

SCHIPHOL AMSTERDAM AIRPORT: FEWER FLIGHTS OR BECOMING MORE SUSTAINABLE?

SOCIAL COSTS AND BENEFITS OF CAPACITY REDUCTION
VERSUS ENVIRONMENTAL MEASURES

SUMMARY



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Summary

Environmental and noise measures, including a higher ticket tax, are much better for social welfare than a capacity reduction at Schiphol Amsterdam Airport. Both options result in lower emissions and less noise, but the effects on emissions are larger in the environment & noise alternative. These positive effects outweigh the direct costs for Dutch air passengers, airlines and Royal Schiphol Group.

Costs and benefits of capacity reduction at Schiphol Amsterdam Airport

The Dutch government wants to reduce the number of flights to and from Schiphol Amsterdam Airport to 440,000 per year. At the request of Royal Schiphol Group, KLM Royal Dutch Airlines, and Barin Board of Airline Representatives in the Netherlands, SEO Amsterdam Economics, CE Delft and Significance conducted a social cost-benefit analysis (SCBA) of this plan. NLR provided input regarding the relevant noise calculations. The study furthermore examined whether other policy choices yield more (net) benefits. The study was conducted independently and uses the SCBA guidelines established by the Netherlands government as a framework.

Baseline alternative

Capacity reduction and other policy alternatives have been compared to a baseline alternative in which the existing restriction of 500,000 flights per year remains in place. Factors effecting the demand for aviation are based on the long-term prosperity and living environment scenarios for the Netherlands (WLO-scenarios). Here, a distinction is made between a low and a high economic scenario. Assumptions about the recovery of aviation after Covid have been added and European policies regarding a more sustainable aviation industry are included. Important elements are the strengthening of the European Emissions Trading System (EU ETS) and a blending obligation for sustainable aviation fuel (SAF).

Policy alternatives

This SCBA focuses on two policy alternatives:

- The 440k alternative: the central government's plan to limit capacity at Schiphol to 440,000 flights per year;
- The environment & noise alternative: no limit regarding the number of flights, an (over time) increasing and distance-dependent ticket tax, fewer night flights and a Dutch subsidy for sustainable aviation fuel (SAF). The ticket tax applies to all passengers, with a reduced rate for transfer passengers (about 60 percent lower). By 2050, this alternative will achieve virtually zero net climate emissions from flights departing from the Netherlands.

In addition, various other policy alternatives have been examined in this study, but often only with indicative calculations:

- An obligation to blend additional SAF;
- A capacity limit of 440k flights for Schiphol, but with the opening of Lelystad Airport;
- A capacity limit of 480k flights;
- An increase in the capacity limit from 500k to 540k flights;
- Fewer night flights only.

The study also examines the impact of a less strict European aviation climate policy on the outcome of the SCBA. In addition, various other sensitivity analyses were performed with different assumptions than in the initial calculations. This summary mainly describes the 440k and environment & noise alternatives.

Methods and assumptions

The effects on aviation have been calculated by Significance using the AEOLUS aviation model. In addition, a competition analysis was conducted and SEO's NetCost model was used to estimate the loss of direct flight destinations. The effects on emissions have been determined using these model calculations. This also includes the global warming effects that are not related to CO₂ (non-CO₂). Based on the AEOLUS results, NLR calculated detailed noise effects. The noise effects were subsequently monetised using environmental valuations from the new Environmental Valuation Handbook (Handboek Milieuprijzen 2023). Wider economic effects have been estimated using an input-output/labour market model developed by SEO.

A difficult question is which monetary valuation of CO₂ should be used. In 2016, CPB Netherlands Bureau for Economic Policy Analysis and PBL Netherlands Environmental Assessment Agency determined CO₂ prices as part of the WLO-scenarios. These can be interpreted as a global CO₂ tax to limit global warming to about 3.75°C and 2.75°C in the low and high economic scenarios, respectively. SCBA guidelines recommend using these prices. In this study, we follow this recommendation, but we also show results based on higher CO₂ prices, which are expected to be more in line with the planned updates of CO₂-prices. Today, climate policy is based on much more ambitious targets than was assumed in 2016. In 2024 or 2025, new WLO-scenarios are expected to be published in which we expect CO₂ prices to be higher. These updates are compatible with warming between 2°C and 1.5°C.

Effects of the 440k alternative

In terms of net benefits, the 440k alternative scores favourably with up-to-date CO₂ prices and negatively with prescribed CO₂ prices. The effects of capacity reduction on aviation and the economy are negative. Total generalized travel costs (including the cost of a ticket and travel times) will increase for Dutch passengers, some destinations are no longer served with direct flights and flight frequencies are lower on many routes. As a result, people are more likely to choose other (foreign) airports, travel by different means of transport or they do not travel. This leads to a loss of social welfare. The number of passengers in 2050 will be 12 percent lower than in the baseline alternative, and so is the amount of freight. The number of transfer passengers is 18 to 21 percent lower. Twenty to thirty percent of the negative effects on passengers are experienced by Dutch travellers. The profits of airlines and Royal Schiphol Group are lower than in the baseline alternative. It is estimated that ten percent of the negative effects on airlines will be borne by Dutch shareholders. Jobs are being lost in aviation and suppliers, but after some years people will find other work and the labour market will reach a new equilibrium, which limits the negative effects in the labour market.

On the other hand, the 440k alternative has beneficial effects on noise and emissions. The costs of noise pollution in 2030 will be 15 to 24 percent lower than in the baseline alternative; by 2050 this will be 22 to 23 percent. Global CO₂ emissions in 2030 will be 0.40 to 0.49 Megatons lower than in the baseline alternative, but that effect will decrease sharply towards 2050 because part of the fuel will be sustainable by then. Non-CO₂ climate impacts in 2030 will be 0.68 to 0.88 Megatons (CO₂ equivalents) lower than in the baseline alternative; in 2050 this will be 0.81 to 0.85 Megatons. Other emissions are also lower.

Effects of the environment & noise alternative

The environment & noise alternative shows favourable net benefits, both at up-to-date CO₂ prices and at prescribed CO₂ prices. This is a robust outcome, given the sensitivity analyses described below. The effects of the environment

& noise alternative for aviation are mixed. Because the current capacity limit of 500,000 flights will be lifted, Schiphol will grow to 535,000 to 560,000 flights in 2050. The number of destinations is larger, and the flight frequency increases on many connections. As a result, more people travel via Schiphol, despite the higher ticket tax. The number of passengers is six to nine percent higher than in the baseline alternative. However, because the ticket tax will be distance-dependent, the number of intercontinental passengers (excluding transfer passengers) will be 12 to 37 percent lower than in the baseline alternative. On balance, the total number of passenger kilometres will be 4 to 13 percent lower. The effects on the wider economy are negative due to a decline in the number of intercontinental visitors to the Netherlands (especially tourists). However, many people find other jobs and the labour market will adapt.

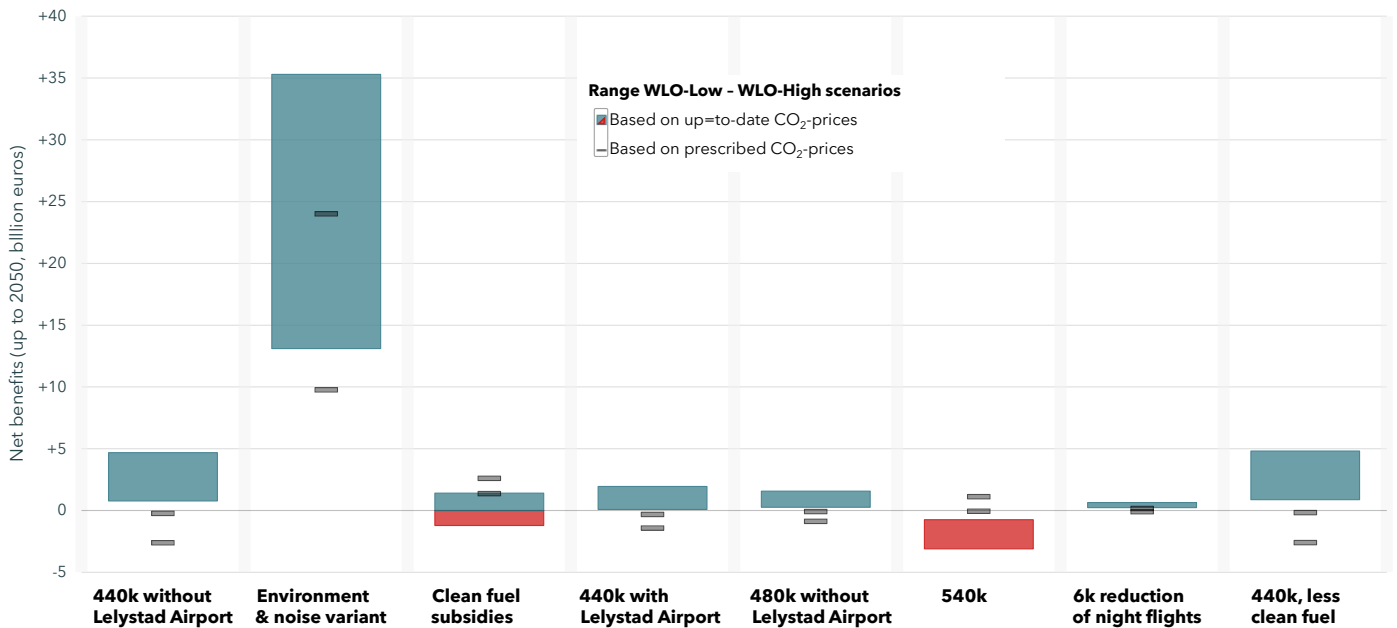
The effects on noise and emissions are favourable. In 2030, the costs of noise pollution will be 12 to 29 percent lower than in the baseline alternative. In 2050, this effect will be smaller (four to eight percent) because the number of flights will increase over time. Global CO₂ emissions will be 0.53 to 0.88 Megatonnes lower in 2030 than in the baseline alternative and 0.37 to 1.00 Megatonnes lower in 2050, mainly due to the reduction of the average flight distance. The reduction in non-CO₂ climate impacts is larger than in the 440k alternative: 0.89 to 1.48 Megatons in 2030 and 0.37 to 1.16 Megatons in 2050. This is also due to the shorter average flight distance. Non-CO₂ effects are related to the flight altitude, which is relatively lower on European flights.

Costs and benefits

Long-term

In the period up to and including 2050, the environment & noise alternative will lead to larger net benefits than other policy options (see the figure below). The magnitude of the net benefits strongly depends on the long-term scenario and the CO₂ valuation used. However, this does not affect the conclusion that the environment & noise alternative performs much better in the SCBA than other policy options.

Figure S.1 The environment & noise alternative is much better for social welfare than other policy options

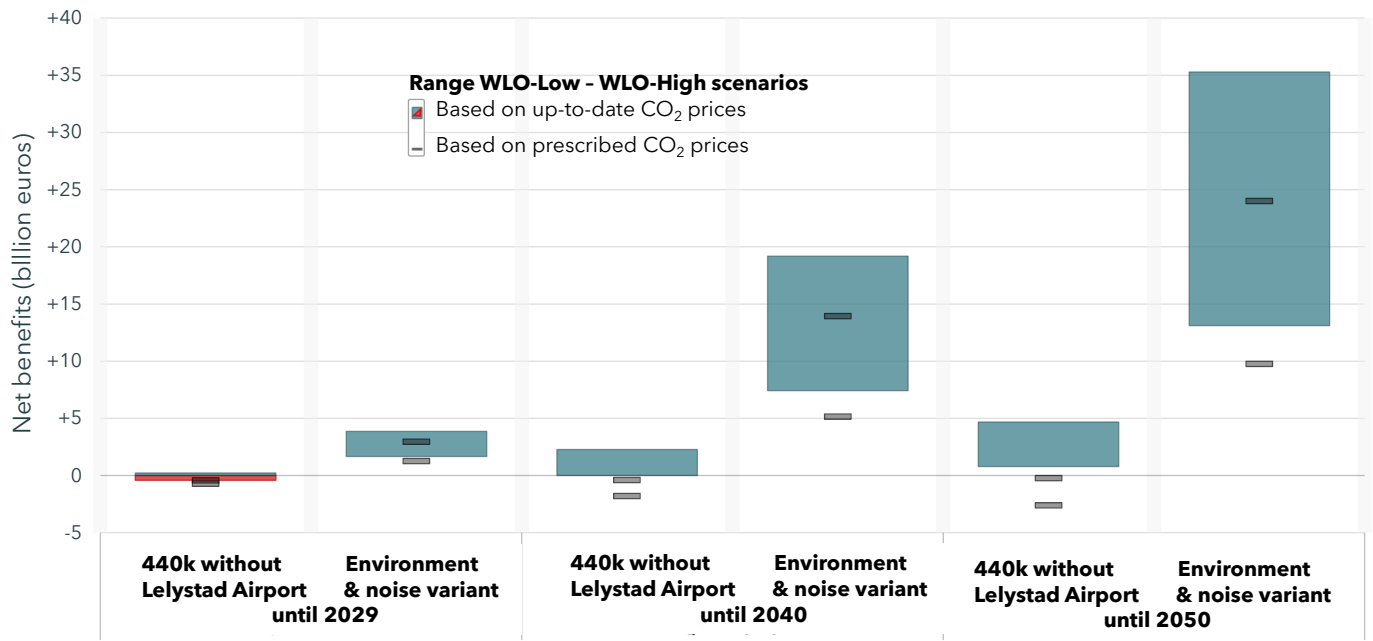


Source: SEO, CE Delft, Significance

Short and long term

The figure below shows that the net benefits of the environment & noise alternative are not only higher in the long term, but also in the periods before, compared to the 440k alternative. This is also the case if only the first five years are considered (2025 to 2029).

Figure S.2 The environment & noise alternative has higher benefits than the 440k-alternative in all periods



Source: SEO, CE Delft, Significance

440k alternative

The figure also shows that reducing capacity at Schiphol to 440k may reduce social welfare in the short term but will increase social welfare in the long term. However, this increase only applies to valuation with more recent (higher) CO₂ prices and not to lower CO₂ prices that are in line with a 2.75-3.75-degree warming scenario. Passengers will experience longer travel times because fewer destinations can be travelled to using a direct flight, they are faced with lower flight frequencies and higher ticket prices. The same direct negative effects apply to air cargo. Airlines will make scarcity rents through higher ticket prices but also will become less cost-efficient and transport fewer passengers and cargo. Royal Schiphol Group will have less users and will become less efficient due to lower economies of scale. The 440k alternative also has negative wider economic effects on tourism and economic activity around Schiphol. In addition, the government will lose tax revenue, especially from the ticket tax. On the other hand, there are benefits of lower emissions and less noise.

Environment & noise alternative

The environment & noise alternative strongly increases social welfare. This is true in the short and long term, in a low and a high growth scenario, and using low and high CO₂ valuations. This is mainly due to the revenues from the higher ticket tax for the government and to favourable climate effects. The other negative environmental effects are also lower in this alternative. In addition, there are benefits of less noise pollution than in the baseline alternative. The effects on passengers and air cargo are negative because they will pay a higher ticket tax. Airlines lose scarcity rents (high ticket prices) that occur in the baseline alternative. The wider economic effects are also negative because the number of intercontinental visitors to the Netherlands is lower than in the baseline alternative.

The higher net social welfare effect of the environment & noise alternative (compared to 440k) has two main causes:

- The distance-dependent ticket tax results in less growth in the number of intercontinental flights, which reduces the number of flight kilometres and thus CO₂ emissions and non-CO₂ effects;
- The higher ticket tax leads to a shift of income from (mostly) foreign airlines to the Dutch government.

Sensitivity analyses

The conclusion that the environment & noise alternative is better for social welfare than the 440k alternative does not change if other assumptions are made. A series of sensitivity analyses show that the valuation of climate impacts has a stronger impact on the SCBA balance than the other assumptions. Capacity reduction to 440k flights has positive net benefits in half of the sensitivity analyses and negative net benefits in the other half. In the case of the environment & noise alternative, all outcomes are positive. The results of the 440k alternative are therefore more uncertain than those of the environment & noise alternative.

Table S.1 In half of the analyses, reducing the airport’s capacity leads to net social welfare gains, while the environment & noise alternative has positive net social welfare effects in all analyses

	Capacity reduction (440k)	Environment & noise alternative
Positive net benefits (number of analyses)	28	60
Negative net benefits (number of analyses)	28	0
Positive net benefits > €5 billion (number of analyses)	2	60
Negative net benefits <-€5 billion (number of analyses)	0	0
Highest net benefits (billion euros)	+10,6	+43,9
Lowest net benefits (billion euros)	-4,4	+9,1

Source: SEO, CE Delft, Significance

Reflection

Controlling negative effects of aviation

In principle, it is better to direct environmental measures at the external effects in outputs such as noise annoyance, climate effects and other emissions than on the total number of flights. This is the applied mechanism behind the design of the environment & noise alternative: reducing the external costs as much as possible. In practice, however, it might be difficult to introduce policy instruments to regulate the relevant outputs directly, especially when it comes to national policy. That is why it is inevitable to steer on other factors. The environment & noise alternative regulates inputs where national policy is possible and that correlate strongly with external costs:

- For CO₂ and non-CO₂ climate effects, we opted for influencing the number of passenger kilometres via a distance-dependent ticket tax. The distance travelled is more strongly correlated with emissions and noise than the number of flights (which is the focus of the 440k alternative);
- In addition, we added a Dutch SAF subsidy. Clean fuel leads to lower CO₂ emissions and therefore has a strong correlation with these emissions. Non-CO₂ emissions are also correlated with clean fuel;
- Specifically for noise, we assumed a reduction in the number of night flights. On average, night flights cause ten times as much noise annoyance as daytime flights. As a result, the number of night flights is much more strongly correlated with total noise pollution than the total number of flights.

The results of the SCBA show that this approach of controlling negative effects yields more social welfare than limiting the total number of flights.

Schiphol's role as a hub airport

In both the 440k alternative and the environment & noise alternative, Schiphol remains a hub with a substantial share of transfer passengers. In the environment & noise alternative, the total number of flights increases, but there are fewer intercontinental flights. In this new constellation, Schiphol will remain a hub, but with a greater emphasis on European flights.

Non-CO₂ climate impacts

In the social cost-benefit analysis results, the benefits of lower non-CO₂ climate impacts are relatively large compared to other costs and benefits. These effects are, on average, twice as large as those of CO₂. Non-CO₂ climate effects arise from condensation trails from aircraft. These 'contrails' can be significantly reduced by avoiding critical layers of air at certain times. By limited detours (and therefore using slightly more fuel and emitting some more CO₂), the non-CO₂ impact of a flight can be significantly reduced. We assume that airlines will not opt for such adjustments on their own because of extra fuel costs. The Netherlands cannot regulate this without other countries. Global regulation leads to an increase in fuel consumption by one percent, but the total non-CO₂ impact decreases by 43 percent. This implies that such global policies have very high benefits.