TAKS
TRANSPORT ANALYSIS AND KNOWLEDGE SYSTEMS

CE Delft
Committed to the Environment

Costs of EU ETS and CORSIA for European aviation

Report prepared by TAKS and CE Delft for Transport and Environment (T&E)
Report nr: 19-12

André van Velzen (TAKS)
Sander de Bruyn and Amanda Bachaus (CE Delft)

November 2019

Utrecht, TAKS, November 2019

Title: Costs of EU ETS and CORSIA for European aviation
Authors: André van Velzen (TAKS); Sander de Bruyn and Amanda Bachaus (CE Delft)
Report nr: 19-12
Prepared for: Transport and Environment (T&E).

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
AOC	Air Operator Certificate
CER	Certified Emission Reduction
CH	Switzerland
CNG2020	Carbon Neutral Growth 2020
CO_2	Carbon dioxide
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
CPF	Carbon Price Floor
CPS	Carbon Price Support
Domestic EEA flight	Flight with the airport of departure and airport of arrival in the same EEA Member States
EASA	European Aviation Safety Agency
EC	European Commission
EEA	European Economic Area (EU28, Norway, Iceland, Liechtenstein)
ETS	Emissions Trading System
EU	European Union
EU28	28 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
GHG	Greenhouse Gas
ICAO	International Civil Aviation Organization
Intra EEA flight	International 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
Outbound EEA flight	International flight the airport of departure in one of the EEA Member States and the airport of arrival outside the EEA
RTK	Revenue Tonne Km
T&E	Transport and Environment

1. Introduction

In 2012 aviation was brought into the EU's emission trading system (EU ETS). 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 EEA Member States (referred to as 'Intra EEA flights') and flights within EEA Member States (referred to as "domestic EEA flights"). 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 [1] was adopted to implement a global Market Based Measure, called the Carbon Offset and Reduction Scheme for International Aviation (CORSIA), which aims to stabilise net emissions at 2020 levels referred to as carbon neutral growth 2020 (CNG2020). CORSIA requires airlines to offset their emissions of international aviation above the baseline level and will start in 2021, from which year ICAO Member States can voluntarily participate. From 2027 onwards CORSIA will be mandatory for 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.

Regulation 2017/2392 envisages a review of the EU ETS for aviation once there is more certainty and clarity about CORSIA, and the steps taken by ICAO Member States for its implementation [2]. This means it is presently unknown how and if the EU ETS will be adjusted should CORSIA be in force from 2021 onwards. One of the policy scenarios discussed is to retain the EU ETS for all intra and domestic EEA flights, and that CORSIA will apply to flights between EEA Member States and other participating ICAO Member States. However, ICAO agreed that CORSIA should apply to all international flights between participating ICAO Member States. All EEA Member States signed the Bratislava Declaration. This signalled their intention to fully implement CORSIA from the start of the pilot phase, provided that certain conditions are met, notably on the environmental integrity of the scheme and global participation. Assuming the conditions will be met, all EEA Member States will join CORSIA, which would mean the scheme will also apply to intra EEA flights. A second policy scenario therefore is that both EU ETS and CORSIA will be applied to intra EEA flights. For flights between EEA Member States and other participating ICAO Member States the second scenario will be the same as the first (i.e. only CORSIA is applied).

This study has looked into two research questions:

1. What are the total costs for European aviation for complying with the EU ETS allowance surrender requirement and CORSIA offsetting requirement over the period 2021 – 2030.
2. Which other sectors covered by the EU ETS are also subject to other economic instruments.

In chapter 2 the two policy scenarios are further defined and described. Chapter 3 is involved with the forecast of aviation emissions for 2030. Projections regarding future prices of EU ETS

allowances and CORSIA international credits are presented in chapter 4. Chapter 5 describes the demand for EU ETS allowances and CORSIA international credits and the related costs for European aviation. Chapter 6 through 8 are involved with other EU ETS sectors with multiple economic instruments. Finally, a summary of the main conclusions from the study is provided in chapter 9.

2. CORSIA and EU ETS policy scenarios

At present 81 ICAO Member States have indicated an intention to join the CORSIA voluntary stages from the start in 2021. This includes all Member States which are also a member of the EEA [3], who have stated that they may participate provided that certain conditions are met, notably on the environmental integrity of the scheme and global participation[1]. From 2027 onwards CORSIA will be mandatory for States that have a share in international aviation above 0.5% of total Revenue Tonne Kilometres (RTKs). Based on international scheduled Revenue Tonne-Kilometres (RTK) by State of Air Operator Certificate (AOC) for 2016 [4] the forecast is that an additional 7 major aviation countries will participate in CORSIA from 2027 onwards[2].

The offset obligations under CORSIA apply to all international flights between participating States. Hence flights between a participating State and a non-participating State are not subject to offset obligations. For the flights between participating States, aircraft operators need to offset emissions above the baseline emissions level. The baseline emissions level is calculated on the average of total emissions covered by CORSIA in the years 2019 and 2020.

Assuming the CORSIA is in place from 2021 onwards and that all EEA Member States will participate in CORSIA from the start, the question is if and how the EU ETS for aviation might be adjusted. The intra EEA flights, which are now covered by the EU ETS, will in principle also be subject to CORSIA. Domestic intra EEA flights can only be subject to the EU ETS, because CORSIA only covers international aviation.

Another development is that in 2017 the EU and Switzerland agreed to link the EU ETS and the Swiss ETS [5]. Currently the Swiss ETS does not cover aviation emissions. The integration of CO_2 emissions from the aviation sector into the Swiss ETS is a prerequisite for linking the two trading systems. The entry into force of linking the two emission trading systems is expected in 2020. According to the linking agreement, the EU ETS will cover flights from EEA Member States to Switzerland. The Swiss ETS will then cover domestic flights in Switzerland and flights from Switzerland to EEA Member States.

At present it is unknown whether the United Kingdom will remain in the EU ETS after Brexit. In this study it is assumed that the United Kingdom is still part of the EU ETS in the period 2021-2030.

The two main CORSIA and EU ETS policy scenarios considered in this study are:

[1] With the exception of Liechtenstein all EEA Member States are also an ICAO Member State. And also Switzerland has signed up to CORSIA.

[2] Brazil, Chile, China, Columbia, India, Panama and Russia.

1. *Retain EU ETS for aviation + CORSIA for outbound*. The EU ETS will be retained for all intra and domestic EEA flights, in line with its current application. Also the flights between the EEA and Switzerland will be subject to the EU ETS in line with the current linking agreement. CORSIA will apply to flights between EEA Member States and other participating ICAO Member States (outbound flights), but the intra EEA flights subject to the EU ETS will be exempted from CORSIA.
2. *Retain EU ETS for aviation + CORSIA for intra and outbound*. The EU ETS will be retained for all intra and domestic EEA flights, in line with its current application. Also the flights between the EEA and Switzerland will be subject to the EU ETS in line with the current linking agreement. CORSIA will apply to intra EEA flights and flights between EEA Member States and other participating ICAO Member States (outbound flights).

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

Table 1. CORSIA and EU ETS policy scenarios for departing flights from EEA airports.

	Scenario 1. Retain EU ETS for aviation + CORSIA for outbound	Scenario 2. Retain EU ETS for aviation + CORSIA for intra and outbound
EU ETS		
Coverage of departing flights from EEA airports	Domestic EEA flights and intra EEA flights + flights from the EEA to CH	Domestic EEA flights and intra EEU flights + flights from the EEA to CH
Aviation cap (EUAAs)	95% of 2004-2006 with LRF of 2.2% per year in 2021-2030	95% of 2004-2006 with LRF of 2.2% per year in 2021-2030
Auctioning of EUAAs	Increase of auctioning percentage by 8.5% per year from 23.5% in 2021 to 100% in 2030*	Increase of auctioning percentage by 8.5% per year from 23.5% in 2021 to 100% in 2030*
Use of emission reduction units	EUAs for emissions above cap for covered flights	EUAs for emissions above cap for covered flights
CORSIA		
Coverage of departing flights from EEA airports	International flights departing from EEA airports to airports in ICAO Member States participating in CORSIA (*except* for flights covered by EU ETS)	International flights departing from EEA airports to airports in ICAO Member States participating in CORSIA (*also* for flights covered by EU ETS)
Baseline	Average of 2019-2020 baseline emission level	Average of 2019-2020 baseline emission level
Use of emission reduction units	International credits	International credits

* Separate what-if scenario with 100% auctioning in 2021-2030.

For both scenarios it is assumed that the EU ETS aviation cap will be adjusted on the basis of the linear reduction factor (LRF) of 2.2% per year which will be applied to the EU ETS in the period 2021-2030 [2]. Furthermore, under the EU ETS currently 15% of the aviation allowances (EUAAs) are auctioned, and 85% are freely allocated. In line with the agenda for the new European Commission [6], it is assumed that the number of free allowances allocated

to airlines will be reduced. It has not yet been decided how the reduction of free allowances for aviation will take place over time. In this study a reduction of the percentage of free allowances by 8.5% per year over the period 2021 – 2030 is assumed. This implies that by 2030 all aviation allowances will be auctioned. The most ambitious would be if all free allowances were abolished in 2021. We have looked at as a separate what-if scenario.

3. Aviation emissions baseline for 2030

In 2018 ICAO published the most recent aviation demand growth forecast for the coming decades [7]. The ICAO demand forecast considers 46 global route groups for which a forecast is made in terms of the growth in passenger km and cargo tonne-km for the years 2025, 2035 and 2045. The forecast for Intra EEA flights (both domestic and international) shows an annual demand increase of 2.6% for passenger demand up to 2030. For EEA departing flights with destinations outside the EEA, the annual passenger demand growth varies between route group, with an average passenger demand growth of 3.3% per year.

The demand growth forecast is included in the emission growth forecast for 2030, on the basis of which baseline CO_2 emissions on flights departing from the EEA for 2030 are computed with the AERO-MS[3]. The ICAO baseline forecast as implemented in the AERO-MS assumes an improvement of the fuel burn characteristics of new aircraft entering the fleet up to 2030. Also, in line with ICAO specifications, it is assumed load factors will go up over time. As a result, the fuel-efficiency per RTK will improve by 1.0% to 1.5% per year, depending on the route. The expected technology improvements and higher load factors are insufficient to stop the growth in CO_2 emissions on flights departing from the EEA.

The forecast of emissions for all EU departing flights for the year 2030 is presented in table 2. A distinction is made between flights with a destination in EEA Member States plus Switzerland (these will be subject to the EU ETS in both scenarios), and flights with a destination outside the EAA plus Switzerland

Table 2. CO_2 emissions in 2017 and 2030 on flights departing from the EEA.

	CO_2 emissions in 2017 (Mt)	CO_2 emissions in 2030 (Mt)	Annual growth rate (%)
EEA departing flights - destination in EEA+CH[4]	66.2	80.2	1.5%
EEA departing flights - destination outside EEA+CH	111.4	146.5	2.1%
All EEA departing flights[5]	177.6	226.8	1.9%

Source: AERO-MS.

[3] The IPR for the AERO-MS is with EASA. Information regarding the model can be found on: https://www.easa.europa.eu/easa-and-you/environment/impact-assessment-tools

[4] Data for 2017 are also reported in the EU ETS Union Registry [8]

[5] Data for 2017 are also reported by Eurostat [9]

CO_2 emissions in 2030 are forecast to have grown to 80.2 Mt for EEA departing flights with a destination in the EEA plus Switzerland, and to 146.5Mt for flights with destinations in other countries. Table 2 also includes CO_2 emissions for the latest year - 2017 - for which registered emission data are available, and the resulting annual growth rates of CO_2 emissions for the period 2017-2030.

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 made of projected future prices for allowances and international credits. Given the uncertainty in prices, a higher and lower price scenario has been taken into account for both the EU ETS allowances and CORSIA 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€. From 2018 onwards the allowance price has gone up significantly, and since April 2019 the price has varied between 25€ and 30€. Various studies have forecasted EU ETS allowances prices for the period 2021-2030. For the higher price scenario to be taken into account in this study use is made of a forecast of ICIS showing an allowance price which goes up to around 43€ (in real terms) in 2024/2025 [9]. For the years 2025-2030 a price stabilisation is assumed. The lower price scenario in this study is based on forecast of Refinitiv showing a price of around 20€ (in real terms) for an EU ETS allowance for the whole period 2021-2030 [10].

Projected prices for international credits are substantially higher than the current prices of Certified Emission Reductions (CERs), which over the last years were traded for prices below 1€ per tonne of CO_2. ICAO has published three price scenarios for international credits to be used under CORSIA [11]. These are indicated as IEA High, IEA low and alternative low. Prices according to the alternative low scenario are lower compared to the prices in the IEA low scenario. The IEA High price scenario seems unrealistic given current CER prices. Therefore in this study we have into taken account the IEA low and alternative low price scenario. The IEA low price scenario assumes an offset price of 8 US$ in 2020 raising to 15 US$ in 2030. Prices for the alternative low scenarios are 6 US$ and 10 US$ in respectively 2020 and 2030. In this study the two ICAO offset scenarios are included in respectively the ‘higher’ and ‘lower’ price scenario. In the ICAO document prices are expressed in $US\$_{2012}$. For this report we have expressed all prices and related costs in $€_{2018}$.

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

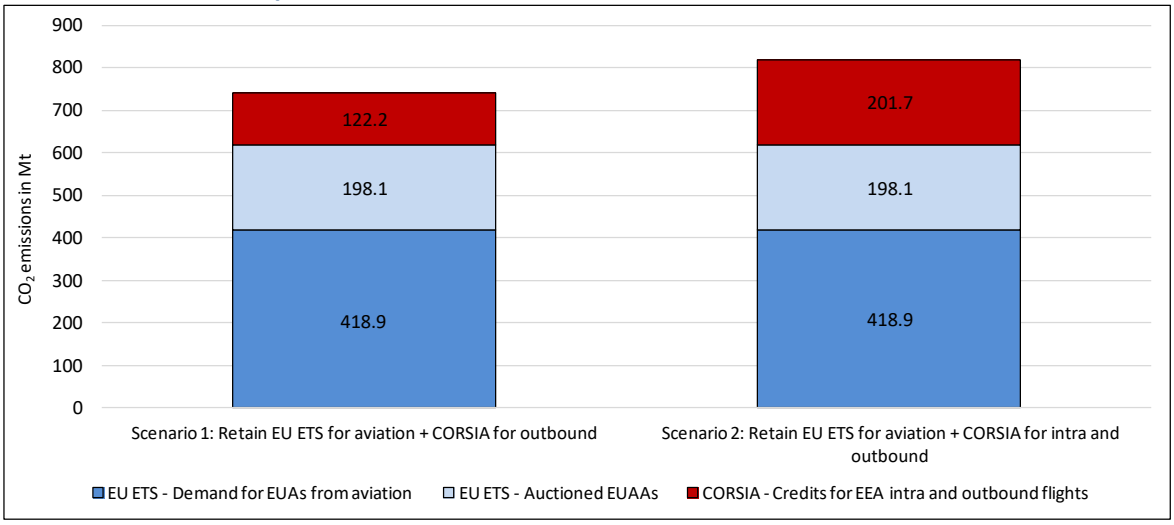
For the 2 scenarios the number of EU ETS allowances and CORSIA international credits have been computed for all flights departing from the EEA in the period 2021-2030. In relation to the EU ETS in this report we present the number of allowances for which a cost apply to airlines. These are EUAs which have to be surrendered by airlines for all CO_2 emissions above

the aviation emissions cap and the EUAAs which are auctioned (i.e. part of the emissions under the cap – see table 1).

The computation of CORSIA related international credits for international aviation is based on the ICAO resolution. In the period 2021-2029 the offset requirement is based on 100% sectoral growth rate and for 2030 the offset requirement is based 80% on the sectoral growth rate and 20% on an aircraft operator's individual growth rate [1].

The annual demand for allowances and international credits for scenario 1 and 2 are presented in respectively figures 4 and 5 in Annex A. For both scenarios the cumulative demand for allowances and international credits over the period 2021-2030 is presented in figure 1 below

Figure 1. Demand for allowances and international credits for both scenarios (cumulative 2021-2030).



Source: AERO-MS

Because the EU ETS coverage is the same in scenario 1 and scenario 2 (see table 1), the demand for EU ETS allowances, both EUAs and auctioned EUAAs, is also the same in both scenarios. The scenarios show an increase of the demand for both EUAs and auctioned EUAAs over time. The increase in the demand for EUAs follows from the growth in emissions on the flights covered by the EU ETS, but also from the reduction of the cap over time (i.e. LRF of 2.2% per year). The increase over time of the number of auctioned EUAAs follows from the increased share of EUAAs which will be auctioned (see table 1). In both scenarios the total demand for EUAs plus auctioned EUAAs from the aviation sector increases from 42.7 Mt in 2021 to 80.2 Mt in 2030.

Also the demand for CORSIA related international credits increases over time in both scenarios. According to the ICAO baseline scenario implemented in the AERO-MS, the sectoral growth rate increases from 2.4% in 2021 to 24.6% in 2030. The individual rate for aircraft operators with their home base in an EEA Member States is generally lower compared to the sectoral growth rate, which is of relevance for the demand for credits in 2030 (i.e. in 2030: 20% individual growth rate). Regarding the outbound EEA flights it has been taken into

account that only EEA departing flights to ICAO Member States which will participate in CORSIA are subject to offset requirements. In the voluntary phases of CORSIA (2021-2026) about 63% of the emissions on EEA outbound flights will be related to flight with a destination in ICAO Member States which have voluntary signed up to CORSIA. For the period 2027-2030 this percentage is about 86%, because it is expected that the mandatory phase (from 2027 onwards) will require that flights to another 7 major aviation countries will become subject to CORSIA. In the results in figures 4 and 5 this is reflected by the jump in the demand for CORSIA related credits between 2026 and 2027.

Because of the coverage of also intra EEA flights by CORSIA in scenario 2, the demand for CORSIA related credits is higher in scenario 2. A comparison between figures 4 and 5 shows the extra demand in scenario 2 (relative to scenario 1) goes from 1.4 Mt in 2021 to 15.9 Mt in 2030. Figure 1 shows that over the whole 10-year period the extra demand in scenario 2 reflects 79.4 Mt of CO_2.

In a next step the costs for airlines to purchase allowances and international credits have been computed. This is done for both the lower and higher price scenario (see chapter 4). The annual costs for scenario 1 and 2, in case of the lower price scenario, are presented in respectively figures 6 and 7 in Annex A. For the higher price scenario the results are presented in figures 8 and 9. The extra costs in scenario 2 (relative to scenario 1), in case of the lower price scenario, go from 7 million € in 2021 to 129 million € in 2030 (compare figures 6 and 7). For the higher price scenario the extra costs go from 9 million € in 2021 to 194 million € in 2030 (compare figures 8 and 9).

For both scenarios we have also looked at the additional costs as a percentage of total airline operating costs. Hereby a distinction is made between outbound EEA flights and intra EEA flights. The results are presented in table 3. The percentages in table 2 can be regarded as the increase in ticket prices if airlines would pass on all costs of allowances and international credits.

Table 3. Costs for allowances and international credits as a percentage of total airline operating costs.

	Scenario 1. Retain EU ETS for aviation + CORSIA for outbound		Scenario 2. Retain EU ETS for aviation + CORSIA for intra and outbound	
	2021	2030	2021	2030
Lower price scenario				
Intra EEA flights	1.2%	1.7%	1.2%	1.8%
Outbound EEA flights[6]	0.0%	0.2%	0.0%	0.2%
Higher price scenario				
Intra EEA flights	1.8%	3.4%	1.8%	3.6%
Outbound EEA flights[6]	0.0%	0.3%	0.0%	0.3%

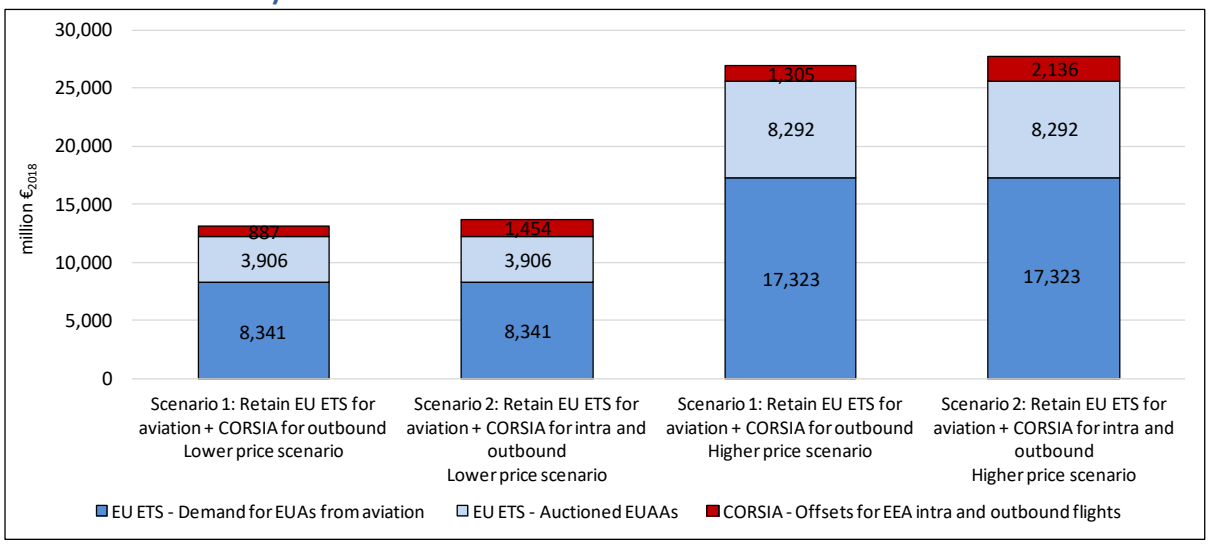
Source: AERO-MS

[6] Only flights subject to CORSIA

Because, in both scenarios, outbound flights are only subject to CORSIA, the cost increase relative to total airline operating costs is limited (reaching a maximum of 0.3% in 2030 in case of the higher price scenario). For Intra EEA flights the relative cost increase is more significant and could reach about 3.5% in 2030 in case of the higher price scenario. The difference between scenario 1 and 2 is limited reflecting that the additional CORSIA related costs in scenario 2 are relatively small compared to the EU ETS related costs which are included in both scenarios for intra EEA flights.

For both policy scenarios and both price scenarios, the cumulative costs for allowances and international credits over the period 2021-2030 is presented in figure 2 below. Total costs for European aviation over the 10-year period vary between 13.1 billion € (scenario 1 with lower price scenario) and 27.8 billion € (scenario 2 with higher price scenario). The figure also shows that for the 10-year period the extra costs in scenario 2, relative to scenario 1, is 567 million € for the lower price scenario and 831 million € for the higher price scenario.

Figure 2. Costs for allowances and international credits for both scenarios (cumulative 2021-2030).



Source: AERO-MS

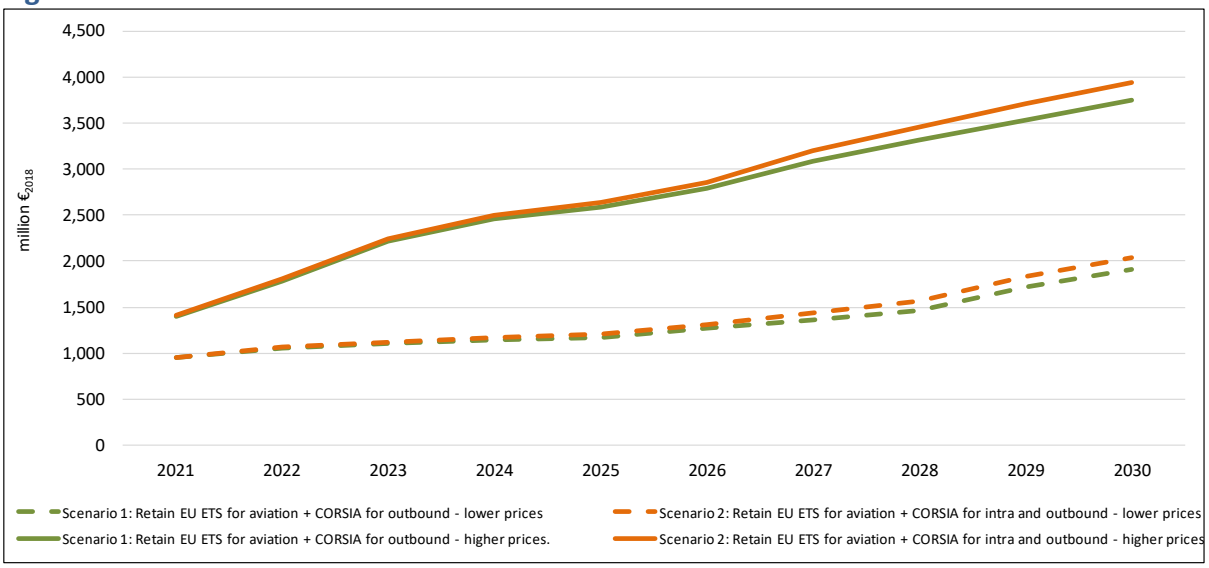
For both policy scenarios the annual costs for airlines to purchase auctioned EUAAs significantly go up over time because of the increased share of EUAAs to be auctioned. Total costs over the 10-year period to purchase EUAAs are 3.9 billion € for the lower price scenario and 8.3 billion € for the higher price scenario. The increase in costs to purchase auctioned EUAAs also reflect increased revenues for EEA Member States. These revenues can be used by Member States to finance further climate policies.

As mentioned in chapter 3 we have also considered a separate what-if scenario if from 2021 onwards all EUAAs would be auctioned. Hereby we have assumed the same two price scenarios. In case of the lower price scenario the cumulative costs for purchasing EUAAs over the period 2021-2030 would go up from 3.9 billion € in the default scenarios to 6.6 billion €. For the higher price scenario the cumulative costs for purchasing EUAAs in the 10-year period

would go up from 8.3 billion € in the default scenarios to 13.5 billion €. Equally auctioning revenues for Member States would increase.

Figure 3 shows total annual cost for allowances and international credits for both policy scenarios and both price scenarios. The cost difference between the policy scenarios is relatively small, and in any case much small compared to the cost difference follow related to the uncertainty in prices for allowances and international credits. Hence also applying CORSIA to intra EEA flights, which is the difference between the two policy scenarios, in relative terms will only have a limited additional cost burden to airlines.

Figure 3. Annual costs for allowances and international credits for both scenarios.



Source: AERO-MS

6. The EU ETS and double taxation: general overview

The EU ETS is the most important climate policy instrument of the European Union. Through the EU ETS carbon emissions of over 12'000 installations/operators in the EU28 plus Norway, Liechtenstein and Iceland are being regulated. The question whether an installation (or an airline operator) falls under the EU ETS depends on two conditions:

1. The activity of the installation or operator falls under the listed activities in the Annex-1 of the EU ETS;
2. The combustion of (fossil) fuels in installations exceeds the capacity threshold of 20MW.[7]

The first criterion implies that installations of most industrial processes are covered by the ETS Directive, the second criterion that there is a threshold below which the installation is not covered by the ETS. While the EU ETS primarily relates to electricity generation, industry and aviation, the scope is not solely limited to those sectors. Within the EU ETs, there are for example also 38 hospitals included because of the emissions from their heat plants.

[7] For various sectors (e.g. airline operators, pig iron production, cement clinker, lime, glass, ceramics, paper cardboard, bulk organic chemicals, hydrogen and mineral wools) other thresholds have been defined.

Participating to the EU ETS does not exempt companies from other forms of environmental, climate or energy related taxes. The EU ETS is often additional to the current tax structure in most countries. As the EU ETS itself is not a tax, we circumvent here the often used term "double taxation". Instead we label the additional taxes that EU ETS participants face on their CO_2 emissions as "complementary taxes".

Within this study we regard two potential complementary taxes, in line with the definition used by the OECD:

- Implicit carbon taxes: taxes on fossil fuel inputs in the production process
- Explicit carbon taxes: CO_2 taxes

7. Implicit additional carbon taxes

Fossil fuel inputs are being taxed in all countries participating to the EU ETS. PWC states that many countries have formulated exemptions for large industries [12]. However, these exemptions can never be lower than what is agreed in the Energy Tax Directive (2003/96/EC).[8] In general, large energy-intensive industries tend to have (much) lower tariffs than SMEs or consumers but the industries that participate in the EU ETs do not have an exemption to energy taxations, with the exception of some specific processes where individual member states can decide not to tax the energy (see footnote 8).

In the OECD Tax Database, an analysis has been made to what extent existing taxes overlap with the EU ETS for companies that participate in the ETS. Table 4 provides an overview.

We see here that in most countries, sectors that participate in the EU ETS are also subject to other taxes, mostly energy taxes. The overlap is larger for the electricity sector than for the industry sector – but even in the industry sector 8% of the emissions in Denmark to over 50% of emissions for industry in Greece are subject to taxation complementary to the EU ETS.

This finding has also been evidenced in other research. CE Delft states that large energy consumers in Austria, Denmark, Germany, France, the United Kingdom, Belgium and Luxembourg are also due to energy input taxes – both for natural gas and electricity [14]. The Netherlands is the only country investigated in that study where the companies that participate to the EU ETS are largely exempt from these taxes if they participate in voluntary agreements to increase energy efficiency.

[8] The Directive provides that the use of energy products when used for non-fuel purposes, in dual use processes and in mineralogical processes fall outside the scope of the Directive and thus may still have a zero tariff if member states decide not to tax these uses.

Table 4. Overlap tax and EU ETS for EU28/OECD countries in the electricity and industry sectors in 2016.

Country	Electricity	Industry
Austria	67%	22%
Belgium	66%	18%
Czech Republic	97%	20%
Denmark	77%	8%
Estonia	95%	23%
Finland	66%	13%
France	96%	36%
Germany	89%	36%
Greece	100%	57%
Hungary	85%	18%
Ireland	95%	49%
Italy	79%	39%
Luxembourg	85%	32%
Netherlands	91%	22%
Poland	93%	20%
Portugal	93%	9%
Slovakia	89%	30%
Slovenia	98%	31%
Spain	99%	36%
Sweden	24%	14%
United Kingdom	96%	29%

Source: OECD [13]: Share of emissions priced and average price signals from taxes and ETS, all country data. Tax and EU ETS can apply in the same emissions base. The overlap describes the percentage of emissions in a sector that is priced by both tax and ETS, not the similarity in value of taxation.

8. Explicit additional carbon taxes

8.1 Introduction

In several countries, governments have installed explicit CO_2 taxes. In all countries these taxes are fuel type specific where the tax rate varies with the carbon content of the fuels. In most countries, industry that participates in the EU ETS is being exempted from such taxes. E.g. In Denmark, Sweden, France and the UK CO_2 taxes do apply for business but companies participating in the EU ETS are being exempted [13 and 14].[9] There are to our knowledge four exceptions to this general rule: price floors in the UK and Dutch electricity markets, and CO_2 taxes overlapping with the ETS in Finland and Estonia. Below these are described in some more detail.

8.2 CO_2 taxes as minimum price floors in the UK and the Netherlands

Both in the UK and the Netherlands, electricity companies may be confronted with additional taxes if the ETS price falls below a minimum value. The carbon price floor (CPF) in the UK was

[9] Denmark's CO2 tax applies to oil products, natural gas and coal and coke products. In France the CO2 tax applies to oil products, natural gas and coal and coke consumption, at rates varying in line with the fuels' carbon content. In the UK the climate change levy (CCL) was introduced in 2001 to encourage energy efficiency by taxing the supply of energy in industry, commerce and the public sector.

introduced on 1 April 2013 to underpin the price of carbon at a level that drives low carbon investment, which the EU ETS did not achieve in those days as prices dropped to levels below the €5/tCO_2 with limited prospects for recovery. The price floor consists of two components which are paid for by electricity generators: (i) The EU ETS allowance price; and (ii) the Carbon Price Support (CPS), which tops up the EU ETS allowance prices, as projected by the Government, to the carbon price floor. The carbon price floor is maximized at £18/tCO_2 from 2016 to 2021. In 2017 the Treasury recouped still £1billion in CPF tax receipts. After the latest revision of the EU ETS early 2018, which announced in the market stability reserve the permanent removal of any oversupply larger than the volume of auctioned allowances, the EU ETS price has strongly recovered and shows now prices higher than the CPF.

In the Netherlands, the government introduced a minimum price for CO_2 emissions by electricity producers starting from January 2020. The minimum price would go into effect when spot market prices fall below the minimum price to emit one tonne of CO_2, which would be set at 12.30 €€ in 2020 and increase to 31.90 €€ in 2030. As actual prices are at present two times higher than the starting minimum price, it can be expected that the law will not generate any revenues in the medium-short term.

8.3 CO_2 taxes overlapping with the ETS

Finland

Finland started their carbon tax in 1990 and became the first country that implemented a carbon pricing initiative [15]. In 2005 the EU ETS was implemented [16]. Finland decided to implement both EU ETS and maintain their scheme for national carbon taxes.

On January 1st 2018 the national carbon tax used for heating and by working machines increased from €58 to €62/tCO_2e [15]. This price increase made sure that the carbon tax rates for heating fuels and liquid transport fuels are now aligned. This price increases results in an increased tax revenues of 75 million € [17]. This carbon tax is implemented for coal, heavy fuel oil and light fuel oil in the industry sector (heating and for machinery and stationary engines) [18]. This carbon tax applies to the industry on top of the EU ETS. However, there are some exemptions. Fuel for refineries and the use of fuel as feedstock are, for example, not covered by this scheme. 36% of the CO_2-emissions in Finland falls under this tax [12].

Estonia

Estonia has a carbon tax for the installations that produce heat in the energy production and industry sector. The tax for the installations is quite low, €2/tCO_2e (2009), and applies on top of the EU ETS. However, the obligation to pay the pollution charge may be dispended by an obligation to finance environmental protection measures if the company reaches a 15% emission reduction, compared to their initial level. This should be done within a term or up to three years from the entry into force of the pollution charge substitution contract. The reduced level must not be exceeded after the termination of the contract either [19].

Other countries: initiatives in preparation

In some other countries they are currently considering CO_2 taxes for industry on top of the EU ETS. In the Netherlands, a carbon tax was announced in the "Climate Agreement" for industry for emissions that would exceed the EU ETS benchmarks minus a predefined reduction path. The tax would start in 2021. However, the exact height of the tax and the emissions that would fall under the tax still have to be decided.

In Spain, in the province of Catalonia, a carbon tax was announced in the Catalonian Law on Climate Change, which was adopted in August 2017 [15]. The tax will apply to GHG emissions from large installations in the power, industry, agriculture and waste sectors, including EU ETS installations. The intended tax rate was €10/tCO_2e (US$12/t$CO_2$e) in 2019, increasing to €30/tCO2e (US$37/tCO2e) in 2025. However, as parts of the Catalonian Law on Climate Change were suspended by the Spanish Constitutional Court, the future of this task is uncertain and will need further legal framework to be operationalized [15].

Similar discussion on CO_2 taxes on top of the EU ETS are currently underway in France and Germany.

9. Summary and conclusions

The study and its main conclusion are summarized below.

1. This study has looked into two research questions:
   - What are the total costs for European aviation for complying with the EU ETS allowance surrender requirement and CORSIA offsetting requirement over the period 2021 - 2030.
   - Which other sectors covered by the EU ETS are also subject to other economic instruments.

Total costs for European aviation EU ETS and CORSIA

2. The study considers the following EU ETS and CORSIA policy scenarios:
   1. Retain EU ETS for aviation + CORSIA for outbound.
   2. Retain EU ETS for aviation + CORSIA for intra and outbound.

3. The first scenario is to retain the EU ETS for all intra and domestic EEA flights and that CORSIA will apply to flights between EEA Member States and other participating ICAO Member States (outbound EEA flights). However, because all EEA Member States signed up to CORSIA, the scheme should also be applied to intra EEA flights. In the second scenario therefore both EU ETS and CORSIA will be applied to intra EEA flights. For outbound flights only CORSIA will apply (as in the first scenario). In line with the agenda for the new European Commission, in both scenarios it is assumed that the number of free allowances allocated to airlines under the EU ETS will be reduced, whereby a gradual reduction leading to full auctioning in 2030 is assumed.

4. Without emission reduction policy measures, aviation emissions on all flights departing from the EEA are forecast to grow by about 2% per year between 2017 and 2030. Emissions on flights to be covered by the EU ETS after 2020 (domestic EEA flights, intra EEA flights plus flights to Switzerland) are forecast to grow from 66.2 Mt to 2017 to 80.2 Mt in 2030 (1.5% per year). Emissions on outbound EEA flights are forecast to grow from 111.4 Mt to 146.5 Mt (2.1% growth per year).

5. For both EU ETS allowances and international credits a lower and higher price for the period 2021-2030 is assumed. Prices for EU ETS allowances are based on various studies. Prices for international credits to be surrendered under CORSIA are based on an ICAO forecast.

6. Because of the coverage of also intra EEA flights by CORSIA in scenario 2, the demand for CORSIA related credits is higher in scenario 2. In scenario 1 the demand for EU ETS allowances and CORSIA related international credits reflects 739.4 Mt of CO_2 over the period 2021-2030. In scenario 2 this number is 818.7 Mt (+79.4 Mt relative to scenario 1).

7. The extra costs in scenario 2 (relative to scenario 1), in case of the lower price scenario, go from 7 million € in 2021 to 129 million € in 2030. For the higher price scenario, the extra costs go from 9 million € in 2021 to 194 million € in 2030.

8. For outbound EEA flights the cost increase relative to total airline operating costs is limited in both policy scenarios (reaching a maximum of 0.3% in 2030 in case of the higher price scenario). For Intra EEA flights the relative cost increase is more significant and could reach about 3.5% in 2030 in case of the higher price scenario. The difference between scenario 1 and 2 is limited reflecting that the additional CORSIA related costs in scenario 2 are relatively small compared to the EU ETS related costs which are included in both scenarios for intra EEA flights. The relative cost increases can be regarded as the increase in ticket prices if airlines would pass on all costs of allowances and international credits.

9. For both policy scenarios the annual costs for airlines to purchase auctioned EUAAs significantly go up over time because of the increased share of EUAAs to be auctioned. The increase in costs to purchase auctioned EUAAs also reflect increased revenues for EEA Member States. These revenues can be used by Member States to finance further climate policies. The revenues could be further increased if all EUAAs would be auctioned from 2021 onwards.

10. The difference in total costs between the policy scenarios is relatively small, and in any case much small compared to the cost difference follow from the uncertainty in prices for allowances and international credits. Hence also applying CORSIA to intra EEA flights, which is the difference between the two policy scenarios, in relative terms will only have a limited additional cost burden to airlines.

Other sectors covered by EU ETS and other economic instruments

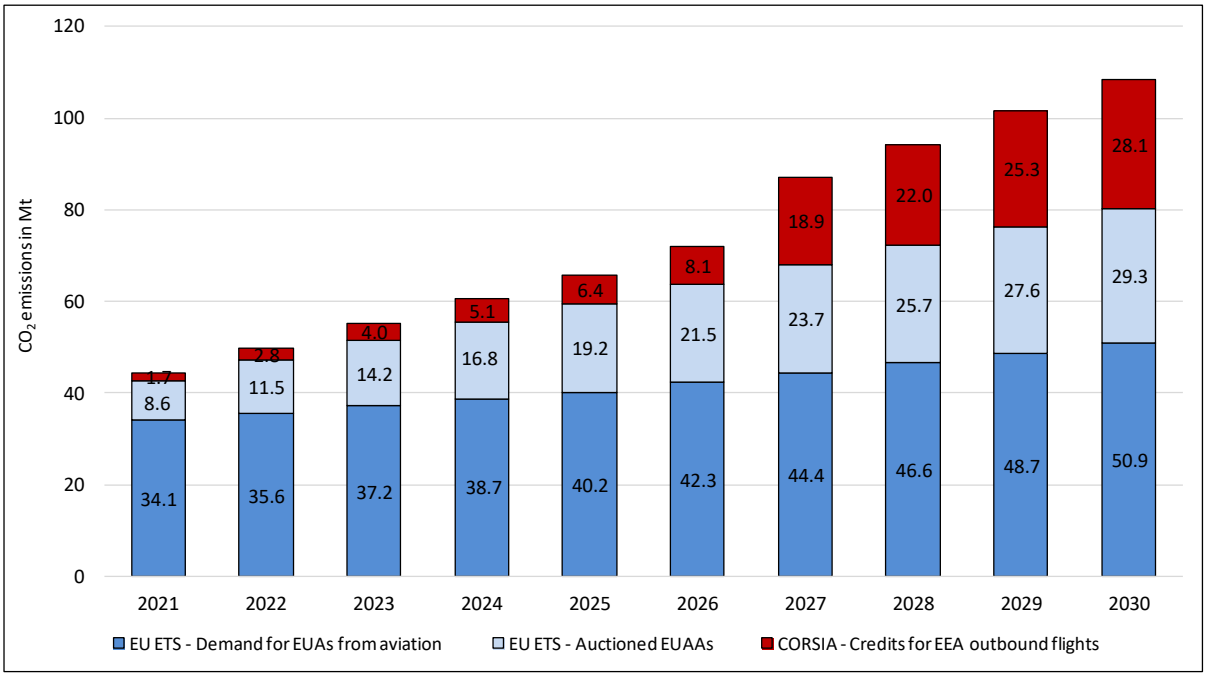
11. This research has investigated to what extent installations in the EU ETS are being confronted with additional climate policies. It appears that in many countries in the European Union, many companies face double taxation on either their energy inputs or CO_2 outputs. For electricity companies, 24% (in Sweden) to 100% (in Greece) of the emissions in EU28 member states face both participation in the EU ETS and a mix of energy input or CO_2 output taxes. For industry, the degree of double taxation is lower but still substantial and ranging between 8% in Denmark to 57% in Greece.

12. Although CO_2 taxes have often been introduced with using exemptions for companies participating in the EU ETS we also observe a recent trend in complementary CO_2 taxes that are being planned in many European countries which would apply on top of the EU ETS.

13. Finally, it should be noted that climate policies are not excluded to these instruments. Another important climate measure adopted by many countries is the phasing out of coal plants such as the Netherlands, Austria, Denmark, the UK and France. The fact that coal fired power plants take part of the EU ETS does not free them from additional climate policies.

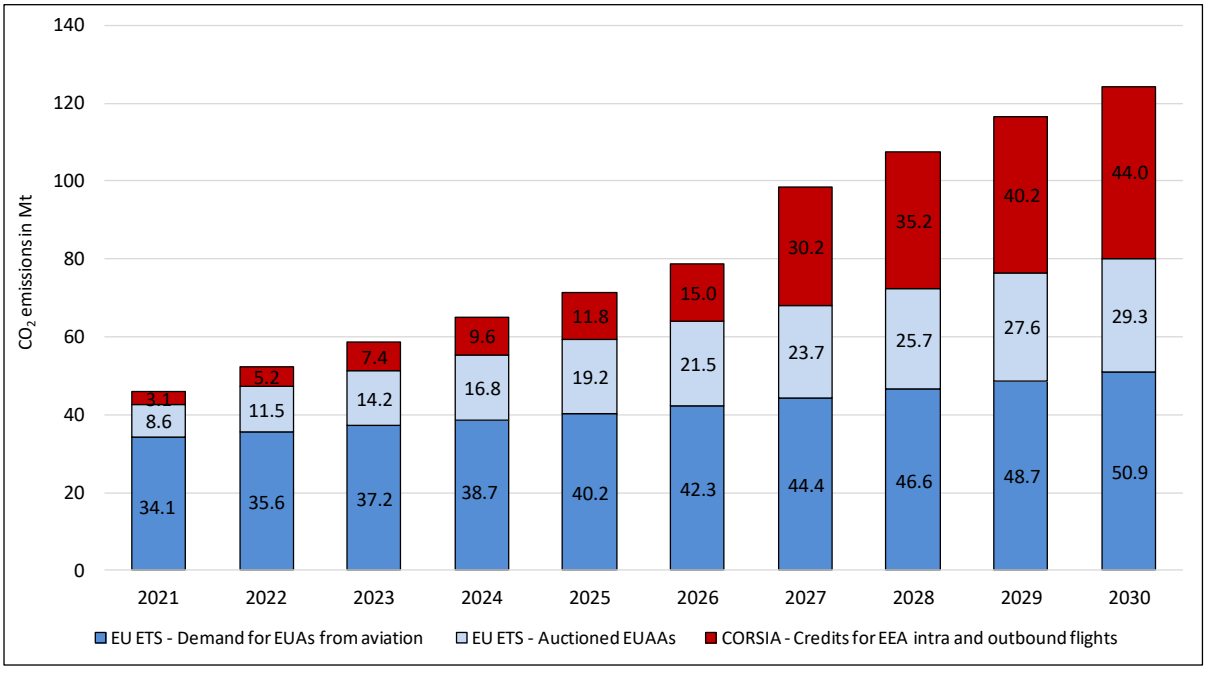
Annex A. Annual results 2021-2030 for policy scenarios

Figure 4. Scenario 1: Retain EU ETS for aviation + CORSIA for outbound - demand for allowances and international credits.



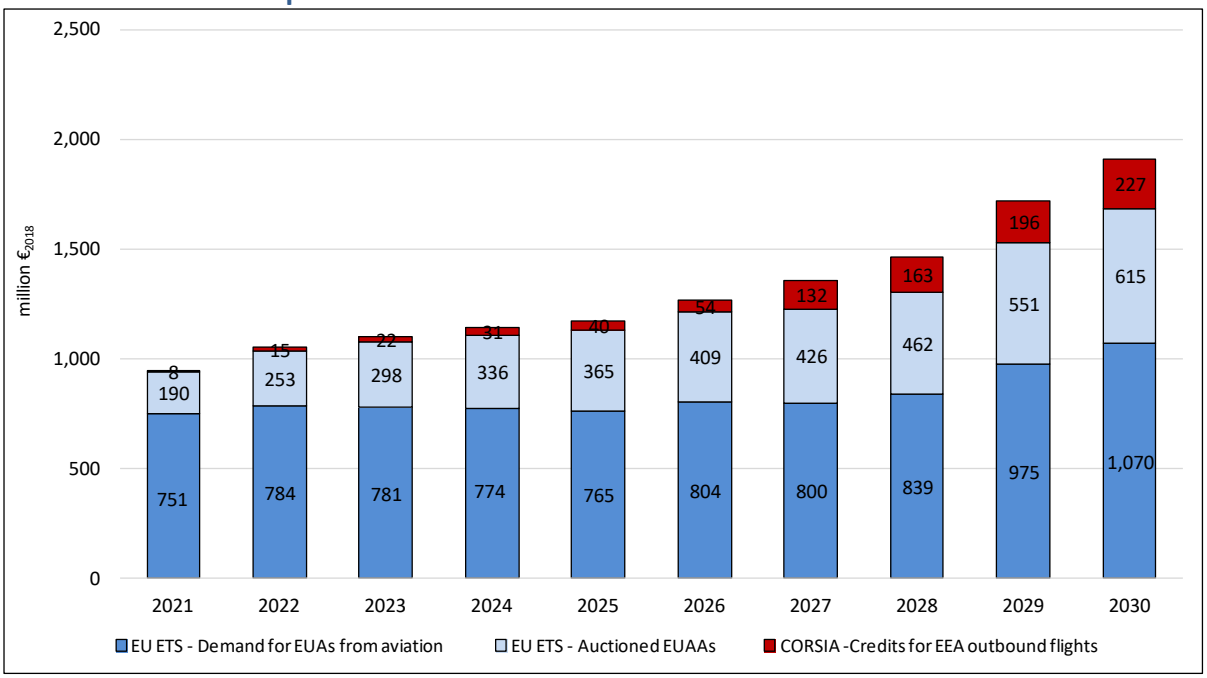
Source: AERO-MS

Figure 5. Scenario 2: Retain EU ETS for aviation + CORSIA for intra and outbound – demand for allowances and international credits.



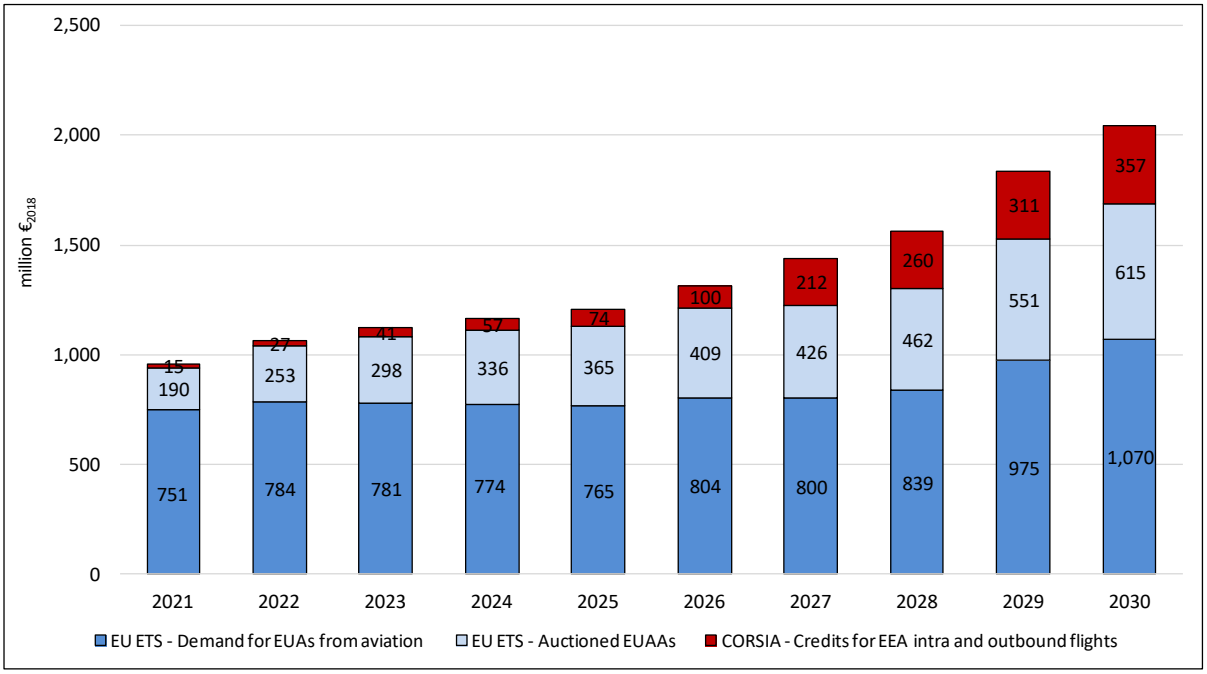
Source: AERO-MS

Figure 6. Scenario 1: Retain EU ETS for aviation + CORSIA for intra and outbound - costs with lower prices.



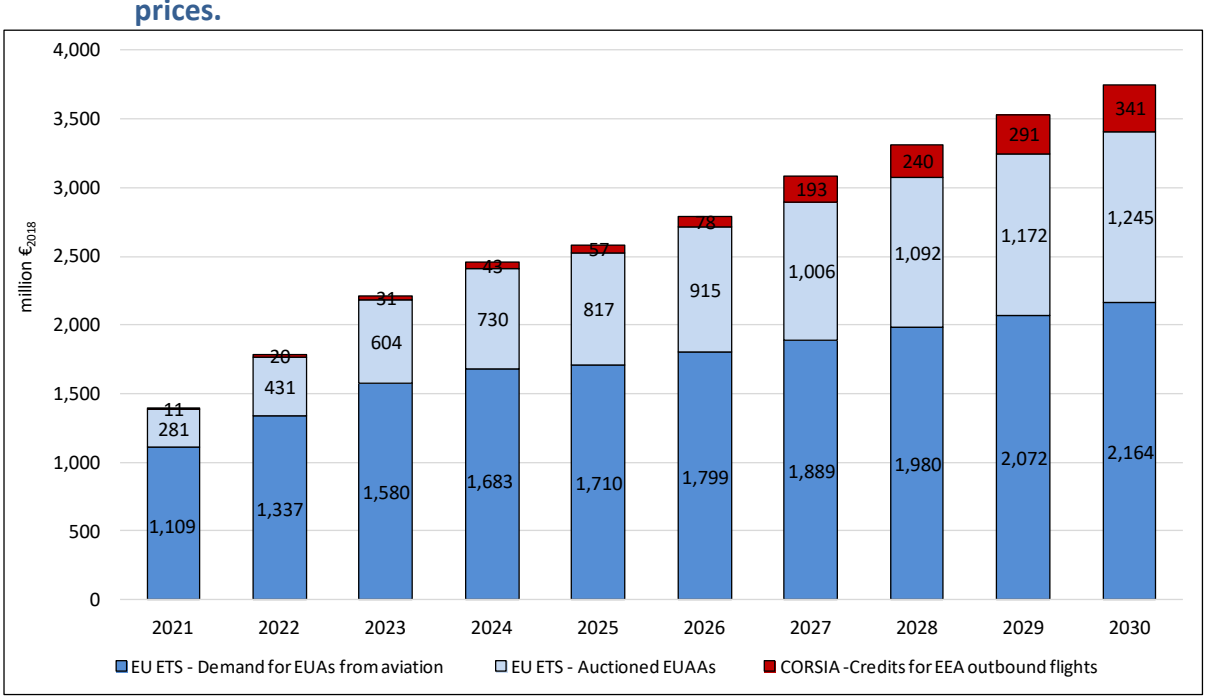
Source: AERO-MS

Figure 7. Scenario 2: Retain EU ETS for aviation + CORSIA for outbound - costs with lower prices.



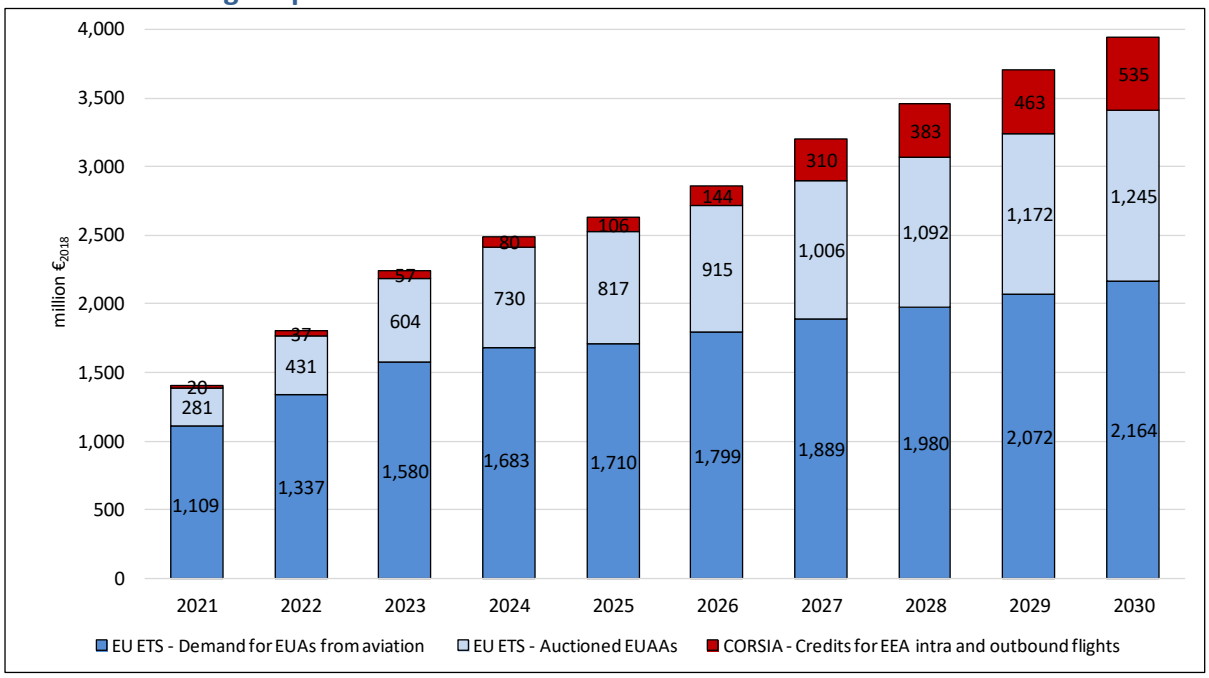
Source: AERO-MS

Figure 8. Scenario 1: Retain EU ETS for aviation + CORSIA for outbound - costs with higher prices.



Source: AERO-MS

Figure 9. Scenario 2: Retain EU ETS for aviation + CORSIA for intra and outbound - costs with higher prices.



Source: AERO-MS

References

[1] ICAO, 2016. Resolution A39-3: Consolidated statement of continuing ICAO policies and practices related to environmental protection – Global Market-based Measure (MBM) scheme
https://www.icao.int/environmental-protection/Documents/Resolution_A39_3.pdf

[2] EC, 2017. Regulation (EU) 2017/2392 of the European Parliament and of the Council amending Directive 2003/87/EC to continue current limitations of scope for aviation activities and to prepare to implement a global market-based measure from 2021. 13 December 2017. (OJ L350/7, 29/12/2017)
https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32017R2392&from=EN

[3] ICAO, 2019. Updated information on the States that intend to voluntarily participate in CORSIA from its outset.
https://www.icao.int/environmental-protection/CORSIA/Pages/state-pairs.aspx

[4] ICAO, 2018. Presentation of 2016 Air Transport Statistical Results.
https://www.icao.int/annual-report-2016/Documents/ARC_2016_Air%20Transport%20Statistics.pdf

[5] EU, 2017. Agreement between the European Union and the Swiss Confederation on the linking of their greenhouse gas emissions trading systems (OJ L322/3, 7/12/2017).
https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:22017A1207(01)&from=EN

[6] A Union that strives for more. My agenda for Europe. By candidate for President of the European Commission, Ursula von der Leyen. Political guidelines for the next European Commission 2019-2024. 2019.
https://ec.europa.eu/commission/sites/beta-political/files/political-guidelines-next-commission_en.pdf

[7] ICAO, 2018. ICAO Long-Term Traffic Forecasts, Passenger and Cargo, April 2018
https://www.icao.int/sustainability/Documents/LTF_Charts-Results_2018edition.pdf

[8] EC, 2019. EU ETS Union Registry.
https://ec.europa.eu/clima/policies/ets/registry_en#tab-0-1

[9] Eurostat, 2019. Eurostat climate change database.
https://ec.europa.eu/eurostat/web/climate-change/data/database

[9] ICIS, 2019. Carbon market: The impact of higher carbon prices on utilities and industries. May 2019.
https://www.icis.com/explore/resources/higher-carbon-prices-on-utilities-and-industries/

[10] Refinitiv, 2018. Will high European carbon prices last? December 2018 https://www.refinitiv.com/perspectives/market-insights/will-high-european-carbon-prices-last/

[11] ICAO, 2018. Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)
- Frequently Asked Questions (FAQs) -. Updated as of 9 August 2018. https://www.icao.int/environmental-protection/CORSIA/Documents/CORSIA_FAQs_Update_9Aug18.pdf

[12] PWC, 2019. De effecten van een nationale heffing op broeikasgas in de industrie

[13] OECD, 2016. Share of emissions priced and average price signals from taxes and ETS, all country data.

[14] CE Delft, 2018. Policy options for greenhouse gas reduction: A quick scan to identify potentially successful policy measures in nine European countries.

[15] World bank, 2018. State and Trends of Carbon Pricing 2018. Washington DC, May 2018

[16] Green Budget Europe, The Ex'tax Project, Institute for European Environmental Policy, Cambridge Econometrics, 2018. Aligning Fiscal Policy with the Circular Economy Roadmap in Finland.

[17] Finnish Government, 2015. Finland, a land of solutions: Strategic Programme of the Finnish Government

[18] Veroskatt, 2016. Energy taxation

[19] Riigi Teataja. 2019. Environmental Charges Act