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Annex III - Impact of Russia’s war of aggression on horizontal flight efficiency

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TECHNICAL NOTE ON THE IMPACT OF THE WAR IN UKRAINE ON HORIZONTAL FLIGHT EFFICIENCY (HFE) INDICATORS

A QUANTIFICATION OF THE EFFECTS OF CONFLICT ZONE AIRSPACE RESTRICTIONS ON HORIZONTAL FLIGHT EFFICIENCY VALUES

Technical note prepared by the EUROCONTROL Aviation Intelligence Unit (AIU)

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1 INTRODUCTION

The invasion of Ukraine which began on February the 24th 2022 has led to extensive airspace closure and the need for airlines to reorganise the affected traffic, either cancelling flights or operating longer flights.

As the Horizontal Flight Efficiency (HFE) indicators utilise flight length as the main proxy for efficiency, those increased lengths have led to higher values for the indicators, which in the case of States close to the restricted airspace (in the northern and eastern part of Europe) have been notably higher. Due to the difference of the traffic flows involved, the effects have not been uniform.

Availability of alternative values of the indicator in which the impact of the exceptional circumstances has been considered is useful when there is a need to have comparisons. Such is the case for example when considering time series, which would otherwise be broken in two periods with different baselines. Similarly, those corrected values enable the comparison with targets which were established under assumptions which were valid at the time the targets were established but could not have envisaged such exceptional circumstances.

The purpose of this Technical Note is to define a methodology which can be used to generate those values, provide the details of the approach and the outcome of applying it to the data currently available.

Some HFE indicators are used in the Single European Sky (SES) performance scheme and targets have been set on the Key Environment indicator based on Actual trajectories (KEA). The technical note therefore provides some detail on the specificities of the indicator adopted for performance purposes and the proposed correction.

The final section of the technical note provides the values of the HFE based on the radar trajectories for the period January 2022 – May 2023, monthly and per SES Member State. Values for the entire SES area are also provided.

KEA is based on the HFE indicator calculated on radar data, with an additional provision to limit the impact of unusual, but temporary, circumstances: it is an annual rolling average in which the ten best and ten worst days are excluded from consideration. The evolving values of the KEA indicator (on the last day of each month) are also provided in the final section.

2 BACKGROUND

2.1 Horizontal Flight Efficiency Indicator

The Horizontal Flight Efficiency Indicator (HFE) uses the length of the trajectory as a proxy for the flight efficiency, so that longer flights are considered more inefficient flights.

For performance purposes it is the entire flight, gate-to-gate, from origin to destination, which is the main interest. For the additional distance, it is also the granularity at which the measurement is unequivocally defined[1].

At the core of the indicator is the consideration that while it is true that the most appropriate unit for performance analysis is the entire flight, there is also interest in splitting the flight in separate phases, or according to the different geographical areas which are traversed by the flight. In those cases, there is also a general expectation that the values of the additional distances are internally consistent. Thus, the goal in defining the indicator was to have a measurement such that the sum of the additional

[1] The distance between the airports being the minimal length possible for a flight and therefore the reference against which the "additional" can be calculated (the "zero" to ensure that all additional distances are positive).

distances, no matter how the entire flight is split into parts, is equal to the additional distance from the airport of departure to the airport of arrival.

As distances are not additive[2], the indicator requires the use of something else than the (great circle) distance to obtain the additivity property described above. "Achieved distance" provides such values.

In the rest of the document distance between two locations refers to the great circle distance between them[3]. The terms origin and destination refer to the first and last point of the trajectory considered for the flight, which in general should correspond to the airport of departure and the airport of arrival[4].

Achieved distances take into explicit consideration:

- For a flight between the airport of departure and the airport of arrival there are two fixed points, corresponding to the location of the two airports; different flights might follow different paths, but all flights between the airport pair will share the two airports as end points[5].
- There is a direction of travel, and the points are in a sequence[6]. Time[7] is a natural way to keep the sequence.

The achieved distance assigns an estimate to the amount of distance between the origin and the destination that has been covered between any two points. The estimate is based on the location of four points: origin, first point, second point, destination. The additional distance is the difference between the amount flown and the amount achieved[8].
The achieved distance is the average of[9]:

- how closer the flight gets to the destination[10]:
    - distance between the first point and the destination minus
    - distance between the second point and the destination, and
- how farther the flight gets from the origin[11]:
    - distance between the origin and the second point minus
    - distance between the origin and the first point.

[2] The defining characteristic of distances is that they satisfy the triangular inequality. Defining the distance as the length of the shortest path joining two points, it means that when considering a third point, the sum of the distances between the two original points and the third one will be the same only when the third point is already on the shortest path, otherwise it will be higher. In Euclidean geometry the shortest distance corresponds to the length of the straight line between the two points, on a sphere it is along the great circle because of the curvature. Hence the use of great circle distance (GCD) for the indicator.

[3] The location of the points is identified by the latitude and longitude instead of x, y, z coordinates in a three-dimensional space, and the distance refers to a path on the surface instead of the straight line, which would be internal to the surface. The GCD takes into consideration the relative location of the points and the curvature.

[4] For the indicator adopted in the performance scheme, this is not always the case.

[5] The distance between them is the length of the shortest path between them.

[6] From the airport of departure to the airport of arrival.

[7] Real, estimated or forecasted.

[8] The flown is the length of the trajectory, which could be the one that results from radar points or the one implied by a flight plan or any other trajectory (e.g., because of a simulation). The achieved is the result of the calculation based on the four points (origin, first point, second point, destination).

[9] It is the difference of values between the two times which counts (closer and farther), not the value of the distance at either points. The direction of travel counts: decreasing distance to destination and increasing distance from origin are indication that the overall goal of the flight is being achieved (hence the name).

[10] Both distances are taken with respect to the destination. It is GCD(origin, destination) at departure and 0 at arrival. Both values are non-negative, while the difference between the two might be negative.

[11] Both distances are taken with respect to the origin. It is 0 at departure and GCD(origin, destination) at destination. Both values are non-negative, while the difference between the two might be negative.

The calculation ensures that the achieved distance:

- Is the total distance to be covered by the flight when the two points are the origin and destination of the flight[12].
- Does not depend on what happens before and after the two points[13], so that the values are not influenced from additional distances in other areas.
- Provides[14] an estimate of the additional distance due to the misalignment of those points with respect to the origin and destination.
- The sum of the achieved distances over all airspaces traversed is equal to the great circle distance between the origin and destination[15].

All the above is not true for regular distances (so called "direct" between the two points), because of the mathematical properties of distances[16]. Regular distances would also ignore the additional information provided by the location of the origin and destination and direction of the flight[17].

For the performance scheme the phase of interest is the en route phase of the flight, which has been defined to begin and end when the flight crosses a cylinder of radius 40 nautical miles centered at the airport(s).

In the version of the indicator which has been adopted for the performance scheme there are two main differences with respect to the plain indicator:

- The origin and destination of the flight have been moved from the airports to the border of the reference area for flights arriving or departing (or both) outside the area[18].
- The inefficiency is calculated in percentage terms with respect to the achieved distance (the comparison between flown and achieved reflects the percentage increase rather than the absolute difference).

[12] The achieved distance is equal to the great circle distance between them. In the description above, the first point is the origin, and the second point is the destination. Closer to destination: GCD(origin, destination) – GCD(destination, destination) = GCD(origin, destination) – 0, farther from origin: GCD(origin, destination) – GCD(origin, origin) = GCD(origin, destination) – 0. Average: (GCD(origin, destination) + GCD(origin, destination)) / 2 = GCD(origin, destination).

[13] Except for the locations of the origin and destination of the flight, which are essential in defining whether there is additional distance implied by the location of the two points with respect to the origin and destination.

[14] The additional distance, which is the difference between the GCD and the achieved distance between the two points, is always positive (or zero). This is because the maximum value possible for the achieved distance is the GCD between the two points, which happens when the two points are on the great circle between origin and the destination, and the two points are also between the origin and the destination. In other words, when the two points are part of the shortest path between origin and destination there is no additional distance.

[15] Every intermediate point will be considered once with a positive sign and once with a negative sign (for each of the two values – towards destination and from the origin), while the origin and destination are taken into consideration once with the value of the overall great circle distance, and once as zero.

[16] To have an analogy with geometry in two dimensions, we can consider straight lines (as shortest, indicating a distance) and curves (not shortest). The more points considered the better the approximation to the length of the curve, and the worse the approximation to the length of the straight line joining the end points. The distance flown is a given, and what is needed for the indicator is the approximation of the portion of the straight line joining the end points.

[17] As an example, flying in the opposite direction with respect to the one from the origin to the destination might be efficient locally but is clearly inefficient for the whole flight.

[18] Consequently, the location of origin and destination might be different from the location of the airport of departure and the airport of arrival. The calculation of the achieved distances is with respect to the locations of origin and destination.

The KEA indicator is built upon the HFE indicator and is based on an annual moving window from which the ten best and worst days are removed.

More details on the calculation of horizontal flight efficiency and on the indicators can be found in the dedicated section of the Aviation Intelligence Unit's website (https://www.eurocontrol.int/portal/pan-european-air-navigation-services-performance-data-portal).

2.2 Airspace closures

Immediately after the invasion of Ukraine, EASA issued a Conflict Zone Information Bulletin (CZIB) detailing restrictions on the operations of flights in Ukraine, Russia and Belarus (the restrictions on Belarus' airspace were active since February 2021), whose validity has been extended several times.

The CZIB is available at the page https://www.easa.europa.eu/en/domains/air-operations/czibs/czib-2022-01r08.

It lists the following as regions in which operators should not operate:

- All altitudes / flight levels of the following Flight Information Regions: FIR LVIV (UKLV), FIR KYIV (UKBV), UIR KYIV (UKBU), FIR DNIPROPETROVSK (UKDV), FIR SIMFEROPOL (UKFV), FIR ODESA (UKOV).
- All altitudes / flight levels of the airspace within 200NM surrounding the borders with Ukraine in the FIR MOSCOW (UUWV).
- All altitudes / flight levels of the FIR ROSTOV-NA-DONU (URRV).

In addition, operators are urged to exercise caution for the entire FIR MOSCOW (UUWW) and reminded that operations are prohibited in the FIR MINSK (UMMV), due to previous safety directives.

A map of the affected airspace is provided as part of the description of methodology in the following section.

3 DESCRIPTION OF THE METHODOLOGY APPLIED

As it is common in the case in counterfactual analysis, the data available cannot directly show what would have been the value of the measurements under different conditions which would have directly or indirectly led to alternative decisions. The analysis must rely therefore on assumptions or simulations. In this case the direct simulation of the trajectories is not available, and the analysis relies on information from the past about flights between airport pairs to identify the flights potentially impacted.

Faced with airspace closures an airline must consider the trade-off between the increased costs due to the need to fly longer trajectories (which might not even be feasible with the type of aircraft originally planned) and the loss of revenue and costs related to the cancellation of the flight.

In the former case the data includes a (possibly very) inefficient flight, while in the latter case the absence of the flight means that the recorded inefficiency is better than the one which would include the flight.

For what concerns the former aspect, the analysis does not exclude completely the affected flights but applies instead for them a correction to the value of the indicator. The latter aspect is not considered in this analysis, as there is no replacement of the missing traffic.

The main rationale behind the counterfactual reasoning is the following:

- Airlines base their decisions on the entire flight, whose end points are the airport of departure and arrival. The location of the two airports is considered a strong predictor of the airspaces which will be traversed.
- For the period before February the 24th 2022, flight plans reveal airlines preferences about the areas to be traversed. These preferences are unaffected by the restrictions, which were not active at that time.
- If airlines did not file to use an airspace in the period preceding the invasion, then its subsequent closure should make no difference to them.

The bulk of the analysis consists of the identification of the flights impacted by the restrictions, based on the information about past behaviour. As it will be shown the information about the airport pairs is not always sufficient to have high coverage of the entire set of flights. This is because some of the flights are operating on markets and destinations which were not served before (or at least not in the period considered, which goes back to the beginning of 2019). Those flights are treated differently, and the identification of impacted flights is based on a categorisation based on area pairs instead of airport pairs.

3.1 Definition of impacted area

While the restrictions are related to airspace closures in Ukraine, Russia and Belarus, their impact might be wider due to the redefinition of the traffic flows.

The analysis considers a slighter wider area than the one directly mentioned in the EASA's CZIB by taking in consideration all FIRs with ICAO code beginning with the following letters: UK, UL, UM, UR, UU[19].

[19] Generally, the first letter of the ICAO codes refers to the geographical region, and the second to an area within the region. The last two letters in the ICAO code for an airport identifie the specific airport within the area.

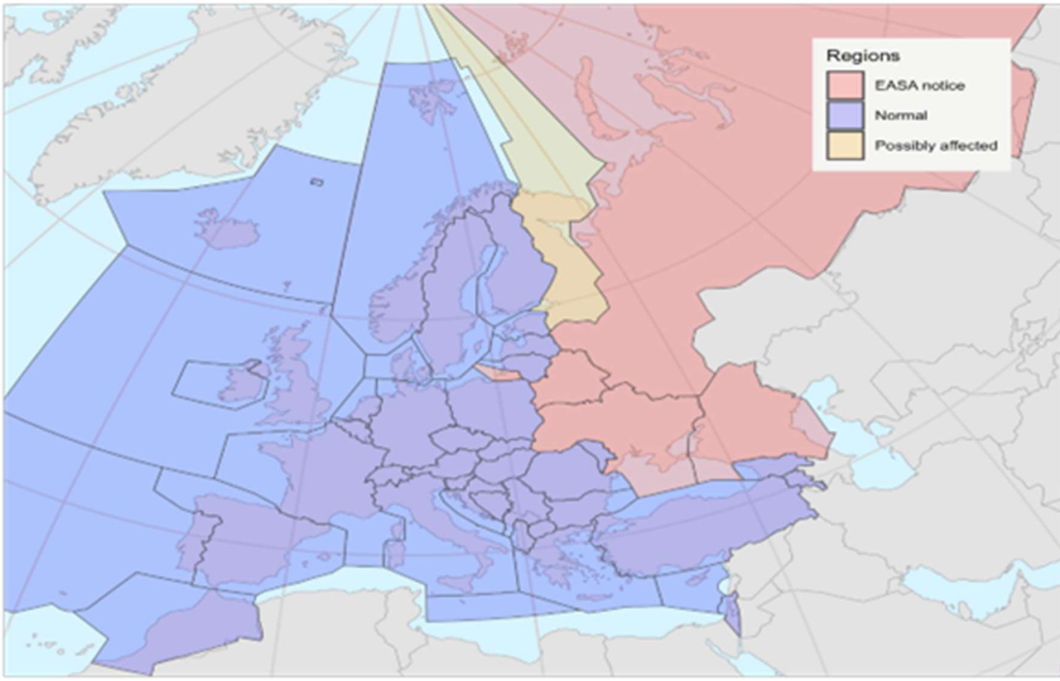


Figure 1: Map of impacted airspace

Figure 1 shows in red the areas directly affected by the notice and in yellow the area considered as very probably affected, UL. It is considered as very probably affected as it is an area which is part of the Russian federation and is wedged between the restricted area and the area of interest for the analysis.

As a preliminary step of the analysis, all flight plans have been categorised based on whether the plan included traversing one or more affected FIR regions (any of the yellow and red areas in the map).

3.2 Dataset available

The dataset considered for the identification of the affected flights consists of all flight plans in the pre-invasion period from January the 1st 2019 to February the 23rd 2022, whose main statistics are summarised in Figure 2.

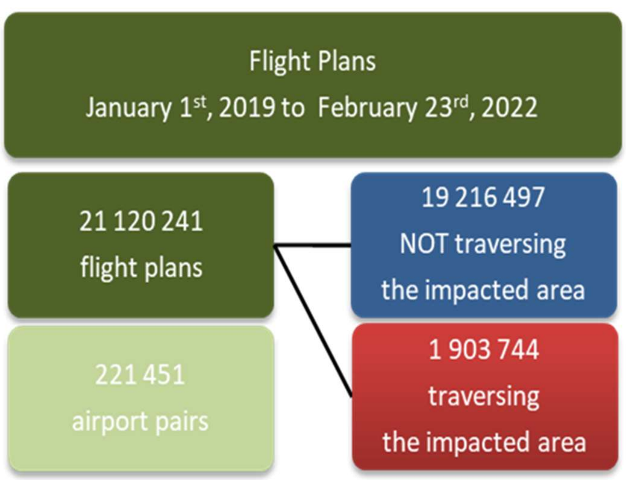


Figure 2: Information on dataset available

It consists of around 21,1 million flight plans, of which around 1,9 million include the traversal of the impacted area[20].

The number of airport pairs included is around 221 thousand. An airport pair is one-directional, distinguishing airport of departure and airport of arrival; AAAA-BBBB and BBBB-AAAA therefore are considered to be two different airport pairs, even if they involve the same two airports: AAAA and BBBB.

[20] Flying into, flying out, flying inside or flying over.

There is not a one-to-one correspondence between airport pairs and traversal of the impacted area, as for the same airport pair some flight plans might include the traversal of the impacted area, while others might not include it (flight plans are specific to the flight and there is no predefined route between airport pairs).

For the purpose of categorising flights in the post-invasion period, though, the goal is to assign them ideally based on airport pairs, so that the information about the airport pair indicates whether or not the flight has been affected by the airspace closures.

3.3 Identification of the impacted flights via airport pairs

For the categorisation to be based on airport pairs, there is the need to assign airport pairs for those cases in which some of the flights have requested to traverse the impacted area while others have not.

A simple approach would be to categorise the airport pair according to the majority rule (whether more than 50% have flown through the impacted area), but in the exploratory phase of the analysis the goal is to have a better idea of how many of the airport pairs would fall in an undecided category, in which the percentages might be close to each other.

For each airport pair the analysis calculates the number of flights for which the flight plan includes the crossing of the impacted area (traversing flights) and what percentage they make of the total for that airport pair. The percentage gives therefore an estimate of the strength of the preference to go through those airspaces when flying between the two airports.

The period considered is the one before February the 24th 2022 in which the area was not restricted and so aircraft operators could decide where to fly. Belarus is an exception as it is an area which has been restricted since 2021. However, the dataset includes the years 2019 and 2020 of higher pre-pandemic traffic, while in 2021 the level of traffic was still low because of the pandemic.

The application of a threshold either side of the bounds on the percentage of traversing flights allows to define three categories: unaffected, unassigned, affected.

The bounds on percentages are 0% and 100%, so a threshold of 1% implies the use of 1% and 99% as cutoff values, while 5% implies the use of 5% and 95% as cutoff values[21].

Table 1 provides some examples showing the categorization based on the total number of flights in the city pair and the number of traversing flights.

Number of flights in the pair	Threshold	Number of traversing flights		
		Unaffected	Undecided	Affected
10	1%	0	1 – 9	10
10	5%	0	1 – 9	10
20	1%	0	1 – 19	20
20	5%	0 – 1	2 – 18	19 – 20
50	1%	0	1 – 49	50
50	5%	0 – 2	3 – 47	48 – 50

Table 1: Categorisation of the pair according to the number of traversing flights

The lower the threshold, the fewer airport pairs (and all flights related) will be unequivocally assigned to the affected or unaffected category.

[21] 1% and 5% are the traditional values used in statistical approaches.

- When the percentage of traversing flights is below the threshold, the airport pair is considered as **unaffected** (all flights between the airport pair would be considered unimpacted post-closure).
- Conversely, when the percentage of traversing flights is above the complementary threshold the airport pair is considered as **affected** (all flights between the airport pair would be considered impacted post-closure).
- When the percentage is between the two values, the airport pair is considered to be "**unassigned**", as it might be considered to be in either category.

Table 3 and Table 2 show the outcome of applying the categorisation based on the value of 1% or 5% as threshold.

A comparison of the two tables shows that by changing the threshold to 5% a small percentage of airport pairs, and a higher one of flights, move out of the unassigned category and into the other two categories, but without major changes. To a change of categorisation of a relatively fewer number of airport pairs corresponds a higher coverage of flights. It also shows that the airport pairs involved have a relatively high number of flights, for which the choice of the 5% is relatively safe (the assignment is based on a bigger sample size).

The stability in the overall percentages is consistent with the fact that the great majority of airport pairs (which includes airport pairs within Europe and arriving from the South or from the West) is not affected by the airspace restrictions and is unequivocally assigned to a category.

Category (Threshold 1%)	Airport Pairs	Flights	Airport Pairs %	Flights %
Unaffected	194 229	18 553 318	87.7%	87.8%
Unassigned	5 283	1 001 668	2.4%	4.7%
Affected	21 939	1 565 255	9.9%	7.4%
Total	221 451	21 120 241	100.0%	100.0%

Table 3: 3-ways categorisation based on airport pairs with 1% threshold.

Category (Threshold 5%)	Airport Pairs	Flights	Airport Pairs %	Flights %
Unaffected	194 975	18 819 669	88.0%	89.1%
Unassigned	4 351	668 015	2.0%	3.2%
Affected	22 125	1 632 557	10.0%	7.7%
Total	221 451	21 120 241	100.0%	100.0%

Table 2: 3-ways categorisation based on airport pairs with 5% threshold.

To reach an either-or decision concerning the categorisation of the airport pair, the conservative decision which errs towards considering an airport pair as impacted is taken. Thus, the unassigned and affected are grouped together in the impacted category.

Category (Threshold 5%)	Airport Pairs	Flights	Airport Pairs %	Flights %
Unimpacted	194 975	18 819 669	88.0%	89.1%
Impacted	26 476	2 300 572	12.0%	10.9%
Total	221 451	21 120 241	100.0%	100.0%

Table 4: 2-ways categorisation based on airport pairs with 5% threshold.

In terms of Table 1 above, it means that the range for the pair to be categorized as impacted is the union of the two ranges in the last two columns (with twenty flights, the airport pair will be considered unimpacted only if zero or one flights were traversing the impacted area, and impacted if two or more flights were traversing the impacted area). Table 4 shows the results after the regrouping.

3.4 Identification of the impacted flights via area pairs

Moving to the analysis of data related to the post-invasion period, it can be verified how successful the methodology would in categorising all the flights.

For the period between February the 24th 2022 and May the 31st 2023, there are 159 632 airport pairs and 11 036 002 flight plans.
Of those, 41 145 are new airport pairs (they were not present in the previous dataset), for a total of 101 831 flight plans.

While it is only 1% of the flights, it is around a quarter of the city pairs, and it would be preferable to have an additional criterion to assign the category of flights between those city pairs. This would necessarily be based on a coarser grouping, as the detailed grouping given by the airport pairs cannot be used (the airport pair is not there, so there is no "look up" value).

The categorisation can be made coarse thus:

- Consideration of the airport's ICAO area (based on the first two letter of the ICAO code) instead of the airport itself.
- Consideration of the unordered pair instead of the ordered pair. This means that the AA-BB is grouped with BB-AA, as the two both describe more generic traffic flows between area AA and area BB.

Category (Threshold 5%)	Area Pairs	Flights	Area Pairs %	Flights %
Unaffected	4565	18 651 624	66.7%	88.3%
Unassigned	695	896 050	10.2%	4.2%
Affected	1581	1 572 567	23.1%	7.4%
Total	6841	21 120 241	100.0%	100.0%

Table 5: 3-ways categorisation based on area pairs with 5% threshold.

Category (Threshold 5%)	Area Pairs	Flights	Area Pairs %	Flights %
Unimpacted	4 565	18 651 624	6.7%	88.3%
Impacted	2 276	2 468 617	33.3%	11.9%
Total	6 841	21 120 241	100.0%	100.0%

Table 6: 2-ways categorisation based on area pairs with 5% threshold.

The results of applying the modified categorisation on the previous dataset are shown in Table 5 and Table 6, and can be compared with the results in Table 2 and Table 4 of the previous section. The conservative categorisation in this case leans slightly more towards the assignment to impacted than when considering the airport pairs.

This is to be expected as the areas defined via the two letter codes could be quite broad and the threshold used is still quite high.

It should be noted that for some airport pairs, the categorisation might be different between the two approaches, as the traffic between the airport pair would be part of the entire traffic flow between areas.

In those cases, we give priority to the categorisation based on the airport pair by following a sequential order, as explained in the next section.

3.5 Summary of steps for assignment of unimpacted status to a flight

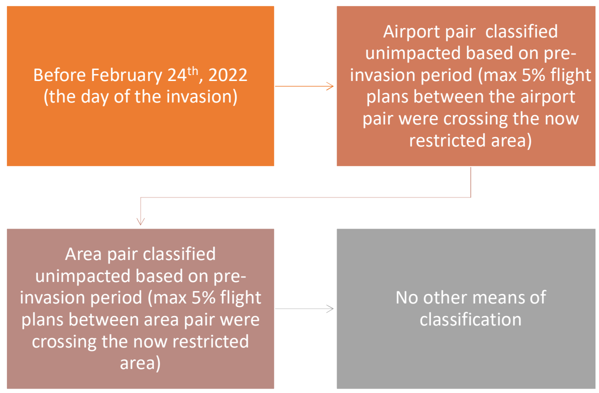


Figure 3: Steps for assignment of unimpacted status to flight

The process of assigning the unimpacted status to flights follows a sequential order illustrated in Figure 3, therefore establishing a priority between the different ways in which a flight can be considered impacted or not.

Flights before February the 24th 2022 are considered all unimpacted because the restrictions were not active.

For flights after that date the assignment is made first on the more detailed information, i.e., the airport pair. The airport pair has been classified as unimpacted if, in the period pre-invasion, maximum 5% of the flights between the airport pair filed to cross the now restricted area.

If that information is not available because there were no flight plans between the airport pair in the pre-invasion period[22], then the assignment is made on the basis of the area pair. The area pair has been classified as unimpacted if, in the period pre-invasion, maximum 5% of the flights filed to cross the now restricted area.

If the category of the area pair is also unknown, lacking any other information it is assumed that the flight would not be operated if particularly inefficient. The flight is therefore assigned to the unimpacted category[23].

3.6 Correction applied to the indicator

As mentioned in the background section, the role of the achieved distances in the HFE indicator is to account for the additional distance which is implied by the location of two local points, such as for example the points of entry into and exit out of an airspace, with respect to the overall flight, in turn characterised by the location of the origin and destination.

The achieved distance is essentially a projection on the shortest path, so that to every possible location corresponds an achieved value between 0 and the great circle distance between the origin and destination.

[22] If the airport pair is known, it has been classified as impacted if, in the period pre-invasion, more than 5% of the flights between the airport pair filed to cross the now restricted area. Thus, at this stage it must be an airport pair which was not present in the period pre-invasion.

[23] The assumption compensates somewhat the small bias towards assuming that the flight has been impacted of the previous two steps.

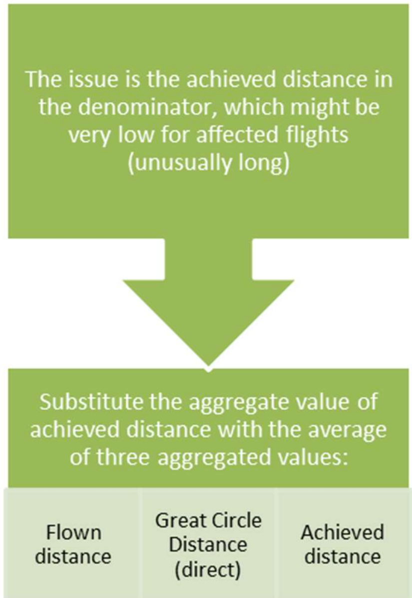


Figure 4: Correction applied to the indicator.

The implicit redistribution of the additional distances is over the whole length of the flight and is slightly more pronounced near the origin and destination of the flight[24], and when the trajectory is far from the shortest path[25].

The more central is the portion of the flight[26], the closer the value of distance and achieved distance between the two points (i.e., the additional distance is closer to zero).

One effect of moving the origin/destination to the border of the area instead of the airports is therefore to have in general lower achieved values with respect to those corresponding to the airports. On the other hand, the points might be better aligned.

As the adopted indicator makes the comparison between flown and achieved based on the ratio, the decrease in the value of the achieved distance is amplified by the use of the achieved distance also in the denominator.

The impacted flights will all be flights for which the origin or destination has been moved on the border, for which the achieved distance is probably reduced.

The correction therefore must be a heuristic one to be applied on the aggregate values. The one proposed is to keep the achieved distance (whose difference from the flown distance would still provide the correct value of the additional distance between origin and destination), but to limit the influence in the denominator by using an average of the flown, direct, and achieved distances in the denominator (the value of the average will necessarily be higher, and the correction will lead to a lower value of the indicator). This correction is applied only for the impacted flights.

4 RESULTS

The first results presented are the KEA values for the year 2022 before and after the proposed correction, and the value of the correction itself.

Table 7 and Figure 5 give a summary per State of those values (plus the value for the entire SES area). In Figure 5, which presents the areas in descending order of the impact of the war on the indicator (year 2022), the value in the white font and the length of the red bar correspond to the correction applied, the blue bar length corresponds to the KEA value after correction and the value in the black font correspond to the value of the KEA indicator (i.e., the sum of the two other values).

[24] They are the two reference points for the calculation of the achieved distances, and the same weight of ½ is given to the distance from origin and distance from destination.
[25] Being far from the shortest path implies more additional distance because it means more effort to join origin and destination.
[26] That is, the farther it is from both origin and destination.

Area	Impact of war	Corr. KEA	KEA 2022
Austria	0.16%	1.93%	2.09%
Belgium	0.07%	3.46%	3.53%
Bulgaria	1.19%	2.09%	3.28%
Croatia	0.06%	1.43%	1.49%
Cyprus	0.57%	3.64%	4.21%
Czech Republic	0.32%	2.23%	2.55%
Denmark	0.10%	1.13%	1.23%
Estonia	3.26%	2.20%	5.46%
Finland	1.73%	1.55%	3.28%
France	0.03%	3.25%	3.28%
Germany	0.14%	2.62%	2.76%
Greece	0.13%	2.20%	2.33%
Hungary	0.76%	1.41%	2.17%
Ireland	0.03%	1.09%	1.12%
Italy	0.04%	2.94%	2.98%
Latvia	3.73%	2.53%	6.26%
Lithuania	7.56%	4.65%	12.21%
Malta	0.05%	1.85%	1.90%
Netherlands	0.10%	2.94%	3.04%
Norway	0.08%	1.24%	1.32%
Poland	2.30%	2.49%	4.79%
Portugal	0.00%	1.52%	1.52%
Romania	1.63%	1.73%	3.36%
Slovakia	1.78%	2.26%	4.04%
Slovenia	0.09%	1.63%	1.72%
Spain	0.02%	3.30%	3.32%
Sweden	0.52%	1.18%	1.70%
Switzerland	0.05%	4.46%	4.51%
SES Area	**0.24%**	**2.72%**	**2.96%**

Table 7: Quantification of impact of war on indicator value for SES States

The following subsections provide the detail at the monthly level for the entire year 2022 and up until the end of May for year 2023, presented in two graphs.

The first graph shows the total number of flights considered (blue bar) and the number of flights which have been considered impacted (orange bar), together with the share of this value over the total number of flights (grey line, right vertical axis). The second graph shows the value of the monthly HFE, both with the current indicator (orange dots) and the corrected one (blue dots). It also shows the value of KEA on the last day of the month (grey bar).

The numerical values are provided in the tables at the bottom of the graphs.

In the future these values will be generated and made available as part of the regular update of the AIU portal, so that stakeholders' activities (e.g., monitoring and target setting for regulatory purposes) can be supported by up-to-date information.

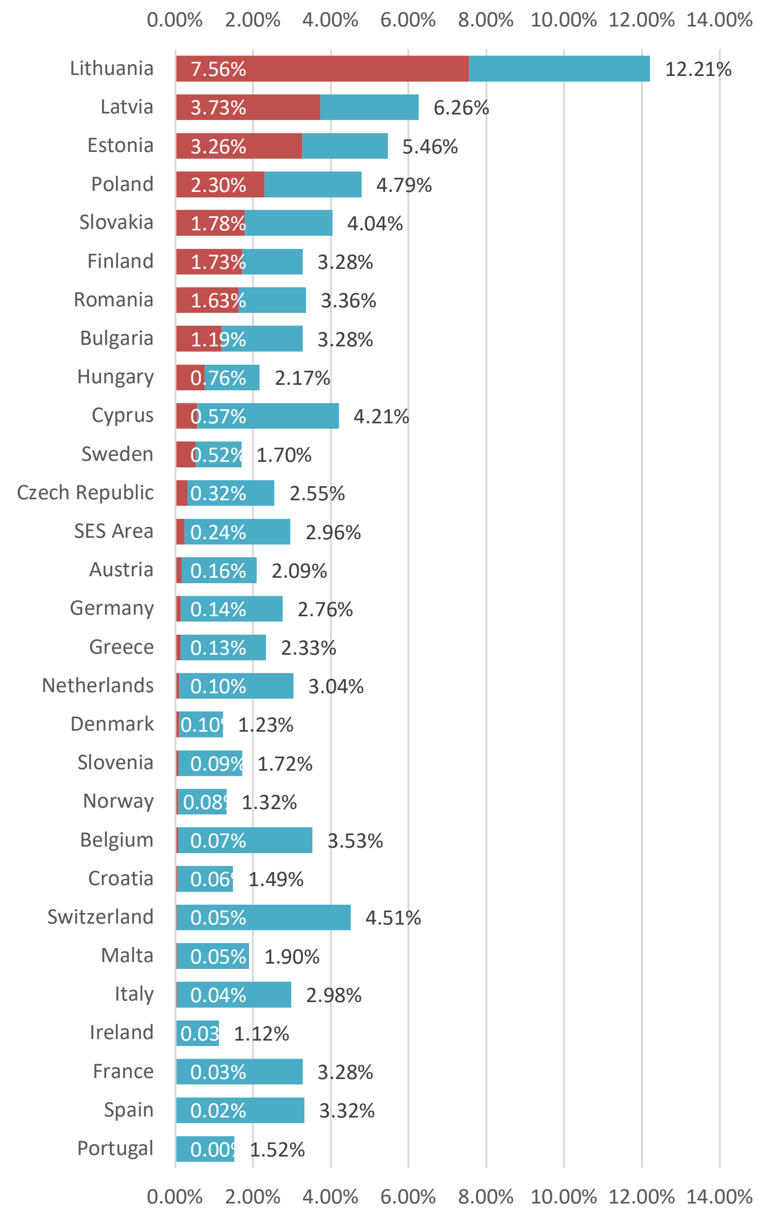
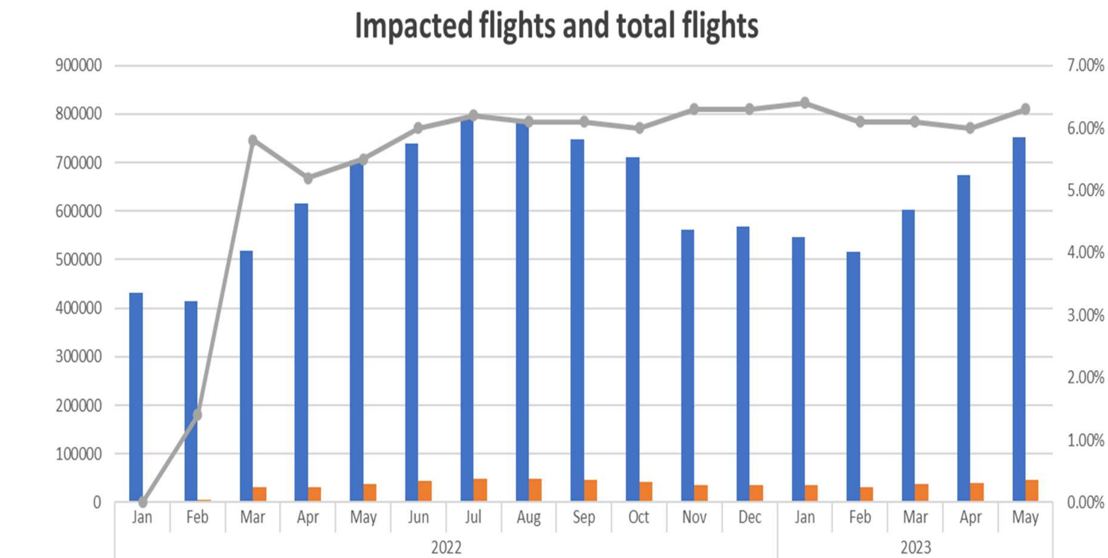


Figure 5: Impact of war on KEA indicator per State, 2022

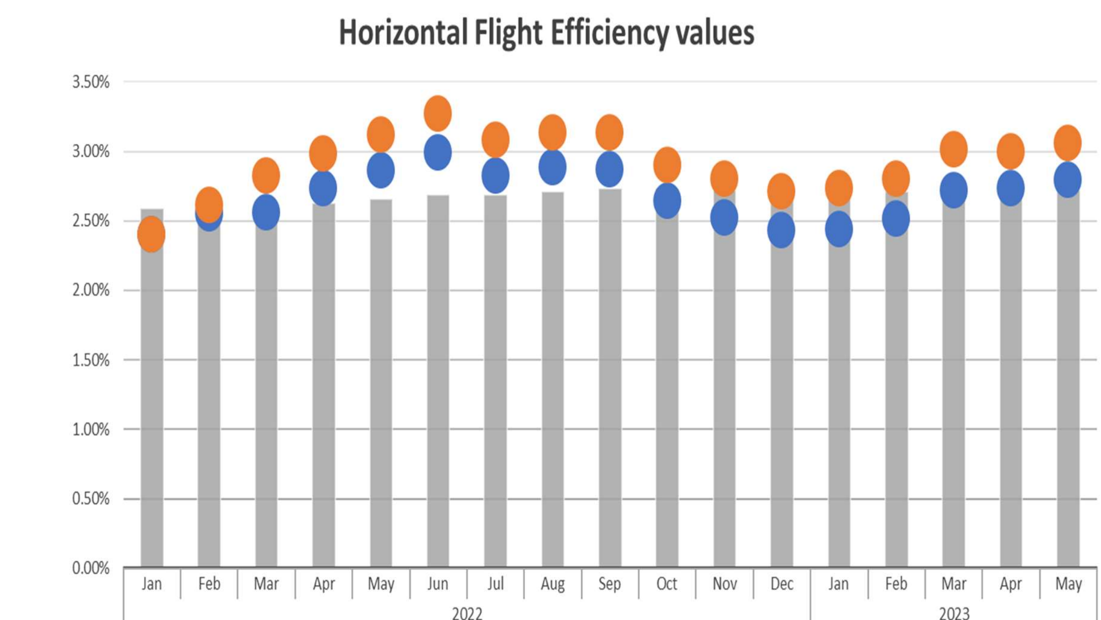
Areas presented in descending order of the impact of the war on the indicator (year 2022).
The value in the white font and the length of the red bar correspond to the correction applied.
The blue bar length corresponds to the KEA value after correction.
The value in the black font correspond to the value of the KEA indicator, uncorrected (i.e., the sum of the two other values).

4.1 SES Area



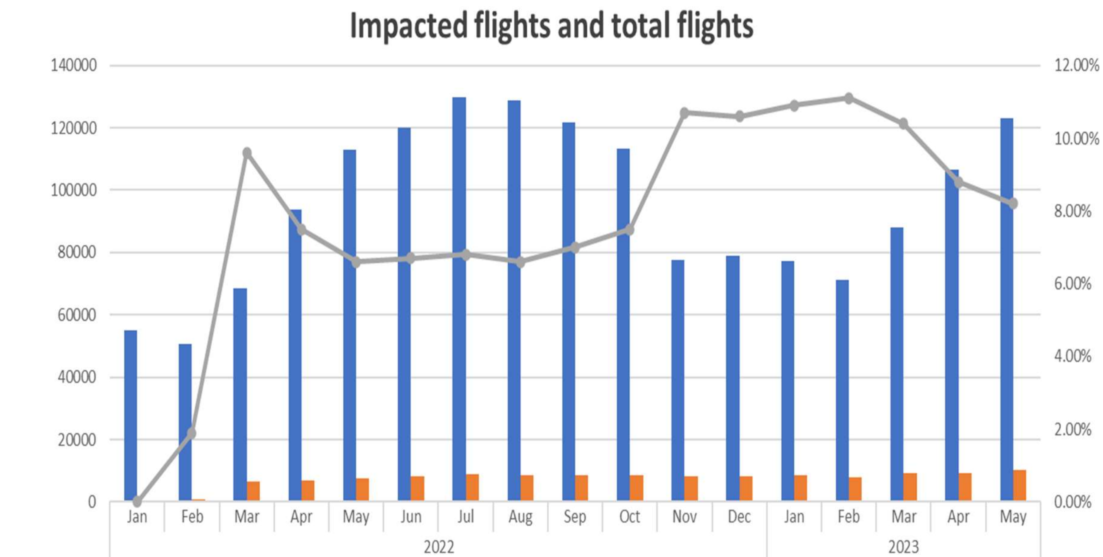
	Jan 2022	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan 2023	Feb	Mar	Apr	May
Flights	430944	414330	518266	616233	703831	740018	790416	788925	747339	710564	561102	568673	547169	516367	602973	674356	751106
Impacted Flights	0	5914	30131	32222	38590	44441	48978	47809	45399	42324	35184	35854	35210	31431	36705	40616	46946
Impacted %	0.00%	1.40%	5.80%	5.20%	5.50%	6.00%	6.20%	6.10%	6.10%	6.00%	6.30%	6.30%	6.40%	6.10%	6.10%	6.00%	6.30%

Flights   Impacted Flights   Impacted %



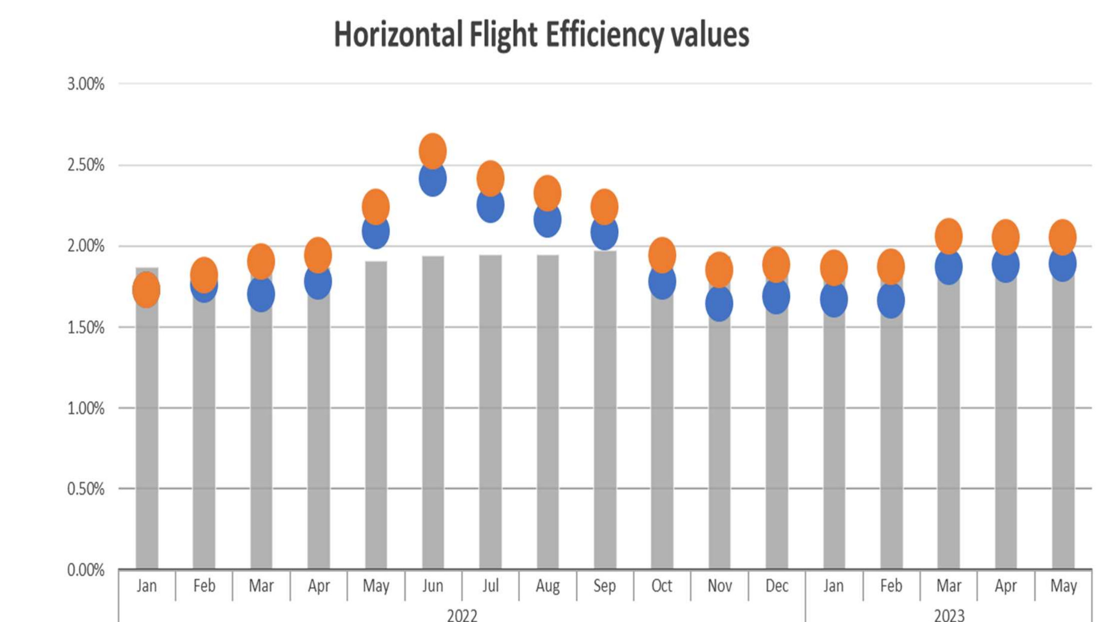
	Jan 2022	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan 2023	Feb	Mar	Apr	May
Corrected KEA	2.59%	2.60%	2.61%	2.63%	2.66%	2.69%	2.69%	2.71%	2.73%	2.73%	2.72%	2.72%	2.71%	2.71%	2.72%	2.72%	2.72%
HFE (corrected)	2.40%	2.55%	2.56%	2.73%	2.86%	2.99%	2.82%	2.88%	2.87%	2.64%	2.52%	2.43%	2.44%	2.51%	2.72%	2.73%	2.79%
HFE	2.40%	2.61%	2.82%	2.98%	3.12%	3.27%	3.08%	3.13%	3.13%	2.90%	2.80%	2.71%	2.73%	2.80%	3.01%	3.00%	3.06%

4.2 Austria



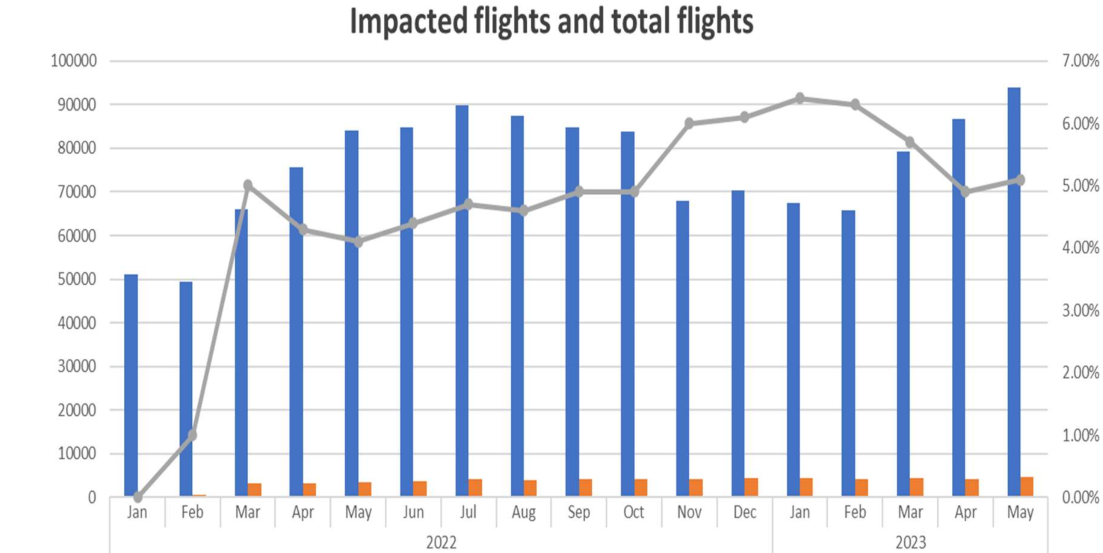
	2022 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2023 Jan	Feb	Mar	Apr	May
Flights	55023	50646	68655	93657	112840	120160	129745	128887	121616	113358	77575	79015	77356	71071	87871	106540	123100
Impacted Flights	0	954	6618	7012	7433	8105	8817	8477	8476	8506	8334	8358	8412	7901	9110	9368	10084
Impacted %	0.00%	1.90%	9.60%	7.50%	6.60%	6.70%	6.80%	6.60%	7.00%	7.50%	10.70%	10.60%	10.90%	11.10%	10.40%	8.80%	8.20%

Flights Impacted Flights Impacted %

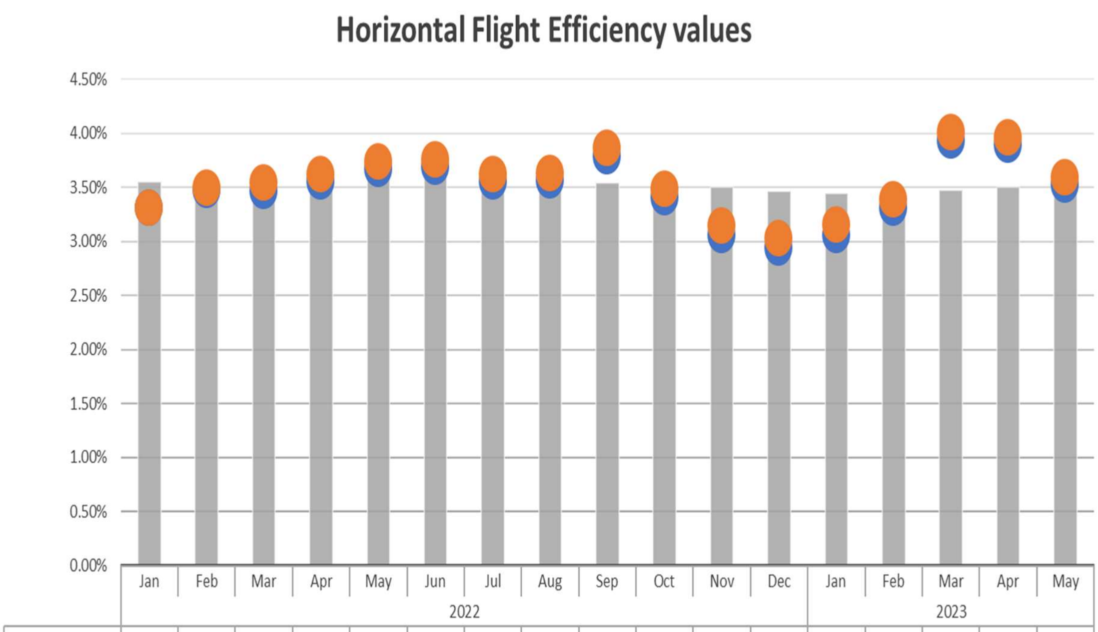


	2022 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2023 Jan	Feb	Mar	Apr	May
Corrected KEA	1.87%	1.87%	1.87%	1.87%	1.91%	1.94%	1.95%	1.95%	1.97%	1.96%	1.94%	1.93%	1.93%	1.92%	1.93%	1.93%	1.91%
HFE (corrected)	1.73%	1.76%	1.70%	1.78%	2.09%	2.41%	2.25%	2.16%	2.08%	1.78%	1.64%	1.69%	1.67%	1.66%	1.87%	1.88%	1.89%
HFE	1.73%	1.82%	1.90%	1.94%	2.24%	2.58%	2.41%	2.32%	2.24%	1.94%	1.85%	1.88%	1.86%	1.87%	2.06%	2.05%	2.05%

4.3 Belgium

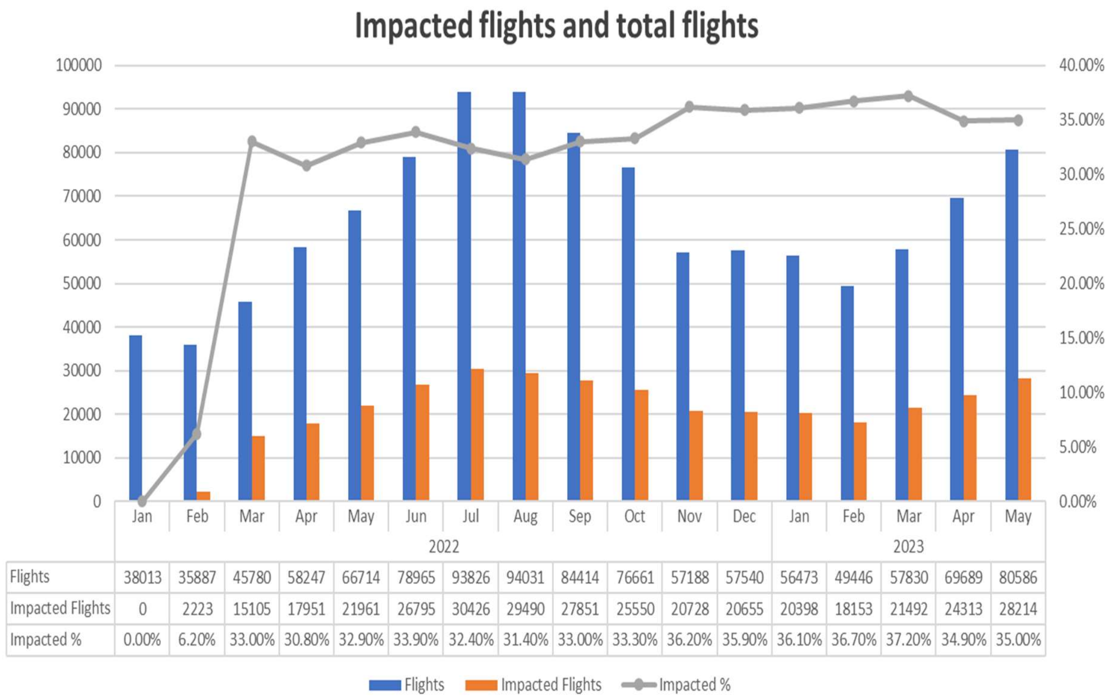


	Jan 2022	Feb 2022	Mar 2022	Apr 2022	May 2022	Jun 2022	Jul 2022	Aug 2022	Sep 2022	Oct 2022	Nov 2022	Dec 2022	Jan 2023	Feb 2023	Mar 2023	Apr 2023	May 2023
Flights	51108	49417	65936	75551	84056	84811	89926	87421	84784	83798	67954	70223	67498	65702	79360	86755	93918
Impacted Flights	0	493	3270	3248	3440	3724	4195	4054	4132	4106	4086	4313	4352	4107	4537	4240	4774
Impacted %	0.00%	1.00%	5.00%	4.30%	4.10%	4.40%	4.70%	4.60%	4.90%	4.90%	6.00%	6.10%	6.40%	6.30%	5.70%	4.90%	5.10%

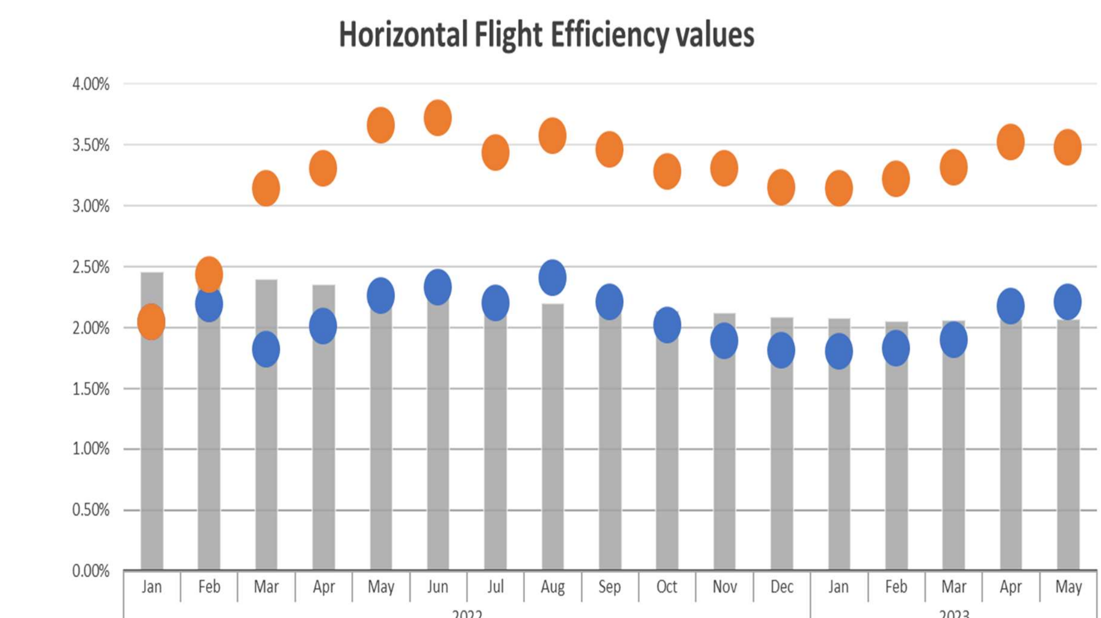


	Jan 2022	Feb 2022	Mar 2022	Apr 2022	May 2022	Jun 2022	Jul 2022	Aug 2022	Sep 2022	Oct 2022	Nov 2022	Dec 2022	Jan 2023	Feb 2023	Mar 2023	Apr 2023	May 2023
Corrected KEA	3.55%	3.57%	3.57%	3.58%	3.61%	3.60%	3.56%	3.54%	3.54%	3.52%	3.50%	3.46%	3.44%	3.43%	3.47%	3.50%	3.49%
HFE (corrected)	3.31%	3.47%	3.46%	3.55%	3.67%	3.69%	3.55%	3.56%	3.78%	3.41%	3.06%	2.94%	3.06%	3.31%	3.93%	3.89%	3.52%
HFE	3.31%	3.49%	3.54%	3.62%	3.74%	3.76%	3.62%	3.63%	3.86%	3.48%	3.14%	3.03%	3.15%	3.39%	4.01%	3.96%	3.59%

4.4 Bulgaria

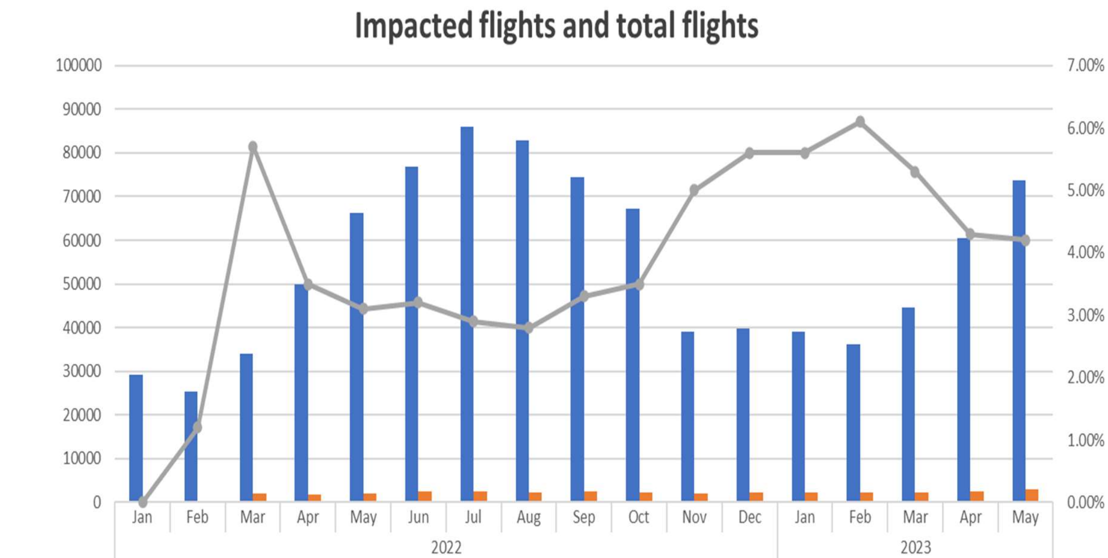


	2022 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2023 Jan	Feb	Mar	Apr	May
Flights	38013	35887	45780	58247	66714	78965	93826	94031	84414	76661	57188	57540	56473	49446	57830	69689	80586
Impacted Flights	0	2223	15105	17951	21961	26795	30426	29490	27851	25550	20728	20655	20398	18153	21492	24313	28214
Impacted %	0.00%	6.20%	33.00%	30.80%	32.90%	33.90%	32.40%	31.40%	33.00%	33.30%	36.20%	35.90%	36.10%	36.70%	37.20%	34.90%	35.00%

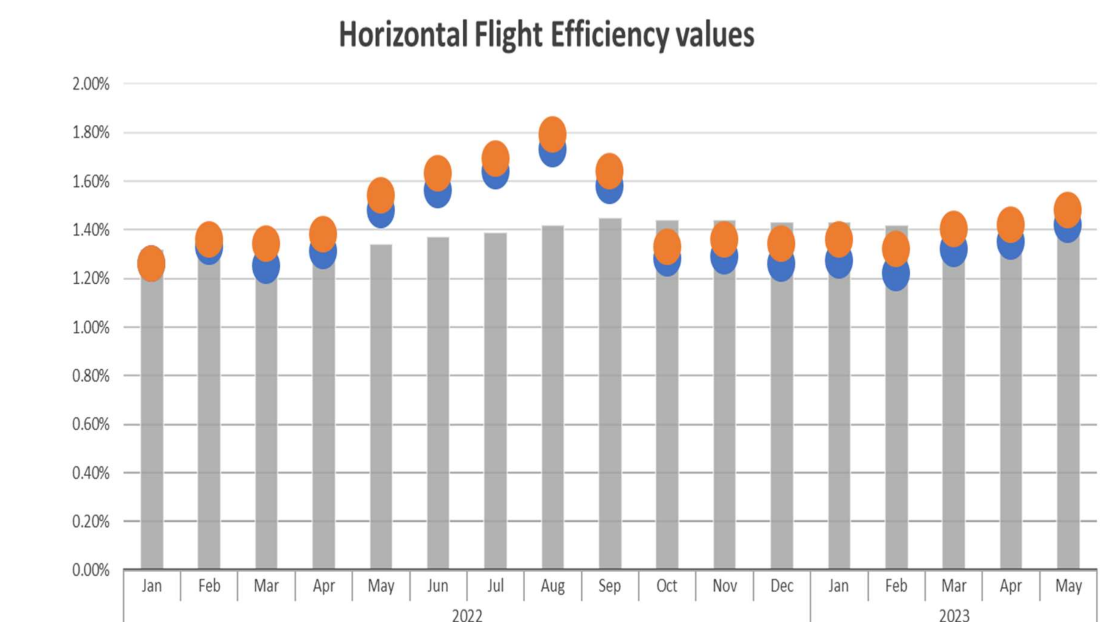


	2022 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2023 Jan	Feb	Mar	Apr	May
Corrected KEA	2.46%	2.45%	2.40%	2.35%	2.31%	2.27%	2.21%	2.20%	2.18%	2.14%	2.12%	2.09%	2.08%	2.05%	2.06%	2.07%	2.07%
HFE (corrected)	2.04%	2.19%	1.82%	2.01%	2.26%	2.33%	2.20%	2.41%	2.21%	2.02%	1.89%	1.81%	1.80%	1.83%	1.90%	2.17%	2.21%
HFE	2.04%	2.43%	3.14%	3.30%	3.66%	3.72%	3.43%	3.57%	3.46%	3.28%	3.30%	3.15%	3.14%	3.22%	3.31%	3.52%	3.48%

4.5 Croatia



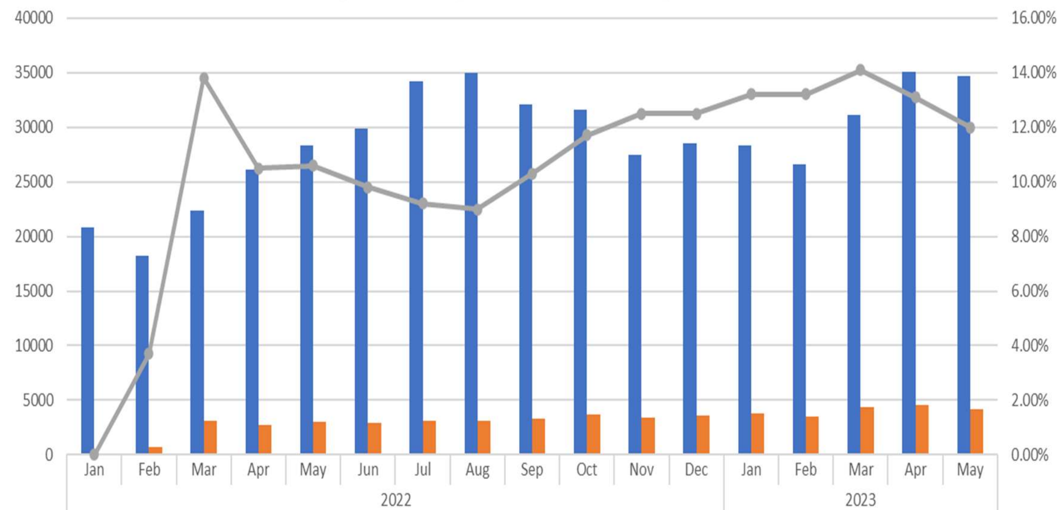
	2022 Jan	2022 Feb	2022 Mar	2022 Apr	2022 May	2022 Jun	2022 Jul	2022 Aug	2022 Sep	2022 Oct	2022 Nov	2022 Dec	2023 Jan	2023 Feb	2023 Mar	2023 Apr	2023 May
Flights	29091	25431	34055	49942	66360	76930	86040	82815	74358	67135	39171	39904	39061	36197	44547	60575	73625
Impacted Flights	0	305	1954	1760	2060	2471	2464	2350	2467	2342	1948	2250	2188	2198	2358	2582	3061
Impacted %	0.00%	1.20%	5.70%	3.50%	3.10%	3.20%	2.90%	2.80%	3.30%	3.50%	5.00%	5.60%	5.60%	6.10%	5.30%	4.30%	4.20%



	2022 Jan	2022 Feb	2022 Mar	2022 Apr	2022 May	2022 Jun	2022 Jul	2022 Aug	2022 Sep	2022 Oct	2022 Nov	2022 Dec	2023 Jan	2023 Feb	2023 Mar	2023 Apr	2023 May
Corrected KEA	1.32%	1.32%	1.32%	1.32%	1.34%	1.37%	1.39%	1.42%	1.45%	1.44%	1.44%	1.43%	1.43%	1.42%	1.42%	1.43%	1.42%
HFE (corrected)	1.26%	1.33%	1.25%	1.31%	1.48%	1.56%	1.64%	1.73%	1.58%	1.28%	1.29%	1.26%	1.27%	1.22%	1.32%	1.35%	1.42%
HFE	1.26%	1.36%	1.34%	1.38%	1.54%	1.63%	1.69%	1.79%	1.64%	1.33%	1.36%	1.34%	1.36%	1.32%	1.40%	1.42%	1.48%

4.6 Cyprus

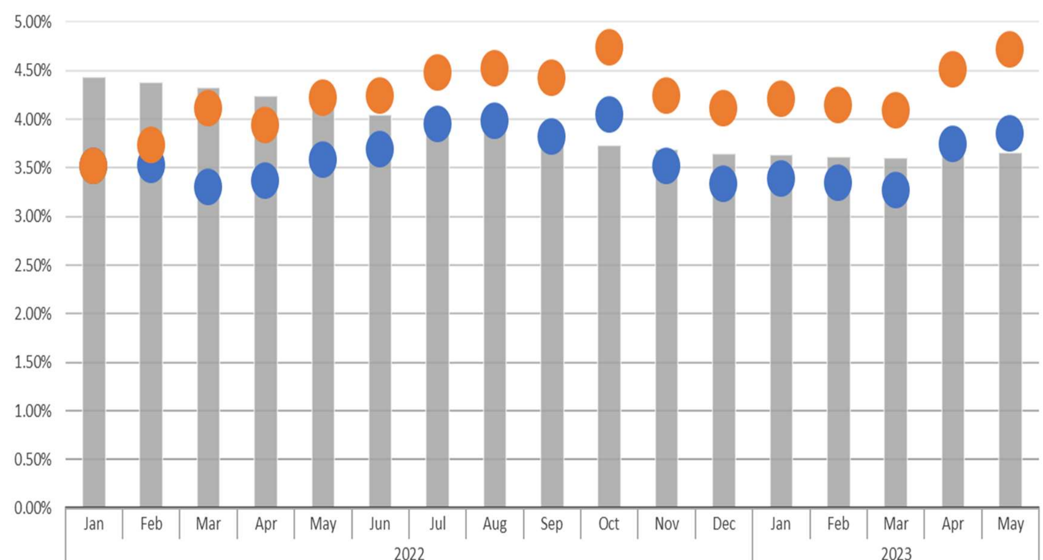
Impacted flights and total flights



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
	2022												2023				
Flights	20823	18236	22350	26070	28297	29908	34216	34990	32096	31554	27493	28567	28360	26627	31078	35109	34713
Impacted Flights	0	677	3093	2736	3011	2929	3136	3143	3301	3677	3434	3559	3751	3503	4390	4595	4163
Impacted %	0.00%	3.70%	13.80%	10.50%	10.60%	9.80%	9.20%	9.00%	10.30%	11.70%	12.50%	12.50%	13.20%	13.20%	14.10%	13.10%	12.00%

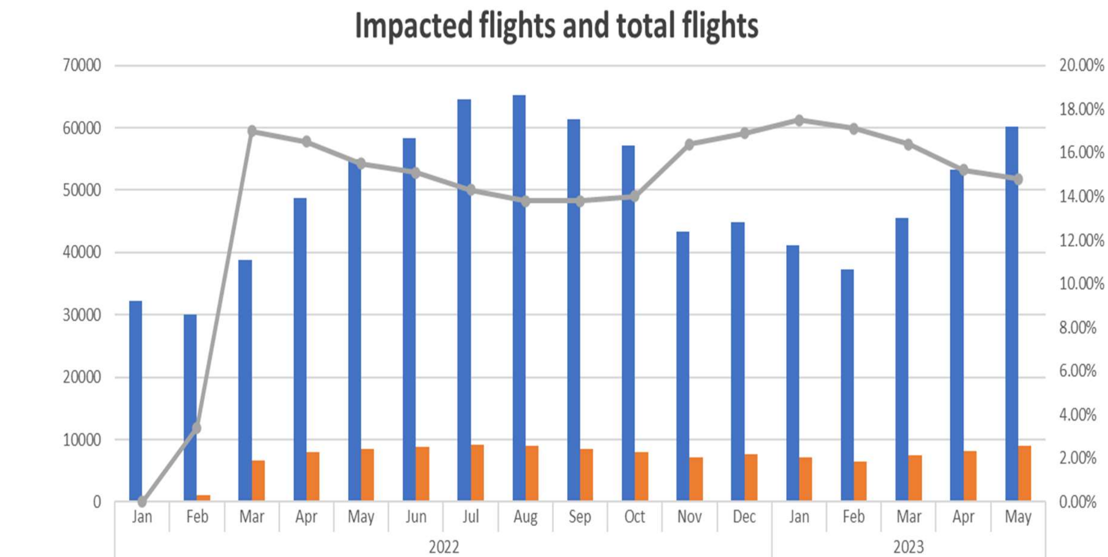
Flights   Impacted Flights   Impacted %

Horizontal Flight Efficiency values

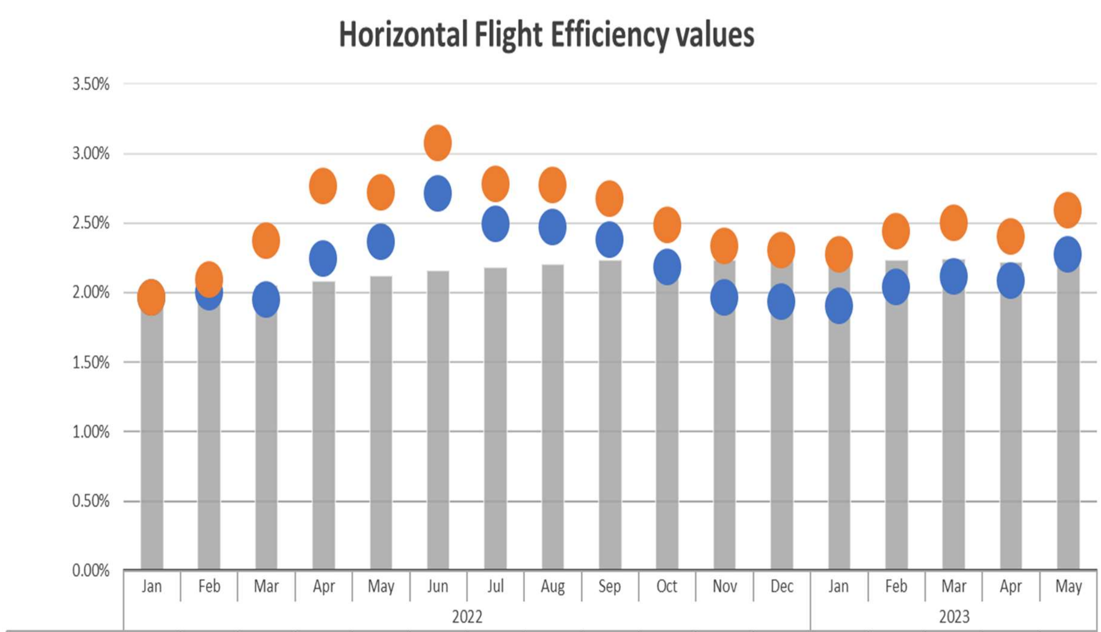


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
	2022												2023				
Corrected KEA	4.43%	4.38%	4.32%	4.24%	4.14%	4.04%	3.95%	3.88%	3.80%	3.73%	3.69%	3.64%	3.63%	3.61%	3.60%	3.63%	3.66%
HFE (corrected)	3.51%	3.53%	3.30%	3.36%	3.58%	3.69%	3.95%	3.98%	3.82%	4.04%	3.52%	3.33%	3.39%	3.34%	3.27%	3.74%	3.85%
HFE	3.51%	3.73%	4.11%	3.94%	4.22%	4.24%	4.48%	4.52%	4.42%	4.73%	4.24%	4.11%	4.21%	4.14%	4.09%	4.51%	4.71%

4.7 Czech Republic

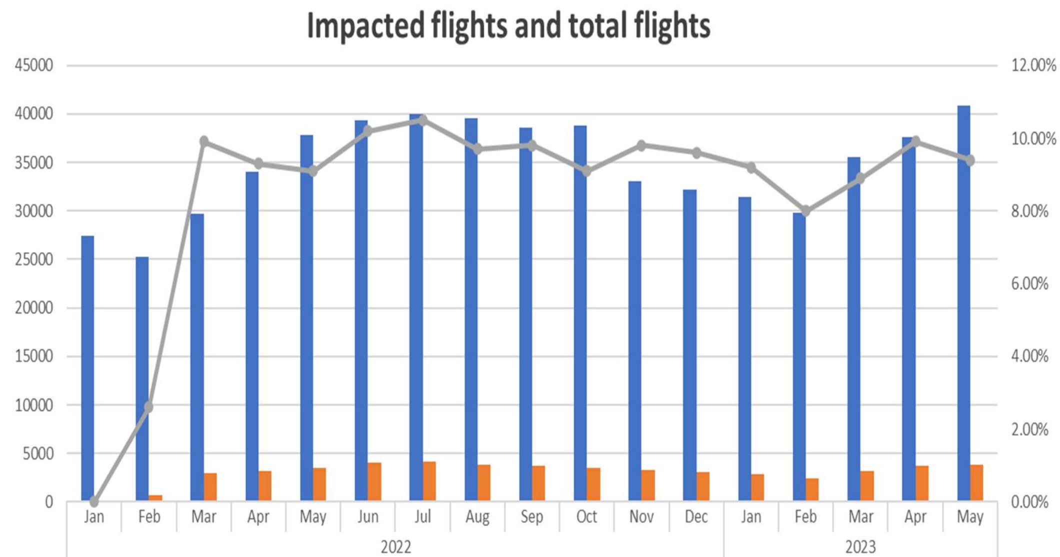


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
	2022												2023				
Flights	32265	30106	38733	48807	54932	58371	64598	65292	61423	57105	43405	44836	41185	37361	45575	53281	60154
Impacted Flights	0	1022	6580	8050	8531	8842	9245	9006	8451	7984	7116	7576	7188	6399	7492	8105	8921
Impacted %	0.00%	3.40%	17.00%	16.50%	15.50%	15.10%	14.30%	13.80%	13.80%	14.00%	16.40%	16.90%	17.50%	17.10%	16.40%	15.20%	14.80%

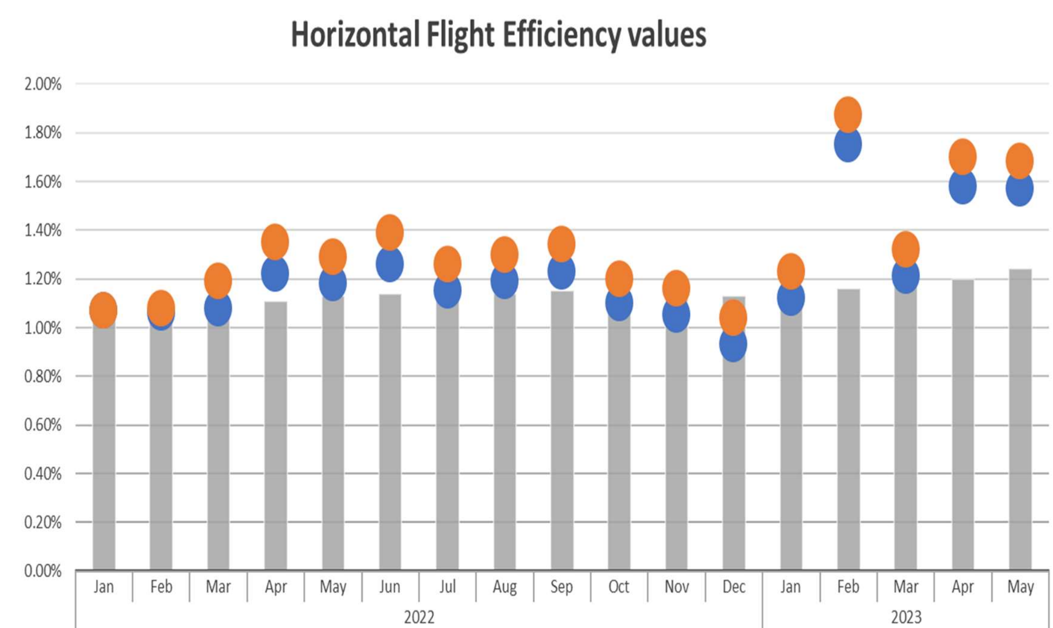


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
	2022												2023				
Corrected KEA	2.03%	2.04%	2.05%	2.08%	2.12%	2.16%	2.18%	2.20%	2.23%	2.24%	2.23%	2.23%	2.23%	2.23%	2.24%	2.22%	2.21%
HFE (corrected)	1.96%	2.00%	1.95%	2.24%	2.36%	2.71%	2.49%	2.47%	2.38%	2.18%	1.96%	1.93%	1.90%	2.04%	2.11%	2.08%	2.27%
HFE	1.96%	2.09%	2.37%	2.76%	2.72%	3.07%	2.78%	2.77%	2.67%	2.48%	2.33%	2.30%	2.27%	2.44%	2.50%	2.40%	2.59%

4.8 Denmark

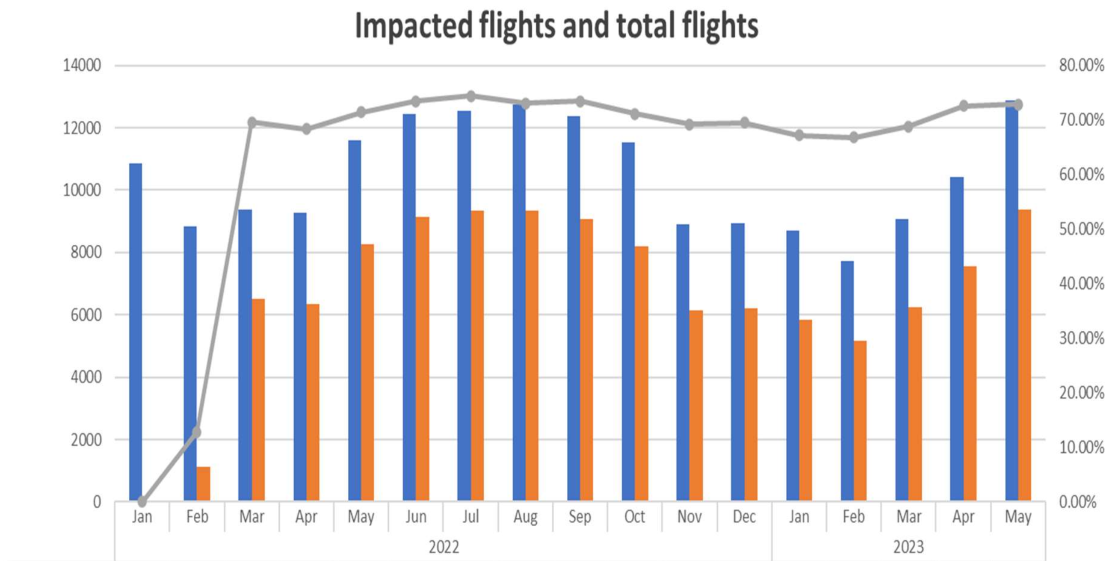


	Jan 2022	Feb 2022	Mar 2022	Apr 2022	May 2022	Jun 2022	Jul 2022	Aug 2022	Sep 2022	Oct 2022	Nov 2022	Dec 2022	Jan 2023	Feb 2023	Mar 2023	Apr 2023	May 2023
Flights	27406	25227	29753	33987	37838	39347	40025	39557	38529	38745	33044	32240	31468	29840	35570	37634	40823
Impacted Flights	0	658	2956	3157	3460	4000	4201	3821	3779	3513	3253	3099	2905	2389	3152	3731	3819
Impacted %	0.00%	2.60%	9.90%	9.30%	9.10%	10.20%	10.50%	9.70%	9.80%	9.10%	9.80%	9.60%	9.20%	8.00%	8.90%	9.90%	9.40%

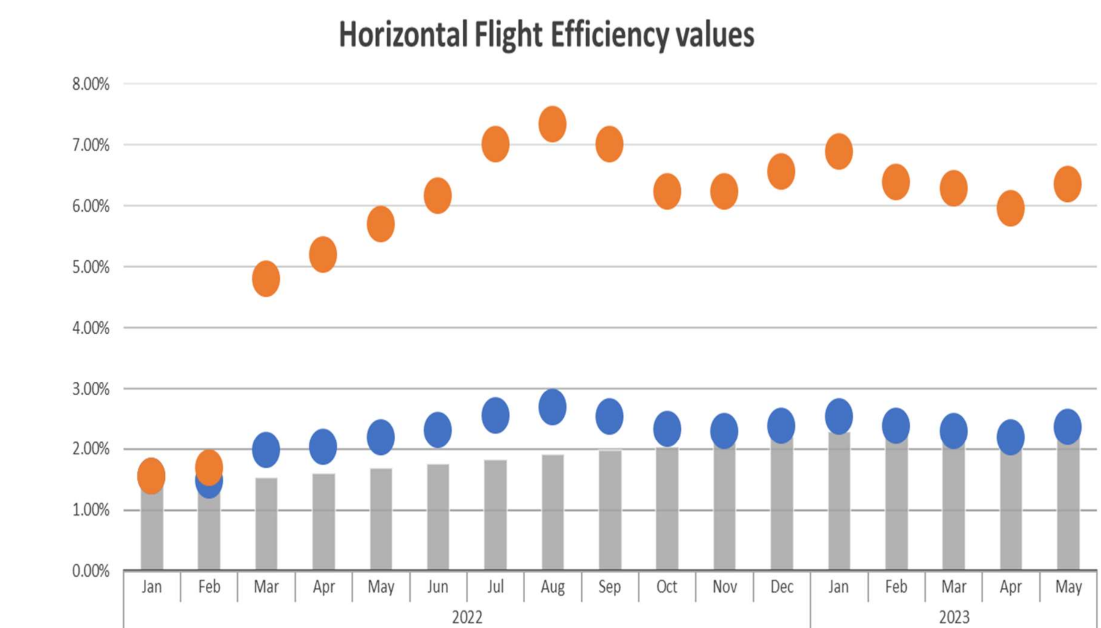


	Jan 2022	Feb 2022	Mar 2022	Apr 2022	May 2022	Jun 2022	Jul 2022	Aug 2022	Sep 2022	Oct 2022	Nov 2022	Dec 2022	Jan 2023	Feb 2023	Mar 2023	Apr 2023	May 2023
Corrected KEA	1.09%	1.09%	1.09%	1.11%	1.13%	1.14%	1.14%	1.14%	1.15%	1.14%	1.14%	1.13%	1.13%	1.16%	1.17%	1.20%	1.24%
HFE (corrected)	1.07%	1.06%	1.08%	1.22%	1.18%	1.26%	1.15%	1.19%	1.23%	1.10%	1.05%	0.93%	1.12%	1.75%	1.21%	1.58%	1.57%
HFE	1.07%	1.08%	1.19%	1.35%	1.29%	1.39%	1.26%	1.30%	1.34%	1.20%	1.16%	1.04%	1.23%	1.87%	1.32%	1.70%	1.68%

4.9 Estonia

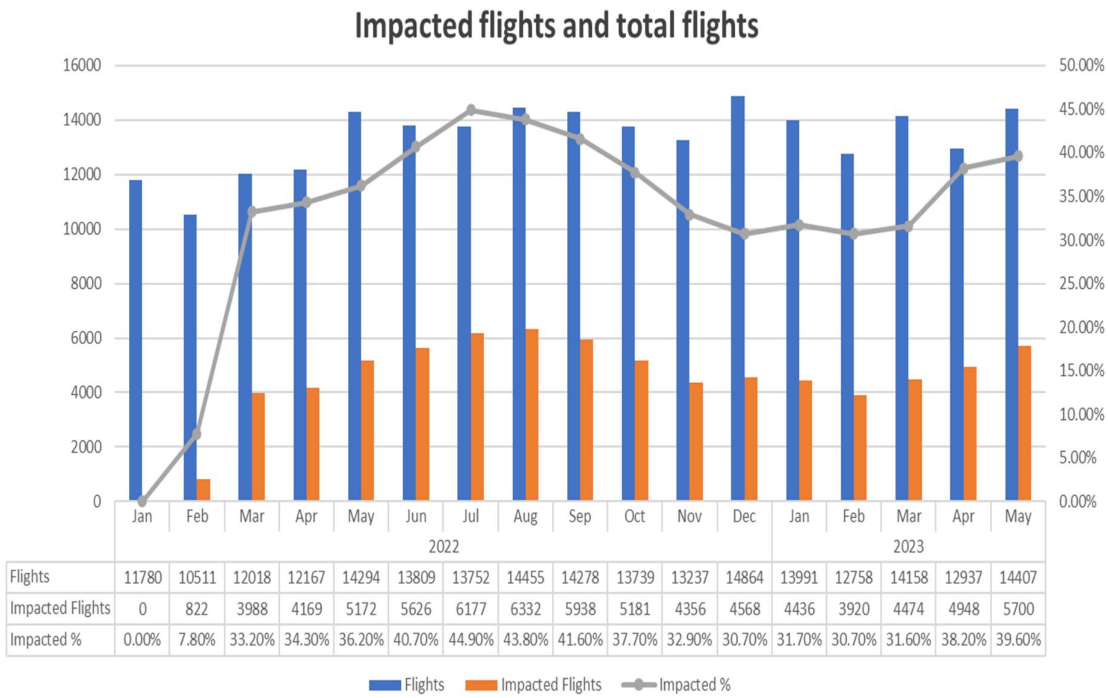


	2022												2023				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Flights	10842	8844	9366	9287	11600	12451	12556	12756	12360	11539	8892	8949	8712	7718	9065	10405	12881
Impacted Flights	0	1130	6521	6342	8281	9134	9337	9326	9069	8206	6151	6221	5853	5157	6238	7549	9392
Impacted %	0.00%	12.80%	69.60%	68.30%	71.40%	73.40%	74.40%	73.10%	73.40%	71.10%	69.20%	69.50%	67.20%	66.80%	68.80%	72.60%	72.90%

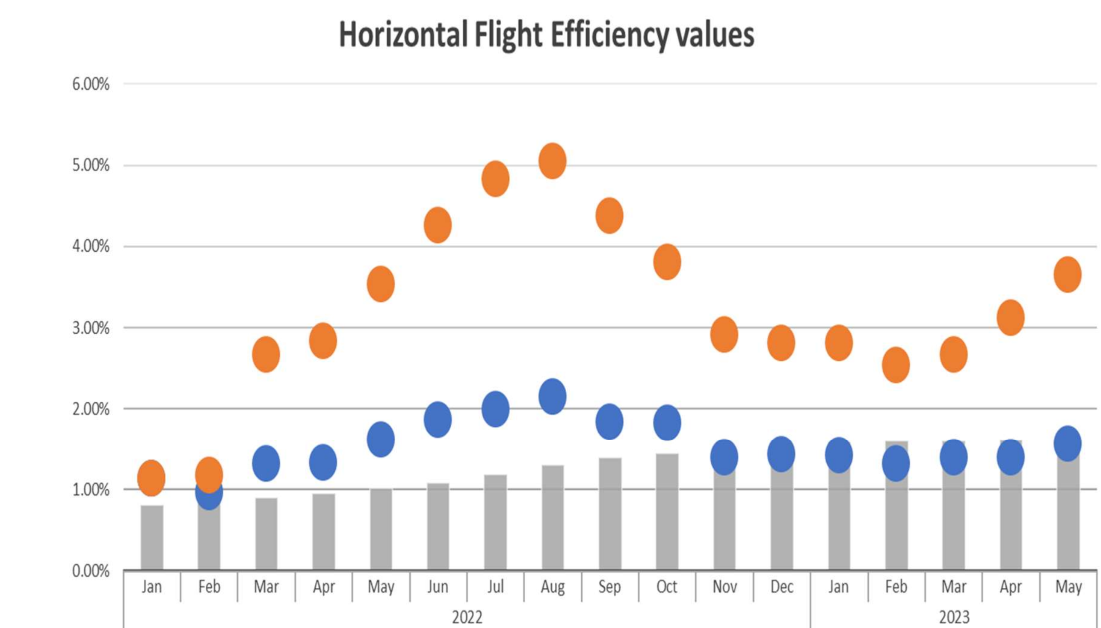


	2022												2023				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Corrected KEA	1.46%	1.48%	1.54%	1.60%	1.68%	1.75%	1.83%	1.91%	1.98%	2.03%	2.11%	2.20%	2.29%	2.36%	2.38%	2.39%	2.40%
HFE (corrected)	1.55%	1.48%	1.98%	2.04%	2.19%	2.31%	2.55%	2.69%	2.54%	2.33%	2.29%	2.38%	2.54%	2.38%	2.30%	2.18%	2.36%
HFE	1.55%	1.68%	4.79%	5.19%	5.69%	6.16%	7.01%	7.33%	7.00%	6.22%	6.23%	6.56%	6.89%	6.39%	6.28%	5.95%	6.34%

4.10 Finland

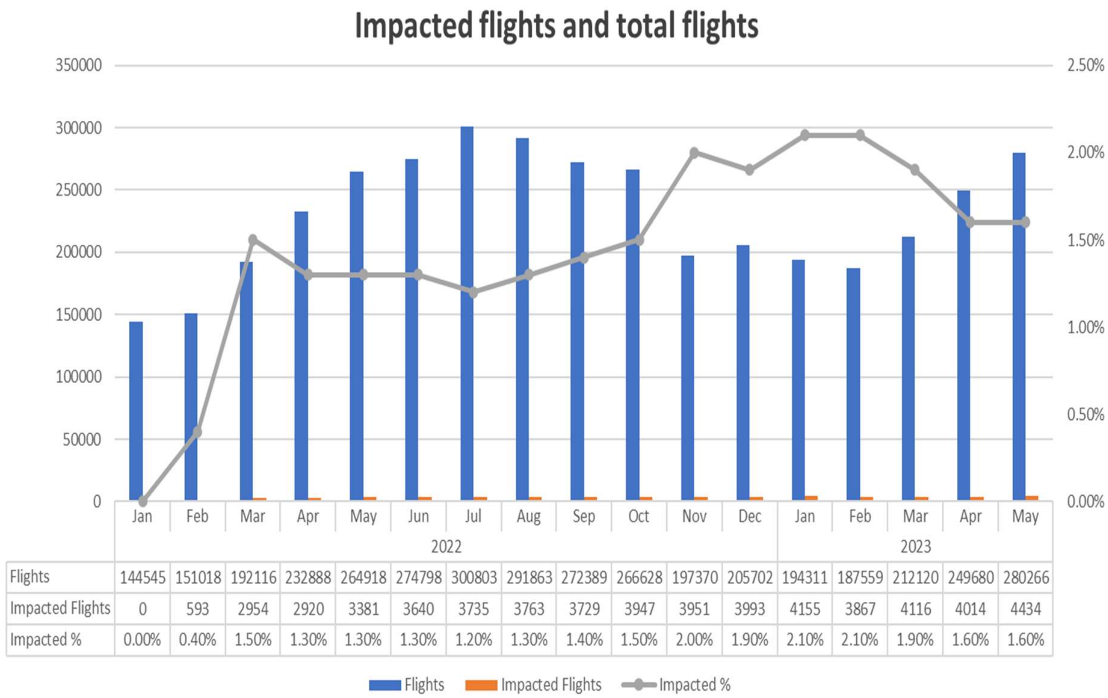


	Jan 2022	Feb 2022	Mar 2022	Apr 2022	May 2022	Jun 2022	Jul 2022	Aug 2022	Sep 2022	Oct 2022	Nov 2022	Dec 2022	Jan 2023	Feb 2023	Mar 2023	Apr 2023	May 2023
Flights	11780	10511	12018	12167	14294	13809	13752	14455	14278	13739	13237	14864	13991	12758	14158	12937	14407
Impacted Flights	0	822	3988	4169	5172	5626	6177	6332	5938	5181	4356	4568	4436	3920	4474	4948	5700
Impacted %	0.00%	7.80%	33.20%	34.30%	36.20%	40.70%	44.90%	43.80%	41.60%	37.70%	32.90%	30.70%	31.70%	30.70%	31.60%	38.20%	39.60%

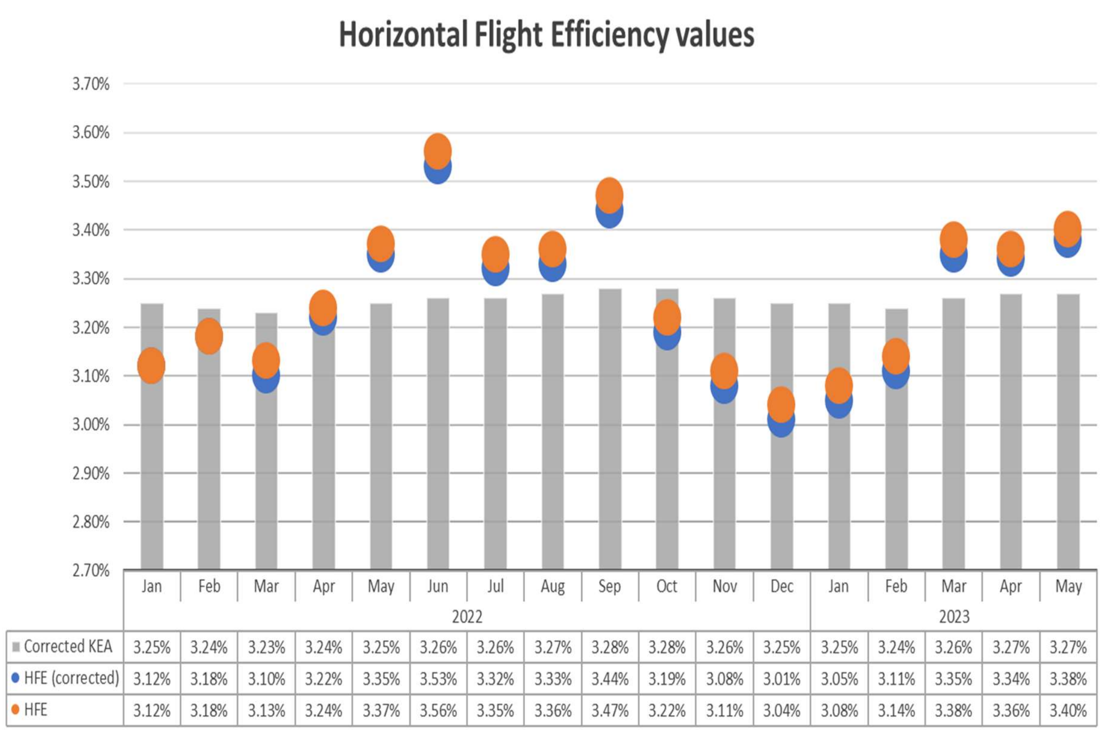


	Jan 2022	Feb 2022	Mar 2022	Apr 2022	May 2022	Jun 2022	Jul 2022	Aug 2022	Sep 2022	Oct 2022	Nov 2022	Dec 2022	Jan 2023	Feb 2023	Mar 2023	Apr 2023	May 2023
Corrected KEA	0.81%	0.84%	0.90%	0.96%	1.02%	1.09%	1.19%	1.30%	1.39%	1.45%	1.50%	1.55%	1.59%	1.60%	1.60%	1.61%	1.60%
HFE (corrected)	1.14%	0.97%	1.32%	1.33%	1.62%	1.86%	1.99%	2.14%	1.84%	1.82%	1.39%	1.43%	1.42%	1.32%	1.39%	1.40%	1.56%
HFE	1.14%	1.17%	2.67%	2.83%	3.53%	4.25%	4.82%	5.04%	4.37%	3.80%	2.91%	2.80%	2.81%	2.53%	2.66%	3.12%	3.65%

4.11 France

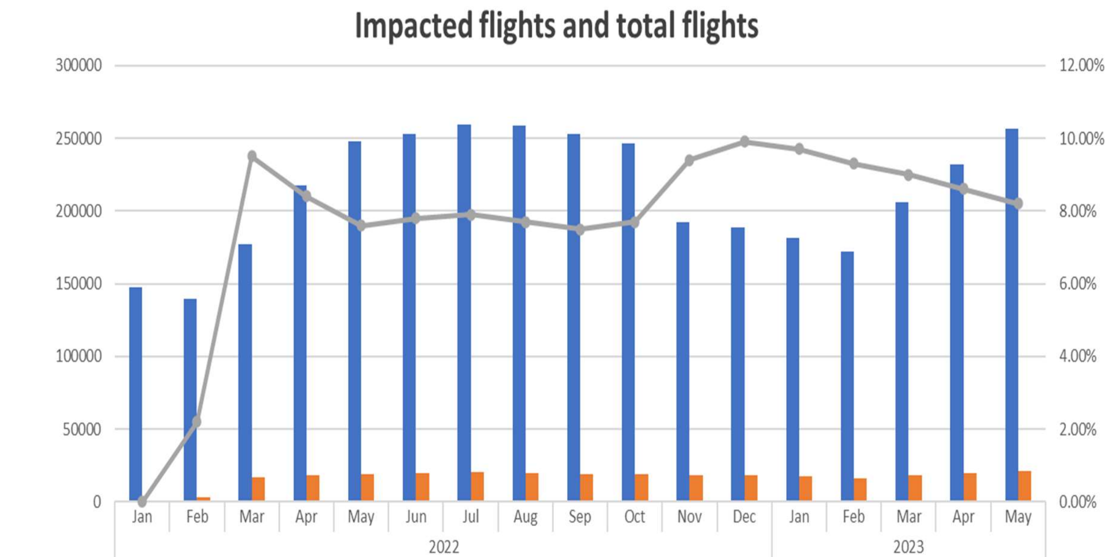


	2022												2023				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Flights	144545	151018	192116	232888	264918	274798	300803	291863	272389	266628	197370	205702	194311	187559	212120	249680	280266
Impacted Flights	0	593	2954	2920	3381	3640	3735	3763	3729	3947	3951	3993	4155	3867	4116	4014	4434
Impacted %	0.00%	0.40%	1.50%	1.30%	1.30%	1.30%	1.20%	1.30%	1.40%	1.50%	2.00%	1.90%	2.10%	2.10%	1.90%	1.60%	1.60%

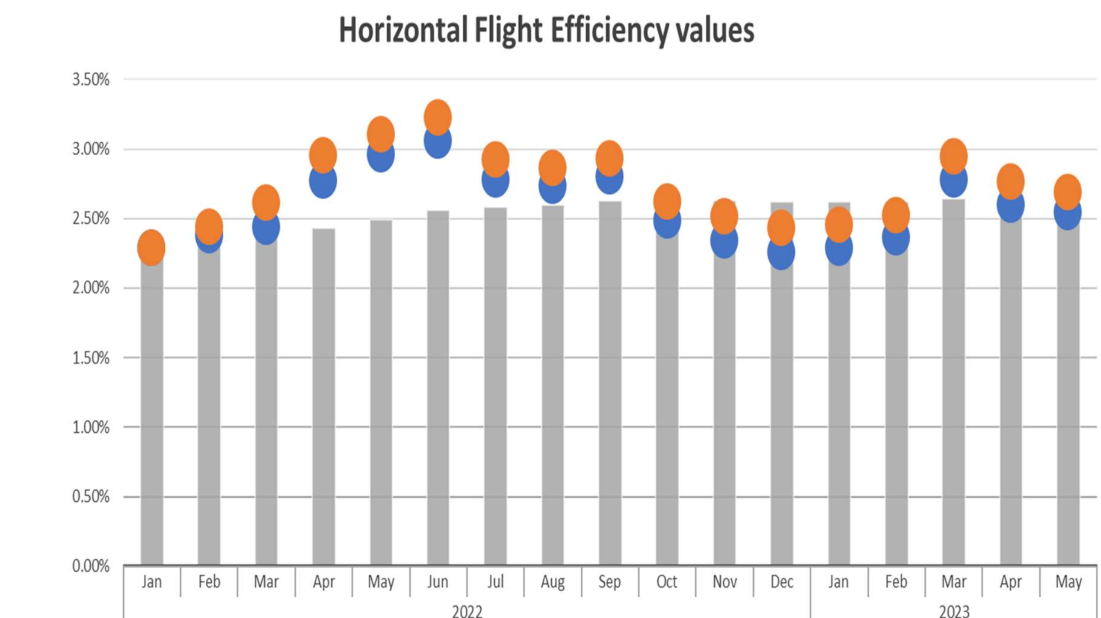


	2022												2023				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Corrected KEA	3.25%	3.24%	3.23%	3.24%	3.25%	3.26%	3.26%	3.27%	3.28%	3.28%	3.26%	3.25%	3.25%	3.24%	3.26%	3.27%	3.27%
HFE (corrected)	3.12%	3.18%	3.10%	3.22%	3.35%	3.53%	3.32%	3.33%	3.44%	3.19%	3.08%	3.01%	3.05%	3.11%	3.35%	3.34%	3.38%
HFE	3.12%	3.18%	3.13%	3.24%	3.37%	3.56%	3.35%	3.36%	3.47%	3.22%	3.11%	3.04%	3.08%	3.14%	3.38%	3.36%	3.40%

4.12 Germany



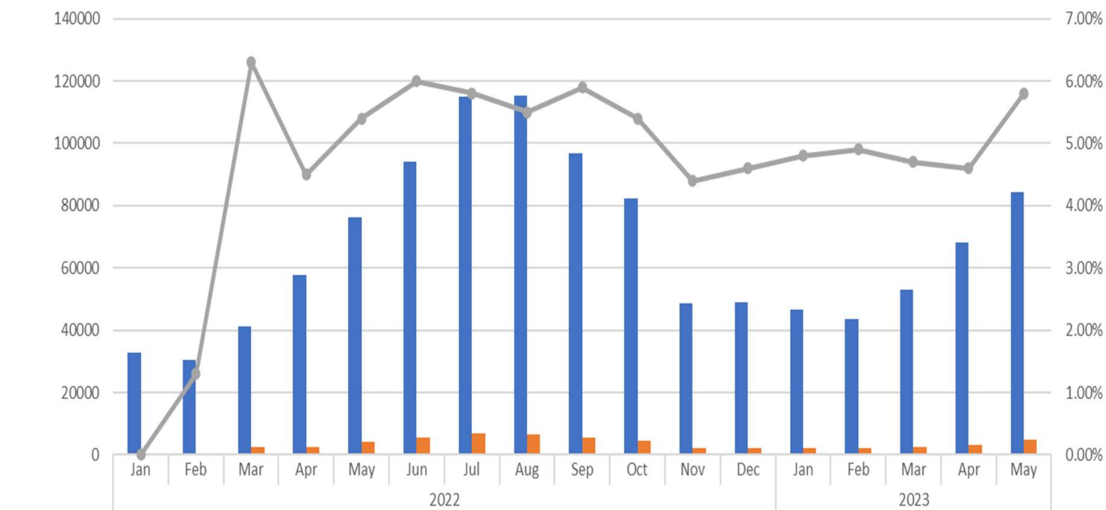
	2022												2023				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Flights	147628	139573	177008	217286	247582	252892	259525	258534	252838	246458	192437	188622	181659	171993	205623	232124	256421
Impacted Flights	0	3055	16742	18163	18888	19831	20497	19808	19081	19056	18112	18587	17649	15934	18520	19925	21006
Impacted %	0.00%	2.20%	9.50%	8.40%	7.60%	7.80%	7.90%	7.70%	7.50%	7.70%	9.40%	9.90%	9.70%	9.30%	9.00%	8.60%	8.20%



	2022												2023				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Corrected KEA	2.32%	2.34%	2.37%	2.43%	2.49%	2.56%	2.58%	2.60%	2.63%	2.64%	2.63%	2.62%	2.62%	2.62%	2.64%	2.63%	2.59%
HFE (corrected)	2.29%	2.38%	2.44%	2.77%	2.96%	3.06%	2.78%	2.73%	2.80%	2.48%	2.34%	2.26%	2.29%	2.36%	2.78%	2.60%	2.54%
HFE	2.29%	2.44%	2.61%	2.95%	3.10%	3.22%	2.92%	2.86%	2.93%	2.62%	2.51%	2.43%	2.45%	2.52%	2.94%	2.76%	2.69%

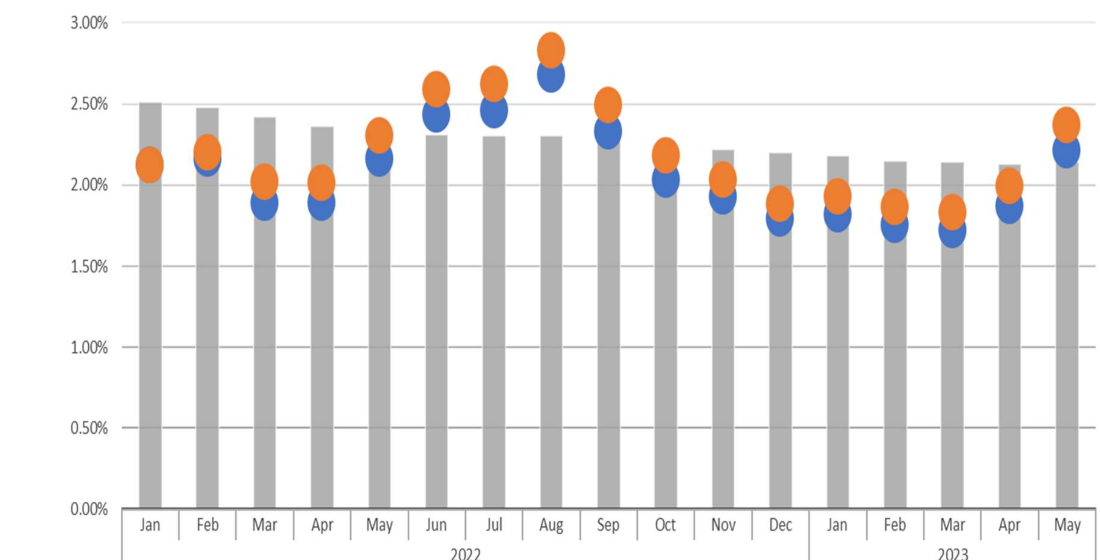
4.13 Greece

Impacted flights and total flights



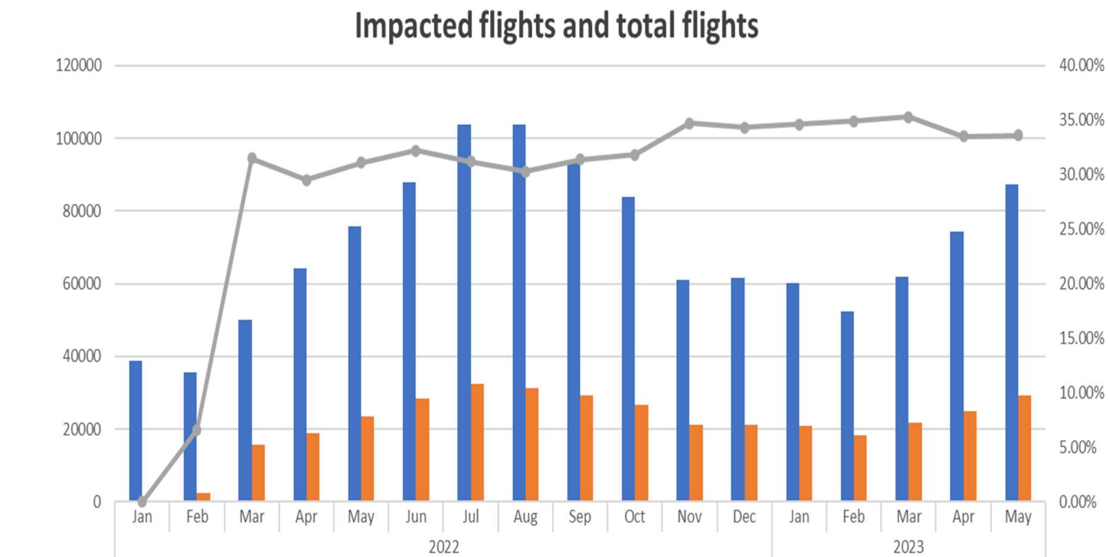
	2022												2023				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Flights	32848	30421	41298	57869	76089	94154	114989	115379	96741	82300	48611	48959	46566	43526	52972	68129	84481
Impacted Flights	0	398	2619	2580	4131	5658	6715	6382	5670	4467	2120	2269	2250	2139	2516	3156	4864
Impacted %	0.00%	1.30%	6.30%	4.50%	5.40%	6.00%	5.80%	5.50%	5.90%	5.40%	4.40%	4.60%	4.80%	4.90%	4.70%	4.60%	5.80%

Horizontal Flight Efficiency values

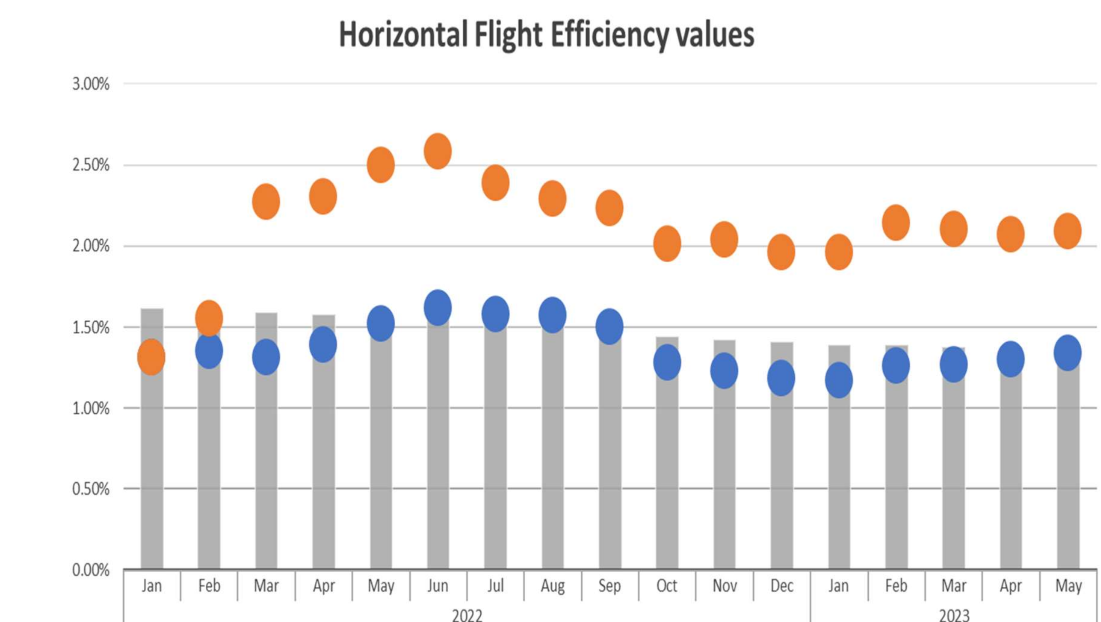


	2022												2023				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Corrected KEA	2.51%	2.48%	2.42%	2.36%	2.33%	2.31%	2.30%	2.30%	2.28%	2.24%	2.22%	2.20%	2.18%	2.15%	2.14%	2.13%	2.14%
HFE (corrected)	2.12%	2.16%	1.89%	1.89%	2.16%	2.43%	2.46%	2.68%	2.33%	2.03%	1.93%	1.79%	1.82%	1.75%	1.72%	1.87%	2.21%
HFE	2.12%	2.20%	2.02%	2.01%	2.30%	2.59%	2.62%	2.83%	2.49%	2.18%	2.03%	1.88%	1.93%	1.86%	1.83%	1.99%	2.37%

4.14 Hungary

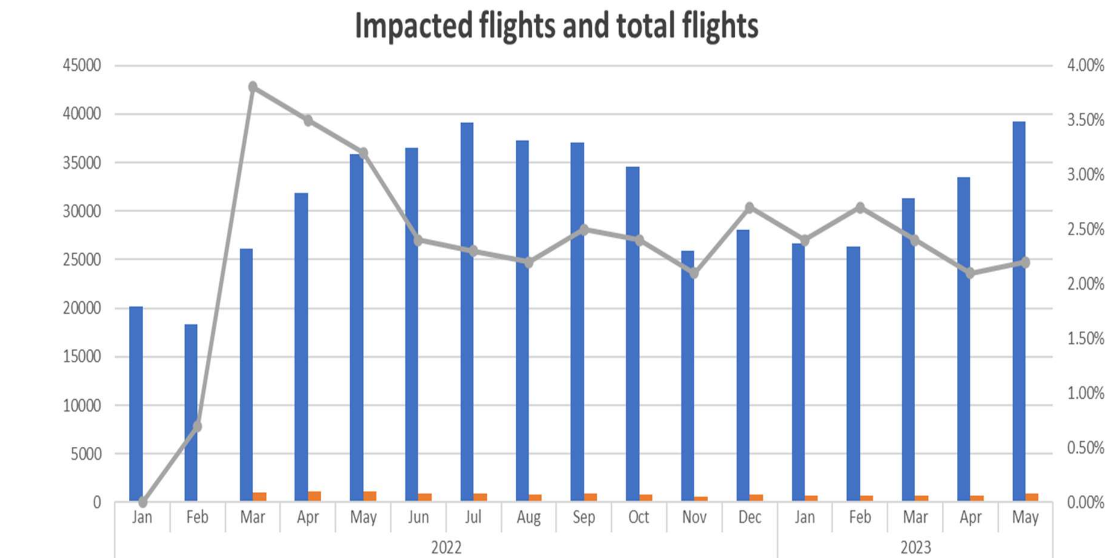


	2022												2023				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Flights	38865	35628	50182	64278	75634	87986	103840	103720	93352	83894	61083	61496	60152	52454	61781	74211	87279
Impacted Flights	0	2359	15805	18981	23502	28332	32448	31405	29353	26664	21193	21102	20832	18284	21838	24870	29296
Impacted %	0.00%	6.60%	31.50%	29.50%	31.10%	32.20%	31.20%	30.30%	31.40%	31.80%	34.70%	34.30%	34.60%	34.90%	35.30%	33.50%	33.60%

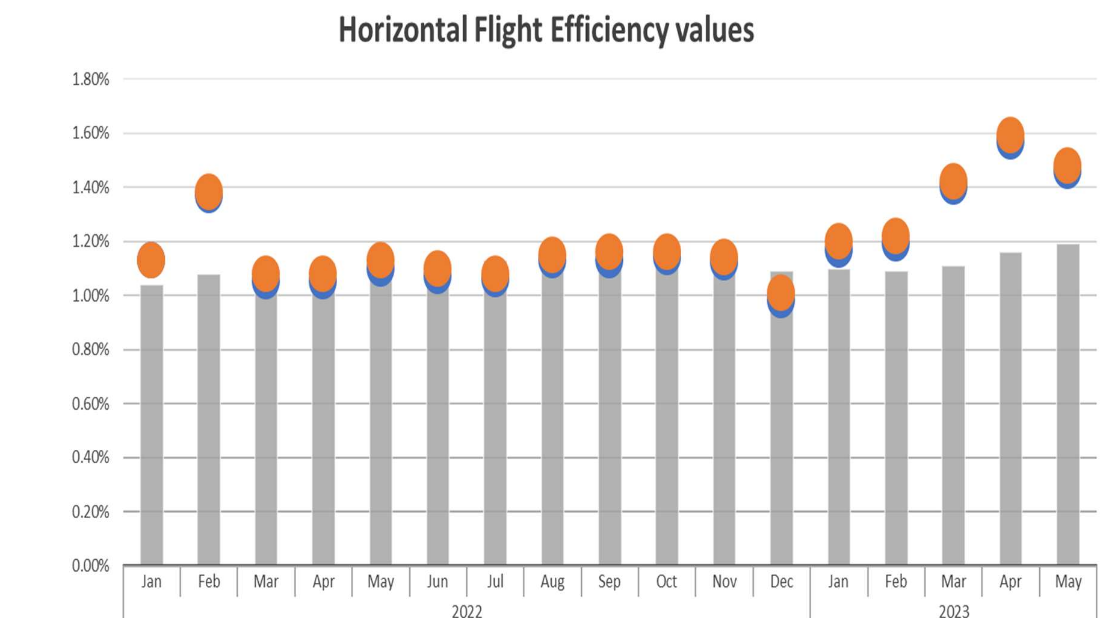


	2022												2023				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Corrected KEA	1.62%	1.61%	1.59%	1.58%	1.58%	1.58%	1.56%	1.51%	1.47%	1.44%	1.42%	1.41%	1.39%	1.39%	1.38%	1.38%	1.36%
HFE (corrected)	1.31%	1.35%	1.31%	1.39%	1.52%	1.62%	1.58%	1.57%	1.50%	1.28%	1.23%	1.18%	1.17%	1.26%	1.27%	1.30%	1.34%
HFE	1.31%	1.55%	2.27%	2.30%	2.50%	2.58%	2.39%	2.29%	2.23%	2.01%	2.04%	1.96%	1.96%	2.14%	2.10%	2.07%	2.09%

4.15 Ireland

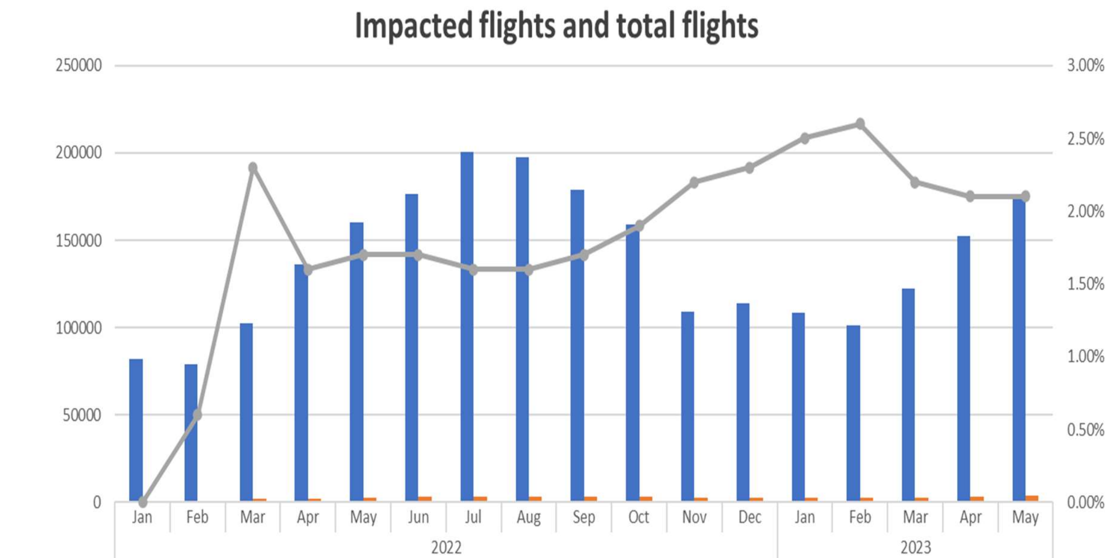


	2022												2023				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Flights	20177	18294	26155	31915	35915	36473	39146	37296	37025	34629	25919	28042	26625	26296	31282	33542	39238
Impacted Flights	0	129	983	1131	1153	883	905	821	920	835	539	766	643	711	737	690	868
Impacted %	0.00%	0.70%	3.80%	3.50%	3.20%	2.40%	2.30%	2.20%	2.50%	2.40%	2.10%	2.70%	2.40%	2.70%	2.40%	2.10%	2.20%



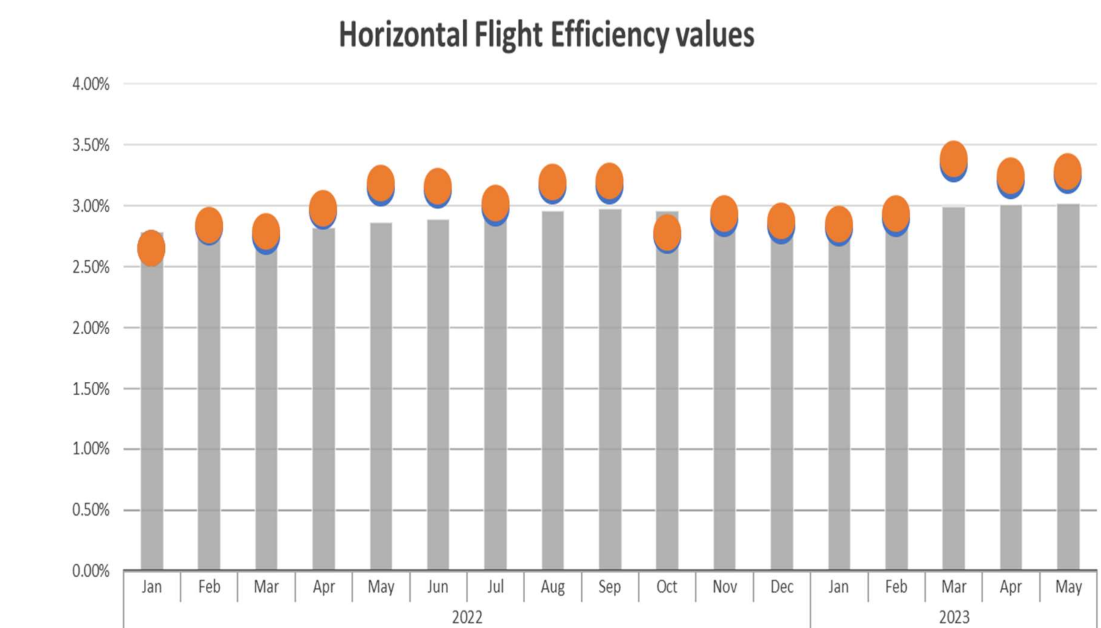
	2022												2023				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Corrected KEA	1.04%	1.08%	1.11%	1.12%	1.14%	1.14%	1.13%	1.12%	1.11%	1.11%	1.11%	1.09%	1.10%	1.09%	1.11%	1.16%	1.19%
HFE (corrected)	1.13%	1.37%	1.05%	1.05%	1.10%	1.07%	1.06%	1.13%	1.13%	1.14%	1.12%	0.98%	1.17%	1.19%	1.40%	1.57%	1.46%
HFE	1.13%	1.38%	1.08%	1.08%	1.13%	1.10%	1.08%	1.15%	1.16%	1.16%	1.14%	1.01%	1.20%	1.22%	1.42%	1.59%	1.48%

4.16 Italy



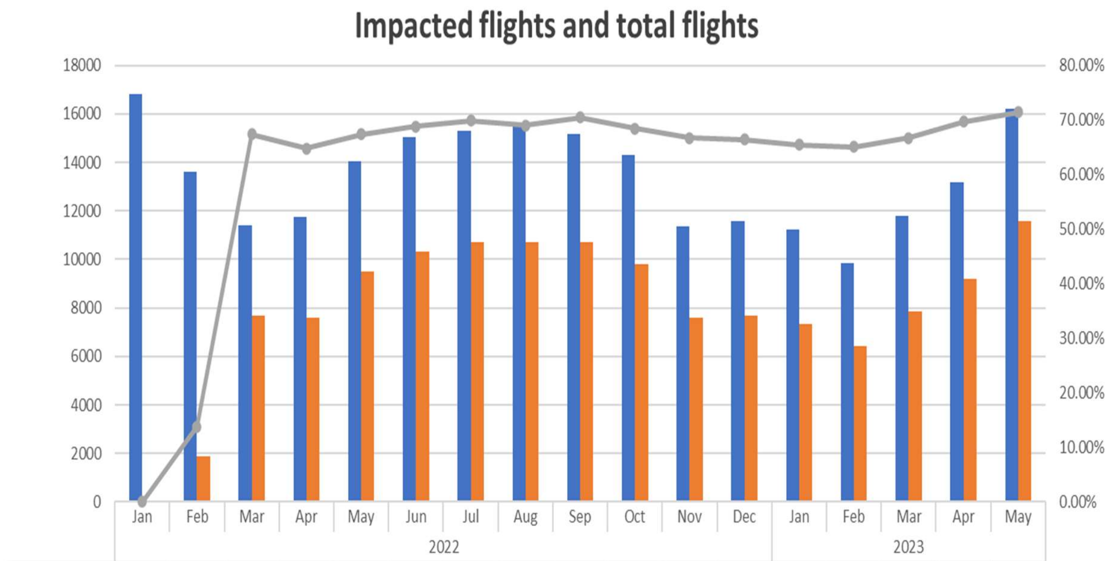
	2022												2023				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Flights	82114	78860	102403	135917	160145	176462	200799	197685	178598	159211	109396	114018	108349	101315	122297	152596	173891
Impacted Flights	0	469	2348	2184	2760	3006	3157	3193	3093	3069	2444	2597	2668	2585	2739	3170	3726
Impacted %	0.00%	0.60%	2.30%	1.60%	1.70%	1.70%	1.60%	1.60%	1.70%	1.90%	2.20%	2.30%	2.50%	2.60%	2.20%	2.10%	2.10%

Flights Impacted Flights Impacted %

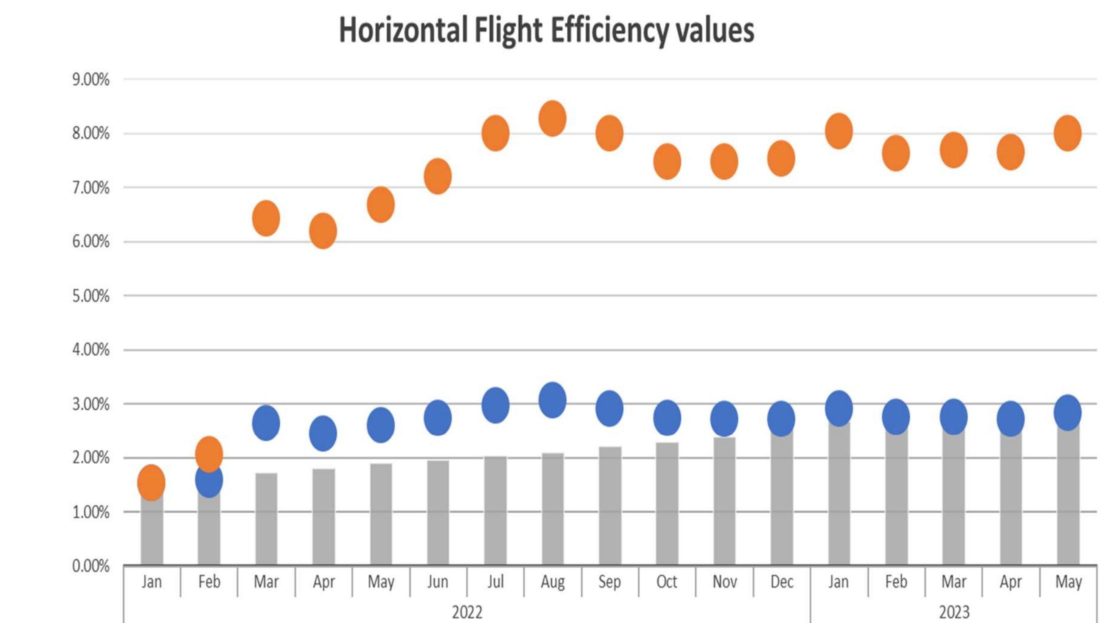


	2022												2023				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Corrected KEA	2.79%	2.80%	2.79%	2.82%	2.86%	2.89%	2.91%	2.96%	2.98%	2.96%	2.95%	2.94%	2.95%	2.95%	2.99%	3.01%	3.02%
HFE (corrected)	2.65%	2.82%	2.74%	2.95%	3.14%	3.12%	2.98%	3.16%	3.16%	2.75%	2.89%	2.83%	2.81%	2.89%	3.34%	3.20%	3.24%
HFE	2.65%	2.84%	2.79%	2.98%	3.18%	3.16%	3.02%	3.19%	3.20%	2.78%	2.93%	2.87%	2.85%	2.93%	3.38%	3.24%	3.28%

4.17 Latvia

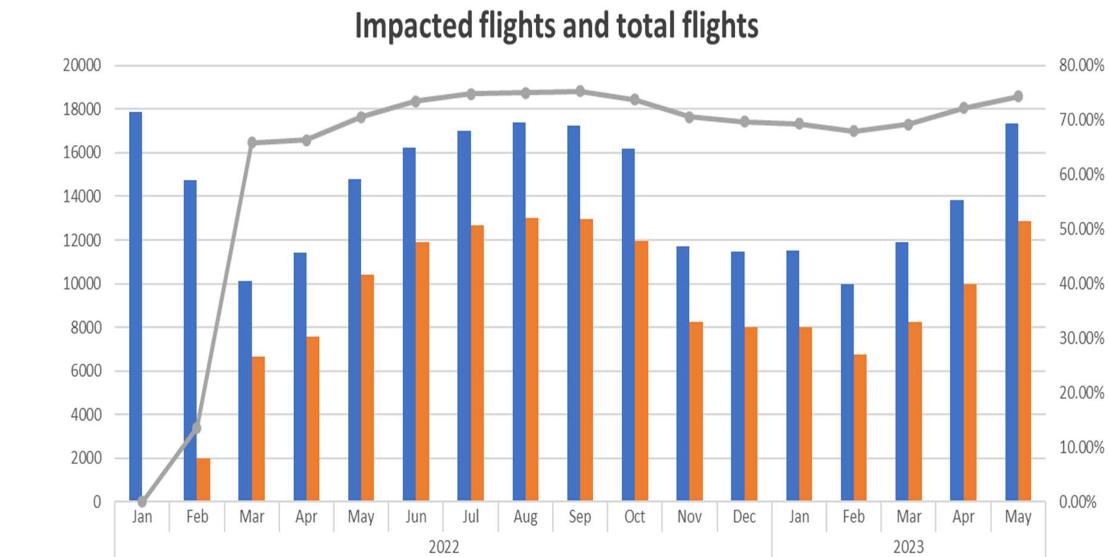


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
	2022												2023				
Flights	16823	13604	11389	11751	14065	15033	15302	15498	15170	14300	11361	11572	11230	9865	11793	13201	16231
Impacted Flights	0	1877	7671	7615	9481	10341	10701	10701	10694	9786	7574	7680	7352	6427	7865	9202	11587
Impacted %	0.00%	13.80%	67.40%	64.80%	67.40%	68.80%	69.90%	69.00%	70.50%	68.40%	66.70%	66.40%	65.50%	65.10%	66.70%	69.70%	71.40%

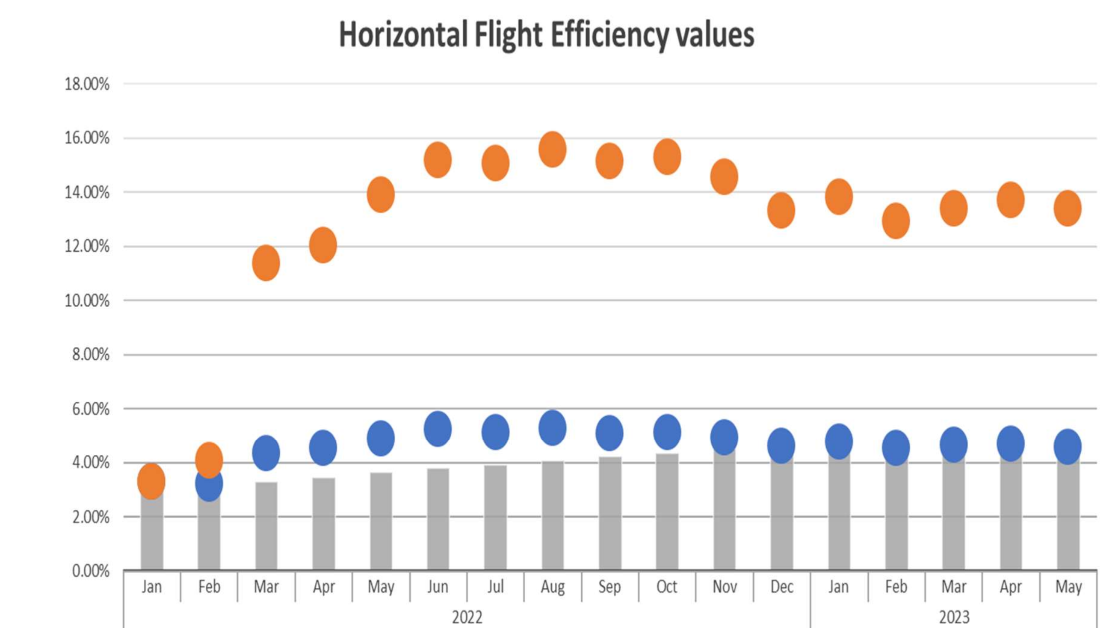


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
	2022												2023				
Corrected KEA	1.63%	1.64%	1.72%	1.80%	1.89%	1.95%	2.03%	2.10%	2.20%	2.29%	2.39%	2.53%	2.68%	2.77%	2.78%	2.80%	2.82%
HFE (corrected)	1.53%	1.58%	2.64%	2.45%	2.59%	2.73%	2.97%	3.07%	2.91%	2.74%	2.71%	2.72%	2.90%	2.76%	2.76%	2.72%	2.84%
HFE	1.53%	2.05%	6.42%	6.20%	6.68%	7.21%	8.00%	8.26%	8.00%	7.48%	7.47%	7.54%	8.03%	7.63%	7.69%	7.65%	8.00%

4.18 Lithuania

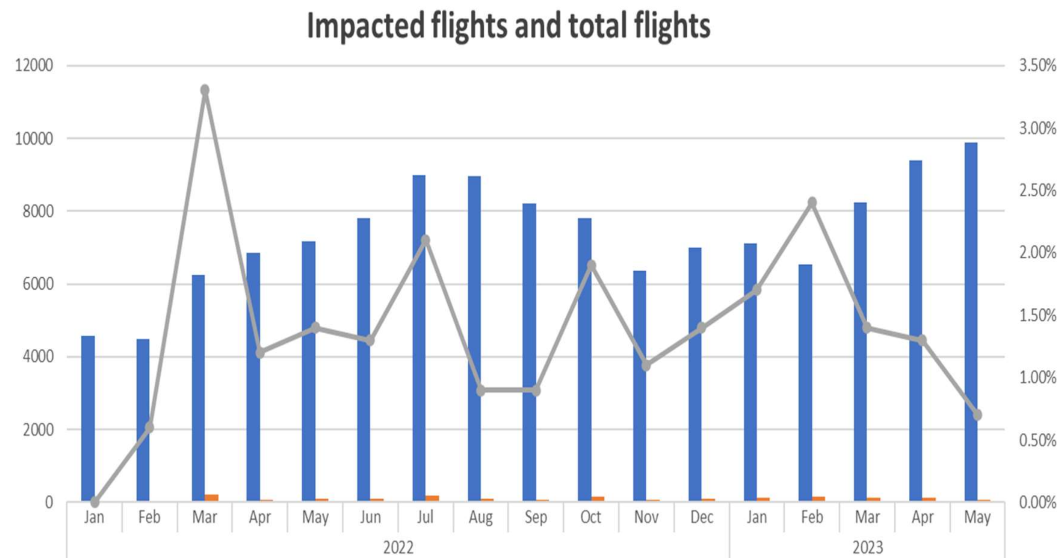


	2022												2023				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Flights	17882	14736	10116	11441	14770	16229	16979	17366	17239	16205	11718	11484	11542	9969	11913	13819	17337
Impacted Flights	0	1999	6659	7585	10431	11910	12693	13027	12978	11939	8270	8000	7999	6778	8247	9982	12881
Impacted %	0.00%	13.60%	65.80%	66.30%	70.60%	73.40%	74.80%	75.00%	75.30%	73.70%	70.60%	69.70%	69.30%	68.00%	69.20%	72.20%	74.30%



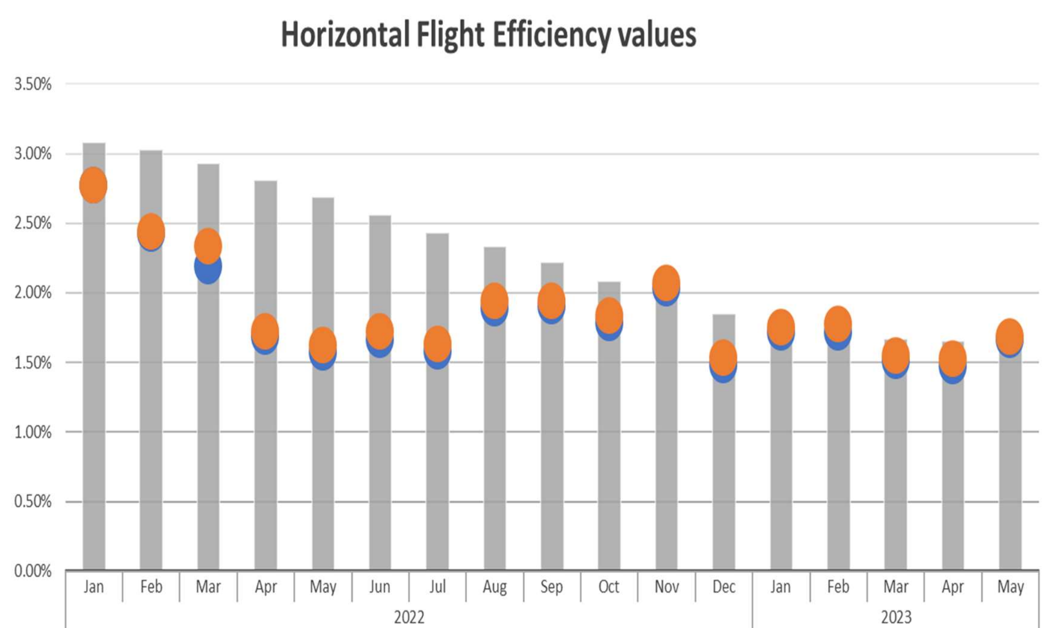
	2022												2023				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Corrected KEA	3.11%	3.17%	3.31%	3.46%	3.65%	3.78%	3.90%	4.06%	4.21%	4.34%	4.49%	4.65%	4.82%	4.92%	4.94%	4.94%	4.91%
HFE (corrected)	3.30%	3.21%	4.34%	4.52%	4.90%	5.22%	5.13%	5.27%	5.07%	5.13%	4.93%	4.62%	4.78%	4.54%	4.66%	4.68%	4.58%
HFE	3.30%	4.07%	11.39%	12.04%	13.89%	15.19%	15.08%	15.55%	15.12%	15.28%	14.57%	13.33%	13.83%	12.94%	13.38%	13.72%	13.38%

4.19 Malta



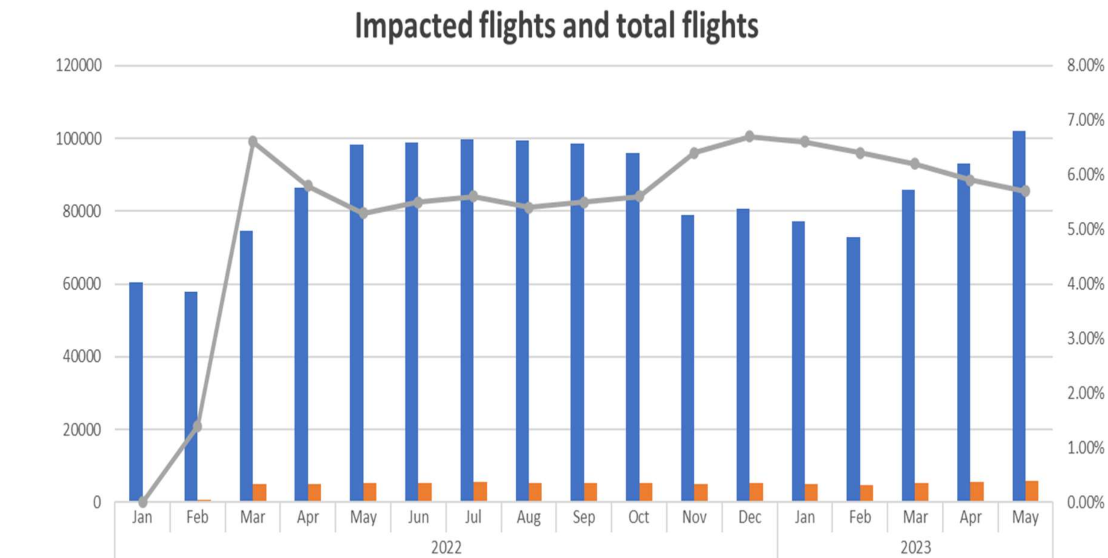
	2022 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2023 Jan	Feb	Mar	Apr	May
Flights	4580	4497	6254	6852	7157	7813	8987	8972	8214	7799	6368	6984	7127	6549	8244	9407	9878
Impacted Flights	0	26	208	79	103	101	192	85	73	151	69	97	121	154	115	125	67
Impacted %	0.00%	0.60%	3.30%	1.20%	1.40%	1.30%	2.10%	0.90%	0.90%	1.90%	1.10%	1.40%	1.70%	2.40%	1.40%	1.30%	0.70%

Flights   Impacted Flights   Impacted %

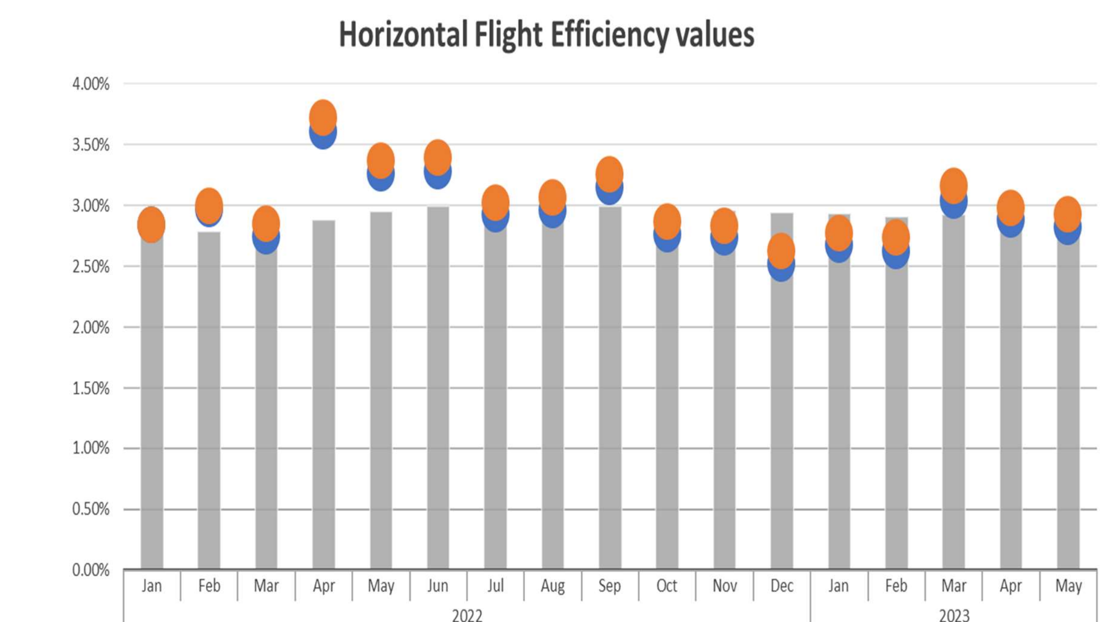


	2022 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2023 Jan	Feb	Mar	Apr	May
Corrected KEA	3.08%	3.03%	2.93%	2.81%	2.69%	2.56%	2.43%	2.33%	2.22%	2.08%	1.98%	1.85%	1.78%	1.73%	1.67%	1.65%	1.65%
HFE (corrected)	2.77%	2.42%	2.19%	1.68%	1.57%	1.66%	1.58%	1.89%	1.90%	1.78%	2.03%	1.48%	1.71%	1.71%	1.51%	1.47%	1.66%
HFE	2.77%	2.44%	2.33%	1.72%	1.62%	1.72%	1.63%	1.94%	1.94%	1.83%	2.07%	1.53%	1.75%	1.77%	1.55%	1.52%	1.68%

4.20 Netherlands

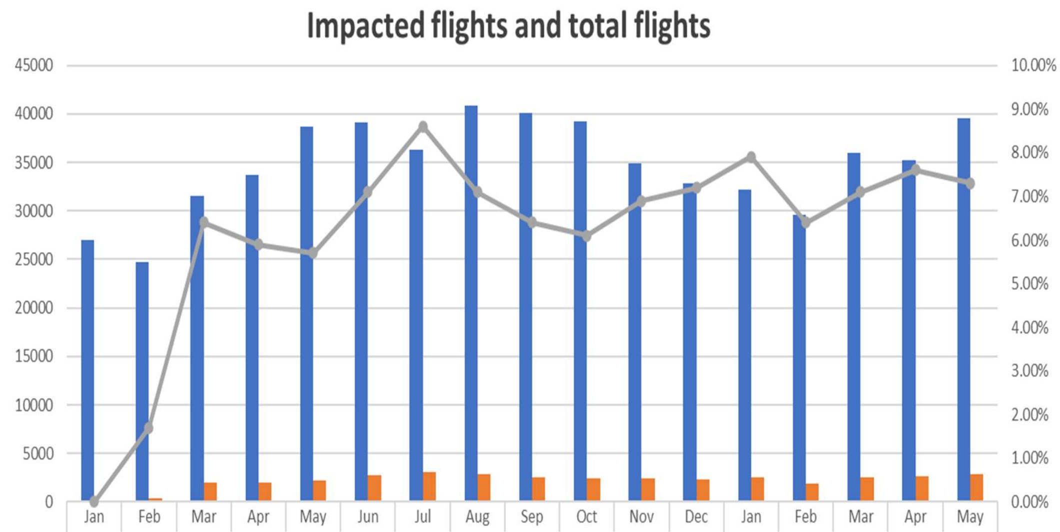


	2022 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2023 Jan	Feb	Mar	Apr	May
Flights	60402	57934	74537	86497	98196	98825	99651	99551	98437	95915	79061	80660	77083	72779	85880	92942	102051
Impacted Flights	0	839	4945	5029	5244	5404	5621	5359	5391	5371	5062	5431	5082	4638	5333	5494	5846
Impacted %	0.00%	1.40%	6.60%	5.80%	5.30%	5.50%	5.60%	5.40%	5.50%	5.60%	6.40%	6.70%	6.60%	6.40%	6.20%	5.90%	5.70%

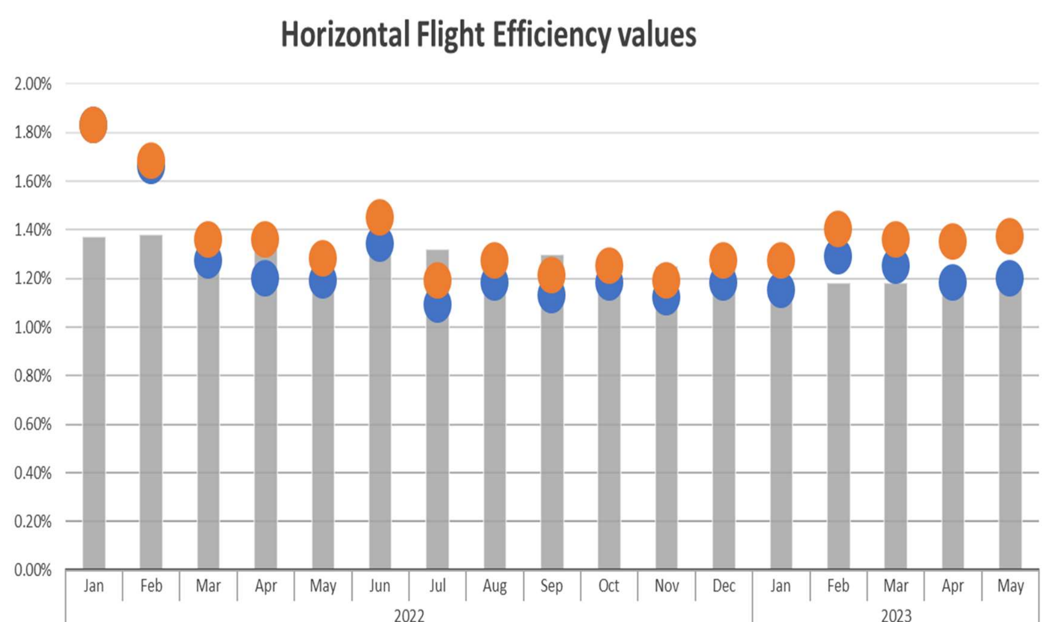


	2022 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2023 Jan	Feb	Mar	Apr	May
Corrected KEA	2.76%	2.79%	2.81%	2.88%	2.95%	2.99%	2.98%	2.97%	2.99%	2.96%	2.96%	2.94%	2.93%	2.91%	2.92%	2.89%	2.85%
HFE (corrected)	2.84%	2.97%	2.74%	3.61%	3.26%	3.28%	2.92%	2.96%	3.15%	2.76%	2.73%	2.52%	2.67%	2.62%	3.04%	2.88%	2.82%
HFE	2.84%	2.99%	2.85%	3.72%	3.36%	3.39%	3.02%	3.06%	3.25%	2.86%	2.83%	2.62%	2.77%	2.73%	3.16%	2.98%	2.92%

4.21 Norway



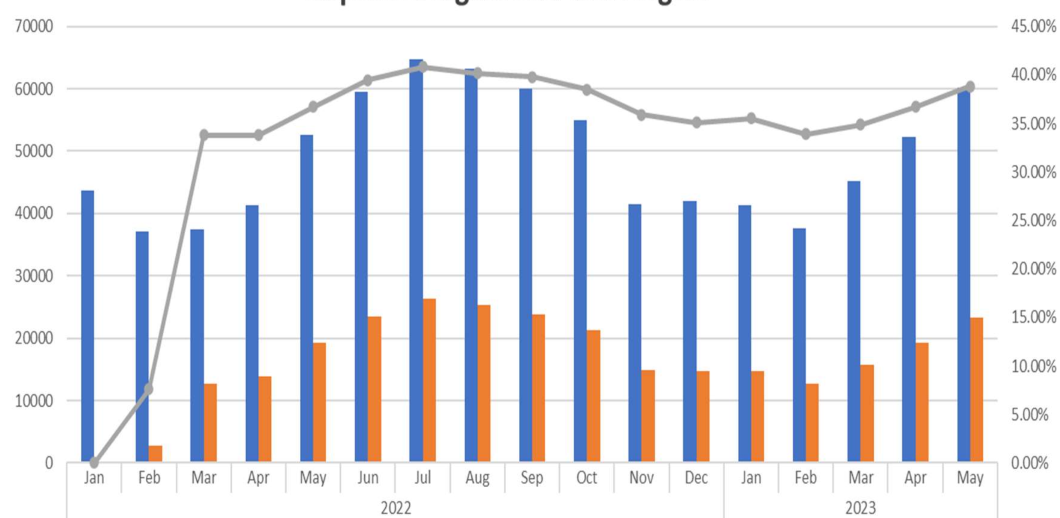
	2022 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2023 Jan	Feb	Mar	Apr	May
Flights	27038	24774	31523	33722	38724	39167	36303	40850	40148	39276	34929	32871	32247	29610	35935	35192	39519
Impacted Flights	0	418	2009	1999	2212	2779	3109	2912	2565	2396	2405	2363	2537	1892	2545	2674	2869
Impacted %	0.00%	1.70%	6.40%	5.90%	5.70%	7.10%	8.60%	7.10%	6.40%	6.10%	6.90%	7.20%	7.90%	6.40%	7.10%	7.60%	7.30%



	2022 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2023 Jan	Feb	Mar	Apr	May
Corrected KEA	1.37%	1.38%	1.34%	1.32%	1.32%	1.33%	1.32%	1.32%	1.30%	1.28%	1.25%	1.24%	1.19%	1.18%	1.18%	1.18%	1.18%
HFE (corrected)	1.83%	1.66%	1.27%	1.20%	1.19%	1.34%	1.09%	1.18%	1.13%	1.18%	1.12%	1.18%	1.15%	1.29%	1.25%	1.18%	1.20%
HFE	1.83%	1.68%	1.36%	1.36%	1.28%	1.45%	1.19%	1.27%	1.21%	1.25%	1.19%	1.27%	1.27%	1.40%	1.36%	1.35%	1.37%

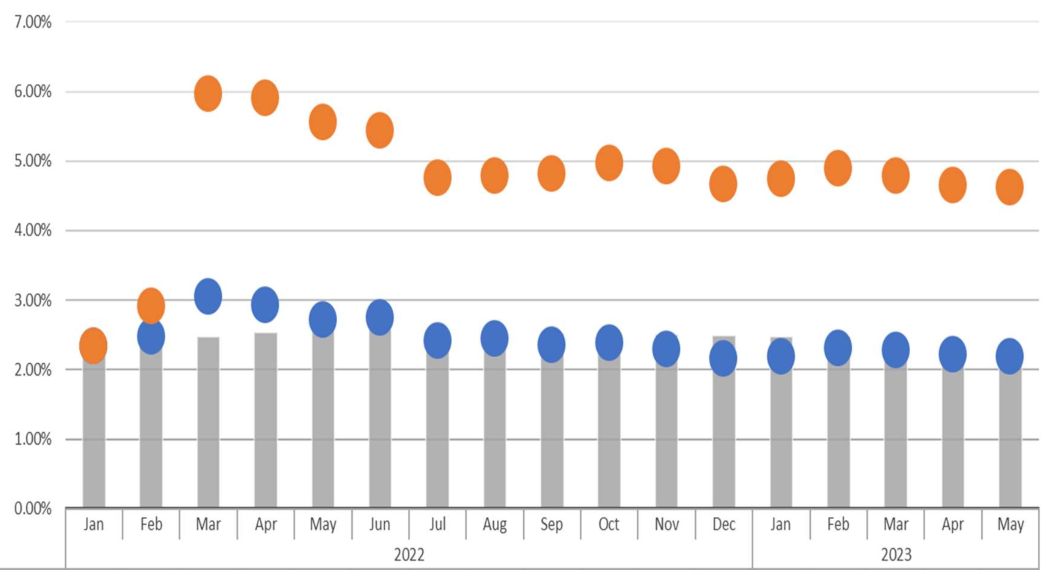
4.22 Poland

Impacted flights and total flights



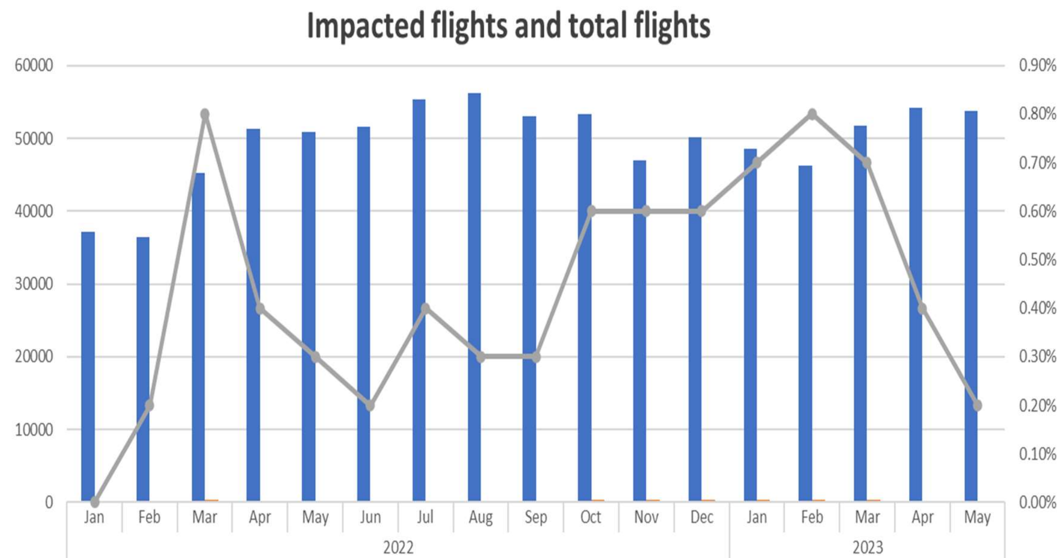
	Jan 2022	Feb 2022	Mar 2022	Apr 2022	May 2022	Jun 2022	Jul 2022	Aug 2022	Sep 2022	Oct 2022	Nov 2022	Dec 2022	Jan 2023	Feb 2023	Mar 2023	Apr 2023	May 2023
Flights	43637	37068	37439	41298	52619	59509	64701	63235	59938	55035	41521	42075	41407	37605	45277	52247	60160
Impacted Flights	0	2823	12657	13950	19285	23525	26398	25402	23863	21214	14917	14779	14687	12754	15787	19194	23358
Impacted %	0.00%	7.60%	33.80%	33.80%	36.70%	39.50%	40.80%	40.20%	39.80%	38.50%	35.90%	35.10%	35.50%	33.90%	34.90%	36.70%	38.80%

Horizontal Flight Efficiency values

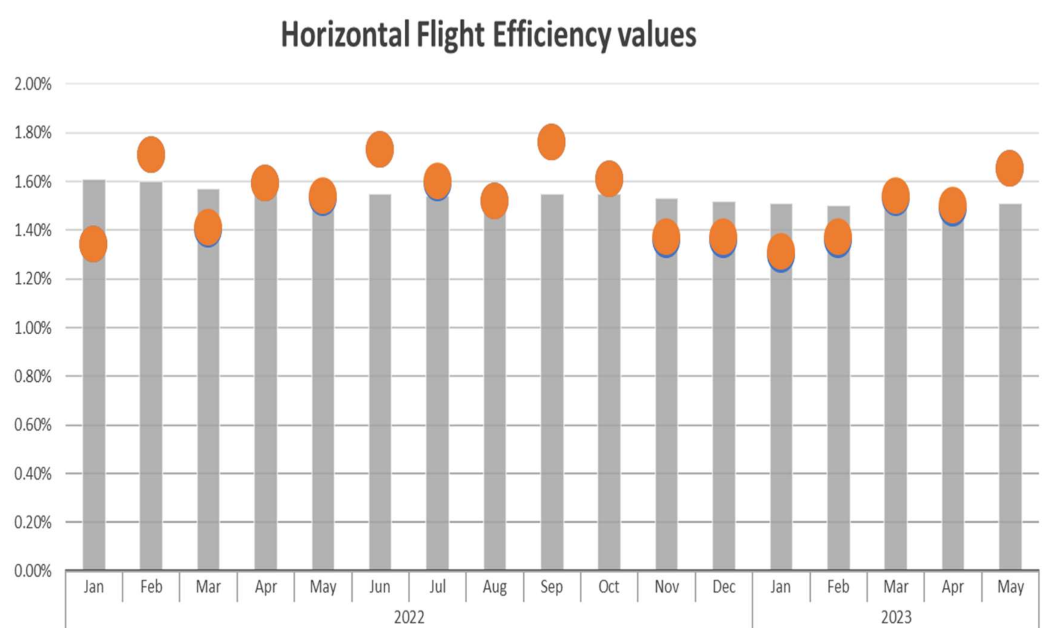


	Jan 2022	Feb 2022	Mar 2022	Apr 2022	May 2022	Jun 2022	Jul 2022	Aug 2022	Sep 2022	Oct 2022	Nov 2022	Dec 2022	Jan 2023	Feb 2023	Mar 2023	Apr 2023	May 2023
Corrected KEA	2.37%	2.41%	2.48%	2.53%	2.57%	2.58%	2.55%	2.53%	2.52%	2.51%	2.51%	2.49%	2.48%	2.47%	2.42%	2.37%	2.32%
HFE (corrected)	2.34%	2.48%	3.05%	2.93%	2.71%	2.75%	2.41%	2.45%	2.35%	2.39%	2.29%	2.16%	2.19%	2.31%	2.27%	2.22%	2.19%
HFE	2.34%	2.91%	5.96%	5.90%	5.56%	5.44%	4.76%	4.79%	4.81%	4.97%	4.92%	4.67%	4.74%	4.89%	4.78%	4.65%	4.62%

4.23 Portugal

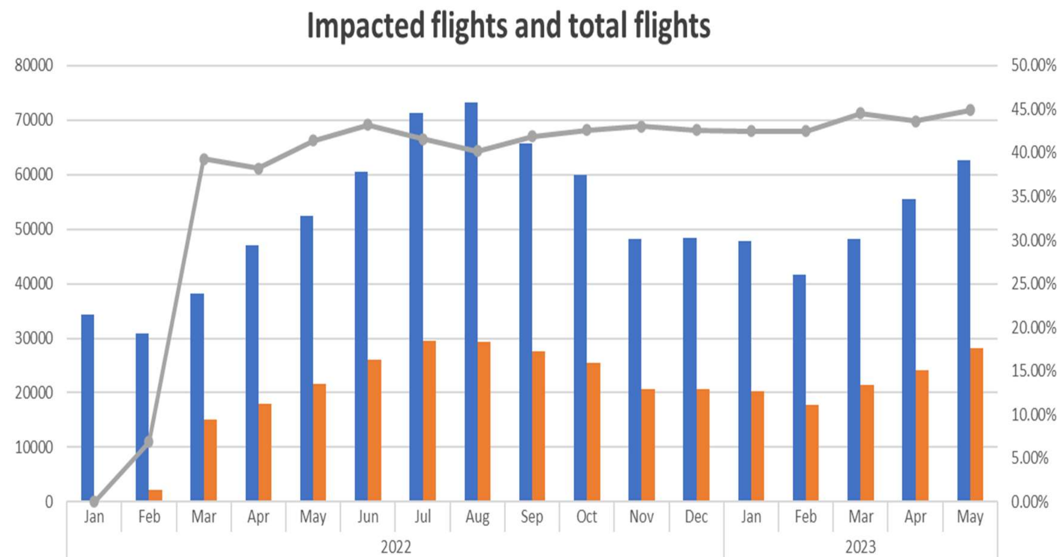


	2022												2023				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Flights	37113	36416	45185	51284	50895	51533	55266	56161	53005	53278	47010	50187	48492	46222	51703	54156	53743
Impacted Flights	0	67	345	196	134	127	233	155	141	305	286	294	361	382	345	232	132
Impacted %	0.00%	0.20%	0.80%	0.40%	0.30%	0.20%	0.40%	0.30%	0.30%	0.60%	0.60%	0.60%	0.70%	0.80%	0.70%	0.40%	0.20%

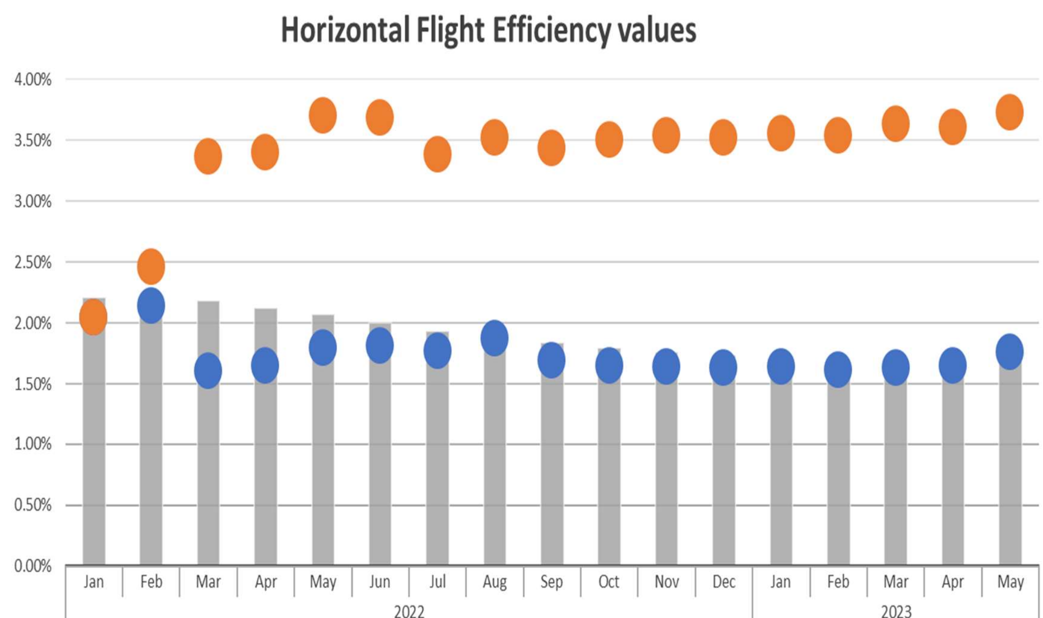


	2022												2023				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Corrected KEA	1.61%	1.60%	1.57%	1.56%	1.54%	1.55%	1.54%	1.54%	1.55%	1.55%	1.53%	1.52%	1.51%	1.50%	1.51%	1.50%	1.51%
HFE (corrected)	1.34%	1.71%	1.40%	1.59%	1.53%	1.73%	1.59%	1.52%	1.76%	1.61%	1.36%	1.36%	1.30%	1.36%	1.53%	1.49%	1.65%
HFE	1.34%	1.71%	1.41%	1.59%	1.54%	1.73%	1.60%	1.52%	1.76%	1.61%	1.37%	1.37%	1.31%	1.37%	1.54%	1.50%	1.65%

4.24 Romania

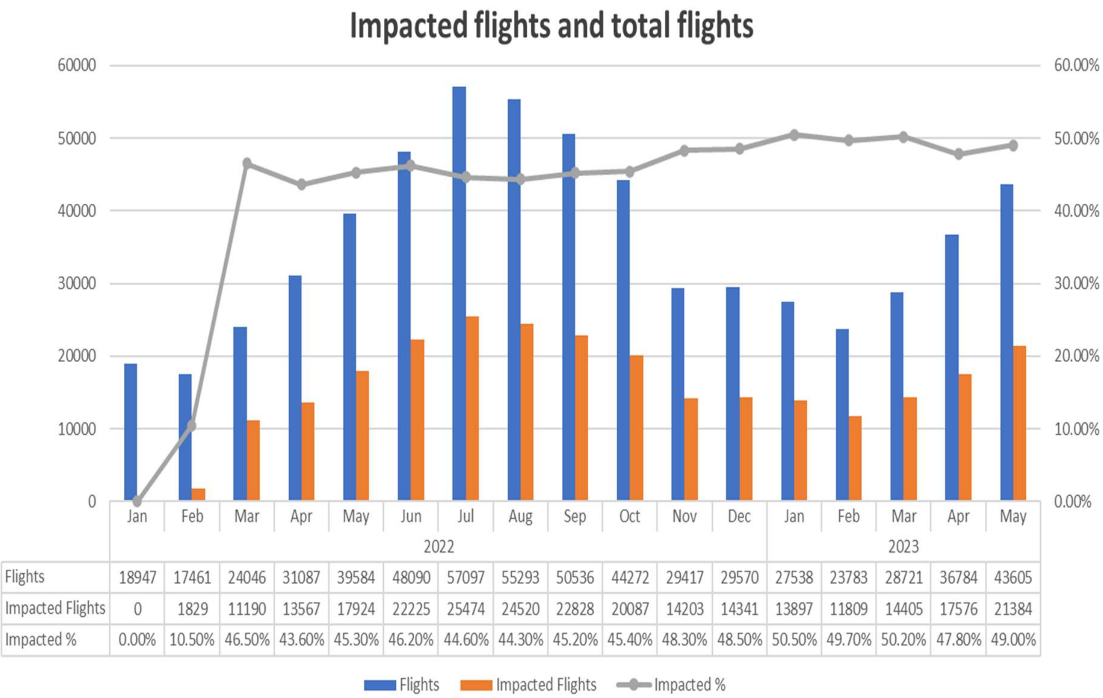


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
	2022												2023				
Flights	34391	30918	38204	46961	52355	60466	71216	73122	65738	59885	48197	48409	47804	41632	48164	55558	62617
Impacted Flights	0	2140	15007	17918	21653	26133	29606	29412	27542	25491	20736	20635	20330	17694	21453	24230	28132
Impacted %	0.00%	6.90%	39.30%	38.20%	41.40%	43.20%	41.60%	40.20%	41.90%	42.60%	43.00%	42.60%	42.50%	42.50%	44.50%	43.60%	44.90%

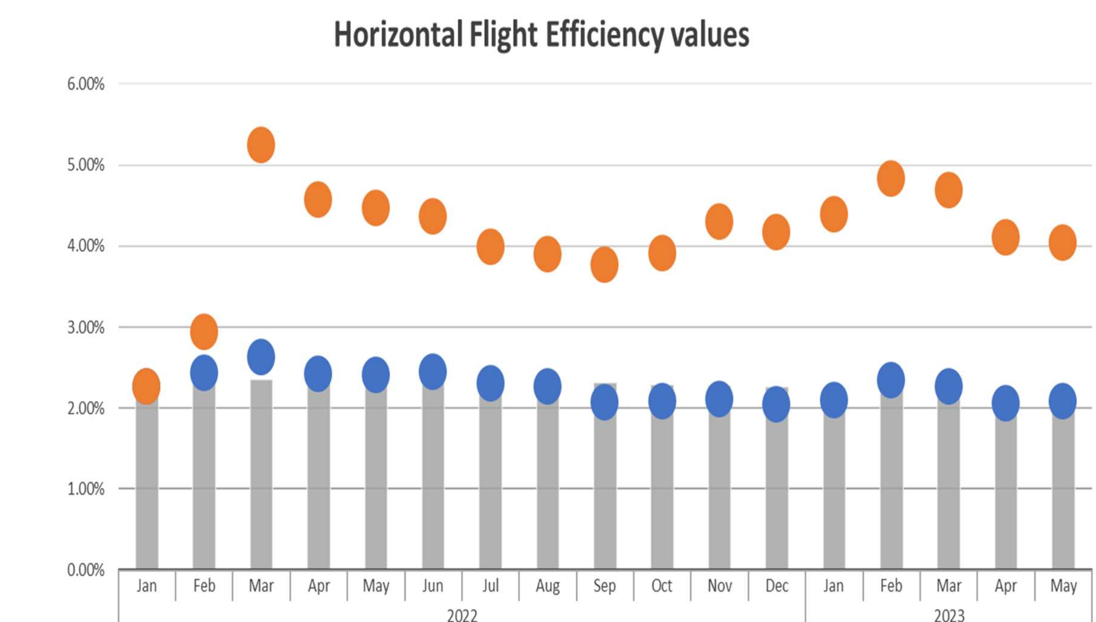


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
	2022												2023				
Corrected KEA	2.21%	2.22%	2.18%	2.12%	2.07%	2.00%	1.93%	1.89%	1.84%	1.79%	1.76%	1.73%	1.71%	1.68%	1.68%	1.68%	1.68%
HFE (corrected)	2.04%	2.14%	1.60%	1.65%	1.79%	1.81%	1.77%	1.87%	1.69%	1.65%	1.64%	1.63%	1.64%	1.61%	1.63%	1.65%	1.76%
HFE	2.04%	2.46%	3.36%	3.40%	3.70%	3.68%	3.38%	3.52%	3.43%	3.50%	3.54%	3.52%	3.55%	3.54%	3.63%	3.61%	3.73%

4.25 Slovakia

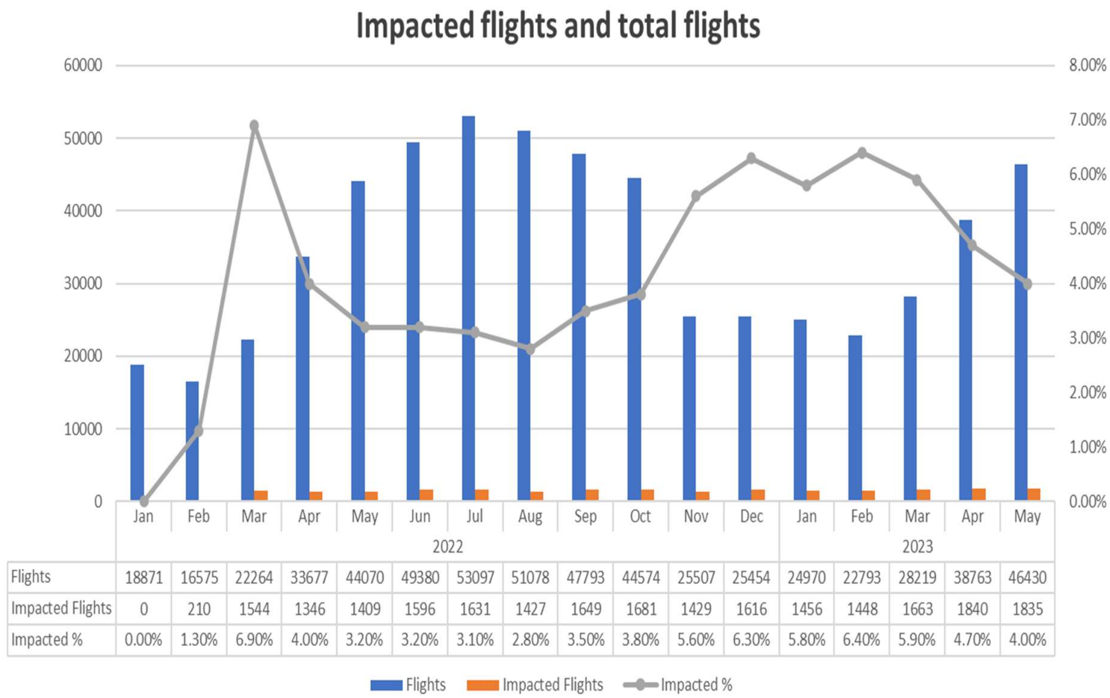


	2022 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2023 Jan	Feb	Mar	Apr	May
Flights	18947	17461	24046	31087	39584	48090	57097	55293	50536	44272	29417	29570	27538	23783	28721	36784	43605
Impacted Flights	0	1829	11190	13567	17924	22225	25474	24520	22828	20087	14203	14341	13897	11809	14405	17576	21384
Impacted %	0.00%	10.50%	46.50%	43.60%	45.30%	46.20%	44.60%	44.30%	45.20%	45.40%	48.30%	48.50%	50.50%	49.70%	50.20%	47.80%	49.00%

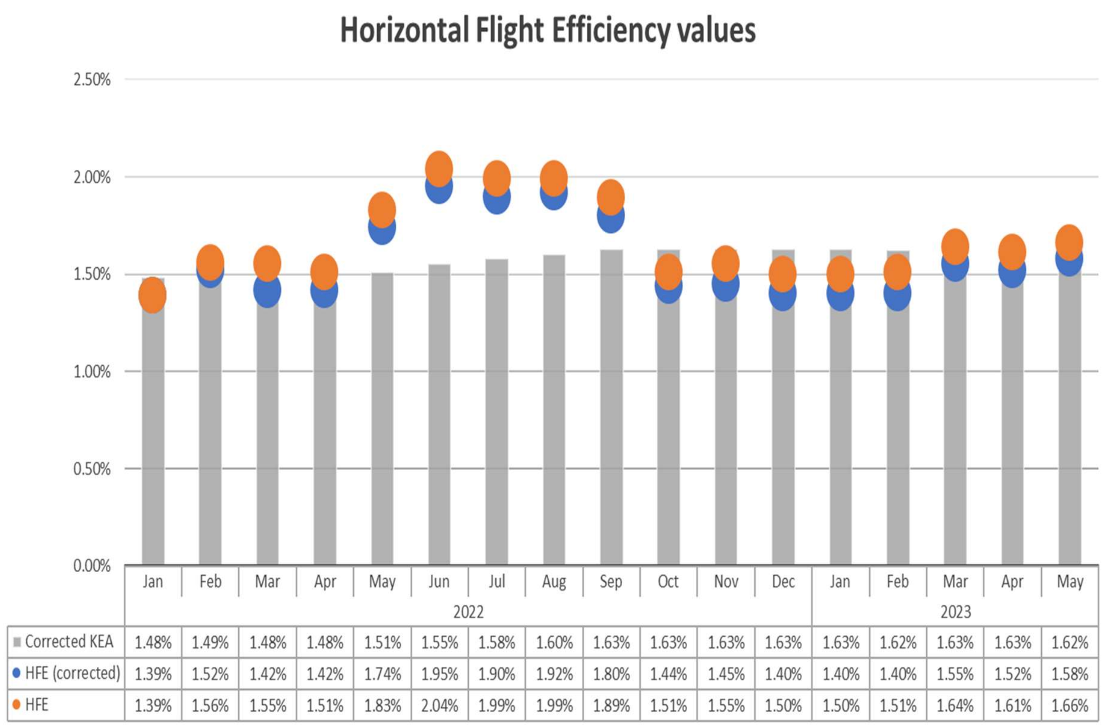


	2022 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2023 Jan	Feb	Mar	Apr	May
Corrected KEA	2.29%	2.31%	2.35%	2.36%	2.37%	2.38%	2.36%	2.34%	2.32%	2.29%	2.27%	2.26%	2.25%	2.25%	2.23%	2.20%	2.17%
HFE (corrected)	2.26%	2.43%	2.63%	2.42%	2.40%	2.45%	2.30%	2.26%	2.07%	2.08%	2.11%	2.04%	2.09%	2.34%	2.26%	2.06%	2.08%
HFE	2.26%	2.94%	5.24%	4.57%	4.46%	4.36%	3.99%	3.90%	3.77%	3.91%	4.29%	4.17%	4.38%	4.82%	4.68%	4.10%	4.04%

4.26 Slovenia



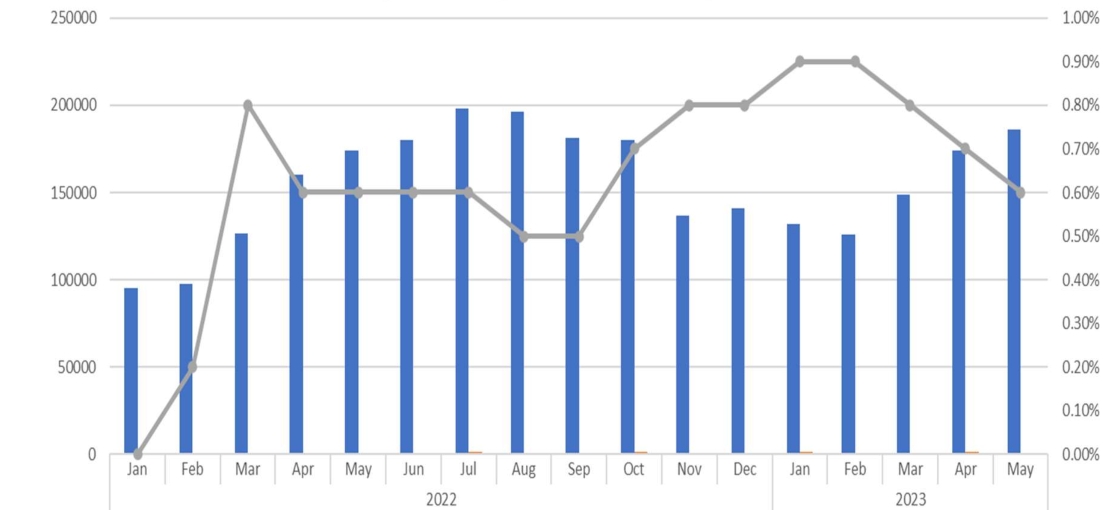
	2022												2023				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Flights	18871	16575	22264	33677	44070	49380	53097	51078	47793	44574	25507	25454	24970	22793	28219	38763	46430
Impacted Flights	0	210	1544	1346	1409	1596	1631	1427	1649	1681	1429	1616	1456	1448	1663	1840	1835
Impacted %	0.00%	1.30%	6.90%	4.00%	3.20%	3.20%	3.10%	2.80%	3.50%	3.80%	5.60%	6.30%	5.80%	6.40%	5.90%	4.70%	4.00%



	2022												2023				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Corrected KEA	1.48%	1.49%	1.48%	1.48%	1.51%	1.55%	1.58%	1.60%	1.63%	1.63%	1.63%	1.63%	1.63%	1.62%	1.63%	1.63%	1.62%
HFE (corrected)	1.39%	1.52%	1.42%	1.42%	1.74%	1.95%	1.90%	1.92%	1.80%	1.44%	1.45%	1.40%	1.40%	1.40%	1.55%	1.52%	1.58%
HFE	1.39%	1.56%	1.55%	1.51%	1.83%	2.04%	1.99%	1.99%	1.89%	1.51%	1.55%	1.50%	1.50%	1.51%	1.64%	1.61%	1.66%

4.27 Spain

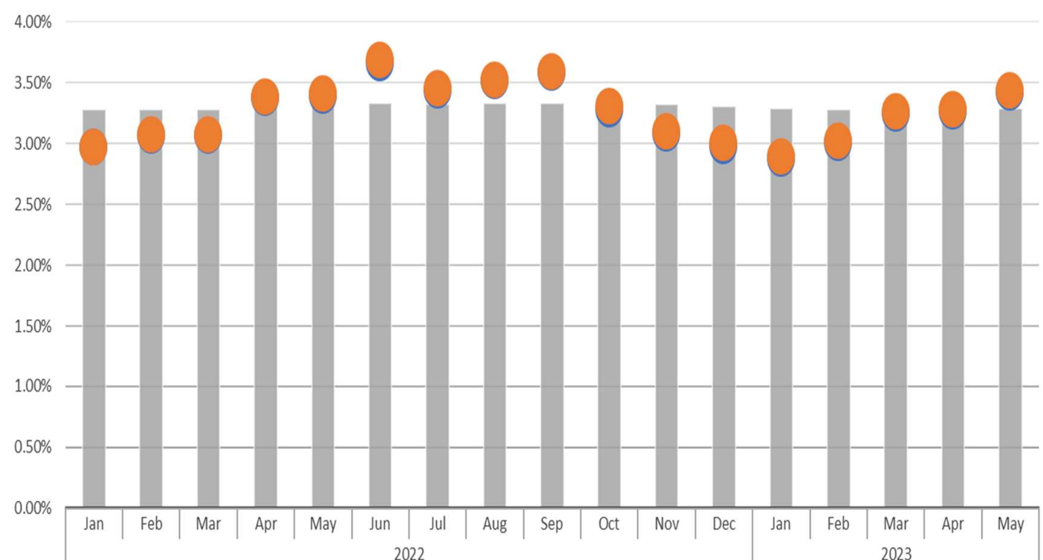
Impacted flights and total flights



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
	2022												2023				
Flights	95495	97851	126739	160067	173912	179908	198147	196233	181044	180306	136564	141120	132194	125837	148663	173833	186264
Impacted Flights	0	230	1010	922	979	1038	1163	989	930	1227	1109	1112	1165	1095	1151	1180	1084
Impacted %	0.00%	0.20%	0.80%	0.60%	0.60%	0.60%	0.60%	0.50%	0.50%	0.70%	0.80%	0.80%	0.90%	0.90%	0.80%	0.70%	0.60%

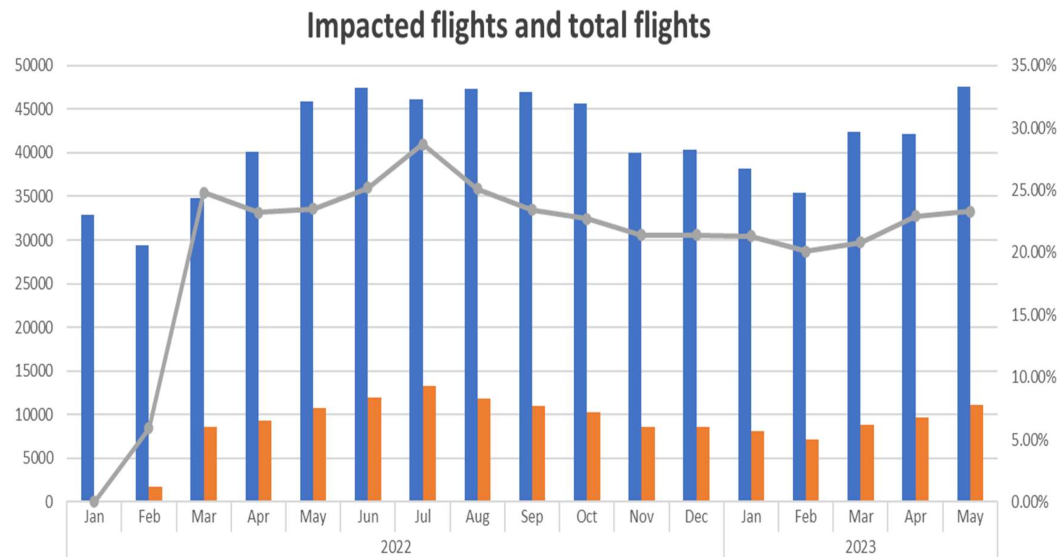
Flights Impacted Flights Impacted %

Horizontal Flight Efficiency values

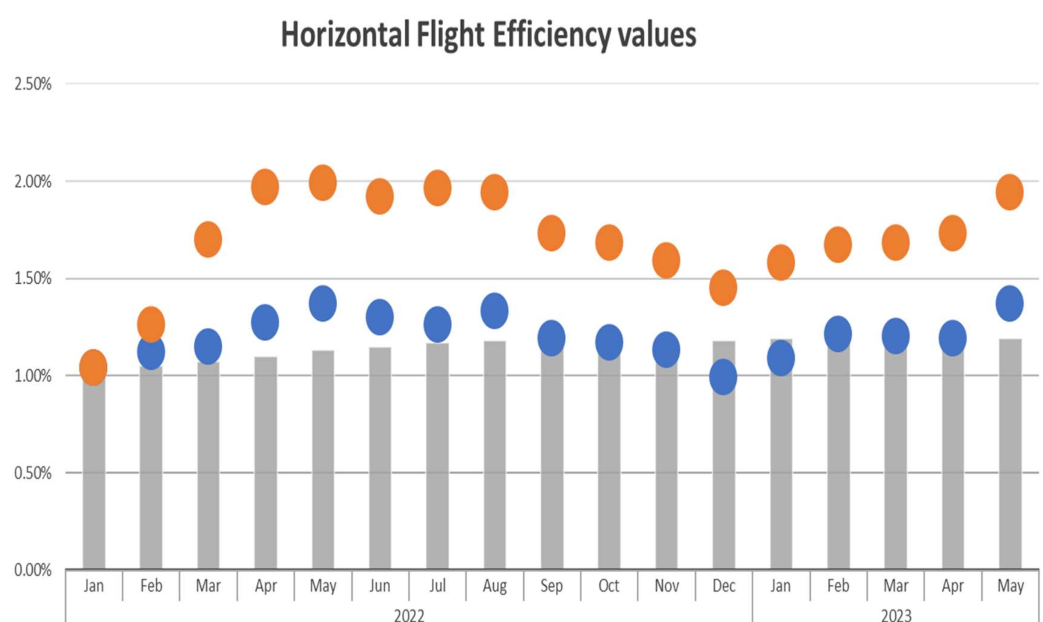


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
	2022												2023				
Corrected KEA	3.28%	3.28%	3.28%	3.30%	3.31%	3.33%	3.32%	3.33%	3.33%	3.33%	3.32%	3.30%	3.29%	3.28%	3.30%	3.29%	3.29%
HFE (corrected)	2.97%	3.06%	3.06%	3.37%	3.39%	3.66%	3.43%	3.51%	3.58%	3.28%	3.08%	2.98%	2.87%	3.00%	3.24%	3.26%	3.42%
HFE	2.97%	3.07%	3.07%	3.38%	3.41%	3.68%	3.45%	3.52%	3.59%	3.30%	3.10%	3.00%	2.89%	3.02%	3.26%	3.28%	3.43%

4.28 Sweden

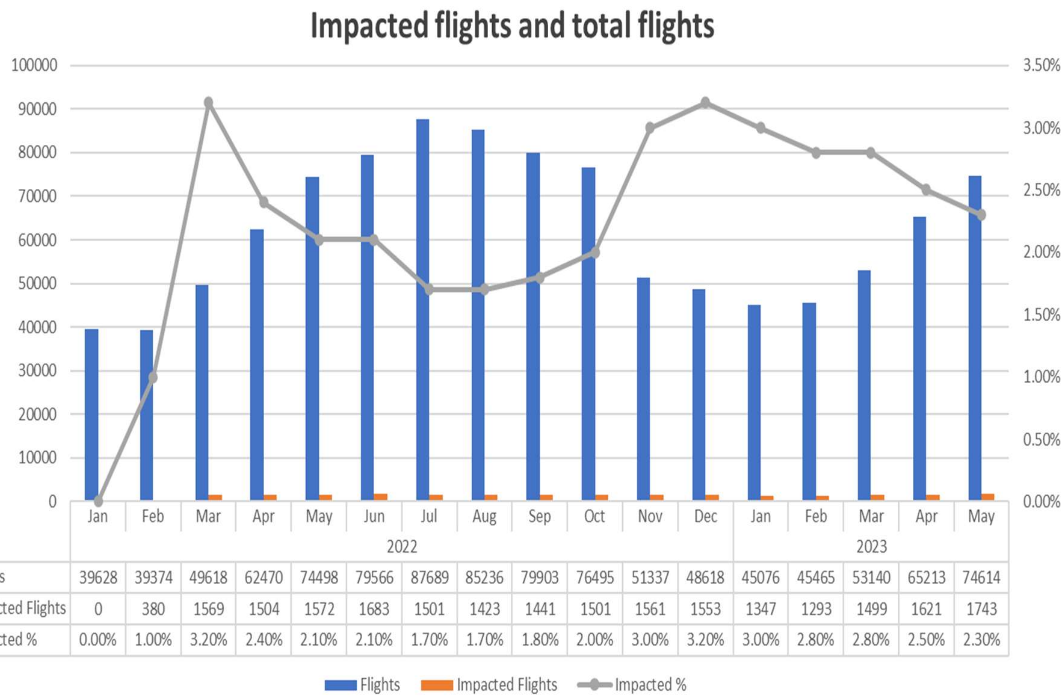


	2022												2023				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Flights	32908	29388	34847	40087	45869	47407	46129	47276	46929	45589	39975	40315	38208	35425	42360	42143	47557
Impacted Flights	0	1723	8628	9290	10787	11934	13240	11872	10986	10331	8554	8631	8120	7116	8825	9641	11096
Impacted %	0.00%	5.90%	24.80%	23.20%	23.50%	25.20%	28.70%	25.10%	23.40%	22.70%	21.40%	21.40%	21.30%	20.10%	20.80%	22.90%	23.30%

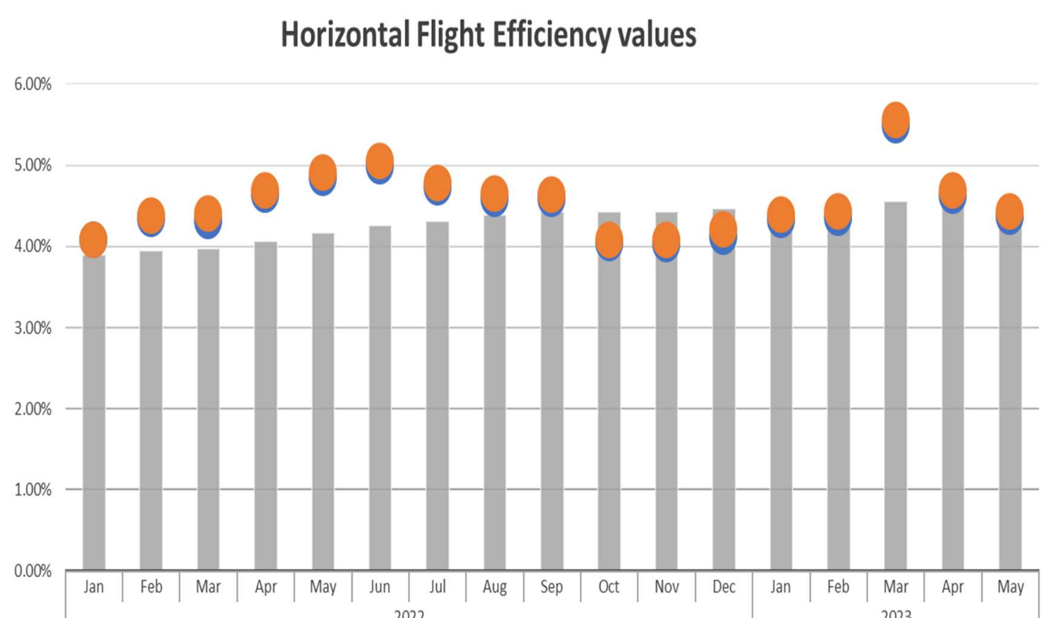


	2022												2023				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Corrected KEA	1.05%	1.05%	1.07%	1.10%	1.13%	1.15%	1.17%	1.18%	1.19%	1.19%	1.19%	1.18%	1.19%	1.20%	1.20%	1.19%	1.19%
HFE (corrected)	1.04%	1.12%	1.15%	1.27%	1.37%	1.30%	1.26%	1.33%	1.19%	1.17%	1.13%	0.99%	1.09%	1.21%	1.20%	1.19%	1.37%
HFE	1.04%	1.26%	1.70%	1.97%	1.99%	1.92%	1.96%	1.94%	1.73%	1.68%	1.59%	1.45%	1.58%	1.67%	1.68%	1.73%	1.94%

4.29 Switzerland



	2022 Jan	2022 Feb	2022 Mar	2022 Apr	2022 May	2022 Jun	2022 Jul	2022 Aug	2022 Sep	2022 Oct	2022 Nov	2022 Dec	2023 Jan	2023 Feb	2023 Mar	2023 Apr	2023 May
Flights	39628	39374	49618	62470	74498	79566	87689	85236	79903	76495	51337	48618	45076	45465	53140	65213	74614
Impacted Flights	0	380	1569	1504	1572	1683	1501	1423	1441	1501	1561	1553	1347	1293	1499	1621	1743
Impacted %	0.00%	1.00%	3.20%	2.40%	2.10%	2.10%	1.70%	1.70%	1.80%	2.00%	3.00%	3.20%	3.00%	2.80%	2.80%	2.50%	2.30%



	2022 Jan	2022 Feb	2022 Mar	2022 Apr	2022 May	2022 Jun	2022 Jul	2022 Aug	2022 Sep	2022 Oct	2022 Nov	2022 Dec	2023 Jan	2023 Feb	2023 Mar	2023 Apr	2023 May
Corrected KEA	3.90%	3.94%	3.97%	4.06%	4.17%	4.26%	4.31%	4.38%	4.43%	4.43%	4.43%	4.46%	4.47%	4.47%	4.55%	4.55%	4.50%
HFE (corrected)	4.08%	4.34%	4.31%	4.63%	4.84%	4.98%	4.72%	4.58%	4.58%	4.03%	4.02%	4.11%	4.32%	4.35%	5.49%	4.62%	4.36%
HFE	4.08%	4.37%	4.40%	4.69%	4.90%	5.05%	4.77%	4.64%	4.63%	4.08%	4.08%	4.20%	4.39%	4.42%	5.55%	4.68%	4.42%