THE PRICE OF FIT FOR 55

AVIATION COSTS OF THE EU'S FIT FOR 55 PROPOSAL

NOTE

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AUTHORS
STEF KONIJN, MARTIN ADLER, THIJS BOONEKAMP & BRAM PEERLINGS

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Roeterstraat 29
1018 WB, Amsterdam
The Netherlands

+31 20 525 1630
secretariaat@seo.nl
www.seo.nl/en/

The price of Fit for 55

The EU Commissions' Fit for 55 legislative package includes a number of proposed measures that aim to make the aviation sector more sustainable and reduce aviation emissions. By modelling these measures within the NetCost model, we can evaluate the accompanying cost increase. In 2030, annual costs increase by €13 billion and in 2050, by €34 billion. For the period 2023-2050, total accumulated costs are estimated at €577 billion. These are spread over EU-ETS allowances (24 percent), CORSIA carbon credits (6 percent), the ETD's kerosene tax (17 percent), and the ReFuelEU Aviation sustainable fuel blending mandate (53 percent).

Research question

In July 2021, the European Commission proposed the Fit for 55 package, which aims to reduce greenhouse gas emissions in the EU by 55 percent by 2030 compared to 1990 levels. A number of proposals aim to make the European aviation industry more sustainable and to reduce emissions. A4E, ACI-EUROPE, ASD, CANSO and ERA commissioned SEO Amsterdam Economics (SEO) and Royal Netherlands Aerospace Centre (NLR) to conduct an assessment of the cost impact of the Fit for 55 package on the aviation sector.[1] To do so, SEO and NLR estimate impacts on ticket prices, demand, CO_2 emissions and carbon leakage based on the NetCost model, a global passenger choice model developed by SEO.[2]

The Fit for 55 regulation

This note focuses on air travel to, from and within the EEA. This approximates the EU scope of the Fit for 55 policies:

- **EU-ETS** (EU Emissions Trading System), and **CORSIA** (Carbon Offsetting & Reduction Scheme for International Aviation)
- **ETD** (Energy Taxation Directive, including a kerosene tax)
- **ReFuelEU Aviation** (Sustainable Aviation Fuel blending mandate)

The EU-ETS is a cap and trade scheme, set to reduce EU emissions in selected sectors by 4.2 percent annually. From 2027 on, airlines have to buy EU-ETS allowances to cover their full CO_2 emissions. EU-ETS is applicable to (domestic) intra-EU flights, including flights to and from Norway, Switzerland, Iceland and Lichtenstein (from now on referred to as the European Economic Area, or EEA).

ICAO's CORSIA is a global carbon emissions offsetting scheme applicable to international flights to and from participating countries. An offsetting scheme has no cap on the total amount of CO_2 emitted into the atmosphere. Rather, the scheme requires participants (airlines) to offset the amount of CO_2 they emit on top of a predetermined baseline value. Among the participating states are almost all countries in Europe, North America and Oceania and

[1] Earlier this year, SEO and NLR (2022, March) conducted a related study '*Aviation Fit for 55: Ticket Prices, Demand and Carbon Leakage*', see https://www.seo.nl/publicaties/aviation-fit-for-55/. The current report complements that study by estimating the total cost impact based on the same model and similar assumptions.

[2] This model was also used in *'Destination 2050: A Route To Net Zero European Aviation'* by NLR and SEO (2021), see https://www.seo.nl/publicaties/destination-2050-a-route-to-net-zero-european-aviation/.

from 2027 onwards, also Russia, China, India and Brazil. The Fit for 55 package proposes to exempt intra-EU flights from CORSIA due to coverage of the EU-ETS scheme, relevant here.

The proposal to introduce a kerosene tax for intra-EU flights is part of the overall Energy Tax Directive (ETD) revision and aims at a final rate of €10.75 per gigajoule in 2033. This is reached by gradually increasing the tax over a 10-year period from 2023 (a rate of zero) to 2033 (full rate). The coverage of the tax is similar to EU-ETS and only applies to domestic and intra-EU flights. Sustainable aviation fuels face lower taxation rates, or a longer exemption period.

The proposal for an EU sustainable aviation fuel (SAF) blending mandate is part of the ReFuelEU initiative and aims at increasing the share of SAF which omit less CO_2. The blending mandate is increased from 2 percent in 2025 to 5 percent in 2030, 20 percent in 2035 and eventually up to 63 percent in 2050 (based on EC's proposal in July 2021).[3] Part of the SAF mandate is an obligation to mix in synthetic aviation fuels, essentially capping the share of biofuels used. Contrary to the EU-ETS and the ETD, the SAF mandate also covers all flights departing from EU airports, including those flying to a non-EU airport.

Box 1 Alternative Fuels Infrastructure Regulation (AFIR)

In addition to the three aforementioned proposals, the Alternative Fuels Infrastructure Regulation (AFIR) proposal launched as part of the Fit for 55 package, affects the aviation industry. AFIR requires airport managing bodies of TEN-T core and comprehensive network airports to ensure the provision of electricity supply to stationary aircraft by 2025 (at gates) and 2030 (at outfield posts). Furthermore, by 2030 at the latest, electricity supplied to stationary aircraft should come from the electricity grid or is generated on site as renewable energy. This effectively prohibits the use of fuel-powered ground power units (GPUs).

In order to comply with this regulation, airport managing bodies will have to make investments. Based on data obtained from ACI EUROPE on the number of gates and stands, the total investment up to 2050 is estimated to be approximately €1.2 billion.[4] This includes anticipated future expansion or redevelopment of airport infrastructure (to accommodate a growing number of flights), but excludes infrastructure maintenance or periodic replacement. Numerous airports have already invested in ground power infrastructure, ahead of AFIR. Taking this into account, the remaining investment up to 2050 is estimated at €640 million.

Given that the costs associated with this requirement are not as high as other elements of the Fit for 55 package, and a number of key uncertainties (on electricity costs to airlines and cost pass-through in the form of airport charges, for example), the investment and cost impacts of AFIR are acknowledged in this box, but not modelled nor included in the total costs below.

Policy proposal and assumptions overview

Table 1 below shows an overview of the different Fit for 55 components, split out between the EC's proposals and some additional assumptions also used in the SEO & NLR (2022) report on the ticket price, demand and carbon leakage impacts of Fit for 55. One column details the geographical applicability and the other proposal component

[3] As of July 2022, the EU Parliament and Council are discussing to strengthen the SAF blending mandate under ReFuelEU from 5% to 6% by 2030. In this case, our cost estimates should be considered conservative as these might underestimate the costs of SAF by up to 20%.

[4] Oxera (2022) estimates a higher investment need of €2B, based on a larger share of widebody gates and stands, and different assumptions about utilisation.

specifications, such as tax rate and price developments. All values are expressed in 2018 Euros and therefore exclude the effect of inflation. The assumptions are based on the EC's proposal in July 2021 and do not reflect any legislative discussions beyond that point.[5]

Table 1 Overview of the Fit for 55 proposal components and model assumptions

Fit for 55 component		Applicability	Specifications
EU-ETS	*Proposal*	• Domestic flights (EEA and OMR) • Intra-EEA flights • EEA flights departing to the UK and CH	• Starting point allowance cost of €189 million in 2017 (EASA, n.d.) • Free allowances phased out until 2027
	Assumption	• Complete EEA, UK & CH region	• Price developments: €130/tCO_2 (2030), €175/tCO_2 (2035), & €315/tCO_2 (2050)
CORSIA	*Proposal*	• EEA ↔ non-EEA flights (applicable countries) • Non-EEA ↔ non-EEA flights (applicable countries, international flights)	• From 2027, mandatory for all non-exempt countries
	Assumption	• No CORSIA for flights covered by EU-ETS (i.e., complete EEA, UK & CH region)	• Price developments: €20/tCO_2 (2030), €55/tCO_2 (2035), & €160/tCO_2 (2050) • Assumed to be strengthened after 2035 to move towards net-zero CO_2
ETD	*Proposal*	• Domestic flights (EU) • Intra-EU flights	• Linear phase-in between 2023 (rate of zero) and 2033 (full rate) • From 2033, €10.75/GJ for fossil kerosene • From 2033, €5.38/GJ for non-advanced SAF (part B) • No tax for advanced SAF (part A, synthetic)
	Assumption	• Only applicable for EU countries	
ReFuelEU	*Proposal*	• Domestic flights (EU) • Intra-EU flights • EU → non-EU flights • Refuelling obligation if departing EU airport	Blending mandate: • SAF (min.): 5% (2030), 20% (2035), & 63% (2050) • Synthetic (min.): 0.7% (2030), 5% (2035), & 28% (2050) • Part A + Part B biofuels (max.): 4.3% (2030), 15% (2035), & 35% (2050)
	Assumption	• Complete EEA, UK & CH region align with the SAF blending mandate • No fuel tankering (due to refuelling obligation)	Price developments: • Part A biofuel: €2,765/ton (2030), €2,521/ton (2035), & €1,790/ton (2050) • Part B biofuel: €1,170/ton (2030), & €1,170/ton (2035); not used in 2050 • Synthetic: €2,900/ton (2030), €2,566/ton (2035), & €1,557/ton (2050)

Source: SEO & NLR (2022; *Aviation Fit for 55*, Table 2.1 and Table 3.1)

The NetCost passenger choice model

To forecast the changes in costs, we use the highly detailed market model called the NetCost passenger choice model. This model was also used in the study *'Destination 2050: A Route To Net Zero European Aviation'* by NLR

[5] The Fit for 55 proposal components are not identical to the assumptions in the Destination 2050 study, see NLR & SEO (2021) p. 16ff.

and SEO (2021). In this way, we are able to generate the expected fares for a set of typical routes, including a break-down highlighting the contribution of each Fit for 55 measure on annual costs. Box 2 details the workings of the NetCost passenger choice model.

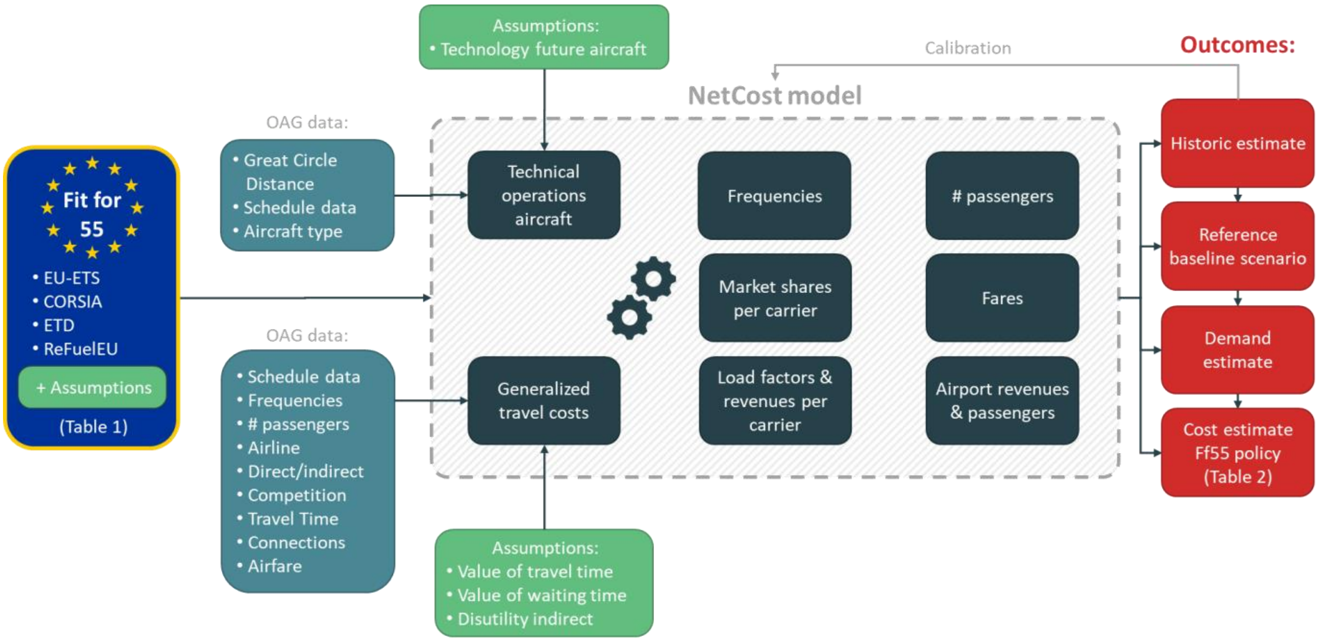
Box 2 The NetCost passenger choice model

SEO's NetCost model is a detailed passenger choice model that can be applied to estimate the impact of cost increases for passengers, thus impacting passenger demand and the number of aircraft movements in 2030, 2035 and 2050. The NetCost model determines the total generalised travel costs for each travel alternative, including the cost of the air fare and travel time. Higher costs, that are passed-through to consumers, increase the cost of air travel and therefore reduce demand, and in turn lead to a reduction in the number of flights and therefore connectivity. The NetCost model estimates the impact of such cost increases on an airport level.

The model distinguishes between direct and indirect flights, as cost increases may differ between direct and indirect flights serving the same market. The model estimates the distribution of passengers over different route options, including indirect route options via individual (European or non-European) hubs. As European policy measures do not apply to non-European hubs, the model can identify a shift of traffic from European hubs to non-European hubs. In the Destination 2050 study, the NetCost passenger choice model has been used to assess the impacts of higher fuel prices and costs of economic measures on demand and supply. The NetCost model has been used in many different studies for IATA, ACI EUROPE, the Civil Aviation Authority of Singapore (CAAS) and the Dutch government. In addition, it has been used in several scientific publications.

Source: SEO (2022)

Figure 1 Overview of the NetCost model, including its inputs and outcomes



Source: SEO (2022)

Figure 1 shows an overview of the workings of the NetCost model. Inputs include the components of the Fit for 55 proposal including several assumptions (shown in Table 1), airline schedule data from Official Airlines Guide (OAG), and additional assumptions on, for example, future aircraft technology and the value of travel and waiting time.

Within the model, the technical aircraft operations and the generalised travel costs are calculated based on all inputs. The model is calibrated based on historical passenger booking data. The model allows detailed price and passenger demand forecasts as well as modules towards calculating emission and connectivity impacts from regulatory policies. This study presents the cost impacts of the Fit for 55 proposal – the impact on passenger demand and CO_2 emissions are shown in *'Aviation Fit for 55: Ticket Prices, Demand and Carbon Leakage'* by SEO and NLR (2022, March). The passenger demand forecasts are based on knowledge about passenger behaviour reacting on a change in prices. Possible destination substitution, for example towards more affordable holiday destinations outside the EEA, is not currently included.

Fit for 55 cost assessment

Based on the model estimations, we find that the annual cost of the Fit for 55 proposal increase from €12.8 billion in 2030 to €21.8 billion in 2035 and €34.4 billion in 2050. Table 2 provides an overview of the costs increases per Fit for 55 component for the years 2030, 2035, 2050 and also the complete 2023-2050 period (from now on referred to as 'total'). The main cost component in 2030 is EU-ETS, whilst in 2035 and 2050 and also for the total period it is (by far) the ReFuelEU Aviaton initiative. For the 2023-2050 timespan, €305 billion out of the complete €577 billion Fit for 55 cost assessment are due to ReFuelEU SAF blending mandate. CORSIA takes up a only a minor part of the total costs with only €35.8 billion for the total period – though, its annual cost in 2050 is higher than that of EU-ETS and the ETD. Allowances for the EU-ETS are the main cost component in 2030 with €6.4 billion out of the total €12.8 billion cost increase for that year. The ETD plays a somewhat constant role over time with costs increasing from €4 billion in 2030 to €5.1 billion in 2035 and subsequently decreasing to €3.3 billion in 2050. The first increase is due to increasing taxation rate during the transition period ending in 2033, whilst the subsequent decrease is due to the increased uptake of SAF (and therefore lower kerosene tax costs). The costs associated with ReFuelEU increase from €2.4 billion in 2030 to €9.0 billion in 2035 and €25.4 billion in 2050. The drop in costs per ton of SAF, as shown in Table 1, are eclipsed by the increased mandate and thus the increased uptake of these fuels. EU-ETS cost are expected to decrease from 2035 to 2050, largely due to the increased use of SAF, for which no ETS allowances have to be surrendered.

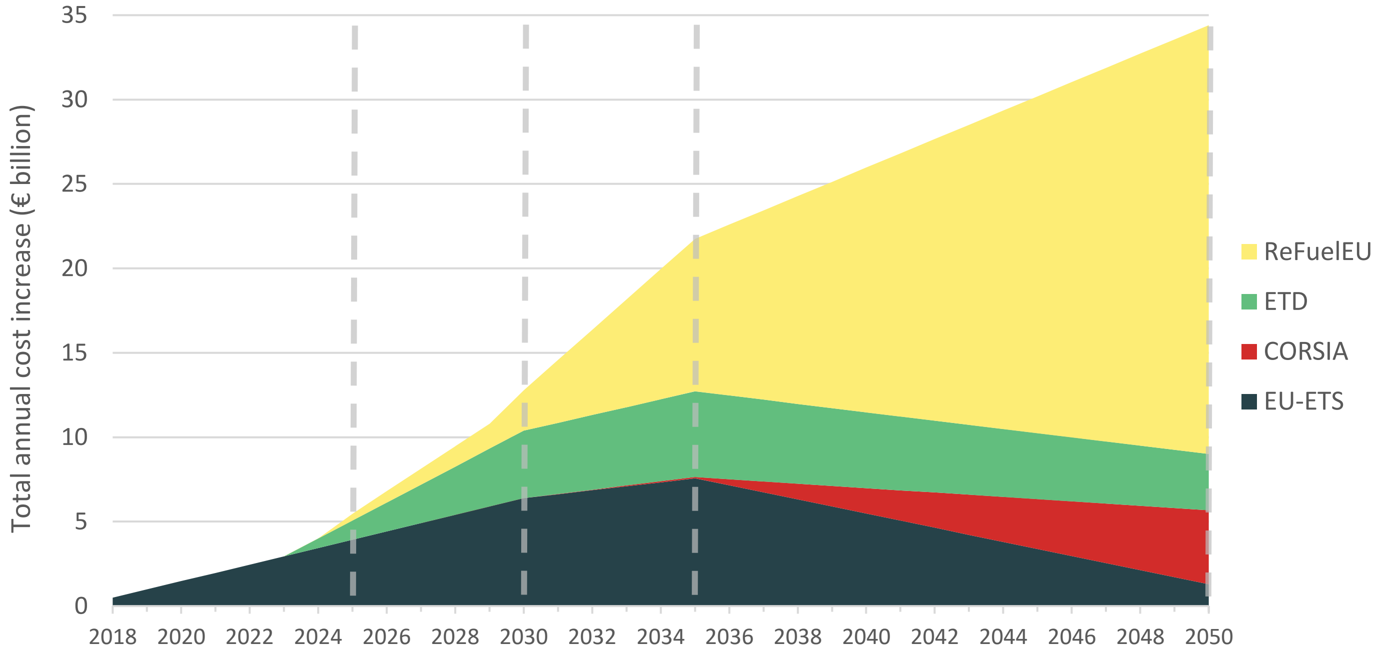
Table 2 The SAF mandate, part of the ReFuelEU Aviation initiative, takes up €305 billion out of the total €577 billion cost assessment of the Fit for 55 proposal

Cost estimate (× € billion)	2030	2035	2050	Total 2023-2050
EU-ETS	6.4	7.6	1.3	136
CORSIA	<< 0. 1	0.1	4.4	36
ETD	4.0	5.1	3.3	99
ReFuelEU	2.4	9.0	25.4	305
Total	**12.8**	**21.8**	**34.4**	**577**

Source: SEO & NLR (2022)

Figure 2 below shows the annual costs for each price component, including the years before and in between 2030, 2035 and 2050. We find that at first, the only Fit for 55 component with substantial costs are the EU-ETS allowances. In 2025 and 2030 the cost increases due the EU-ETS equal €3.9 billion and €6.4 billion respectively. In 2025, the only other cost components are the ETD with €1.1 billion and ReFuelEU with €0.4 billion. Post-2035, EU-ETS costs begin to decrease due to lower emissions from higher SAF blending and hydrogen-powered single aisle aircraft, but are largely compensated by the CORSIA carbon credits. This is in line with our assumption on CORSIA that gradually all emissions have to be off-set at increasing carbon abatement prices and with no mandatory SAF uptake for flights outside the EEA. The ETD (including the kerosene tax) starts in 2024 and is relatively stable over time, but nonetheless peaks in 2035. Contrary to the other cost components, we find that the ReFuelEU SAF blending mandate increases ever more up to 2050 after starting to pose a cost from 2025 onwards. The annual costs of the Fit for 55 proposal reach a total of more than €34 billion in 2050.

Figure 2 From 2034 onwards, instead of the EU-ETS allowances, ReFuelEU is the main Fit for 55 cost component



Source: SEO & NLR (2022)
Note: For the annual EU-ETS costs, the pre-2030 assessment is based on a linear increase from €189 million in 2017 (EASA, n.d.) to the 2030 NetCost model estimate of €6.4 billion (see Table 2).

Average cost increase per flight

Table 3 below shows the average ticket price increase per passenger for different distances of return flights in 2030, 2035 and 2050. Short-haul (a total of 1,500 km adding go and return) and medium-haul (3,000 km) are assumed to be of domestic or intra-EEA flights and long-haul flights (6,000 km) are between EEA and non-EEA airports. Therefore, different rulings apply between these types of destinations. For short-haul flights, the average ticket price increase goes up from €23 in 2030 to €31 in 2035 and subsequently decreases to €26 in 2050. This implies a respective price increases of 15, 21 and 17 percent relative to an illustrative €150 return ticket. The main factors for the latter drop are the significant reduction of EU-ETS and ETD costs per passenger kilometre as well as the lower per unit SAF cost. For medium-haul intra-EEA flights, cost developments are similar in relative terms. The average ticket price increase goes up from €45 in 2030 to €63 in 2035 and subsequently drops to €51. For 6,000 kilometre return flights going between an EEA and non-EEA airport, the ticket price increase consistently goes up over time. In 2030, the cost increase averages €14 and afterwards, it increases to €33 per ticket in 2035 and €48 in 2050. The relative price increases are 2, 6 and 8 percent, respectively, compared with a €600 return ticket. The difference compared to short- and medium-haul flights is due to the fact that the costs of CORSIA carbon credits increase over time which compensates the reduction in EU-ETS and ETD costs.

Table 3 In 2050, ticket prices for medium-haul intra-EEA return flights increase with €51 on average

Flight distance	Fit for 55 component	Average price increase (€per passenger for return flights) 2030	2035	2050
Short-haul (1,500 km) *(Domestic or intra-EEA)*	EU-ETS	12.00	13.05	2.40
	CORSIA	0	0	0
	ETD	7.95	9.30	4.20
	ReFuelEU	2.70	9.00	19.05
	Total	**€22.65**	**€31.35**	**€25.65**
	Relative to €150 return ticket	+ 15.1%	+ 20.9%	+ 17.1%
Medium-haul (3,000 km) *(Domestic or intra-EEA)*	EU-ETS	24.00	26.10	4.80
	CORSIA	0	0	0
	ETD	15.90	18.60	8.40
	ReFuelEU	5.40	18.00	38.10
	Total	**€45.30**	**€62.70**	**€51.30**
	Relative to €300 return ticket	+ 15.1%	+ 20.9%	+ 17.1%
Long-haul (6,000 km) *(EEA ↔ non-EEA)*	EU-ETS [a)]	4.80	5.40	1.20
	CORSIA	≈ 0 [b)]	3.00	13.80
	ETD [a)]	3.60	4.20	1.80
	ReFuelEU	6.00	20.40	31.20
	Total	**€14.40**	**€33.00**	**€48.00**
	Relative to €600 return ticket	+ 2.4%	+ 5.5%	+ 8.0%

Source: SEO & NLR (2022), based on SEO & NLR (2022; *Aviation Fit for 55*, Table 4.1)

Note: Flight distances are based on distinctions made by EUROCONTROL (2011, p. 21), that is, short-haul (<1,500km), medium-haul (1,500-4,000km), and long-haul (>4,000km) flights. This report assumes a return flight, such that a short-haul flight, for example, is a flight going 750 km back and forth. The ticket prices in the table are purely illustrative to show the relative price increases.

[a)]: Even though EU-ETS and the ETD only apply to domestic or intra-EEA flights, there are –on average and only to some extend– still such price increases for flights between EEA and non-EEA airports when there is a transfer *within* the EEA region.

[b)]: In 2030, CORSIA's ticket price increase for long-haul flights between EEA and non-EEA airports approximates zero on average.

Conclusion

By modelling the measures of the EU's Fit for 55 proposal within the NetCost model, we evaluate the associated cost increase. In 2030, annual costs are €12.8 billion and in 2050, €34.4 billion. For the period 2023-2050, total accumulated costs are estimated at €577 billion. These are spread over EU-ETS allowances (24 percent), CORSIA carbon credits (6 percent), the ETD's kerosene tax (17 percent), and the ReFuelEU Aviation sustainable aviation fuel blending mandate (53 percent).

References

EASA (n.d.). The EU Emissions Trading System. Retrieved from https://www.easa.europa.eu/eaer/topics/market-based-measures/the-eu-emissions-trading-system

EUROCONTROL (2011). Study into the impact of the global economic crisis on airframe utilisation. Retrieved from https://web.archive.org/web/20150606044528/https://www.eurocontrol.int/sites/default/files/content/documents/official-documents/facts-and-figures/coda-reports/study-impact-global-economic-crisis-2011.pdf

NLR & SEO (2021, February). Destination 2050: A Route To Net Zero European Aviation. *NLR-CR-2020-510*. Retrieved from https://www.seo.nl/publicaties/destination-2050-a-route-to-net-zero-european-aviation/

Oxera (2022, June). Assessment of the impact of the Fit for 55 policies on airports. Retrieved from https://www.aci-europe.org/component/attachments/?task=download&id=2065:Impact-assessment-of-Fit-for-55-policies-on-the-aviation-sector_final_300522

SEO & NLR (2022, March). Aviation Fit for 55: Ticket Prices, Demand and Carbon Leakage. *SEO report, 2022-16.* Retrieved from https://www.seo.nl/publicaties/aviation-fit-for-55/