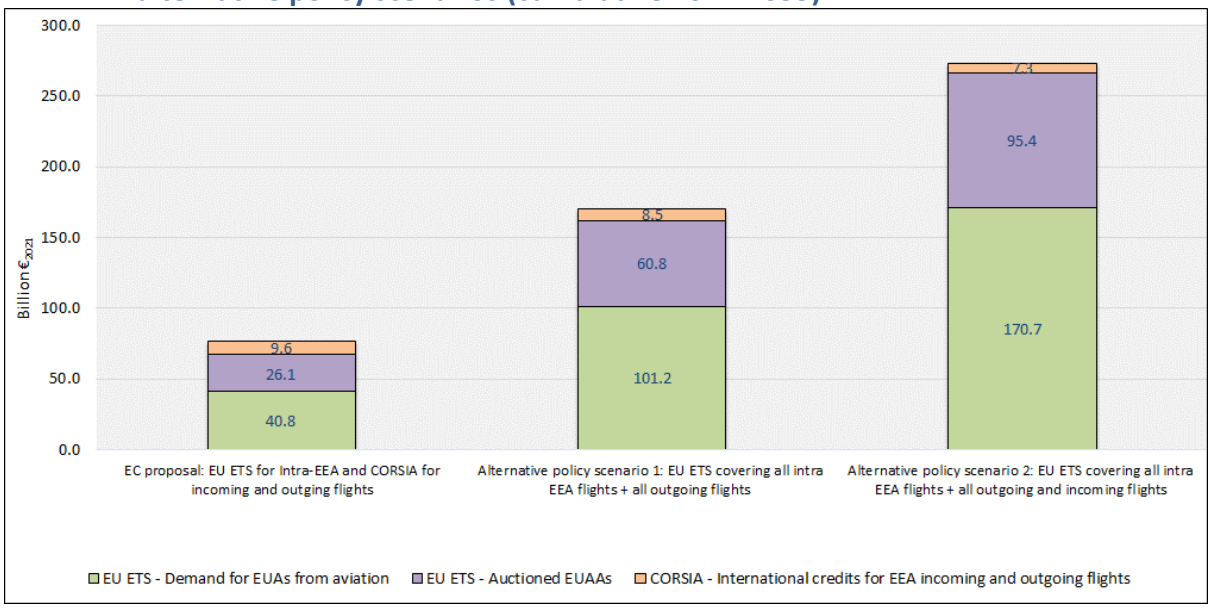
If both 2019 will become the baseline and the 5 major aviation countries will not join CORSIA, the demand for international credits on incoming and outgoing flights will be reduced by 77%. Hence only about a quarter of the international credits to be bought to cover the CORSIA related offset obligations for EEA incoming and EEA outgoing flights in case of the EC proposal has a high level of certainty to actually take place.

In a next step the costs for airlines to purchase allowances and international credits have been computed. The costs are computed based on the prices presented in chapter 4. The cumulative costs on intra EEA flights and EEA outgoing and incoming flights for the period 2021-2035 is presented in figure 5 below. The annual costs for the EC proposal and the 2 alternative policy scenarios are presented in figures 9 through 11 Annex A.

Figure 5 shows that relative to the EC proposal the additional costs over the 15 year period for alternative policy scenario 1 is 94 billion €. For alternative policy scenario 2 these additional costs are 197 billion €. The figure shows that the additional costs are related to both the purchase of additional EUAAs on the auctioning market and additional EUAs. Relative to the EC proposal the costs for the purchase of CORSIA international credits are somewhat lower for the 2 policy scenarios which is related to the somewhat lower demand for international credits.

The costs for purchasing auctioned EUAAs over the 15 year period for the EC proposal is 26.1 billion €. Hence auctioning revenues for EEA Member States are also 26.1 billion €. As indicated in chapter 2 we have also looked at the situation where full auctioning would be directly implemented from 2024 onwards. In that case the auctioning revenues for the EC proposal would rise to 29.4 billion €. For alternative policy scenarios 1 and 2 auctioning revenues are computed to respectively 60.8 billion € and 95.4 billion € (see figure 5) whereby a gradual phase-in of full auctioning over the period 2024-2027 is assumed. In case of full auctioning from 2024 onwards the auctioning revenues for alternative policy scenarios 1 and 2 would increase to respectively 68.4 billion € and 107.4 billion €.

Figure 5. Costs for purchasing EU ETS allowances and CORSIA international credits on intra EEA flights and EEA outgoing and incoming flights for EC proposal and 2 alternative policy scenarios (cumulative 2021-2035).



Source: AERO-MS

To put the costs for purchasing EU ETS allowances and CORSIA international credits into perspective, these costs are also expressed as a percentage of total airline operating costs. Hereby a distinction is made between intra EEA flights and EEA outgoing and incoming flights. The results for the years 2025 and 2035 are presented in table 2. The costs for international credits, which are compensated in case of policy scenarios 1 and 2 (see table 1), have not been considered in the percentages for EEA outgoing and incoming flights.

For intra EEA flights the relative cost increase is computed to 5.1% in 2025 going up to 6.1% in 2035. The cost increases are the same for the EC proposal and the 2 alternative policy scenarios. The relative cost increase for EEA outgoing and incoming flights in case of the EC proposal, whereby outgoing and incoming flights are only subject to CORSIA but not to the EU ETS, are much smaller with a maximum of 0.7% in 2035. This limited cost increase is related to the purchase of international credits for which prices are expected to be lower compared to allowances prices (see also chapter 4). Also it is noted that, as discussed above, the number of international credits to be surrendered in case of the EC proposal is to a large extent uncertain. Hence the relative cost increase for EEA outgoing and incoming flights in case of the EC proposal could turn out to be significantly lower.

In case of the 2 alternative policy scenarios the EU ETS is applied to EEA outgoing and incoming flights in a similar way then it is applied to intra EEA flights. Therefore the relative cost increases for intra EEA flights versus EEA outgoing and incoming flights are much more in line with each other. For alternative policy scenario 1 the relative costs for EEA outgoing and incoming flights is still lower compared to the relative costs for intra EEA flights. This is because for this policy scenario the EU ETS is only applied to EEA outgoing flights. For policy scenario 2 the relative costs for EEA outgoing and incoming flights is higher compared to the

relative costs for intra EEA flights. This is because for EEA incoming flights there is no limitation of EU ETS related costs following the use of SAFs.

Table 2. Costs for allowances and international credits as a percentage of total airline operating costs.

	2025	2035	Total (2021-2035)
Intra EEA flights			
EC Proposal	5.1%	6.1%	5.5%
Alternative policy scenario 1	5.1%	6.1%	5.5%
Alternative policy scenario 2	5.1%	6.1%	5.5%
EEA outgoing and incoming flights*			
EC Proposal	0.1%	0.7%	0.3%
Alternative policy scenario 1	3.1%	3.7%	3.4%
Alternative policy scenario 2	6.0%	7.9%	6.8%
Intra EEA flights plus EEA outgoing and incoming flights			
EC Proposal	1.7%	2.3%	1.9%
Alternative policy scenario 1	3.7%	4.4%	4.0%
Alternative policy scenario 2	5.8%	7.4%	6.4%

* The costs for international credits which are compensated in case of policy scenarios 1 and 2 have not been considered in these percentages.
Source: AERO-MS

Finally the compensation costs for the 2 alternative policy scenarios have been compared with the additional EUAA auctioning revenues. These additional auctioning revenues are related to the higher cap (in absolute terms) in case of the alternative policy scenarios[16] In case of alternative policy scenario 1 the additional EUAA auctioning revenues are related to the EEA outgoing flights. For alternative policy scenario 2 the additional EUAA auctioning revenues are related to the EEA outgoing and incoming flights. Table 3 shows that the monetary compensation for CORSIA related international credits can be easily financed by the additional EUAA auctioning revenues. For both alternatives the compensation costs are about 10-11% of the additional EUAA auctioning revenues over the period 2021-2035. At the end of the period this percentage is around 25%. In absolute terms the net additional revenues (i.e. additional EUAA auctioning revenues minus CORSIA related compensation costs) for EEA Member States over the 15 year period are computed to 31.2 billion € for alternative policy scenario 1 and 61.9 billion € for alternative policy scenario 2. These net additional revenues are available to finance additional climate policies.

For alternative policy scenario 2 the compensation costs are 7.3 billion €, which is more than twice as high compared to the compensation costs of 3.4 billion € in case of alternative policy scenario 1. This is because EEA incoming flights are not subject to the EC SAF blending

[16] Table 1 indicates that in relative terms the cap for the 2 alternative policy scenarios is as strict as the cap for the EC proposal. However, because of the larger scope of flights subject to the EU ETS in the 2 alternative policy scenarios, in absolute terms the cap is higher implying more auctioning revenues.

mandate as is the case for EEA outgoing flights. Hence the compensation costs as a % of auctioning revenues (10.6% for 2021-2035) for alternative policy scenario 2 is somewhat higher compared to the % for alternative policy scenario 1 (10.0% for 2021-2035).

Table 3. Compensation costs as a percentage of additional EUAA auctioning revenues for 2 alternative policy scenarios.

Alternative policy scenario 1: EU ETS covering all intra EEA flights + all EEA outgoing flights			
Year	EUAA auctioning revenues -EEA outgoing flights (billion €)	CORSIA compensation costs - EEA outgoing flights (billion €)	Compensation costs as % of EUAA auctioning revenues
2025	2.1	0.1	2.5%
2030	3.0	0.3	10.0%
2035	2.6	0.6	23.5%
Total (2021-2035)	**34.6**	**3.4**	**10.0%**
Alternative policy scenario 2: EU ETS covering all intra EEA flights + all EEA outgoing and EEA incoming flights			
Year	EUAA auctioning revenues – EEA outgoing and incoming flights (billion €)	CORSIA compensation costs - EEA outgoing and incoming flights (billion €)	Compensation costs as % of EUAA auctioning revenues
2025	4.1	0.1	2.5%
2030	6.0	0.6	10.3%
2035	5.3	1.4	26.2%
Total (2021-2035)	**69.3**	**7.3**	**10.6%**

Source: AERO-MS

6. Summary and conclusions

The study and its main conclusion are summarized below.

1. In July 2021, the European Commission presented the Fit-for-55 (FF55) legislative package to achieve the EUs climate objectives. Part of FF55 is to revise the EU Emission Trading System (EU ETS) for aviation, including the introduction of the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) for European aviation. The EC proposal is to retain the EU ETS for intra EEA flights and for CORSIA to cover EEA incoming and outgoing flights from and to countries that participate in CORSIA.

2. This study has looked into the environmental and economic impacts of two alternative policy scenarios:
   - EU ETS covering all intra EEA flights + all EEA outgoing flights. CORSIA covering all flights other than intra EEA with monetary compensation for international credits purchased to cover outgoing flights from EEA Member States

- EU ETS covering all intra EEA flights + all EEA outgoing and EEA incoming flights. CORSIA covering all flights other than intra EEA with monetary compensation for international credits purchased to cover outgoing and incoming flights from/to EEA Member States.

3. Impacts of both the EC proposal and the two alternative policy scenarios have been assessed for the period 2021-2035 relative to a baseline scenario. This baseline scenario has taken into account the impacts of COVID-19 on international aviation demand and emissions.

4. For both EU ETS allowances and international credits a price scenario is taken into account in the analysis. Prices for EU ETS allowances are assumed to increase from current price levels (around 80 € per tonne of CO_2) to 125 € in 2035. Prices for international credits, which can be used to fulfil offset obligations under CORSIA, are expected to increase to around 22 € per tonne of CO_2 in 2035.

5. Emission reduction resulting from the EU ETS or CORSIA will take place in two ways. The first is a reduction within the aviation sector. Secondly emissions are reduced by the aviation sector purchasing EUAs (in case of EU ETS) or international credits (in case of CORSIA) to cover the remaining emissions above the aviation cap or baseline. EUAs and international credits are assumed to reflect equal emission reductions in other economic sectors.

6. The emission reduction for the EC proposal on intra EEA flights and EEA incoming and outgoing flights over the period 2021-2035 is computed to 1.108 Mt. For policy scenario 1 this reduction is 1.693 Mt (53% higher compared to the EC proposal). For policy scenario 2 the emission reduction is 2.358 Mt (113% higher compared to the EC proposal). For policy scenario 2 this emission reduction reflects 72.5% of total aviation emissions on Intra EEA flights and EEA outgoing and incoming flights for the period 2021-2035 in the baseline scenario.

7. For the 2 alternative policy scenarios the reduction within the aviation sector is around 10% of the overall emission reduction. For the EC proposal this is somewhat lower. Hence for both the EC proposal and the 2 alternative policy scenarios the vast majority of the emission reduction is related to purchasing EUAs and international credits reflecting emission reductions in other economic sectors.

8. The default CORSIA assumptions are that the baseline will be 2019/2020 from 2024 onwards and that 5 major aviation countries, which have not signed up to CORSIA for the voluntary phase, will join the mandatory CORSIA phase from 2027 onwards. However, there are uncertainties in relation to these assumptions. As part of the study it has been assessed that compared to for the EC proposal, if the baseline changes and these countries do not apply the scheme, the CORSIA related emission reduction could be 77% lower compared to the situation with the default CORSIA assumptions. This implies that only about a quarter of the international credits to be bought to cover the CORSIA related

offset obligations for EEA incoming and EEA outgoing flights in case of the EC proposal has a high level of certainty to actually take place.

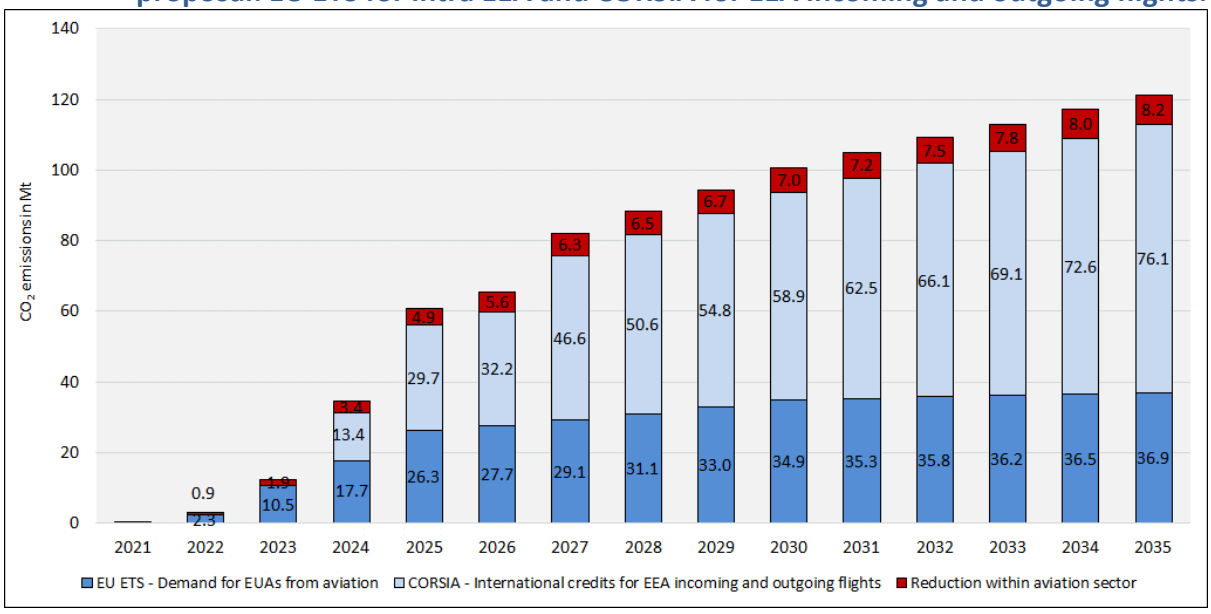
9. The costs for airlines related to the purchase of EU ETS related allowances (EUAs and EUAAs) and CORSIA related international credits have been computed. Over the period 2021-2035 for the EC proposal these costs are 77 billion €. For alternative policy scenarios 1 and 2 these costs are respectively 171 and 273 billion €. The higher costs for the alternative policy scenarios are related to both the purchase of additional EUAAs on the auctioning market and additional EUAs given the increase in emissions coverage.

10. The costs are also expressed as a percentage of total airline operating costs. Hereby a distinction is made between intra EEA flights and EEA outgoing and incoming flights. For the EC proposal the relative cost increase on intra EEA flights (around 5-6%) is much higher compared to the relative cost increase on EEA outgoing and incoming flights (<1%). For the 2 alternative policy scenarios the relative cost increases for intra EEA flights versus EEA outgoing and incoming flights are much more in line with each other.

11. Finally the compensation costs for the 2 alternative policy scenarios have been compared with the additional EUAA auctioning revenues. For both alternatives the compensation costs are about 10-11% of the additional EEAA auctioning revenues over the period 2021-2035. Hence the monetary compensation for CORSIA related international credits can be easily financed by the additional EUAA auctioning revenues. This implies there will be net additional revenues (i.e. additional EEAA auctioning revenues minus CORSIA related compensation costs) for EEA Member States. These net additional revenues are available to finance additional climate policies.

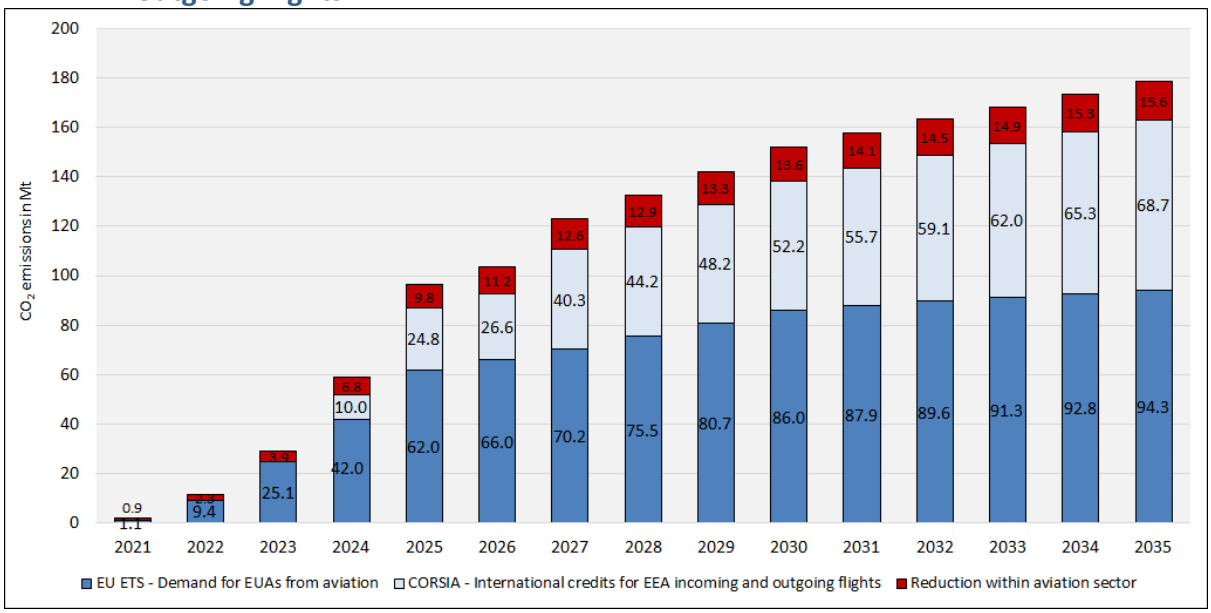
Annex A. Annual results 2021-2035 for policy scenarios

Figure 6. Emission reduction including demand for EUAs and international credits for EC proposal: EU ETS for intra EEA and CORSIA for EEA incoming and outgoing flights.



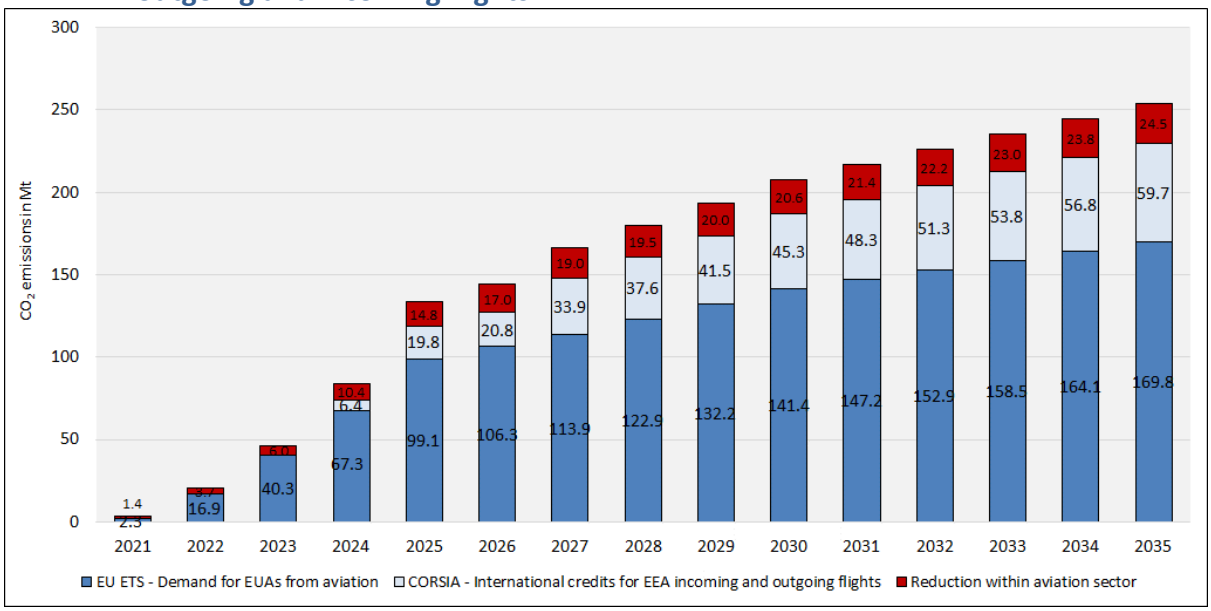
Source: AERO-MS

Figure 7. Emission reduction including demand for EUAs and international credits for alternative policy scenario 1: EU ETS covering all intra EEA flights + all EEA outgoing flights.



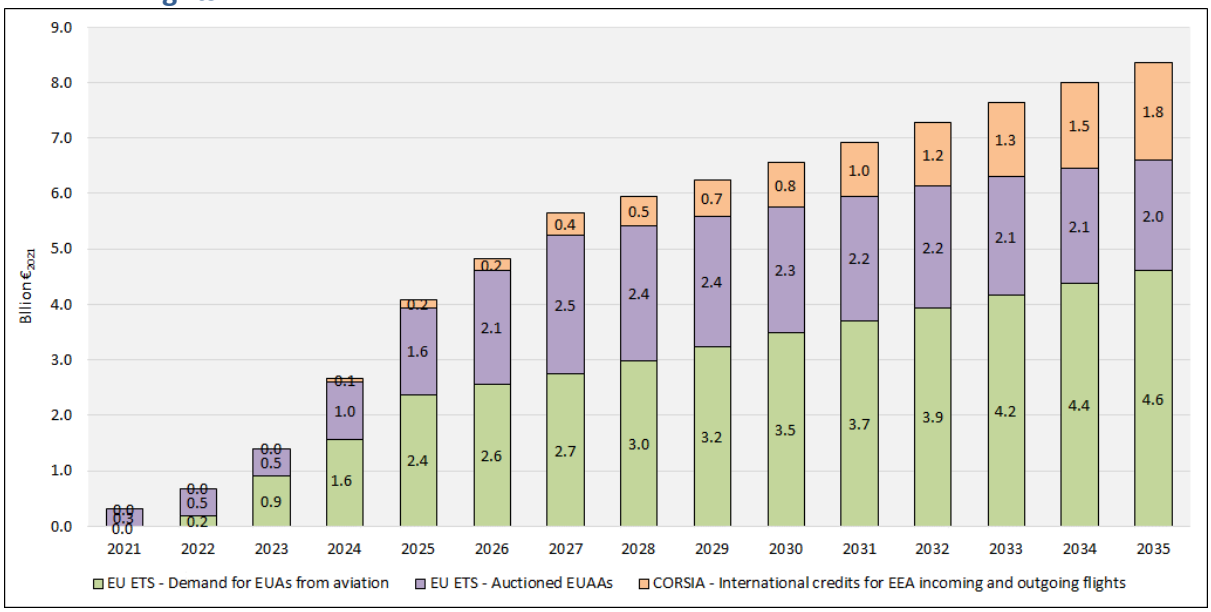
Source: AERO-MS

Figure 8. Emission reduction including demand for EUAs and international credits for alternative policy scenario 2: EU ETS covering all intra EEA flights + all EEA outgoing and incoming flights.



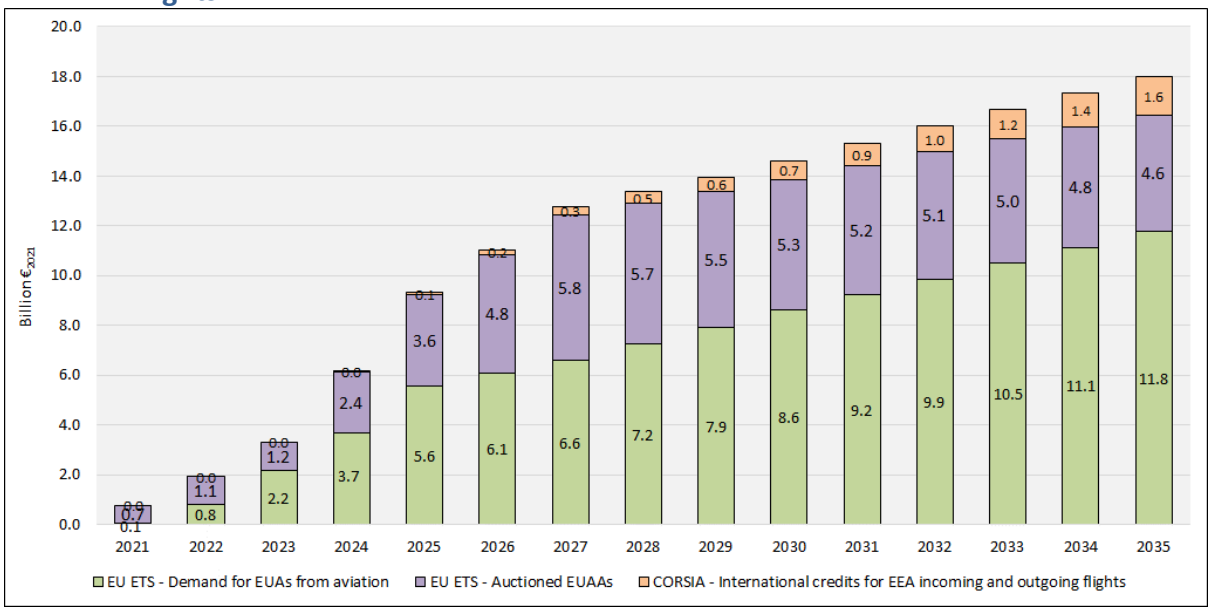
Source: AERO-MS

Figure 9. Costs for purchasing EU ETS allowances and CORSIA international credits for EC proposal: EU ETS for intra EEA and CORSIA for EEA incoming and outgoing flights.



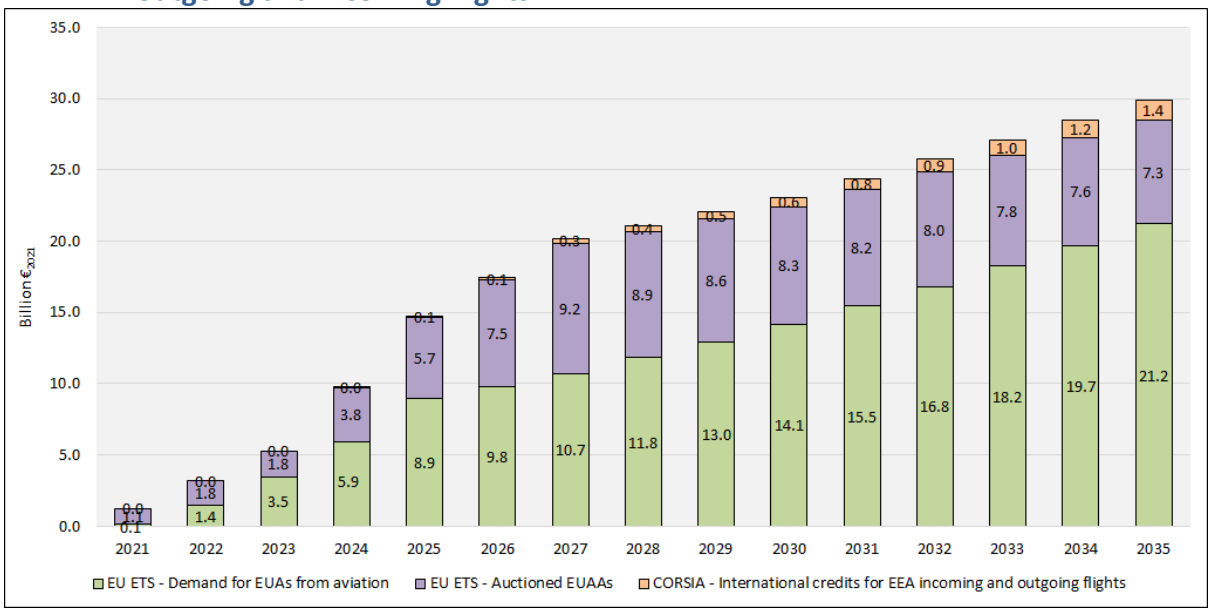
Source: AERO-MS

Figure 10. Costs for purchasing EU ETS allowances and CORSIA international credits for alternative policy scenario 1: EUT covering all Intra EEA flights + all EEA outgoing flights.



Source: AERO-MS

Figure 11. Costs for purchasing EU ETS allowances and CORSIA international credits for alternative policy scenario 2: EU ETS covering all intra EEA flights + all EEA outgoing and incoming flights.



Source: AERO-MS