Aviation Consultants

23.171.05 • November 2023

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Report

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The Hague, November 2023

Executive Summary

The objective of this study is to design a distribution key that allocates the CO_2 budget available within the CO_2 ceiling amongst airports to fit the operation of the airports. The potential distribution keys are assessed based on advantages and disadvantages, whilst considering flexibility to cope with potential future developments as an important element.

In this study, airports are extensively involved to provide feedback, and other stakeholders are involved as well. Based on the input from the stakeholders and expert judgement, To70 determined three potential distribution keys: based on realized traffic, based on permitted budget and based on forecasted movements.

To70 concludes the following for the distribution keys:

1. A distribution key based on **forecasted movements** is not considered to be favourable, because the forecast is based on assumptions, the accuracy could be apparent and forecasting for small airports is difficult. Consequently, this invites for discussion because outcomes can be challenged and enforcement can be difficult.
2. This is different for the distribution key based on **permitted budget**. Therefore, this distribution key is most favoured. This distribution key aligns with limitations based on noise and it takes foreseen developments into account, but most importantly, it is based on accepted numbers. Therefore, the risk of discussion is smaller. However, this distribution key requires all airport decrees are in place and have at least one overlapping reference year. This could be a complicating factor, because the application process of an airport decree is complex and therefore sensitive for delays.
3. If the airport decrees are not in place at the moment of designing the distribution key, the distribution key based on **realized traffic** is recommended, with a reference year of 'moment of distribution minus one year'. Alternatively, 2019 can be used as reference year, but this will result in a lower level of accuracy. In both cases, an extra CO_2 budget for Maastricht and Groningen could be considered, because there is hardly any room for desired growth developments within the noise constraints without the extra CO_2 budget.

For the three distribution keys, an example distribution in terms of CO_2 budget has been performed. The results can be found in Table 1. This also includes an indication for the number of movements that would be possible when 6% of SAF is blended and the average rate of fleet renewal continues (scenario 4), based on the average CO_2 emissions per flight per airport in 2019.

Table 1 Comparison of distribution keys for a scenario with sustainable developments

Scenario 4	Schiphol	Eindhoven	Groningen	Maastricht	Rotterdam	Total
Realized traffic 2019[1]	94,94%	3,27%	0,19%	0,43%	1,17%	100,00%
	537,7 k	43,5 k	3,6 k	7,9 k	20 k	612,7 k
Permitted budget	93,00%	3,63%	0,99%	1,02%	1,36%	100,00%
	526,8 k	48,3 k	18,7 k	18,7 k	23,2 k	635,6 k
Forecasted movements	94,77%	3,24%	0,28%	0,36%	1,34%	100,00%
	536,8 k	43,1 k	5,3 k	6,6 k	22,9 k	614,6 k

Table 2 Differences between lowest and highest aircraft numbers

Scenario 4	Schiphol	Eindhoven	Groningen	Maastricht	Rotterdam
Lowest value	526,8 k	43,1 k	3,6 k	6,6 k	20 k
Highest value	537,7 k	48,3 k	18,7 k	18,7 k	23,2 k
Difference (%)	2%	12%	421%	183%	16%

When 6% of SAF is blended and the average rate of fleet renewal continues, it can be concluded that the outcome in maximum number of aircraft movements differs between the airports for the different distribution keys. Especially for Groningen and Maastricht the difference is large.

Besides the distribution key, this study focuses on flexibility to cope with potential future developments, since these could lead to a desire for redistribution of CO_2 budget amongst airports. One of these developments is the opening of Lelystad Airport, or the closing of an existing airport. For the opening of Lelystad Airport, it is recommended to transfer CO_2 budget from Schiphol Airport to Lelystad Airport, because Lelystad Airport is appointed as overflow airport for Schiphol Airport, taking over specific flights from Schiphol Airport. The CO_2 budget required to cover the emissions related to these flights should be deducted from the CO_2 budget of Schiphol Airport and added to the CO_2 budget of Lelystad Airport. For the autonomous growth of Lelystad Airport, the CO_2 budget is distributed from other airports after recalibration.

In case an existing airport closes, it depends on the situation of the closing airport how to cope with this. When another airport is taking over the flights, the CO_2 budget shall be transferred accordingly. When this is not the case and flights are removed, it is recommended to recalibrate the distribution key and distribute the available CO_2 budget amongst the other airports. Alternatively, the available CO_2 budget could be taken out of the market as a reservation. In that case, the climate targets will be achieved earlier. However, this is a political decision, since it impacts the CO_2 ceiling as a whole.

Besides the opening of Lelystad Airport, other developments can occur, which may be yet unforeseen. Since the CO_2 ceiling is a new concept and the impact of unforeseen developments is unknown, flexibility to adjust after unwanted effects is important. At the same time, airports need a level of certainty for making investments, based on a long term strategy or business case. So, a balance is necessary between flexibility and certainty. This balance can be found through including several recalibration moments.

[1] In case another reference year is selected, the distribution of the CO_2 budget may differ.

These are moments at which a redistribution of the CO_2 budget might be desired, because the distribution does not fit the actual (and future) situation of the airports anymore. Recalibration after a specific period of time is not preferred by stakeholders, because there was no consensus over the most suited period of time. Instead, recalibration in case of certain events is preferred. In total, seven possible events have been identified, for which the likelihood of recalibration may differ. When a new airport opens or an existing airport closes, recalibration is certainly required. In case of large airport developments - like a reduction in aircraft movements after a Balanced Approach procedure - or CO_2 policy adjustments, a recalibration is probably required. Finally, recalibration may be requested by stakeholders, and the likelihood of recalibration depends on the nature of the request and the criteria for recalibration.

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1 Introduction

In the Civil Aviation Policy Memorandum 2020 - 2050 ("Luchtvaartnota 2020 - 2050"), the Ministry of Infrastructure and Water Management has set targets for reducing the CO_2 emissions of the Dutch aviation sector: reaching the CO_2 emission level of 2005 in 2030, reducing CO_2 emissions by 50% in 2050 compared to 2005, and zero CO_2 emission in 2070. Nevertheless, these ambitions are not legally binding. As a result, the targets are not directly enforceable and failure to meet these targets will have no consequences.

To gain control of the emissions and make the targets enforceable, the Ministry of Infrastructure and Water Management is implementing a CO_2 ceiling. The CO_2 ceiling will serve as a mechanism to assure the CO_2 emissions from departing international flights from the Netherlands will remain below the threshold that fall under the abovementioned targets. In this way, the Ministry assures the aviation industry contributes to achieving the national climate targets. The amount of allowed CO_2 emissions will be in line with agreements within the Sustainable Aviation Agreement, so if these agreements are lived up to, the enforcement of the CO_2 ceiling will not function as a limiting factor.

In March 2023, the cabinet took a decision in principle for the implementation of a national CO_2 ceiling for all Dutch airports of national importance. Such an implementation requires setting up a distribution key per airport to determine the CO_2 budget for each airport. This is a key element and a substantial part of the implementation process. The distribution key will determine the maximum amount of CO_2 emissions allowed for each airport for a perennial enforcement period. In doing so, the targets set in the Civil Aviation Policy Memorandum 2020 - 2050 ("Luchtvaartnota 2020 - 2050") are pursued.

1.1 Research objective

The Ministry of Infrastructure and Water Management has requested To70 to identify and assess methods to distribute the total CO_2 emission budget within the CO_2 ceiling amongst the Dutch airports. Each airport will get a CO_2 budget which is formalized in its airport decree. This will be the maximum amount of CO_2 that may be emitted from international flights departing at the airport. This study aims to identify and assess the most suitable distribution key for the CO_2 ceiling. A main element in this distribution key is flexibility, because the development of airports is difficult to predict. Therefore, the distribution key should be sufficiently flexible to cope with these potential developments.

1.2 Questions

This study aims to provide answers to the following research question to gain insights in the most suitable distribution key where the CO_2 emission budget is divided amongst airports while considering a CO_2 ceiling:

What is the most suitable distribution key for the airport variant of the CO_2 ceiling?

To answer this research question, the following sub-questions will also be considered:

- In what ways can the emission budget be divided amongst airports?
- How will the opening of a new airport be handled?

- How will the closing of an existing airport be handled?
- How will the adjustment of national CO_2 targets be handled?
- When should the distribution key be recalibrated in the future?
- Is the distribution key flexible enough to take the uncertain development of airports into account?
- What are the advantages and disadvantages of different distribution methods, also considering the potential side effects and unintended consequences?

1.3 Methodology

A previous study in 2021 discussed different distribution *methods*. During an internal workshop and multiple stakeholder sessions, both plenary and individual, these distribution methods are discussed. Based on the results from these session, the best distribution methods are chosen for further investigation. Based on these distribution methods, *specific* distribution keys are defined, with input from the Ministry regarding assumptions. A qualitative analysis of the specific distribution keys is performed to determine the advantages and disadvantages. Next to that, a quantitative analysis of the aircraft movements and corresponding CO_2 emissions in 2030 is performed to understand the translation of the CO_2 ceiling to a CO_2 budget per airport. This analysis is indicative for this report, and should be performed again once the distribution key is selected and relevant circumstances are known. A sensitivity analysis is included for different scenarios for sustainability developments at the airports. Afterwards, the most suitable distribution key according to To70 is recommended for further consideration.

Besides the most suitable distribution key, several options are analysed for opening Lelystad Airport or closing an existing airport. Also, several options are determined if and when to recalibrate the distribution key. The latter two topics are based on expert judgment with both the aviation sector parties and To70.

1.4 Assumptions and scope

This study takes previously made decisions as starting point, such as the choice for the CO_2 ceiling per airport. The most important demarcations for this study are listed below:

- <u>Airports:</u> This study concerns all Dutch airports of national importance. This means that it includes Schiphol Airport, Eindhoven Airport, Rotterdam Airport, Groningen Airport Eelde, Maastricht Aachen Airport and Lelystad Airport, a combination of slot coordinated and non-slot coordinated airports.
- <u>Flights:</u> The CO_2 ceiling includes all CO_2 emissions from all international departing flights with a minimum of 5700 MTOW from the abovementioned airports. This concerns the emissions for the full length of the flight, for both passenger and cargo flights.
- <u>2005 CO_2 emissions:</u> The first target within the CO_2 ceiling is to limit aviation carbon emissions to the level of 2005. However, it depends on the calculation method what is the exact 2005-level. For this study, the level of 2005 is calculated using the same method as the calculation for the distribution key, which is the Small Emitters Tool (Eurocontrol). Using this tool, the emitted CO_2 in 2005 is established at 9.8 megatons.

This study explicitly does not include the development of a monitoring system for the CO_2 ceiling. Also the governance for the distribution key is out of scope of this project, together with the legal assessment.

1.5 Structure

This report starts with an overview of a study conducted by To70 in 2021, in chapter two. In this study, four potential distribution methods have been examined, and these have been used as starting point in discussions with sector stakeholders. Subsequently, in chapter three, three distribution keys have been further defined. For these options, the advantages and disadvantages are considered, and a calculation is made for the distribution of CO_2 between the airports, resulting in a recommendation for the most suitable distribution key. Then, in chapter four, several options for dealing with the opening of Lelystad Airport or closing of an existing airport are discussed. Finally, in chapter five, moments for recalibration of the distribution key are assessed. The conclusions and recommendations for this study are drawn in chapter six, followed by the appendices.

2 Previous study

This chapter provides an overview of previously explored variants of a potential distribution methods for the CO_2 emission budget amongst airports. Besides this overview, other potential distribution strategies are mentioned to gather insights for this study.

In the analytical report 'Nationaal CO_2 plafond voor luchtvaart' (September 2021), conducted by To70 in 2021 as commissioned by the Ministry of Infrastructure and Water Management, various elements of a CO_2 ceiling for all involved Dutch airports were explored. In this study, the two following research questions were addressed:

1. How can the available CO_2 budget be allocated (considering a centralized norm or different types of decentralized systems)?
2. Which parameter should be used to (fairly) distribute the available CO_2 budget?

Besides an appropriate application level of the distribution method, it is important to develop an objective method for the distribution of the available CO_2 budget across the airports. Four different parameters were explored on which the distribution method could be based:

- Realized traffic parameters: Distribution of the CO_2 budget based on data values of specific operational parameters, such as number of aircraft movements, number of passengers, number of seats, flown kilometres, available seat kilometre, etc.
- Realized fuel data: Distribution of the CO_2 budget between airports based on the fuel uplifted at the airports in a certain reference period.
- Modelled CO_2 emissions using realized traffic data as input: Distribution of the CO_2 budget based on CO_2 emissions calculated with a certain model using realized traffic data as input. This traffic data includes a combination of multiple parameters.
- Soft factors: Distribution of the CO_2 budget based on soft factors, such as the ambitions of airports, the ambition of the Ministry with respect to specific airports, local circumstances and its long-term expectations. These soft factors, in combination with statistics, form a 'mild distribution method', in which a broader spectrum of (soft) factors can be considered.

2.1 Distribution method based on realized traffic parameters

The first distribution method that has been explored within the study of 2021 is an approach based on the realized traffic data from airports. In this variant, the distribution of the CO_2 emission budget is carried out by employing one of several traffic parameters. The parameters mentioned are: the number of departing international flights, the number of passengers, the freight volume in tonnes, the flight distances, the maximum take-off weight (MTOW) in tonnes and the available seat kilometres (ASK). A translation of these parameters into a potential distribution of the CO_2 budget amongst the five airports is presented in table 3. This distribution is based on data from the year 2019. Lelystad Airport is not included, because there was no significant commercial traffic at this airport in 2019.

Table 3 Distribution key according to different traffic parameters

Airport	Departing int. flights	Number of pax	Freight volume (tonnes)	Flight distances	MTOW (tonnes)	Available Seat Km (ASK)
Schiphol	88%	89%	93%	91%	91%	94%
Eindhoven	7%	8%	0%	5%	4%	4%
Maastricht	2%	<1%	7%	2%	2%	1%
Rotterdam	3%	3%	<1%	2%	2%	2%
Groningen	<1%	<1%	<1%	<1%	<1%	<1%

The advantages of this distribution method are the direct link with data and the simple process. There are little steps required to determine the CO_2 budgets. The disadvantage of this distribution method is that one single traffic parameter only gives a partial image of the total CO_2 emissions by airports, while in practice CO_2 emissions depend on all of the above-mentioned parameters. Table 4 lists the characteristics of the operations that have an influence on the CO_2 emissions, but are not taken into account for the distribution when only the specific parameter is considered.

Table 4 Missing information of each individual transport parameter

Transport parameter	Not taking into account
Number of departing international flights	Aircraft type, aircraft size, and flight distance
Number of departing passengers	Number of movements, aircraft type, flight distance, and cargo flights
Outbound freight volume	Passenger flights
Flight distance (great circle distance)	Aircraft type and size
Max. take-off weight (MTOW)	Actual weight
Available Seat Kilometer (ASK)	Aircraft size and flight distance

The study discussed that the available seat kilometre (ASK), which is a combination of frequency, number of seats, and flight distance, is the indicator that combines the most information. The available ton kilometre (ATK) combines the same factors for cargo traffic. A combination of ASK and ATK would provide the most comprehensive view of all indicators. However, these global indicators still have the disadvantage that they do not account for specific emission characteristics of aircraft type and achieved load factors, which makes the combination of these indicators only moderately representative for the amount of CO_2 emissions. Table 5 provides a summary of this distribution method variant, with its advantages and disadvantages.

Table 5 Summary of a distribution method based on realized traffic parameters

Distribution method: Realized traffic parameters	
Characteristics	• Distribution of the CO_2 budget amongst airports based on the realized traffic data values on specific transport parameters.
Advantages	• Direct link with data, little processing steps.
Disadvantages	• No direct relation between one transport parameter and the actual CO_2 emissions, taking into account the aircraft type, fuel type and load factors.

2.2 Distribution method based on realized fuel data

The second distribution method mentioned in the study of 2021 uses realized fuel data, which involves allocating the CO_2 budget amongst airports based on the fuel uplifted at the airports during a reference period. Data for these purchases are publicly available and can be retrieved from the Central Bureau of Statistics (CBS). A clear advantage of this distribution method is the direct relationship between fuel consumption and CO_2 emissions. A disadvantage is the uncertainty within the data, which may result in a potentially distorted view of CO_2 emissions. An example of such an uncertainty is tankering. This is a practice by airlines to limit or avoid uplifting fuel at the arrival airport, for example to perform a quicker turn-around or because fuel is more expensive at the arrival airport. As a consequence, the fuel uplifted is not equal to the fuel consumed for the departing flight from the Netherlands. Another disadvantage is that the CBS currently reports fuel purchases on a national level, but not on an airport level. Therefore, the data is not detailed enough for the distribution of CO_2 budget amongst airports.

The upcoming Refuel EU intends to mitigate some of these disadvantages, as it proposes detailed monitoring and reporting of aviation fuel data by fuel suppliers and airlines. The initiative addresses reporting individual airport fuel data and includes measures against tankering, which may reduce the difference between fuel uplifted and fuel consumed during flight. However, realising the potential of the Refuel EU Aviation initiative to enhance the future use of realized fuel data is highly dependent on the actual implementation. On top of that, the ReFuel EU is not valid for all airport within the CO_2 ceiling, Groningen Airport Eelde and Maastricht Aachen Airport are not subject to the ReFuel EU regulations. Table 6 provides a summary of this distribution method, with its advantages and disadvantages.

Table 6 Summary of a distribution method based on realized fuel data

Distribution method: Realized fuel data	
Characteristics	• Distribution of the CO_2 budget based on the fuel consumed.
Advantages	• Use of publicly available data; • Direct relation between fuel consumption and CO_2 emissions; • With the introduction of Refuel EU Aviation, several disadvantages are mitigated.
Disadvantages	• Individual airport data not (yet) available at CBS; • Uncertainties in the data, due to tankering (difference between tanked fuel and consumed fuel during the from the Netherlands departing flight); • Up to the introduction of Refuel EU Aviation, sustainable aviation fuels are not systematically reported.

2.3 Distribution method based on past modelled CO_2 emissions

A distribution method based on past modelled CO_2 emissions, which combines various factors from the 'realized transport data' distribution method variant (section 2.1.1) to approximate the CO_2 emissions, is explored as a third variant in the study. The Small Emitters Tool (SET) by EUROCONTROL is an example of such a CO_2 model, which is used in Europe to verify and (under certain circumstances) calculate CO_2 emissions by EU-ETS flights, by incorporating the values of several relevant transport parameters. A potential distribution of the CO_2 budget amongst the airports that is based on the emissions as presented by EUROCONTROL is provided in Table 7. The use of other models will result in different distributions.

Table 7 Distribution of CO_2 budget when using the SET

Reference year	Schiphol	Eindhoven	Groningen	Maastricht	Rotterdam
2019	93.69%	3.33%	0.17%	1.49%	1.32%

Modelling CO_2 emissions has various advantages and disadvantages. Models are versatile and flexible in their use, and provide an accurate estimation when large numbers are included. The choice between using an existing CO_2 model or developing an own custom model is based on the consideration between implementing a validated model which can only estimate the CO_2 emissions or a model that will also be employed for monitoring and enforcement, respectively. The SET currently does not include sustainable aviation fuels (SAF), which is deemed to be an important sustainable development within the aviation industry. A custom model could be developed in such a way that it can include the administration of SAF and can make data available. A clear disadvantage of using models is that models are a simplification of reality, while requiring a lot of data processing, maintenance, and input data updating. Table 8 shows a summary of this distribution method variant with its advantages and disadvantages.

Table 8 Summary of a distribution method based on a CO_2 model

Distribution method: CO_2 model	
Characteristics	• Distribution of the CO_2 budget based on the modelled CO_2 emissions with realized traffic as input.
Advantages	• The model is able to respond well to the various traffic data of the airports and can look forward; • There are existing validated models of independent parties such as EUROCONTROL, which could be used; • An own model has the advantage that it can be adjusted to specific aspects, for example with focus on monitoring and enforcement; • Models can provide very accurate and reliable estimates, especially when looking at multiple flights (e.g., with a CO_2 ceiling).
Disadvantages	• Modelling requires more data processing; • An own model requires development, validation and maintenance; • Existing models should be evaluated per case for their limits, accuracy and usability for the goals of CO2 ceiling • A model remains an approximation of reality. Especially when looking at an individual flight, differences could exist with respect to reality. For example, as a result of specific weather conditions. • There is a trade-off between accuracy of the model and data requirements. For instance, fuel use and CO2 emissions of flights depend on payload weight (load factors), especially for the long-haul flights that use relatively large amounts of fuel

2.4 Distribution method based on soft factors

The final distribution method based on soft factors, as proposed in the study of 2021, is an alternative which is not only based on statistics. This variant also considers additional factors such as the airports' and Ministry's ambitions with respect to specific airports, local conditions and the corresponding long-term expectation. This distribution method is a flexible alternative, which has the advantage to take additional considerations into account, but at the same time copes with the disadvantage that the approach may differ per airports. This might result in less consensus amongst parties regarding the resulting distribution key. Table 9 provides a summary of this distribution method with its advantages and disadvantages.

Table 9 Summary of a distribution method based on soft factors

Distribution method: Soft factors	
Characteristics	• Distribution of the CO_2 budget based on a combination of statistics, ambitions and circumstances.
Advantages	• Offers flexibility in defining a distribution key; • Can include expected development towards a future perspective, be aligned as much as possible with forecasts; • Takes into account the considerations underlying the granting of previous permits (proportionality, reliable government).
Disadvantages	• A distribution based on less hard numbers could reduce support. • Invites discussion between airports, challenging outcomes and possibly politicize decisions on allocation of CO_2 ceiling values between airports

2.5 Conclusion

In the previous study, four distribution methods were analysed. From the study, no obvious best distribution method could be concluded, since all distribution methods have relevant advantages and disadvantages. Therefore, the four distribution methods have been discussed with the stakeholders during individual and group stakeholder meetings, to identify their preferences. During these meetings, most stakeholders have made clear that they prefer a distribution key that takes into account future developments, because it gives a more complete image of the CO_2 emissions than when only is looked back. At the same time, it is acknowledged that this could lead to discussions and outcomes may be challenged. On top of that, stakeholders have indicated that they prefer a CO_2 model, because this takes into account multiple elements and therefore provides a more complete image of the CO_2 emissions.

3 Analysis of the specific distribution keys

In the previous chapter, four possible distribution methods are discussed, of which two distribution methods are preferred by stakeholders to be further analyzed: modelled CO_2 and soft factors. Within the modelled CO_2 method, one distribution key is defined, namely based on realized traffic. In this distribution key, traffic from a previous year is used as input for a model to determine CO_2 emissions and determine a distribution key based on the outcomes. Within the soft factors method, two distribution keys have been defined: permitted budget and expected number of movements. Both of these distribution keys take into account potential future developments.

1. Realized traffic: Based on performed number of movements in reference year 2019 or distribution moment minus one year (*distribution method: CO_2 model*);
2. Permitted budget: Based on permitted number of movements in airport decree (*distribution method: soft factors*); and
3. Expected number of movements: Based on forecast of number of movements in 2030 (*distribution method: soft factors*).

In this chapter, the mechanism behind each distribution key is described. Subsequently, an example calculation of the distributed CO_2 budget for each airport is provided. These calculations result in a percentage of CO_2 budget for each airport, including an estimation of the number of movements possible within the CO_2 budget without sustainable developments. Also, in chapter 3.5, estimations are given for number of movements when airports take measures to reduce CO_2 emissions (Table 10). These measures are categorized in scenarios. These estimations are indicative, based on the current level of service (ratio in destinations and frequencies). Another report, *Impact assessment of the CO_2 ceiling* (CE Delft et al., 2022-1), provides more detailed effects of the ceiling in very diverse scenarios that take the current national and international policy into account. The CO_2 budget (in tonnes) will finally be recorded in the airport decree, not the number of movements. Airports are free to adjust destinations and frequencies, which could result in a different number of movements. In order to perform these calculations, a calculation method must be chosen. Appendix A describes the different potential calculation methods. Then, the impact in terms of movements is provided, followed by the advantages and disadvantages.

Table 10 Sustainable scenarios by airports to reduce CO_2 emissions

Sustainable scenarios	
Scenario 1	0% SAF blend, no fleet renewal compared to 2019
Scenario 2	6% SAF blend, no fleet renewal compared to 2019
Scenario 3	0% SAF blend, 1% efficiency gains per year since 2019 due to fleet renewal
Scenario 4	6% SAF blend, 1% efficiency gains per year since 2019 due to fleet renewal

SAF will be counted with an emission factor of 0 within the CO_2 ceiling. This is in line with the counting system within the EU-ETS. Therefore, a 6% blend of SAF will result in 6% of CO_2 emissions reduction. Even though ReFuel EU imposes a 6% SAF blending target for the EU in 2030, this does not mean that Member States, or even all airports will blend exactly this amount. Until 2035, the obligation counts for the

European Union (EU) as a whole, which means that it is possible that some airports reach a higher SAF-blending percentage whilst no SAF might be blended at other airports. Therefore, the 6% which was used for these calculations should be seen as an indicative assumption. If more (or less) SAF is blended at a specific airport, the emission reduction will be higher (or lower).

An average reduction of CO_2 emissions of 1% per year due to fleet renewal is assumed. Over the past years, a stable trend is visible of CO_2 emissions reduction due to fleet renewal between 1% and 2%. For this study, the lowest side of the spectrum is assumed.

3.1 Calculating CO_2 emissions

In this chapter, all distribution keys are analyzed using the modeling technique of the SET. It is assumed that the Ministry will use modeling for monitoring and enforcement. However, there are several options for calculating the CO_2 emissions for all flights and the distribution of these emissions amongst airports, and it is recommended to align the calculation method for the distribution key with the method used by the Ministry to monitor and enforce the CO_2 ceiling, because these two activities are highly related to each other. Because the Ministry has not (yet) decided on a calculation method, it is important to mention that the two options are still open. The first option is to use data of uplifted fuel. This method is not supported by stakeholders and To70, but is one of the options for the monitoring and enforcement method by the Ministry and should therefore be included as one of the calculation methods. The advantages and disadvantages of uplifted fuel data can be found in chapter 2.2. The second option is modeling. The advantages and disadvantages of modelling can be found in chapter 2.3.

3.2 Distribution key 1: Realized traffic

This distribution key uses realized traffic as input for the distribution of the CO_2 budget amongst airports. From a certain reference year in the past, the amount of CO_2 emissions from all flights and the distribution of these emissions amongst airports are determined. Traffic data shall be provided by the airports. This sub chapter first describes the potential reference year, followed by the options to calculate the CO_2 emissions from all flights and concludes with the advantages and disadvantages.

3.2.1 Defining the reference year

The reference year is the year which is used to determine the CO_2 emissions and to distribute these emissions amongst airports. The objective of the distribution key is to distribute the CO_2 budget in a way that is representative for the true CO_2 emissions of each airport. This means that the year should be recent. Moreover, the reference year should represent an 'average' year for each airport, which means that unusual circumstances, such as runway maintenance, should not have occurred during the reference year. These two requirements pose a challenge. Currently, the latest representative year was 2019, due to Covid-19. On top of that, most airports have faced specific circumstances or trends over the past years.

Schiphol:	Is very close to its noise constraints. Also, Schiphol is in the process for a new airport decree with reduced maximum aircraft movements.
Eindhoven:	43.500 movements in 2019 allowed, now 41.500 movements allowed.
Groningen:	There is room for growth with respect to noise constraints. Capacity was higher than the demand in 2019.

Maastricht: In 2023 major maintenance has taken place for the runway, resulting in closure of the airport for months. There is room for growth with respect to noise constraints. Capacity was higher than the realized traffic.

Rotterdam: In the recent years, Rotterdam has more destinations further away than in 2019.

Lelystad: Lelystad Airport has not performed international commercial flights yet, due to political issues. As a result, the number of international commercial flights in any reference year is zero.

Distribution moment minus one year

Due to the different circumstances of the airports, it is impossible to select a reference year that is favored by each airport. Therefore, the most recent reference year is selected, as long as this year is not impacted by large external factors. With this, a referral is made to Covid-19, which has harmed the aviation industry majorly. However, when the definite CO_2 budgets for the airports are determined, the aviation industry possibly has recovered and a more recent reference year can be used. Airport Council International (ACI) has reported that by the end of 2023, the passenger numbers in Europe will be at 95.5% of 2019 levels (ACI, 2023). According to ACI, the global aviation industry will fully recover from the pandemic in 2024. When the distribution key is determined in 2025, it is recommended to use 2024 as a reference year. This option is called 'distribution moment minus one year'.

Sustainable developments since 2019

The reference year also has an impact on the potential behavior of airports regarding environmental improvements. When the CO_2 budget is distributed amongst airports based on CO_2 emissions from the recent past or the future, this has two side effects on airports that have already established environmental improvements in the past, or are planning these for the near future. The first side effect is that these airports have already reduced 'their' CO_2 emissions, for example by implementing fleet renewal or uplifting SAF, and therefore are allocated less CO_2 budget. For these airports, this seems contradictory, because these airports will be negatively affected as a consequence of their environmental efforts. The second side effect for these airports is that they will have a more difficult task to further reduce CO_2 emissions in the future, because there are less options remaining for improvement. In contrast, airports that have not yet reduced CO_2 emissions receive more CO_2-budget and have more options to reduce CO_2 emissions. In response of these negative effects, airports are discouraged to implement environmental improvements until the distribution key is determined. When the distribution of CO_2 budget amongst airports is determined with 2019 as a reference year, this discouragement is avoided, because future behavior will not influence the distribution key. However, this risk is considered to be low, because the climate targets in 2030 remain unchanged, so it does not significantly impact the total CO_2 emissions up to 2030.

3.2.2 Impact on CO_2 emissions and maximum aircraft movements

For the calculation of this distribution key, 2019 is used as reference year, as input for the CO_2 model. Table 11 provides an overview of the CO_2 budget for each airport when the SET is used for calculation. This overview also includes an indicative estimation of possible number of movements within the CO_2 budget, using the four scenarios with sustainability developments SAF and fleet renewal.

Table 11 Impact on CO_2 emissions and indication of aircraft movements for realized traffic 2019[1]

	Schiphol	Eindhoven	Groningen	Maastricht	Rotterdam	Total
Movements	496,8 k	40,2 k	3,4 k	7,2 k	18,4 k	566 k
Total budget	10,428 Mt	0,359 Mt	0,021 Mt	0,047 Mt	0,128 Mt	10,984 Mt
Share of budget	94,94%	3,27%	0,19%	0,43%	1,17%	100%

It must be noted that in 2019, Schiphol Airport realized almost 500k of movements and it is highly uncertain whether these high numbers of movements will be reached again in the future. By 2030, the Balanced Approach procedure should be finished and a new system for noise should be implemented, reducing the number of movements at Schiphol Airport. For the Balanced Approach, the number of movements is 452.500. If this number of movements is used as input, the movements for all airports fit within the CO_2 ceiling. The same goes for using 2022 as input.

3.2.3 Advantages

The distribution key based on realized traffic contains the following advantages:

- Based on realized traffic data: The input data is not subject to discussion, because the movements have taken place and this data is reported by the airports.
- Takes expected market developments into account: Flights are performed, because there is a market demand for these flights. This distribution key takes into account this market demand, because it only looks at realized flights. This is an advantage, because it reduces the risk of unused CO_2 at some airports while exceeding the CO_2 budget at other airports.

3.2.4 Disadvantages

However, this option also contains the following disadvantages:

- Does not take foreseen developments into account: Determining a distribution key with realized traffic as input contains a risk of forcing a status quo from the past, as the situation in 2030 is likely to be different than for example the situation in 2019. In eleven years, many things could change in operated destinations and aircraft types. As a consequence, there is a risk of an incorrect, and therefore sub optimal allocation, in which some airports might have more CO_2 budget than needed and other airports less budget than needed. When the distribution key is determined in a later stage, a later reference year can be used and the distribution will reflect better on a new reality, but the risk remains.
- Specific circumstances can create deviations: For some airports, a specific reference year may not be representative for the average operation, because of maintenance on infrastructure (lower capacity) or special events (higher demand).

3.3 Distribution key 2: Permitted budget based on number of movements in airport decree

In the second distribution key, the CO_2 budget for each airport is determined based on the number of movements - based on destinations and aircraft types - possible within the airport decree. In the Netherlands, all airports are required to have an airport decree. It includes the operational and environmental constraints of the airport, the activities that are allowed, what types of aircraft are

permitted and the operating hours. Each airport has specific constraints for noise, which may not be exceeded. The airport is obliged to operate within these noise constraints.

For Schiphol Airport, Groningen Airport Eelde, Eindhoven Airport[2] and Maastricht Aachen Airport, a maximum aircraft movement is included in the airport decree. For Rotterdam Airport, a maximum number of movements is not mentioned in the airport decree, but the translation from limiting noise values into possible number of aircraft movements is performed by the airport itself.

3.3.1 Calculating the CO_2 emissions

This distribution key will be based on a traffic forecasts that is used for the application for the airport decrees and permit for shared use. For each airport, the traffic forecast is based on a traffic scenario that is accepted by various stakeholders through an extensive process. Based on these traffic forecasts, the CO_2 emissions can be calculated using the SET (or other model).

3.3.2 Impact on CO_2 emissions and maximum aircraft movements

The impact on CO_2 emissions depends on the calculation method used for the distribution of CO_2 budget amongst airports. Table 10 provides an overview of CO_2 budget for each airport using the SET.

At the moment of the study, all airports were in the process of obtaining a new airport decree. Therefore, the number of movements within the new decrees were not available. For calculating the impact of this distribution key, numbers of movements are retrieved from most of the existing airport decrees. However, the future of the airports are uncertain. For example, Groningen Airport Eelde has made clear that traffic needs to double in order to keep operating, Schiphol Airport is involved in political plans to reduce the number of movements, and Eindhoven Airport is facing a reducing noise contour. Consequently, the outcomes could be different when all airport decrees have been formalized. For Schiphol Airport, the number of movements from the Balanced Approach is used. The numbers of movements are then multiplied by the average CO_2 emissions per flight for each airport (Appendix A) in order to determine the total CO_2 emissions per airport. When the airport decrees are available, the average CO_2 emissions per flight are not needed for calculation.

[2] As shared use of a military base (Dutch: Vergunning burgermedegebruik Eindhoven Airport)

Table 12 Impact on CO_2 emissions and indication of aircraft movements for permitted budget

	Schiphol	Eindhoven	Groningen	Maastricht	Rotterdam	Total
Movements	452,5 k	41,5 k	16 k	16 k	20 k	546 k
Total budget	9,498 Mt	0,371 Mt	0.101 Mt	0,104 Mt	0,139 Mt	10,212 Mt
Share of budget	93,00%	3,63%	0,99%	1,02%	1,36%	100%

Within all the airport decrees combined, a total of 546k aircraft movements are possible, resulting in 10,212 Mt of CO_2 emissions, based on an average CO_2 emission per flight (2019 network and aircraft types). Since the assumed target within the CO_2 ceiling for this study for 2030 is 9,8 Mt, an overall reduction of 4% is necessary.

3.3.3 Advantages

Taking the permitted budget as input for the distribution key has three advantages:

- Takes foreseen developments into account: The objective of an airport decree is to provide certainty for the upcoming years, for both the airport as the living environment. The airport decrees are based on a traffic forecast, including aircraft types and volumes that will be operating at the airport in the upcoming years. As a result, the airport decrees take foreseen developments in to account.
- Alignment with limitations based on noise: The maximum number of movements in airport decrees is a translation of the limiting noise values at airports. By distributing the CO_2 budget based on the same (number of) movements, the risk is minimized that one limit is far earlier restrictive than the other. It avoids that one airport is limited in movements based on noise, and at the same time has unused CO_2 budget. It could be expected that both will be restrictive around the same number of movements (with an equal distribution on distances). If this would not have been avoided, it could lead to a sub optimal allocation, in which some airports could be left with unused CO_2 budget, while other airports exceed the CO_2 budget. *Note: this is only valid if the average CO_2 emissions per flight remain the same in the (near) future.*
- Based on accepted numbers: The process of awarding an airport decree is a careful process that includes multiple stakeholders, such as municipalities, residents, local corporates, environmental organizations and airport users. The interest of all these stakeholders are included in the airport decree. Therefore, the number of movements resulting from the airport decree is a number that is accepted by a broad group of stakeholders, minimizing the risk of discussion and challenged outcomes.

3.3.4 Disadvantages

Nevertheless, the option of the distribution key based on number of movements as per airport decree also has several disadvantages:

- Possible apparent optimization for noise: This distribution key aims to align with limitations based on noise, in order to avoid a sub optimal distribution of CO_2 budget amongst airports. However, CO_2 has different characteristics than noise. One important element is the flight distance. For noise, the flight distance only has a small impact, but for CO_2, the flight distance is

one of the main drivers. When the CO_2 budget is aligned with the limitations for noise, it would hinder airlines to operate longer flights, even though this has a fairly limited impact for noise.

- Depending on the timing of airport decrees from all airports: This distribution key can only be executed once all airport decrees are established for at least one common reference year. This could be problematic, because airport decrees do not have the same start and end date. As a result, the airport decrees may overlap. This could lead to a situation where one new airport decree has not yet completed, while another airport decree has expired. If this happens, there would be no common reference year to use for the distribution key. It is not possible to distribute the CO_2 budget when at least one airport is still missing a (new) airport decree. This is a significant disadvantage, because the application process for an airport decree is a time-consuming and complex process which is often subject to delays. Alternatively, existing airport decrees can be used, but this is not recommended, because these stem from the period between 2009 and now, and are therefore not representative.
- Does not take market demand into account: At the moment, Groningen Airport Eelde and Maastricht Aachen Airport are not fully using the available capacity for noise, but have ambitions to grow in the future. However, these ambitions are dependent on market demand from airlines to operate from these airports. Currently, this market demand is lower than the airport capacity and it is not certain if the market demand will grow in the future. If the airport receives additional CO_2 budget for growth, but the market demand stays low, this could mean that part of the CO_2 budget remains unused.

3.4 Distribution key 3: Forecasted number of movements in 2030

A third option is to determine a future scenario based on a number of forecasted movements. This means that a forecast of air traffic in 2030 is required. Based on this forecast, a CO_2 budget for each airport can be determined, using the average CO_2 emissions per flight which has been described in the previous chapter. There are multiple ways to forecast air traffic, such as traffic forecasts by airports and forecasts by commercial parties. For this study, AEOLUS forecasts are used, since these are used and administered by the Ministry,

For this study, no specific modelling has been performed to forecast the number of movements, based on the most recent developments. When a distribution key based on modelling is selected by the Ministry, it is recommended to include the most recent developments in this exercise.

3.4.1 Impact on CO_2 emissions and maximum aircraft movements

The impact on CO_2 emissions depends on the calculation method used for the distribution of CO_2 budget amongst airports. Table 13 provides an overview of CO_2 budget for each airport when the SET is used for calculation, based on AEOLUS input for the number of flights in 2030. These numbers are obtained from scenario 8 of the impact assessment of the CO_2 ceiling for aviation (CE Delft et al., 2022-2). This scenario can be considered as a reasonable possible future, but in practice the number of flights in 2030 is difficult to forecast and it depends on many different factors. For comparison with the other distribution keys, Lelystad Airport is set to 0 commercial aviation movements.

Table 13 Impact on CO_2 emissions and indication of aircraft movements for forecasted movements

	Schiphol	Eindhoven	Groningen	Maastricht	Rotterdam	Total
Movements	452,1 k	36,3 k	4,5 k	5,6 k	19,3 k	517,8 k
Total budget	9,489 Mt	0,325 Mt	0,028 Mt	0,036 Mt	0,134 Mt	10,013 Mt
Share of budget	94,77%	3,24%	0,28%	0,36%	1,34%	100%

According to the forecast from AEOLUS, a total of 517,800 of aircraft movements will be performed in 2030, resulting in 10,0 Mt of CO_2 emissions, based on an average CO_2 emission per flight (2019 network and aircraft types). Since the assumed target within the CO_2 ceiling for this study for 2030 is 9,8 Mt, an overall reduction of 2% is necessary.

3.4.2 Advantages

The distribution key based on forecasted number of movements has two advantages:

- Takes expected market developments into account: This option includes all flights that are expected to be realized, according to AEOLUS. This means that CO_2 budget may be distributed to airports for development purposes. As a consequence, the allocation of CO_2 budget is considered to be more optimal than for the distribution key based on realized traffic and permitted budget.
- Takes foreseen developments into account: When forecasts are used to determine the distribution key, it is possible to estimate the number of movements in the year 2030. Consequently, this could provide a certain level of accuracy. However, this requires the forecasts to be accurate and to have developments taken into account. The level of accuracy and the possibility to take potential developments into account depends on the assumptions that are made for the forecast.

3.4.3 Disadvantages

The distribution key based on forecasted number of movements also has three disadvantages:

- Invites for discussion: Different forecasts have different outcomes. As a result, one forecast might be advantageous for one airport, while the other forecast might be advantageous for the other airport. This leaves room for discussion and the support from airports to use forecasts to distribute CO_2 amongst airports is expected low. Enforcement of this distribution key could be difficult, because stakeholders may object to the assumptions used for this distribution key and challenge the outcomes.
- Apparent accuracy: This option will forecast up to 2030 and therefore seems to be more accurate than a distribution key based on a reference year in the past. However, this is greatly depending on the accuracy of the forecast. If the forecast is inaccurate, the distribution of CO_2 budget will be inaccurate as well.
- Difficult to forecast for small airports: There is a risk of an inaccurate forecast, because small airports are largely impacted by small changes to the operation. It can make a large difference for the CO_2 emissions of an airport when a new airline starts operating from the airport, or an existing airlines stops operating. These developments are difficult to forecast, although the impact is large. This has an impact on the CO_2 budget of all airports.

3.5 Sensitivity analysis

A sensitivity analysis is performed to analyse the effect when using the different distribution keys for the available CO_2 budget in 2030. In Table 14, the maximum aircraft movements are shown for the four scenarios to reduce CO_2 emissions and for the three distribution keys for each scenario. It should be noted that these numbers are indicative and that the recommendation for most suitable distribution key is done based on advantages and disadvantages.

Table 14 Overview of maximum aircraft movements for different scenarios

Scenario 1		Schiphol	Eindhoven	Groningen	Maastricht	Rotterdam	Total
Realized traffic 2019[1]	%	94,94%	3,27%	0,19%	0,43%	1,17%	100,00%
	movements	443,3 k	35,9 k	3 k	6,5 k	16,5 k	505,1 k
Permitted budget	%	93,00%	3,63%	0,99%	1,02%	1,36%	100,00%
	movements	434,2 k	39,8 k	15,4 k	15,4 k	19,2 k	524 k
Forecasted movements	%	94,77%	3,24%	0,28%	0,36%	1,34%	100,00%
	movements	442,5 k	35,5 k	4,4 k	5,4 k	18,9 k	506,7 k

Scenario 2		Schiphol	Eindhoven	Groningen	Maastricht	Rotterdam	Total
Realized traffic 2019[1]	%	94,94%	3,27%	0,19%	0,43%	1,17%	100,00%
	movements	471,6 k	38,1 k	3,1 k	6,9 k	17,5 k	537,3 k
Permitted budget	%	93,00%	3,63%	0,99%	1,02%	1,36%	100,00%
	movements	461,9 k	42,3 k	16,4 k	16,4 k	20,4 k	557,4 k
Forecasted movements	%	94,77%	3,24%	0,28%	0,36%	1,34%	100,00%
	movements	470,7 k	37,8 k	4,6 k	5,8 k	20,1 k	539 k

Scenario 3		Schiphol	Eindhoven	Groningen	Maastricht	Rotterdam	Total
Realized traffic 2019[1]	%	94,94%	3,27%	0,19%	0,43%	1,17%	100,00%
	movements	501,3 k	40,5 k	3,3 k	7,3 k	18,6 k	571,1 k
Permitted budget	%	93,00%	3,63%	0,99%	1,02%	1,36%	100,00%
	movements	491 k	45 k	17,4 k	17,4 k	21,7 k	592,5 k
Forecasted movements	%	94,77%	3,24%	0,28%	0,36%	1,34%	100,00%
	movements	500,4 k	40,2 k	4,9 k	6,1 k	21,3 k	572,9 k

Scenario 4		Schiphol	Eindhoven	Groningen	Maastricht	Rotterdam	Total
Realized traffic 2019[1]	%	94,94%	3,27%	0,19%	0,43%	1,17%	100,00%
	movements	537,7 k	43,5 k	3,6 k	7,9 k	20 k	612,7 k
Permitted budget	%	93,00%	3,63%	0,99%	1,02%	1,36%	100,00%
	movements	526,8 k	48,3 k	18,7 k	18,7 k	23,2 k	635,6 k
Forecasted movements	%	94,77%	3,24%	0,28%	0,36%	1,34%	100,00%
	movements	536,8 k	43,1 k	5,3 k	6,6 k	22,9 k	614,6 k

Based on this sensitivity analysis, it can be concluded that the different distribution keys result in different outcomes as maximum aircraft movements for the different scenarios.

Table 15 Differences between lowest and highest aircraft numbers

Scenario 4	Schiphol	Eindhoven	Groningen	Maastricht	Rotterdam
Lowest value	526,8 k	43,1 k	3,6 k	6,6 k	20 k
Highest value	537,7 k	48,3 k	18,7 k	18,7 k	23,2 k
Difference (%)	2%	12%	421%	183%	16%

Scenario 4 contains the circumstances that are the most likely to when all actions are taken from the Sustainable Aviation Agreement. When looking at this scenario in Table 15, it can be seen that the differences in distribution key for Schiphol are small, while for Maastricht and Groningen there is a large difference between the maximum aircraft movements for the different distribution keys. The differences for the total number of aircraft movements between the distribution keys is caused by the fact that flights from Schiphol have higher CO_2 emissions per flight on average than flights from the other airports.

3.6 Summary and conclusions

There are three distribution keys described to distribute the available CO_2-budget amongst airports. Two of these options are based on forecasts, one option is based on realized traffic. The advantages and disadvantages of the distribution keys are listed in Table 16.

Table 16 Summary of distribution keys

Options	Advantages	Disadvantages
Based on realized traffic	• Based on realized traffic data • Takes expected market developments into account	• Does not take foreseen developments into account • Specific circumstances can create deviations
Permitted budget	• Takes foreseen developments into account • Alignment with limitations based on noise • Based on accepted numbers	• Possible apparent optimization for noise • Depending on the timing of airport decrees from all airports • Overlapping time frames • Does not take market demand into account
Expected number of movements	• Takes expected market developments into account • Takes foreseen developments into account	• Invites for discussion • Apparent accuracy • Difficult to forecast for small airports

It may be concluded that no distribution key stands out, all distribution keys have advantages and disadvantages. The distribution key based on forecasted movements is the least recommended, because the forecasted numbers invites for discussion as there a lot of uncertainties for the future. Currently, there are many developments ongoing for airports and the airport decrees. This discussion can lead to challenged outcomes from sector parties when enforcement is needed.

It is recommended to implement the distribution key based on het permitted budget, on the premise that some disadvantages can be eliminated. This is the case when all airports have a (valid) airport decree with an overlapping validity period. Then, all airports have a permitted budget for a calculated number of aircraft movements. These numbers are undisputed and take into account foreseen developments. The calculation of the CO_2 emissions has to be done with SET (or another model) with the traffic forecast that is used as input for the airport decree. This distribution key has the most support from the airports. This key can accommodate for all the flights within the limits of the CO_2 ceiling and for growth development within the noise constraints.

If the airport decrees are not in place at the moment of defining the CO_2 ceiling, it is recommended to implement the distribution key based on realized traffic. This distribution key is the easiest to implement. On top of that, it is the least subject to discussion, because it is based on actual performed flights. If possible, it is recommended to use the reference year of 'moment of distribution minus one year' to have

a more actual situation than reference year 2019. Alternatively, 2019 can be used as a reference year. In that case, an extra CO_2 budget for Maastricht and Groningen have to be considered, because there is hardly any room for growth developments within the noise constraints without the extra CO_2 budget.

Based on the calculation for the distribution keys, it seems that the difference between the distribution keys may seem to be small. However, when looking at the sensitivity analysis the differences are large in terms of maximum aircraft movements. For the permitted budget distribution key and the forecasted movements distribution key, most airports will stay within their CO_2 limits.

Table 17 Comparison of distribution keys

	Schiphol	Eindhoven	Groningen	Maastricht	Rotterdam	Total
Realized traffic 2019[1]	94,94%	3,27%	0,19%	0,43%	1,17%	100%
Permitted budget	93,00%	3,63%	0,99%	1,02%	1,36%	100%
Forecasted movements	94,77%	3,24%	0,28%	0,36%	1,34%	100%

Table 18 Differences between lowest and highest aircraft numbers

Scenario 4	Schiphol	Eindhoven	Groningen	Maastricht	Rotterdam
Lowest value	526,8 k	43,1 k	3,6 k	6,6 k	20 k
Highest value	537,7 k	48,3 k	18,7 k	18,7 k	23,2 k
Difference (%)	2%	12%	421%	183%	16%

The following chapters describe how to incorporate the flexibility required to deal with uncertain developments.

4 Dealing with the opening of Lelystad Airport, or closing of existing airports

This chapter describes the options and impact of the opening of Lelystad Airport, and the closure of one or more of the existing airports.

4.1 Opening of Lelystad Airport

Within the group of six airports, Lelystad Airport presents a specific case as it is intended to function as an overflow airport of Schiphol Airport. In this way, Schiphol will retain more room for business traffic and intercontinental flights. However, the future of Lelystad Airport is still uncertain. Assuming the eventual full use of the granted capacity, the airport could handle a maximum of 22,500 departing movements. This number of movements will be reached gradually. Given its function as an overflow airport for Schiphol, it is reasonable to allocate the necessary emissions budget for Lelystad Airport from Schiphol's CO_2 budget rather than from the total budget for all airports. Nevertheless, it is possible that a broader consideration of various factors may lead to the decision to allocate a separate budget for Lelystad Airport. It is essential that such a policy choice is made concerning the distribution of the CO_2 budget amongst the airports.

As previously mentioned, the exact development of Lelystad Airport as an overflow airport for Schiphol, remains uncertain. Assuming the maximum granted capacity in the long term, the airport could handle a maximum of 22,500 departing movements. In the allocation of the CO_2 budget amongst airports, a decision must be made in advance regarding the role of Lelystad Airport in the distribution. Four options for dealing with the opening of Lelystad Airport have been considered:

1. The emission budget for Lelystad Airport is specifically reserved for this airport in advance and will come at the expense of the emissions budget for all individual airports.
2. The CO_2 budget required for Lelystad Airport is collected from all the other airports.
3. The necessary CO_2 budget for Lelystad Airport will be transferred from Schiphol's CO_2 budget when the airport becomes operational, given its function as an overflow airport.
4. A temporary increase in the CO_2 ceiling for the required emission budget, after which Lelystad Airport needs to imbed a steeper reduction path towards the 2050 climate target.

4.1.1 Option 1 – The new airport's CO_2 emission budget is reserved upon establishment of distribution

One of the scenarios for dealing with the opening of Lelystad Airport is to make a reservation for the emission budget for Lelystad Airport upfront. The reserved emission budget is allocated to the new entrant when the airport becomes operational. In this scenario, the CO_2 ceiling is not adjusted for the higher number of (future) involved parties. This means that the other airports will have to share the emission budget with the new entrant upfront, even when Lelystad Airport is not operational yet. An advantage of this option is that it provides the other airports with a level of certainty, since they will not be impacted when Lelystad Airport opens. However, this option comes with severe disadvantages. The future of Lelystad Airport is highly uncertain. If Lelystad will ever open, it is not sure when this happens. In the meantime, for every year the airport is closed, a reservation is kept for Lelystad Airport, which cannot be used by other airports. In addition, if Lelystad Airports opens, it is not sure with how many movements, to which destinations and with which aircraft types. Therefore, it is difficult to determine the CO_2 budget that should be reserved for Lelystad Airport.

4.1.2 Option 2 – The CO_2 budget for Lelystad Airport is collected from all the other airports

Another strategy for dealing with the opening of Lelystad Airport is based on the principle of taking action when it is definitive that the new entrant will be introduced. When Lelystad Airport becomes operational, the collective CO_2 budget from all the airports will be redistributed. This means that CO_2 budget for Lelystad Airport is collected from other airports, which will be compromised in their CO_2 budget once Lelystad Airport opens. An advantage of this option, compared to the reservation of CO_2, is that there will not be a risk of unused CO_2 budget. However, there will be a level of uncertainty for all the airports, because it is not clear when, if, and with how many movements Lelystad Airport will open. Another concern from airports is that they will all have to contribute to the budget of Lelystad Airport, even though they are not benefiting from it in any way. Therefore, this option is not supported by airports.

4.1.3 Option 3 – The CO_2 budget for Lelystad Airport is transferred from Schiphol Airport

A third option for dealing with the opening of Lelystad Airport is to transfer CO_2 budget from Schiphol Airport to Lelystad Airport. Given the function of Lelystad Airport as overflow airport for Schiphol Airport, taking over numerous flights from Schiphol Airport, this is considered to be a reasonable option by stakeholders. The budget of CO_2 that will be available for Lelystad Airport should be directly linked to the flights that are taken over from Schiphol. This option has the same advantages as option two, but does not have the disadvantage that other airports will have to contribute. Arrangements between Lelystad Airport and Schiphol Airport have been made in the past and are considered to be clear by the involved parties. Therefore, it seems logical to select this option for dealing with the opening of Lelystad Airport.

4.1.4 Option 4 – The CO_2 budget for Lelystad Airport is temporarily added to the CO_2 ceiling, with a dedicated (steeper) reduction path for Lelystad Airport

A fourth option does not only focus on Lelystad, but also potential other airports that might open in the future and are not taking over flights from other airports. For these airports, a dedicated CO_2 budget may be given, with a dedicated reduction path. This means that, when the new airports opens, the national CO_2 ceiling will temporarily be increased with the extra CO_2 budget of the new airport. Hereafter, the new airport needs to imbed a steeper reduction path towards the 2050 climate target. An advantage of this option is that existing airports will not be impacted by new airports, but it should be noted that temporarily rising the CO_2 ceiling is not in line with the objective of the CO_2 ceiling.

4.1.5 Summary and conclusion

Given the function of Lelystad Airport as overflow airport from Schiphol, it is considered to be fair by stakeholders that the CO_2 budget for Lelystad Airport is subtracted from the CO_2 budget of Schiphol, so this option is recommended for the transferred flights. The exact budget will depend on the amount of CO_2 that comes from the flights that are taken over by Lelystad Airport. In case there is a reduction in maximum aircraft movements for Schiphol *before* Lelystad Airport will be opened, it is recommended that the CO_2 reduction should be deducted from Schiphol and be reserved for Lelystad Airport (for some years).

However, according to the original plans for Lelystad Airport, there will also be room for autonomous growth. For this growth, there is no other solution than collecting the CO_2 budget from all other airports. This will happen after recalibrating the distribution key (see chapter 5).

Table 19 Summary of options to deal with the opening of Lelystad

Option	Advantages	Disadvantages
1: Reservation	• Provides other airports with a level of certainty	• Risk of unused CO_2 • Uncertainty about the amount of CO_2 that must be reserved
2: From all airports	• National CO_2 budget is optimally used	• Uncertainty for airports due to uncertain future of Lelystad Airport • Considered to be unjust by other airports
3: From Schiphol Airport	• Only Schiphol Airport is impacted • Considered as fair option, given the overflow function of Lelystad Airport • Already agreed on by Lelystad Airport and Schiphol Airport	• No solution for autonomous development of Lelystad Airport
4: Dedicated reduction path	• Could be applied to other airports (that are yet unknown)	• Could lead to opinions from the public

4.2 Closure of an existing airport

For the closure of an existing airport, there are three options, and they are more or less the counter options from chapter 4.1:

1. The emission budget that will become available is specifically reserved for an airport or airports for future usage.
2. The emission budget that will become available is transferred equally to all airports.
3. The emission budget that will become available is transferred to a specific airport budget when the traffic moves from the to be closed airport to an existing airport.

It depends on the situation of the closing airport how to deal with this.

4.2.1 Option 1 – The available CO_2 emission budget is reserved for future usage

One of the scenarios for dealing with the closure of an airport is to make a reservation for the CO_2 budget that will become available. This is the case when it is unclear whether the existing aircraft movements will be transferred to another airport. It is recommended to have the reservation for several years, because

then two recalibration moments (closure of the airport and opening or transfer to another airport) could be avoided. A recalibration is not necessary until clarity about the reservation is given.

4.2.2 Option 2 – The available CO_2 budget will be transferred equally to all the airports

The second situation is that the existing airport will stop operating without flights being transferred to other airports. In this situation, CO_2 budget from this airport may become available to other airports. A recalibration is not necessary.

4.2.3 Option 3 – The available CO_2-budget will be transferred to another airport

The third option is when flights are transferred to another airport. In this situation, the CO_2 emissions that are connected to these flights will be added to the CO_2 budget of the airport that will accommodate these flights.

There are good arguments for not distributing the available CO_2 budget amongst other airports when an airport closes, for example that the climate targets are achieved earlier when CO_2 budget is taken out of the market. However, the objective of this study is to distribute the available CO_2 budget amongst airports. The size of the budget is a political decision. Therefore, when an airport closes, the available CO_2 budget would be distributed amongst the other airports, unless the political decision is taken to reduce the overall CO_2 budget.

Table 20 Summary of options to deal with the closure of an airport

Option	Advantages	Disadvantages
1: Reservation	• Provides other airports with a level of certainty • Possibility to open a new airport with CO_2 budget from reservation	National CO_2 budget is not optimally used
2: To all airports	• National CO_2 budget is optimally used	
3: To another airport	• Only one airport is impacted • Other airport has the opportunity to accommodate for the transferred flights.	

Depending on the situation, one option prevails over the others. When an airport closes, and it is foreseen to open another airport or to transfer flights in the near future, a reservation is recommended. When flights will be transferred to another airport, it is recommended to transfer the equivalent CO_2 budget to that other airport. In other cases, it is recommended to share the available CO_2 budget amongst the other airports.

5 Recalibration of the distribution key

The development of airports is per definition uncertain. Therefore, it is desired that the distribution key is flexible enough to cope with possible changes and developments in the future. At the same time, it is important that airports have a level of certainty, for their long-term planning. For this reason, a balance between flexibility and predictability should be incorporated in the distribution key. This can be done by a recalibration, which is defined as redistributing the CO_2 budget amongst airports. In this chapter, moments for recalibration of the CO_2- budget are discussed.

5.1 Assessment of recalibration with a predetermined frequency

For the moments with a certain frequency, or time-dependant moments, a balance between flexibility and certainty is searched for. In Table 21, the possible moments in time for recalibrating the distribution key are shown.

Table 21 Possible time-dependant moments to recalibrate the distribution key

Possible time-dependant moments to recalibrate the distribution key	
Possible moments in time	**Flexibility** — **Certainty**
Never	●(near Certainty end)
Every 10 year	●(towards Certainty)
Every 3-5 years	●(towards Flexibility)
Every year	●(near Flexibility end)

The more frequent the distribution key is recalibrated, the better the distribution of CO_2 budget aligns with reality. However, it also brings more uncertainty when airports do not have an idea of the CO_2 budget they have for the upcoming year. From the stakeholder sessions, it is concluded that stakeholders are not in favour of recalibrating with a predetermined frequency, because there is no common timeframe that suits everyone. Large airports have a much smaller window to look into the future than small airports, because the operation is much more complex, so the preferences are too far apart. At the same time, some moments of recalibration triggered by an event will eventually come down to recalibration after a certain period of time, in a way. This is the case for recalibration after exceedance of the CO_2 ceiling and recalibration at the evaluation moment.

5.2 Assessment of recalibration triggered by an event

There are several developments possible that make it desirable to recalibrate the distribution key. In this chapter, these developments are described, including considerations for recalibration. These considerations must be taken seriously, because a recalibration will require an update of at least two airport decrees, and maybe more. These are complex processes.

5.2.1 Opening of a new airport

The reason for the opening of a new airport is important for the decision whether to recalibrate or not. There are two possible reasons for opening a new airport. The first possibility is that a new airport is opened to take over flights from an existing airport. This is the case for Lelystad Airport, which is supposed to take over some flights from Schiphol Airport. In this situation, a recalibration is not required, because the CO_2 emissions that are connected to the transferred flights will transfer along to the new airport. Other existing airports are not affected by this. A second possibility is that the new airport will develop autonomously. In this situation, the new airport will perform new flights and therefore produce additional CO_2 emissions. There is not another solution than that the budget for these emissions will come from other airports. In this situation, a recalibration is required.

5.2.2 Closing of an existing airport

See paragraph 4.2. This paragraph describes the three possible situations. Depending on the situation, a recalibration is recommended for one airport or more airports.

5.2.3 Large airport developments

It has already been mentioned that the future of the Dutch airports is uncertain. There has been a political wish to reduce the number of flights at Schiphol Airport, Eindhoven Airport has a reducing noise contour, Groningen Airport Eelde needs growth in order to exist and it is unclear whether Lelystad Airport will ever become operational. These uncertainties make it difficult to determine a distribution key that fits the future reality. In order to make sure the distribution key is flexible enough to adjust to future developments, it is recommended to recalibrate the distribution key with large airport developments. Large airport developments are considered to be developments that result in significantly more or less movements at one or more airports, resulting structurally in significantly more or less CO_2 emissions. As a result, the distribution key does not fit the actual situation anymore and recalibrating is desired. An example of such a large airport development is when the number of movements at Schiphol Airport is reduced to 452.500 after completing the Balanced Approach procedure. A threshold for defining a large airport development could be a change in CO_2 emissions of more than 5%.

5.2.4 CO_2 policy adjustment

The climate targets that are included in the CO_2 ceiling have been established by the National Climate Agreement. It could happen that the political landscape changes and the climate targets are adjusted. The climate targets could become less stringent, but also more stringent. This could have as a consequence that the CO_2 budgets for the airports change. This reduction should not automatically have to lead to a recalibration, because it would mean that each airport has to intensify the sustainable efforts equally. However, when the political landscape changes, with adjustments of climate targets as a result, it is recommended to recalibrate the distribution key, because it is likely that the change of political landscape will have other consequences for the airports as well. The change of political landscape can be considered as a large development, and therefore recalibration is recommended.

5.2.5 At the evaluation moment

The Ministry will evaluate the CO_2 ceiling after five years from implementation. At that moment, it is possible to have a recalibration. Potentially, the recalibration will not lead to a different distribution of CO_2 budget amongst airports, but it still recommended to use that moment to recalibrate, because the moment is meant to evaluate the CO_2 ceiling, and the distribution key is a central part of this.

5.2.6 On request

The objective of the recalibration is to deal with uncertain developments. The abovementioned recalibration moments aim to cover most of the potential unforeseen developments, but it is impossible to cover all potential future developments. Therefore, it is recommended to give all airports and the Ministry the opportunity to request a recalibration. This request can be submitted when a situation occurs that is not covered by any of the abovementioned recalibration moments. The Ministry must determine the conditions for the request.

Table 22 Possible event-dependant moments to recalibrate the distribution key

Possible event-dependant moments to recalibrate the distribution key			
Possible events	**Reasons for recalibration**	**Considerations**	**Likelihood of recalibration**
Opening of a new airport	CO_2 budget for new flights must come from existing airports.	Recalibration is only needed when the new airport can grow autonomously.	Certain
Closing an existing airport	Left-over CO_2 budget can be used by other airports.	Recalibration is only needed when flights are not transferred to other airports.	Certain
Large airport developments	Can have a large impact on the distribution key.	It should be determined what is considered as 'large airport development'.	Probably
CO_2 policy adjustments	Will have a large impact on the aviation sector as a whole.	The distribution will remain the same when policy targets are adjusted.	Probably
At the evaluation moment	This is a moment to evaluate the CO_2 ceiling, of which the distribution key is a central part.		Maybe
On request	Provides additional flexibility into the distribution key, because it allows for airports and Ministry to respond to unforeseen circumstances.	It should be determined what are the conditions for this request, for example when a request is accepted.	Depends on nature of the request

5.3 Conclusion

The objective of the recalibration is to make sure that the distribution key fits the actual situation again after potential developments, which are yet unknown. Recalibration will offer the Ministry and the airports the flexibility needed to deal with these unforeseen developments. At the same time, a high level of flexibility results in a low level of certainty, and this is also not desired. Therefore, a balance between flexibility and certainty must be found.

In agreement with the stakeholders, it has been decided that recalibration with a certain timeframe is not desired, because the differences between the airports regarding looking into the future are too large. Therefore, only recalibration moments triggered by events are recommended. However, some of these events occur on a regular basis, so in a way, recalibration moments are sometimes still driven by time. For some events, it is important to first identify the cause of the event before the decision is made to recalibrate. This is because there are sometimes easier solutions than recalibrating the distribution key, for example when flights are taken over by another airport, but also because a recalibration should not occur as a result of lacking efforts from airports to stay within the CO_2 budget.

6 Conclusions and recommendations

The objective of this study is to design a distribution key that allocates the CO_2 budget amongst airports to fit the operation of the airports. The potential distribution keys are assessed based on advantages and disadvantages, whilst considering flexibility to cope with potential future developments as an important element.

To70 defined three potential distribution keys: based on realized traffic, based on permitted budget and based on forecasted movements. The following is concluded for the distribution keys:

1. A distribution key based on **forecasted movements** is not considered to be favourable, because it is difficult to determine the needed forecast, the accuracy could be apparent and forecasting for small airports is difficult.
2. The most favoured distribution key is the distribution key based on **permitted budget** within the airport decrees, because this distribution key aligns with limitations based on noise, it takes foreseen developments into account, and it is based on accepted numbers. However, this distribution key requires all airport decrees are in place and have at least one overlapping reference year. This could be a complicating factor, because the application process of an airport decree is complex and therefore sensitive for delays.
3. If the airport decrees are not in place at the moment of designing the distribution key, the distribution key based on **realized traffic** is recommended, with a reference year of 'moment of distribution minus one year'. Alternatively, 2019 can be used as reference year, but this will result in a lower level of accuracy. In that case, an extra CO_2 budget for Maastricht and Groningen could be considered, because there is hardly any room for desired growth developments within the noise constraints without the extra CO_2 budget.

For the three distribution keys, an example distribution in terms of CO_2 budget has been performed. The results can be found in table 1. This also includes an indication for the number of movements that would be possible when 6% of SAF is blended and the average rate of fleet renewal continues (scenario 4), based on the average CO_2 emissions per flight per airport in 2019.

Table 23 Comparison of distribution keys for a scenario with sustainable developments

Scenario 4	Schiphol	Eindhoven	Groningen	Maastricht	Rotterdam	Total
Realized traffic 2019[1]	94,94%	3,27%	0,19%	0,43%	1,17%	100,00%
	537,7 k	43,5 k	3,6 k	7,9 k	20 k	612,7 k
Permitted budget	93,00%	3,63%	0,99%	1,02%	1,36%	100,00%
	526,8 k	48,3 k	18,7 k	18,7 k	23,2 k	635,6 k
Forecasted movements	94,77%	3,24%	0,28%	0,36%	1,34%	100,00%
	536,8 k	43,1 k	5,3 k	6,6 k	22,9 k	614,6 k

Table 23 Differences between lowest and highest aircraft numbers

Scenario 4	Schiphol	Eindhoven	Groningen	Maastricht	Rotterdam
Lowest value	526,8 k	43,1 k	3,6 k	6,6 k	20 k
Highest value	537,7 k	48,3 k	18,7 k	18,7 k	23,2 k
Difference (%)	2%	12%	421%	183%	16%

When 6% of SAF is blended and the average rate of fleet renewal continues, it can be concluded that the outcome in maximum number of aircraft movements differs between the airports for the different distribution keys. Especially for Groningen and Maastricht the difference is large.

Besides the distribution key, this study focuses on flexibility to cope with potential future developments, since these could lead to a desire for redistribution of CO_2 budget amongst airports. One of these developments is the opening of Lelystad Airport, or the closing of an existing airport. For the opening of Lelystad Airport, it is recommended to transfer CO_2 budget from Schiphol Airport to Lelystad Airport, because Lelystad Airport is appointed as overflow airport for Schiphol Airport, taking over specific flights from Schiphol Airport. The CO_2 budget required to cover the emissions related to these flights should be deducted from the CO_2 budget of Schiphol Airport and added to the CO_2 budget of Lelystad Airport. For the autonomous growth of Lelystad Airport, the CO_2 budget is distributed from other airports after recalibration.

In case an existing airport closes, it depends on the situation of the closing airport how to cope with this. When another airport is taking over the flights, the CO_2 budget shall be transferred accordingly. When this is not the case and flights are removed, it is recommended to recalibrate the distribution key and distribute the available CO_2 budget amongst the other airports. Alternatively, the available CO_2 budget could be taken out of the market as a reservation. In that case, the climate targets will be achieved earlier. However, this is a political decision since it impacts the CO_2 ceiling as a whole.

Besides the opening of Lelystad Airport, other developments can occur, which may be yet unforeseen. Since the CO_2 ceiling is a new concept and the impact of unforeseen developments is unknown, flexibility to adjust after unwanted effects is important. At the same time, airports need a level of certainty for making investments, based on a long-term strategy or business case. So, a balance is necessary between flexibility and certainty. This balance can be found through including several recalibration moments. These are moments at which a redistribution of the CO_2 budget might be desired because the distribution does not fit the actual (and future) situation of the airports anymore. Recalibration after a specific period is not preferred by stakeholders, because there was no consensus over the most suitable period. Instead, recalibration in case of certain events is preferred. In total, seven possible events have been identified, for which the likelihood of recalibration may differ. When a new airport opens or an existing airport closes, recalibration is certainly required. In case of large airport developments - like a reduction in aircraft movements after a Balanced Approach procedure - or CO_2 policy adjustments, a recalibration is probably required. Finally, recalibration may be requested by stakeholders, and the likelihood of recalibration depends on the nature of the request and the criteria for recalibration.

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A Appendix: assumptions for calculations

The calculations for the allocation/distribution keys are performed using several assumptions:

- The number of flights are assumed, based on potential future situations;
- The CO_2 budget is assumed, based on average CO_2 emissions per flight in 2019.

The combination of these two factors results in the expected CO_2 emissions of Dutch airports in a future reference year. There are several reasons why these results have some weaknesses due to assumptions, and should therefore not be considered as final.

Firstly, in order to calculate the CO_2 emissions over the full year, average CO_2 levels per flight must be determined. This assumption is made based on historical data, which shows that there are variations between the different airports as well as the different years. Generally, the larger airports show less fluctuations, which is logical, due to the force of large numbers. A minor deviation has a smaller impact on the total. For smaller airports, this is different. For example, Maastricht Aachen Airport shows a stable number of movements over the years, but in 2018 and 2019, CO_2 levels have increased majorly. This indicates that flight distances have been increased, more polluting aircraft types have been used, or a combination of both. The deviation in CO_2 levels per flight at smaller airports make it difficult to choose 2019 as a reference year and translate this to a future reference year, because it might be very different in the future.

For the larger airports, there is also a level of uncertainty in the CO_2 levels per flight. This is related to potential capacity limitations at airports. The future of Schiphol is uncertain due to the potential reduction of flights, meanwhile Rotterdam Airport and Eindhoven Airport have already reached the maximum capacity in terms of aircraft movements. In response to this, airlines might change their behavior which has an influence on the CO_2 levels per flight. With a cap on number of flights, airlines may need to find solutions to transport more passengers with the same number of movements. One option is to use larger aircraft and this has an impact on the CO_2 per flight. A second option is to replace short distance flights by alternative modes of transport and exclusively offer long distance. An example of an airlines discovering alternative modes of transport for short distances is TUI. Instead of offering holiday packages with the aircraft, customers have the option to select the train. If an airline does this, the airline will have slots available to perform more long distance flights. Therefore, the CO_2 levels per flight are not only difficult to assume for smaller airports, but also for larger airports.

Second, the number of movements is assumed, but this includes a high level of uncertainty, because the future of various Dutch airports is a subject to a lot of discussion. The political wish is to reduce the number of flights at Schiphol, but legal constraints make this difficult and it is not certain how many flights Schiphol will operate in the future. The same goes for Lelystad Airport, which has been declared controversial, and it is not sure if Lelystad will ever open. In the meantime, Groningen Airport is pursuing growth, but it is uncertain whether they will succeed, and if they succeed, how many movements they will operate. For these calculations, several scenarios are established, but the high number of uncertainties at different airport make it difficult to have a solid forecast.

Third, available data was not complete, so a fair comparison could not be made. Available data included all flights at Dutch airports, while only departing international commercial flights are subject to the CO_2 ceiling. Therefore, annual reports of airports have been retrieved to exclude other traffic, such as general aviation flights and student flights. However, for data about CO_2 emissions, this was not possible, because these numbers are not publicly available. As a result, the data for CO_2 levels includes more flights than the data for air traffic. In the end, this is considered to be acceptable, because general aviation flights and student flights are only accountable for a very small amount of CO_2, compared to commercial flights, but it should be noted that there is a small difference.

Calculating the average CO_2 emissions per flight per airport

The average CO_2 emissions per flight for each airport is calculated by dividing the total CO_2 emissions by the number of movements for 2019 (see figure 1). For Lelystad, the average of Eindhoven Airport and Rotterdam Airport is used, because the profile of Lelystad Airport is similar as for these airports. For the example calculations in Table 11 - Table 13, 2019 is used as a reference year. This year is chosen, because it is the most recent reference year that is representative at the moment of writing this report. With this reference year, all future reductions are calculated with comparison to 2019. For the example calculations, the total CO_2 emissions are retrieved from Eurocontrol and number of movements are retrieved from annual reports of the airports. This results in an incorrect distribution, because the data from Eurocontrol includes CO_2 emissions from all flights, thus also including training flights and general aviation flights, while these flights are not included in the CO_2 ceiling and are therefore not included in the data of traffic. For the calculation of the average CO_2 emissions per flight, it is important to exclude these flights, because a larger share of the flights at Groningen Airport Eelde and Rotterdam Airport is non commercial traffic.

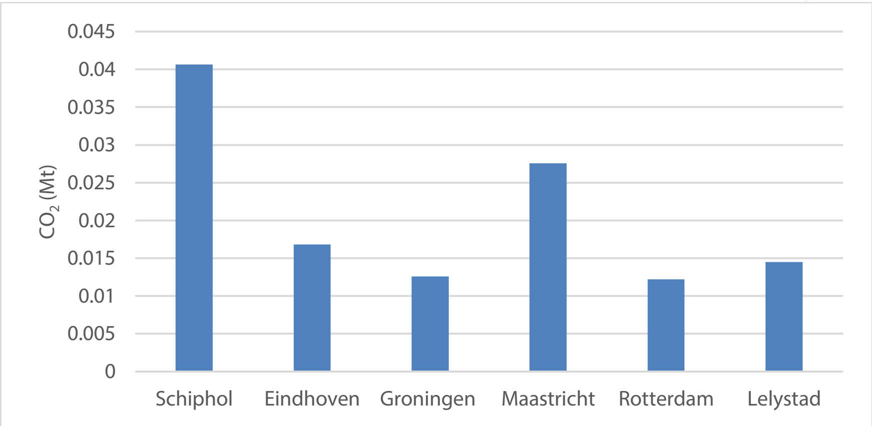

Figure 1 Average CO_2 emissions per flight for Dutch airports

In order to diminish these weaknesses, it is recommended to request actual traffic data from the airports at the moment of distributing the CO_2 budget amongst airports. With this data, an accurate estimation of the average CO_2 emissions per flight can be made. For this estimation, the SET from Eurocontrol can be used, but the Ministry could also develop its own tool. A self-developed tool brings the advantage that it can be adjusted to suit the Dutch context better, but it will involve costs for development and maintenance of the tool as a disadvantage.