Abridged

Environmental Statement 2023

Air traffic control and climate protection

EMAS
GEPRÜFTES UMWELTMANAGEMENT
DE-160-00016

DFS Deutsche Flugsicherung

Contents

Environmental Statement 2023

1.1. Foreword

For air transport, 2023 was another year of recovery from the pandemic-related slump. With 2.8 million controlled flights, the volume of traffic was still 15 percent below the 2019 level, which is roughly the same as 20 years ago. However, there is one big difference. While the number of overflights continued to rise, the number of flights within Germany reached an all-time low. Market-driven effects in particular led to passengers switching to other modes of transport, such as rail. This continues a long-term trend, which also has a positive effect on en-route efficiency in German airspace.

In 2023, DFS was also able to implement an important measure towards CO_2-reduction, namely the switch to green electricity. This was achieved despite the fact that the conditions for a tender of this size were anything but simple, with great uncertainty and cost fluctuations dominating the energy market in 2023. From 2024, DFS will source all of its electricity, around 44 GWh, from defined renewable plants in Germany and reduce its CO_2 footprint by around half. This is an important milestone in the commitment of DFS to greater climate protection.

But we also took a closer look at the other perspective in 2023 – "How does the climate affect DFS?". Heavy rain, flooding, heatwaves and dry spells are weather phenomena that will occur more frequently in the coming years. In a vulnerability analysis, we analysed which buildings and technical systems are particularly at risk. We use this information when searching for new sites and when modernising existing facilities and buildings.

Over the next few years, we will also be working intensively on moving our air traffic control systems to the cloud. This allows the systems to run more efficiently, saving electricity and CO_2. We put the first of the three planned cloud systems into operation in 2023. We are already running more than 300 virtual systems for testing and developing ATM services.

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Chairman and Chief Executive Officer (CEO)

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DE-160-00018

Cover image: Peregrine falcons have been living on the grounds of the DFS Campus in Langen for years. They produce offspring every year. The fledglings regularly make their first attempts to fly in spring. (Photo: DFS)

1.2. Account of environmental contributions

The DFS Campus in Langen is home to various rare bird species, such as this pair of European bee-eaters. (Photo: DFS)

1.2.1. The year 2023

The year in figures

Size of the airspace controlled by DFS:

390,000 square kilometres

Flights controlled by DFS
(IFR, instrument flight rules):

2.839 million

IFR take-offs and landings:

1.744 million

Horizontal flight efficiency
(deviation from the direct route):

0.99% (corresponds to approx. 3.4 km)

Staff:

5,687 staff members (parent company)

1.2.2. Current status of the environmental management system & target achievement

The DFS environmental management system has been validated in accordance with EMAS at four sites (Langen, Bremen, Karlsruhe and Munich) since 2023.

Scope of the environmental management system and EMAS validation

The environmental management system (EMS) of DFS applies to all employees of DFS Deutsche Flugsicherung GmbH as well as to the employees of the German Federal Aviation Office (LBA) assigned to DFS and is an integral part of the DFS management system. The EMS covers all business areas and activities of the organisation at all sites. The measures of the environmental programme as well as the data and indicators of the environmental account also cover the entire company. External validation by an environmental auditor in accordance with EMAS is initially limited to the Langen Campus (Headquarters), Bremen, Karlsruhe and Munich.

Achievement of environmental targets

In 2023, various measures led to a significant improvement in the environmental performance of DFS overall. This relates to both direct and indirect environmental aspects.

Indirect environmental aspects

Average deviation from direct route

With an average deviation from the ideal track of 0.99 percent (equivalent to 3.4 km deviation per flight), DFS was able to achieve a reduction of 4.9 percent over 2022. The European benchmark for horizontal flight efficiency is 1.6 percent average deviation per flight.

Direct environmental aspects

Energy efficiency: Reduction of the total energy requirements of DFS by at least 5% by 2025

Compared to 2021, absolute electricity consumption has fallen by 4.09 percent, which also affects the associated indicator (electricity/m^2: -4.23%).

Decarbonisation: Reduction of CO_2 emissions (Scope 1 and 2) by 50% by 2025

CO_2 emissions (Scope 1 and 2) have improved slightly since 2021 (-2.44%). From 2024, DFS will use CO_2-neutral green electricity, which is expected to halve CO_2 emissions.

Mobility: Reduction of CO_2 emissions for mobility by 20% by 2025

CO_2 emissions for mobility (business trips, commuting) have also only decreased slightly compared to 2021 (-3.4%). Overall, the number of business trips, which was curtailed in 2020 due to the pandemic, rose significantly again in 2023 (+31.13 %), as did the proportion of air travel.

Resource efficiency: Reduction of waste volume by at least 5% by 2025

The absolute waste volume generated by DFS has decreased significantly since 2021 (non-hazardous waste: -21.77%, hazardous waste: -4.6%). The corresponding indicator figure has also developed positively:

- Non-hazardous waste / employee: -23.71%
- Hazardous waste / employee: -8.70%

Resource efficiency: Reduction of resource consumption (water, paper) by at least 5% by 2025 and increase of the proportion of near-natural areas by at least 5% by 2025

Owing to more digitalisation, DFS was also able to achieve a reduction in **paper consumption** of 12.26% in 2023 compared to 2021 (paper consumption / employee: -14.06%).

With an increase of 12.1% compared to 2021, **water consumption** in 2023 did not develop in line with the targets (water consumption / employee: +10.23%). However, the comparison with 2022 (-5.72%) already shows a positive trend.

The **proportion of near-natural areas** more than doubled (+67.88%) thanks to various measures to promote biodiversity and re-naturalisation.

1.2.3. Measures 2023

Decarbonisation & energy efficiency

From 2024, all the externally sourced electricity for DFS will come from renewable sources. (Photo: Shutterstock)

Green light for DFS-wide use of green electricity

From 2024, DFS will, for the first time, procure its electricity for all sites except for the DFS Campus exclusively from renewable energy plants in Germany, thereby reducing its CO_2 emissions by 50 percent.

DFS procures around 44 gigawatt hours (GWh) of electricity per year for the control centre and tower branches and the approximately 400 CNS remote sites outside of the Langen Campus. This corresponds to the amount of electricity used by around 11,000 four-person households.

Previously, the electricity DFS purchased reflected the German electricity mix and was not procured according to environmentally relevant criteria. Green electricity was used for the first time in 2023 as part of regular electricity procurement, more specifically, under a so-called power purchase agreement (PPA).

Under such an arrangement, a binding and long-term electricity purchase agreement is concluded with a green electricity producer. This has the great advantage that some energy plants such as wind turbines, which will no longer receive government subsidies in the next few years, can still sell their electricity economically.

Similarly, the long-term purchase commitment supports the construction of new turbines. This approach was also the result of a study commissioned two years ago about supplementing sustainable energy sources at the DFS sites. The electricity used from 2024 onwards will be supplied by a German energy supplier exclusively from its own domestic wind farms.

A photovoltaic system on the roof of the Bremen control centre has been supplying the DFS branch with solar power since 2023. (Photo: DFS)

Bremen control centre puts photovoltaic system into operation

As part of the roof renovation of the Bremen control centre, a PV system was installed to generate our own electricity. With a maximum output of 99 kWp, it helps to reduce the amount of electricity sourced from the public grid. All roof areas where it was structurally possible were also planted, a total area of around 200 square metres.

Green COM implemented at the Brinkum site

The DFS COM sites (radiotelephony) are standardised and therefore well suited to become pilot sites for green technology. The aim is to generate the maximum possible proportion of the energy required on site. This concept was successfully implemented at the pilot site in Bremen-Brinkum. A photovoltaic system with an output of 14 kWp and a battery storage system significantly increases the site's self-sufficiency rate, up to 20 percent of the electricity required can be generated on site.

Further reduction in number of omnidirectional radio beacons

Due to the gradual introduction of satellite-based flight procedures at more than 60 German airports, the conventional VOR (CVOR) are being continuously modernised. In 2023, the Cologne Bonn, Düsseldorf and Nienburg facilities were converted to Doppler VOR (DVOR). This technology is more robust against interference from wind turbines and is significantly more energy efficient. The CVOR Frankfurt am Main (Charlie) was decommissioned in November.

Demolition of the old building in Munich

At the Munich site, the technical systems of the old building, which was very unfavourable in terms of energy efficiency, were gradually decommissioned and dismantled. During the demolition and new construction of the new building, DFS has been renting office space in the neighbouring Lab Campus. DFS is testing concepts for modern working environments there under the term 'new work'.

General switch for test and reference systems

The Technical Centre at the Langen site operates test and reference systems for all air traffic control systems used in operations. This is where new software releases are put through their paces before they are installed in the operational systems. As these systems usually have to run around the clock, a general switch was installed in each room so that the monitors can be switched off centrally in the evenings and at weekends.

Conversion to LED lighting at the Bremen site

The lighting at the Bremen site was largely converted to energy-saving LEDs. The conversion of the lighting in the operations rooms will follow in stages over the coming years.

Air traffic control systems go into the cloud

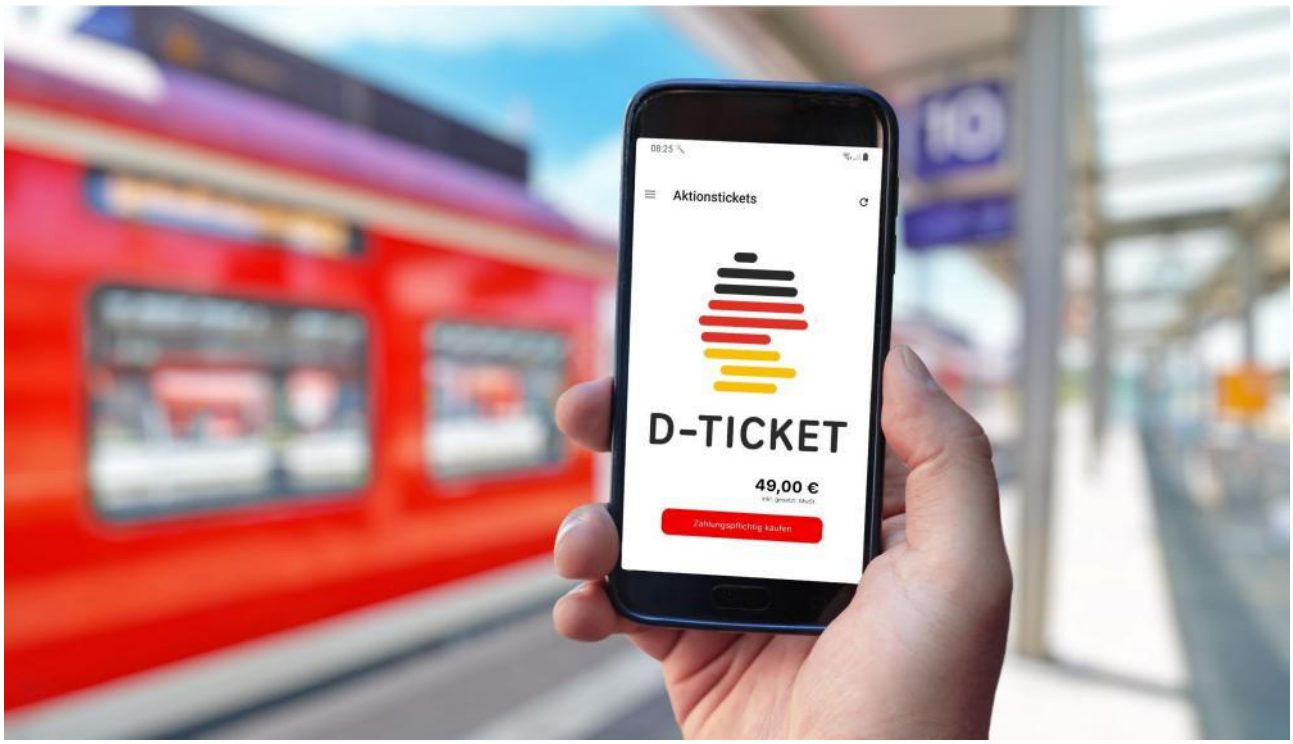
Starting in 2023, the IT applications of the air traffic control systems are being gradually transferred to a cloud infrastructure. (Photo: Shutterstock)

DFS is pursuing the goal of gradually transferring the technical systems required for the provision of air navigation services to a cloud infrastructure. This makes DFS a pioneer in the field of European air navigation services. The cloud model has the potential to continuously reduce the energy consumption of the IT infrastructure.

The hybrid cloud infrastructure is characterised by a three-pillar approach. Each pillar is designed to meet specific operational needs, ensuring the safe and reliable operation of air traffic control systems.

The first of the three planned cloud pillars was put into operation in 2023. More than 300 virtual systems for testing and developing air navigation services are run under this pillar. The next cloud pillar is scheduled to follow at the end of 2024.

Climate-friendly mobility



Around 1,5000 employees use the subsidised DFS JobTicket Deutschland when using public transport, which has been available since May 2023. (Photo: Shutterstock)

Introduction of the DFS JobTicket Deutschland

Since May 2023, all DFS employees have been able to purchase a subsidised ticket which is valid in all public transport across the whole of Germany (with very few exceptions). DFS had already been offering a subsided job ticket for public transport, but only for the Rhine-Main region. Now, staff members can apply for the DFS JobTicket Deutschland, which can be used nationwide. This offer is very popular – around 1,500 tickets were issued in 2023 – and its popularity is set to continue to grow.

DFS is top 'job bike' employer 2023

Since 2020, DFS has been offering tax-incentivised bicycle leasing in cooperation with its partner *Jobrad*. This scheme is also known as *Jobrad* in German, or job bike. The offer met with a great response right from the start, around 1,100 bikes are currently being leased through the organisation *Jobrad*, and staff members have already bought around 500 bikes out of the leasing programme. This is why *Jobrad* honoured DFS last year as a top job bike employer 2023.

Sharp rise in the number of business trips

In 2023, significantly more staff travelled than during the previous years of the pandemic, with the number of business trips increasing from around 11,000 to around 13,000.

The number of kilometres travelled by air and rail increased in equal measure, with international flights playing a particularly significant role. To make rail travel more attractive, DFS is promoting the BahnCard Business internally, a railcard for businesspeople. This card is free of charge for employees. Just under 70 of these were issued in 2023.

Guidelines for low-emission company cars

Since the beginning of the year, the leasing of DFS-owned company cars has been restricted to low-emission vehicles with hybrid or electric drives. This was an important milestone on the way to a 100 percent low-emission fleet, which DFS is aiming for by 2025.

More e-charging infrastructure at DFS sites

Not only the electrification of the DFS fleet progressed in 2023 but also the development of the corresponding infrastructure. The number of e-charging points at the Langen site was increased from 5 to 35. Four additional e-charging points were also put into operation at the Munich site, and wall chargers were also installed at the Leipzig tower site and at individual external sites.

Resource efficiency

A wooded area next to the DFS branch in Karlsruhe was reforested and enhanced with various nesting aids for birds and insects. (Photo: DFS)

Climate-resistant trees and nesting boxes for the Karlsruhe site

The plot the Karlsruhe control centre occupies includes an approximately 1,800 square metre area of forest, which was gradually re-naturalised in 2023 in line with its own eco-concept. For example, 40 nesting boxes for birds and 10 nesting boxes for bats were attached to trees. These are suitable for various native bird species such as tits, black and common redstarts, nuthatches, tree sparrows and starlings. An initial inspection shows that 17 of 40 bird nesting boxes have already been used for nesting.

Water-saving technology in Karlsruhe

The wet cooling plants in Karlsruhe were replaced with new closed cooling plants at the end of 2022, which led to a significant reduction in water consumption in 2023. The sanitary facilities were also extensively renovated in 2023. Among other things, the water running time for hand basins and showers was reduced.

Paper consumption steadily reduced

Less and less is being printed due to ongoing digitalisation – in 2023, the print volume fell again by 4.9 percent to 3.07 million pages, which corresponds to 15.3 tonnes of paper. The digital signing of contracts was also broadened – around 4,500 contracts were signed digitally in 2023 in the DFS Group, which corresponds to a saving of around 90,000 sheets of paper. In addition, DFS only uses recycled paper that complies with the Blue Angel standard.

DFS staff in Langen can donate their deposit on drink containers by placing them in four special bins. (Photo: DFS)

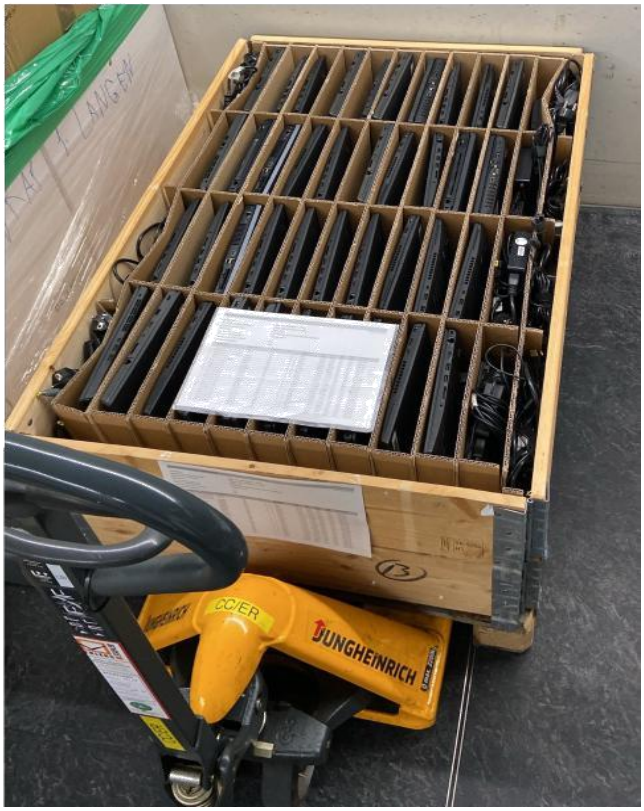
Cooperation with *Pfandnetzwerk* & *Brillen weltweit* at the Langen site

Four collection bins have been set up in the cafeterias at the Langen site, where employees can return their bottles to donate the deposit. The deposit containers come from the Nuremberg start-up *Pfandnetzwerk*, which connects companies and social organisations. The Langen-based association *Juki-Farm e.V.* will receive 100 percent of the proceeds. Since the campaign began at the start of 2023, the monetary value equivalent to over 2,000 returnable bottles has been channelled into the work of the youth and children's farm.

DFS also collects used spectacles every year for the organisation *Brillen weltweit* (spectacles worldwide). Instead of being thrown away, around 150 pairs of old glasses belonging to DFS staff members ended up in the refurbishment workshop of *Brillen weltweit* in Koblenz. There, they were reground and refurbished by a master optician and, according to the organisation, passed on free of charge to people living in poverty.

IT hardware resold instead of scrapped

For years, DFS has been selling laptops and PCs that are no longer needed to a reseller, who then refurbishes and resells them. Special reusable cardboard boxes were purchased to prevent the devices from becoming scratched so much during transport. This simple measure significantly increased the quality and resale rate of the devices.



Instead of being shipped to the reseller in pallet cages, the decommissioned notebooks are now sent in reusable cardboard packaging. (Photo: DFS)

Dealing with climate risks

Example of danger from flooding: Düsseldorf Airport is located on the edge of potential flooding areas which could also affect DFS technical facilities. (Visualisation: DFS)

Visualisation of the effects of climate change in the DFS Geoportal

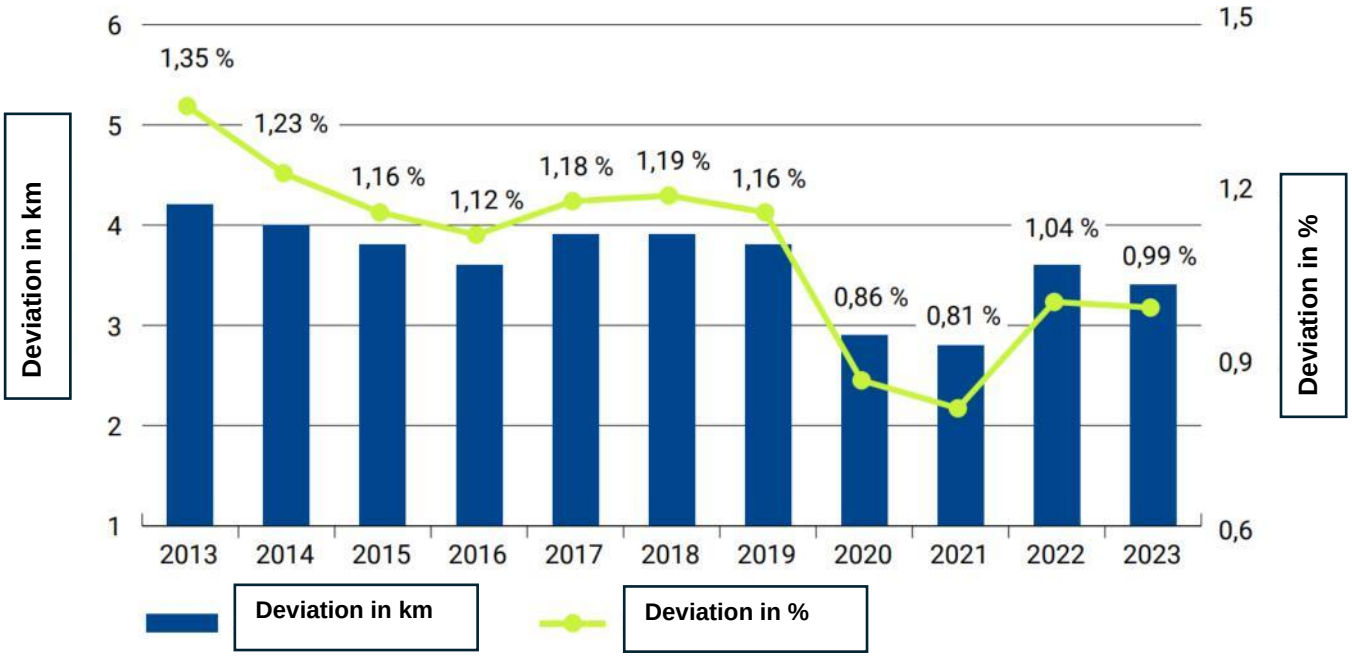
As part of the EMAS context analysis, the question of how DFS would deal with the forecast weather and temperature conditions, particularly when planning and modernising technical facilities, was assessed as one of the most important developments with a high risk potential. This is because DFS operates around 400 radio, navigation and radar facilities throughout Germany, which are located close to airports but also in remote forests or among fields.

Flooding or heavy rainfall can damage the facilities, and when planning and modernising facilities and buildings, the cooling infrastructure should also be designed for longer periods of heat. It must also be considered whether there is a risk of flooding due to localised heavy rainfall events and general flooding.

Based on data from the German Meteorological Service (DWD) and the German Federal Institute for Hydrology (BfG), DFS analysed weather scenarios in collaboration with the Darmstadt University of Applied Sciences and developed a risk assessment for all technical sites.

The good news is that all facilities are already designed to be very robust, so that wind, snow, heavy rain or frost will not pose a risk in future. However, some facilities will be affected by a greater number of hot days in future, while others are located in potential flooding areas. To improve the visualisation of these results, the new map topic "Climate change" was added to the company-wide Geoportal and is being continuously expanded to include the latest climate data.

Helping to promote climate-friendly flying



Despite more air traffic and complexity in airspace, en-route flight efficiency improved slightly in 2023. (Visual: DFS)

Direct flights

In 2023, air traffic volumes in Germany continued to recover from their slump. A total of 2.84 million flights under instrument flight rules were controlled in German airspace. Compared with the previous year, this corresponded to an increase of more than 7.14 percent (2022: 2.64 million flights). Despite the increase in volumes, capacity bottlenecks and delays were reduced, which had a positive impact on horizontal flight efficiency (HFE). Even the more extensive military activities did not lead to a deterioration in HFE. With an average deviation from the ideal line of 0.99 percent (equivalent to 3.4 km deviation per flight), DFS was able to achieve a reduction of 4.9 percent over 2022.

DFS and Maastricht expand cross-border free route airspace

The DFS branch in Karlsruhe and Maastricht UAC have prepared the large-scale introduction of free route airspace in 2023. This enables shorter and individually optimised planning options for airspace users across borders, which has a positive impact on the flight path and thus also on fuel consumption and CO_2 emissions.

Airspace users have the option of planning a direct route from the entry into Maastricht airspace at the UK boundary to the exit from Karlsruhe airspace in the direction of Poland without the need to file additional intermediate points. This also applies to flights from east to west.

On the route from the UK south-eastwards to the traditional holiday destinations of Greece, Turkey, Malta, etc. and back, the flight plans do not require a waypoint along the Maastricht-Karlsruhe airspace boundary.

The next step will be to implement cross-border free route airspace with Poland and the Czech Republic. Its implementation depends on the introduction of new air traffic control systems that can process flight plan data on the basis of trajectories and not, as previously, by sector.

The same applies to the gradual introduction of free route airspace in Germany's lower airspace, which is linked to the introduction of a new air traffic control system.

Research on non-CO_2 effects

Since 2022, DFS has been working closely with the German Aerospace Centre (DLR), the German Meteorological Service (DWD) and a number of German airlines to investigate how non-CO_2 effects in the form of long-lasting contrails in upper airspace can be avoided.

The test flights are part of the aviation research programme known as D-KULT, (demonstrator for climate and environmentally friendly air transport). The first results are to be presented at the conclusion of the research programme at the end of 2025.

The project mainly involves conducting multiple test flights. In addition, simulations are to calculate the resulting climate effect of the flight.

OPD (optimised profile descent) developed

DFS bundles selected activities related to climate-friendly flying internally in the initiative Green Flying. This initiative includes measures aimed at reducing the CO_2 emissions from air traffic that can be influenced by DFS. In 2023, various arrival routes were identified in the approach area of Frankfurt Airport, which were refined into an optimised profile descent (OPD). OPD enables a continuous descent through level windows above certain waypoints (flying through "airspace tubes"), which can significantly reduce the aircraft's fuel consumption.

In the next step, selected OPD profiles are to be extended into upper airspace so that a continuous descent is also possible from cruising level down to the entry into the terminal area.

Noise abatement procedures for arrivals and departures

Frankfurt: Expansion of RNP-X

The GPS-based approach procedure RNP-X (formerly called RNP-Y) avoids flying over large, densely populated cities and saves fuel thanks to shorter flight paths. Trial operations for this procedure began in 2022 and included a non-binding application from 22:00 hrs local time (instead of 23:00 hrs). This extends the noise respite period for cities and municipalities by one hour. Based on initial findings, the application rate of this procedure is high, so that the segmented approach is to be introduced as the standard approach procedure between 22:00 hrs and 5:00 hrs by 2024.

Stuttgart: TEDGO in regular operations

TEDGO-new is a new departure procedure introduced at Stuttgart Airport in February 2023. It provides for an almost 180-degree turn along the TEDGO waypoint towards the south-west or south immediately after taking off from runway 07. The satellite-based procedure makes it possible to fly around densely populated areas and to avoid unnecessary detours.

TEDGO-new is a regular procedure defined by the German Federal Supervisory Authority for Air Navigation Services (BAF). A one-year test phase was agreed as part of the consultations at the Noise Abatement Commission for Stuttgart Airport, which ended at the beginning of 2024.Current calculations by the Lufthansa Group show fuel savings of around 30 kilograms per flight. Noise pollution for the local population (measured by the continuous sound level) is also reduced. The procedure has been in use in regular operations since June 2024.

Berlin: Hoffmann Curve

One of the most prominent noise abatement endeavours in the vicinity of Berlin Brandenburg Airport (BER) is the so-called Hoffmann Curve. This refers to a departure procedure when runway 07 is in use (easterly wind) that turns southwards shortly after take-off and before reaching the communities of Zeuthen, Schulzendorf and Königs Wusterhausen. DFS has raised awareness among all airlines operating at BER in order to increase the utilisation rate following the introduction of the procedure. DFS remains in constant contact with the airlines to keep the utilisation rate of the procedure as high as possible. The Hoffmann Curve is being monitored and continuously analysed so that it can be adjusted if necessary. Potential changes, especially in the context of the EU-wide prescribed RNP procedure changeover, are always made with a view to retaining this special noise avoidance concept.

1.2.4. Outlook 2024-2027: Decarbonisation

1 mW programme 2030

DFS has set itself the goal of systematically increasing the proportion of renewable energy it generates itself. The aim is to generate up to one megawatt of power from solar energy by 2030 by installing photovoltaic units on the roofs of the control centres, towers as well as radar and radio facilities.

This poses a major challenge for the Langen Campus in particular. The PV systems must be sensibly integrated into the DFS site's own power supply without reducing the efficiency of the DFS combined heat and power plant. At the same time, the principle of stand-alone operations in an emergency must be guaranteed.

Refrigerant

When replacing refrigerants, increased attention is being paid to both a low GWP value [global warming potential] of the refrigerant and the absence of PFAS (per- and polyfluoroalkyl substances). Comprehensive bans on PFAS are expected in the EU from 2026.

Energy efficiency

Across-the-board installation of LED lights

All sites are gradually being converted to energy-saving LED technology. As many rooms are used around the clock for technical or operational purposes, this measure can be expected to result in significant energy savings.

Nevertheless, the special requirements for lighting in operations rooms must also be observed. The quantity also makes this project challenging. At the Langen Campus alone, several thousand lights need to be replaced bit by bit.

Mobility

Electrification of the DFS fleet

After moving to convert all DFS company cars and pool vehicles from combustion engines to hybrid technology by the end of 2025, DFS plans to fully electrify its vehicle fleet by 2031 in accordance with the German Clean Vehicles Procurement Act (SaubFahrzeugBeschG). The plan is to offer only fully electric vehicles from 2028.

More e-charging infrastructure in Karlsruhe

Another e-charging station for DFS-owned vehicles is to be installed in 2024. In 2023, the supply lines for 20 additional e-charging points, which are to be installed in the car park in 2024, were also put in. They can also be used by all DFS employees for their private vehicles. Up to 100 e-charging points are possible in an expansion stage.

Resource efficiency

Significant reduction in printers

DFS uses multifunctional devices for printing and copying. These must be replaced by 2025, when DFS plans to significantly reduce the number of devices procured (DFS-wide reduction from 222 to 160 devices).

In particular, there will be around 50 percent fewer printers at DFS Headquarters in Langen in future. Various environmental aspects are anchored in the tender (energy requirements, criteria analogous to the Blue Angel).

Dealing with climate risks

Investigation of heat load at radio stations

The DFS radio stations are built in a standardised container design. In summer, this leads to higher temperatures inside and more air conditioning output.

To avoid potentially higher energy consumption, the Green COM pilot site in Brinkum will be used to investigate what temperatures are reached and how the rooftop photovoltaic system installed there counteracts the heating of the container.

Helping to promote climate-friendly flying

Development of environmental indicators for operations

The contribution of air navigation services to possible additional fuel consumption and CO_2 emissions are to be calculated for each flight level. These calculations will be based on the flight trajectories recorded by DFS and general models to calculate the fuel consumption of commercial aircraft. These data will be used to measure the environmental performance of air navigation services and will also be available for further detailed (retrospective) analyses.

Extension of optimised profile descent (OPD) procedures into upper airspace

In 2024, the OPD approach procedure via the TANJO waypoint will be extended from the north-west to Frankfurt in upper airspace and linked to the DFS control centre in Langen via a letter of agreement with the Maastricht control centre. This enables a continuous descent from cruising altitude to the entry into the terminal area, which can significantly reduce fuel consumption in this flight segment.

Noise abatement procedures for arrivals and departures

Germany-wide implementation of the PBN standard (performance-based navigation)

As a result of an EU regulation, all of the approximately 2,500 flight procedures at the 59 IFR airports in Germany must be successively converted to a new, modern area navigation standard by 2030This is intended to ensure Europe-wide standards in flight guidance, for example to enable more airspace capacity and greater track compliance of aircraft with the defined flight procedures.

1.2.5. Environmental programme

Measures and targets 2023-2030

Decarbonisation of energy demand and reduction of CO_2 emissions (Scope 1 and 2) by 50% by 2025 (base year: 2021)

Measure	Description	Implementation	Status
Conversion to district heating at the Karlsruhe control centre	Replacing the gas heating system with an ecologically more effective district heating connection at the Karlsruhe control centre.	2022	Completed
Conversion from natural gas to district heating at the tower of Nürnberg Airport	Dismantling the gas heating system at Nürnberg tower and putting a district heating connection into operation.	2022	Completed
Concept, planning and implementation for Green COM at the SST Brinkum pilot site (radio)	Standardising the COM sites (radiotelephony), making them suitable as pilot sites for green technology. The aim is to generate the maximum possible proportion of energy from photovoltaic systems and small wind turbines at the site.	2023	Completed
Construction of a photovoltaic (PV) facility at the Bremen site	Installing a PV system to generate our own electricity (output: 99 kWp) as part of the roof renovation of the Bremen control centre. Also designing large parts of the roof as a green roof.	2023	Completed
Sourcing electricity from renewable sources via direct procurement	Using green electricity (except for DFS Campus Langen) exclusively from defined plants (solar, wind power) by concluding a PPA (power purchase agreement).	2024	Completed
Construction of PV systems at the Karlsruhe site	In 2024, a PV system totalling approx. 33 kWp will be put into operation on the east and west roof areas. In 2025, the feasibility and scope of a PV façade installation is to be examined and, if necessary, implemented.	2024	In implementation
Achieving a 50% quota for low-emission pool vehicles	DFS operates almost 200 pool vehicles which may only be used for business purposes. DFS is aiming for a company-wide quota of 50 percent for low-emission pool vehicles (max. 50g CO_2/km).	2025	In implementation
Replacement of gas heating systems at the towers of Hannover, Düsseldorf and Leipzig airports	As part of their regular maintenance, the outdated gas heating systems at the DFS towers in Hannover, Düsseldorf and Leipzig are being replaced with efficient heat pumps. A photovoltaic system will also be installed on each tower to generate energy (output 45 to 99 kWp each).	2026	Open
Installation of heat pumps at the Bremen site	Heat pumps will be installed at the Bremen control centre to replace a chiller and a boiler.	2027	Open

Reduction of the total energy requirements of DFS by at least 5% by 2025 (base year: 2021)			
Measure	**Description**	**Implementation**	**Status**
Conversion of outdoor lighting to LED at the Karlsruhe site	Converting the car park lighting that is permanently in operation at night and the other outdoor lighting to energy-saving and insect-friendly LEDs.	2022	Completed
Conversion to LED lighting at the Bremen site	The entire lighting at the Bremen centre will gradually be converted to energy-saving LED lighting	2023	In implementation
Demolition of the old building of the Munich control centre	The old building of the Munich control centre, which was very inefficient in terms of energy consumption, was already decommissioned at the end of 2022 and gradually dismantled. Demolition is currently planned for 2024, which will significantly reduce the Munich branch's energy consumption.	2024	In implementation
Systematic start-up and shutdown of test and reference systems	With the help of a 'power manager' developed in-house, the test and reference systems, which are otherwise always switched on, are to be systematically shut down at night and at weekends.	2024	In implementation
Conversion to LED lighting at the Langen site	Starting with the Technical Centre, the Systems House and the multi-storey car parks, the lighting on the Langen Campus is being converted to energy-saving LED lighting. Where possible, additional sensors (motion detectors, dimming function) are also being installed so that the lights only switch on when required.	2025	In implementation
Converting CVOR to DVOR omnidirectional radio beacons and decommissioning VOR sites	Due to the gradual introduction of satellite-based flight procedures at more than 60 German airports, seven CVOR beacons will be converted into DVOR beacons between 2021 and 2025. Six VOR facilities will also be decommissioned during this period.	2025	In implementation
Reorganisation of the kitchen in the company restaurant in Langen	The production and storage areas of the canteen in Langen are being extensively modernised and restructured. Better work organisation, more modern appliances and more efficient use of cooling and production areas can significantly reduce water consumption (dishwashing technology and wet waste disposal) and energy requirements (less connected load for appliances and less exhaust air).	2027	Open

Reduction of CO_2 emissions for mobility by 20% by 2025 (base year: 2021)

Measure	Description	Implementation	Status
Facilitating remote working	DFS continues to enable up to 50 percent of working time to be performed remotely (known as FlexOffice at DFS) and is expanding offers for climate-friendly alternatives for commuting.	2023	Ongoing
Subsidising the Deutschland-Ticket	Creating an incentive for the entire workforce to use public transport to commute to work by subsidising the Deutschland-Ticket from May 2023.	2023	Completed
Launch of e-charging infrastructure for employee vehicles at major DFS sites	DFS is installing e-charging facilities at DFS sites where there is a high demand for e-charging among the workforce. This will be carried out to uniform standards (operating concept, billing, payment and quality of the electricity) and in cooperation with local partners.	2025	In implementation
Reduction of business trips through virtual events and incentivising rail travel	Climate protection will be given greater consideration in the choice of mode of transport and travel behaviour and this will be anchored accordingly in internal regulations. More incentives are being offered for using the train and key routes are defined on which rail use is mandatory.	2025	In implementation
Achieving a quota of 100% low-emission vehicles for those personally assigned	For vehicles that are personally assigned (company cars and employee vehicles), DFS is aiming for a company-wide quota of 100 percent of low-emission company cars and employee vehicles (max. 50g CO_2/km).	2025	In implementation

Reduction of waste volume by at least 5% by 2025 (base year: 2021)

Measure	Description	Implementation	Status
Development of a DFS standard for a uniform waste separation concept and optimisation of waste separation	Having a DFS standard is the prerequisite for collecting waste with the greatest possible separation rate. Updating the way waste is separated at the control centre sites. Reporting a recycling and waste separation rate to demonstrate success and effectiveness.	2022	Completed
Development of a waste guide	Raising staff awareness of the need to separate waste by type as far as possible by drawing up a waste guide containing the key regulations, contacts and disposal options.	2022	Completed
Improving waste separation at all towers	Implementing the DFS standard for waste separation for all DFS towers where it was not yet in place, namely the towers at Cologne Bonn, Düsseldorf, Leipzig, Dresden and Nürnberg airports.	2023	Completed
Review of the continued use of UPS batteries (uninterruptible power supply)	For an uninterruptible power supply, there are batteries at key DFS sites that are regularly replaced. To reduce hazardous waste, examining options for the systematic continued use of these batteries, which are generally still in good working order.	2023	Completed

Reduction of resource consumption by at least 5% by 2025 and increase of the proportion of near-natural areas by at least 5% by 2025 (base year: 2021)			
Measure	**Description**	**Implementation**	**Status**
Extending the service life of administrative IT hardware	IT hardware in the office communication environment (laptops, smartphones, printers) is used in line with maximum life cycles. This is particularly evident in the design of maintenance contracts with manufacturers, in the planning of standardised hardware replacement and in the preference for repair over replacement.	2022	Ongoing
Stockpiling of technical spare parts and inhouse repairs	To avoid waste from electronic waste and with the aim of reducing costs, old electronic components of technical air navigation facilities and systems are tested and kept in stock as spare parts. Repairs and replacements are also carried out in-house at DFS.	2022	Ongoing
Expansion of the evaluation matrix for procurement processes to include environmental aspects	Increasingly taking into account environmental and sustainability aspects in the selection and evaluation of suppliers in the tendering/procurement process.	2022	Completed
DFS-wide use of recycled paper for printing and copying	Changing the paper standard to recycled paper (ISO 20494, Blue Angel) throughout DFS. No longer procuring DFS corporate stationery with embossed DFS logo, as well.	2022	Completed
Selection and procurement of advertising materials and give-aways in line with environmental criteria	Having advertising materials and give-aways meet environmental criteria in terms of material, durability and origin. Only including products in the range based on these factors.	2022	Completed
Re-naturalisation of the land around the radar facility in Dreieich-Götzenhain as a pilot project for other radar sites	Creating a Forest for the Future (climate-resistant trees) as well as areas for ground nesting birds and nesting aids for wild bees in cooperation with local nature conservation organisations on the 13,000 square metre meadow at the radar facility in Dreieich-Götzenhain.	2022	Completed
Development and implementation of an ecological tree and planting concept for the external grounds at the Karlsruhe site	Developing and implementing an overall concept in cooperation with local nature conservation experts. The plan involves planting only native and climate-appropriate tree species on the company's premises and on its own woodland.	2023	Completed
Creation of a wildflower meadow on the demolition site of the old building in Munich	A wildflower meadow will be temporarily sown on the site of the old building after demolition in order to re-naturalise the area. After completion of the construction project, part of the wildflower meadow is to be retained, as the new building will be smaller than the old building based on current planning.	2024	Open
Installation of digital water meters at the Karlsruhe site	With the help of digital water meters, displaying water consumption much more accurately and analysing consumption better.	2024	Completed
Widespread installation of water-saving aerators on hand basins	To reduce water consumption, water-saving aerators will be installed at all hand wash basins. Their use in the showers in the sports and relaxation rooms is also being examined.	2024	Open

Reduction in printer coverage and reduction of single-user printers	At DFS Headquarters in Langen in particular, the number of multifunctional devices is being significantly reduced (currently over 100 devices). Similarly, single-user printers in the office communication environment will be further scaled back due to their	2025	In implementation
Development of a drainage concept for the DFS Campus	In view of the frequent occurrence of heavy rainfall events, an overall concept to manage stormwater runoff is being developed for the Campus. Rainwater is to be safely drained even during heavy rainfall and used in the best possible way as so-called grey water.	2025	In implementation

Reduction of emissions that can be indirectly influenced (CO_2 and non-CO_2) from air traffic

Measure	Description	Implementation	Status
Establishment of an indicator for measuring fuel consumption and CO_2 emissions from air traffic	Fuel consumption and CO_2 emissions are to be calculated continuously at the level of the individual flight. These calculations will be based on the flight trajectories recorded by DFS and the BADA (Base of Aircraft Data) model. These data are displayed in the DFS dashboard and are also available for further detailed (retrospective) analyses.	2024	In implementation
Reduction in fuel consumption for approaches to the designated international airports in Germany	Arrival routes are being analysed as part of the international HERON (high efficient green operations) project. The planned and actually flown route in a 30 NM circle around the airport are compared. The 90th percentile of the distance actually flown is selected and published. Shorter plannable distances for approaches mean that less fuel has to be factored in and transported, which in turn leads to lower fuel consumption and less CO_2 emissions.	2024	In implementation
Participation in research on non-CO_2 effects/climate-sensitive level bands	Studies of the German Aerospace Centre (DLR) show that the formation of contrails in certain regions (vertically and horizontally) of the Earth's atmosphere may have a much greater impact on the climate than previously assumed, depending on weather conditions. DFS is therefore participating in research projects to reduce non-CO2 effects (D-KULT project).	2025	In implementation
Further development of CDO/CCO procedures linked to upper airspace and across borders	With OPD (optimised profile descent), DFS currently provides airlines with CDO procedures for the approach to Frankfurt Airport, which enable a continuous optimised descent, if possible, from cruising level down to approach control. Further potential for CDOs at Frankfurt, Cologne Bonn and Düsseldorf airports is to be analysed together with airlines as a next step.	2025	In implementation
Operational utilisation of new ways of digital air–ground communications	From 2027, newly built aircraft that fly higher than flight level 285 are to transmit their currently planned optimum flight profile to air traffic control via datalink (ADS-C EPP). To date, individual aircraft have already been equipped with this technology. By comparing the ADS-C flight profile of the aircraft with the flight profile calculated in the DFS system and the flight profile actually flown, conclusions can be drawn about optimisation potential for existing procedures and letters of agreement between control centres. As a result, fuel consumption and CO_2 emissions can be reduced.	2025	In implementation

Working with tools for the analysis of trajectories with regard to CO_2 emissions and determination of optimisation potential	Relevant tools for analysing flights and flight procedures in terms of fuel consumption and emissions are to be identified, evaluated and modified for DFS requirements. These tools are to calculate the fuel consumption and emissions of a flight on the basis of the recorded flight tracks and a flight performance model.	2025	In implementation
Expansion of Airport-CDM at Frankfurt and Munich airports	The introduction of a ground coordination process at Frankfurt and Munich airports fulfils the requirements of Advanced A-CDM and is therefore a preliminary stage to Total Airport Management. The joint coordination between air traffic control, airport, apron control and airlines will be expanded and deepened in terms of time and procedures with the aim of reducing issues at the interfaces between the system partners.	2027	Open

Reduction of aircraft noise emissions that can be directly influenced by DFS in the terminal control area of international airports

Measure	Description	Implementation	Status
Germany-wide implementation of the PBN standard (performance-based navigation)	In accordance with Commission Implementing Regulation (EU) No. 2018/1048, DFS is gradually converting all of the approximately 2,500 flight procedures at the 59 IFR airports in Germany to a new, modern area navigation standard by 2030. This is intended to ensure Europe-wide standards in flight guidance, for example to enable more airspace capacity and greater track compliance of aircraft with the defined flight procedures.	2030	In implementation

1.2.6. Environmental account

Company-wide and site-specific environmentally relevant consumption and emissions

DFS (parent company)	2021	2022	2023	+/-% year-on-year
Flights under instrument flight rules (million)	1.669	2.636	2.839	+7.70
Average deviation (%)	0.81	1.04	0.99	-4.81
Average deviation (km)	2.8	3.6	3.4	-5.56

The average deviation from the ideal route (defined as the Europe-wide indictor horizontal: en-route flight efficiency) relates in each case to the en-route flight segment between the terminal control area of the departure and destination airports. This area is defined by a great circle with a radius of 40 nautical miles (NM), in which flexible approach and departure control and noise abatement concerns are prioritised. But with 2.8 million controlled flights, air traffic volumes in 2023 were still 15 percent below the 2019 level and thus roughly the same as 20 years ago. However, there is one big difference. While the number of overflights continued to rise, the number of flights within Germany reached an all-time low.

Total energy consumption

DFS (parent company)	2021	2022	2023	+/-% year-on-year
Electricity (MWh/year)	65,484	65,167	62,806	-3.62
Natural gas (MWh/year)	7,547	5,130	4,020	-21.64
Heating oil (l/year)	53,986	196,401*	87,930	-55.23
Fuel (diesel) (l/year)	112,493	184,502	177,657	-3.71
Heating water (MWh/year)	13,962	12,453*	10316	-17.16
Steam (MWh/year)	508	435	406	-6.67
Chilled water (MWh/year)	13,955	13,592	13,130	-3.40

Various energy and resource efficiency measures have led to a reduction in electricity, gas and heat consumption. Heating oil use declined at an above-average rate in 2023 due to annual fluctuations in filling up the tanks of the emergency power supply systems.

*Values were added retrospectively due to the very late delivery of operating cost statements from some airports.

Langen Campus	2021	2022	2023	+/-% year-on-year
Electricity (MWh/year)	23,208	22,717	21,681	-4.56
Heating oil (l/year)	6,830	3,958	6,549	+65.46
Heating water (MWh/year)	11,390	9,957	8,916	-10.45
Steam (MWh/year)	508	435	406	-6.67
Chilled water (MWh/year)	13,955	13,592	13,130	-3.40

Bremen control centre	2021	2022	2023	+/-% year-on-year
Electricity (MWh/year)	4,890	5,438	5,321	-2.15
Natural gas (MWh/year)	2,454	1,886	2,052	+8.80
Heating oil (l/year)	18,347	74,233	0	--

Karlsruhe control centre	2021	2022	2023	+/-% year-on-year
Electricity (MWh/year)	4,922	4,973	4,891	-1.65
Natural gas (MWh/year)	1,449	908	-	-
Heating water (MWh/year)		265	786	+196.60
Heating oil (l/year)	11,000	4,355	8,900	+104.36

Munich control centre	2021	2022	2023	+/-% year-on-year
Electricity (MWh/year)	8,688	8,732	7,775	-10.96
Heating water (MWh/year)	1,373	1,335	1,063	-20.37
Heating oil (l/year)	5,354	4,666	0	--

Fuel (diesel)

Diesel (l)	2021	2022	2023	+/-% year-on-year
DFS (parent entity)	**112,493**	**184,502**	**177,657**	**-3.71**
Langen Campus	112,493	65,996	70,961	+7.52
Bremen control centre	-	13,218	10,470	-20.79
Karlsruhe control centre	-	3,052	4,133	+35.42
Munich control centre	-	23,946	27,226	+13.70

Fuel consumption corresponds to the tank volume of all DFS-owned vehicles (pool vehicles, company cars and technical vehicles). Since 2022, fuel consumption has been broken down by site. This is based on the kilometres travelled per vehicle stationed at the site.

Fuel (electricity)

MWh/year	2021	2022	2023	+/-% year-on-year
DFS (parent entity)	**2.05**	**3.72**	**52.65**	**+1270**
Langen Campus	1.55	2.86	5.15	+80.07
Bremen control centre	--	--	--	--
Karlsruhe control centre	0.5	0.86	1.9	+120.66
Munich control centre	--	--	45.6	--

Charging electricity for DFS vehicles is shown separately here but is included in the total electricity consumption of the respective site.

Total generation of renewable energies

MWh/year	2021	2022	2023	+/-% year-on-year
DFS (parent entity)	95	103	92	-10.68
Langen Campus	95	103	92	-10.68
Bremen control centre	0	0	0	0
Karlsruhe control centre	0	0	0	0
Munich control centre	0	0	0	0

At the Langen Campus, electricity is generated by our own photovoltaic system and fed entirely into the public grid.

Total consumption of renewable energies

MWh/year	2021	2022	2023	+/-% year-on-year
DFS (parent entity)	0	0	0	0
Langen Campus	0	0	0	0
Bremen control centre	0	0	0	0
Karlsruhe control centre	0	0	0	0
Munich control centre	0	0	0	0

Material efficiency

DFS (parent company)	2021	2022	2023	+/-% year-on-year
Paper consumption	17,464	16,116	15,323	-4.92

Paper consumption continued to fall significantly in 2023. This was mainly due to the digitalisation of previously paper-based processes and the continued increase in remote working.

Langen Campus	2021	2022	2023	+/-% year-on-year
Paper consumption	11,346	11,242	11,262	+0.18

Bremen control centre	2021	2022	2023	+/-% year-on-year
Paper consumption	763	893	791	-11.42

Karlsruhe control centre	2021	2022	2023	+/-% year-on-year
Paper consumption	1,023	923	886	-4.01

Munich control centre	2021	2022	2023	+/-% year-on-year
Paper consumption	1,158	1,153	609	-47.18

Water consumption

DFS (parent company)	2021	2022	2023	+/-% year-on-year
Fresh water consumption (m^3/year)	59,541	70,893*	66,841	-5.72

The consumption of fresh water fell significantly in 2023 due to a number of technical measures in Karlsruhe and Munich. *Values were added retrospectively due to the very late delivery of operating cost statements from some airports.

Langen Campus	2021	2022	2023	+/-% year-on-year
Fresh water consumption (m^3/year)	27,450	28,671	31,709	+10.60

Bremen control centre	2021	2022	2023	+/-% year-on-year
Fresh water consumption (m^3/year)	10,757	9,379	8,428	-10.14

Karlsruhe control centre	2021	2022	2023	+/-% year-on-year
Fresh water consumption (m^3/year)	5,193	7,364	6,385	-13.29

Munich control centre	2021	2022	2023	+/-% year-on-year
Fresh water consumption (m^3/year)	7,348	8,384	6,969	-16.88

Waste volume

DFS (parent entity)	2021	2022	2023	+/- % previous year
Non-hazardous waste (kg/year)	**541,416**	**533,630**	**423,574**	**-20.62**
Residual waste (commercial)	149,412	163,913	124,997	-23.74
Paper / cardboard / cardboard packaging	117,434	106,681	107,432	+0.7
Recyclables	220,555	153,075	133,814	-12.58
Organic waste	54,015	109,961	57,331	-47.86
Hazardous waste (kg/year)	**127,401**	**121,167**	**121,541**	**+0.31**
Special waste	51,156	53,842	56,923	+5.72
Electrical/electronic waste	76,245	67,325	64,618	-4.02

The volume of hazardous and non-hazardous waste has continued to fall across DFS. There are different reasons for this depending on the type of waste:

- **Mixed waste for recycling (AzV) – commercial residual waste:** Less bulky waste (approx. 8.5 tonnes) was the main reason for the overall decrease of approx. 39 tonnes.
- **Recyclable materials (packaging, used glass, metal, waste wood...):** In the case of recyclable materials, there was a reduction in the amount of waste of approx. 27 tonnes compared to the previous year. The main deviations here are due to the more precise quantity calculation for the lightweight packaging (LVP) component. There were also significant decreases in waste wood (approx. 1.8 tonnes) and scrap metal (approx. 3.3 tonnes).
- **Hazardous waste (batteries, chemicals; used oil, light bulbs...):** The waste volume from the various components fell slightly overall. However, an oil separator emptying of 15 tonnes led to a slight increase overall.
- **Organic waste:** The decrease in organic waste (approx. 52 tonnes) by almost half is striking. However, this does not indicate a deterioration in biowaste collection (this was even improved at some sites) but is essentially due to individual effects (minus 20 tonnes of grease separator contents, minus 26 tonnes of garden waste). Organic waste collection has now been introduced at the Tower branches in Stuttgart, Düsseldorf and Hannover. Organic waste collection is currently not feasible at the remaining smaller tower sites for infrastructural reasons.

Waste utilisation

DFS (parent company)	2021	2022	2023	+/-% year-on-year
Total waste volume (kg/year)	**668,817**	**654,797**	**545,115**	**-16.75**
Proportion separated (kg/year)	-	490,884	420,118	-14.42
Percentage separated (%)	-	74.97	77	+2.71
Disposal (%)	-	3	3	0.00
Material recycling (%)	-	78	78	-
Thermal utilisation (%)	-	19	19	-
Investigation and administrative fine proceedings	-	0	0	-

The percentage of waste separated (separately collected waste components) improved slightly in 2023. The recycling/utilisation rates were determined on the basis of information provided by the waste management companies, general information from industry and sector associations and publications by the authorities. A total of 45 waste components are collected separately at DFS.

Langen Campus	2021	2022	2023	+/-% year-on-year
Non-hazardous waste (kg/year)	**225,916**	**198,396**	**190,986**	**-4.00**
Residual waste (commercial)	46,865	28,357	26,620	-6.13
Paper / cardboard / cardboard packaging	42,719	62,163	59,424	-4.41
Recyclables	124,602	92,151	92,824	+0.73
Organic waste	11,730	16,265	12,118	-25.50
Hazardous waste (kg/year)	**93,897**	**108,608**	**105,950**	**-2.45**
Special waste	29,242	49,648	44,537	-10.29
Electrical/electronic waste	64,655	58,960	61,413	+4.16

Bremen control centre	2021	2022	2023	+/-% year-on-year
Non-hazardous waste (kg/year)	**64,655**	**60,500**	**60,252**	**-0.41**
Residual waste (commercial)	38,400	37,600	43,750	+16.36
Paper / cardboard / cardboard packaging	5,420	6,210	5,372	-13.49
Recyclables	16,835	14,290	7,210	-49.55
Organic waste	4,000	2,400	3,920	+63.33
Hazardous waste (kg/year)	**4,850**	**2,317**	**2,008**	**-13.34**
Special waste	3,490	466	1,368	+193.56
Electrical/electronic waste	1,360	1,851	640	-65.42

Karlsruhe control centre	2021	2022	2023	+/-% year-on-year
Non-hazardous waste (kg/year)	**62,385**	**52,749**	**66,461**	**+25.99**
Residual waste (commercial)	15,700	22,340	17,880	-19.96
Paper / cardboard / cardboard packaging	14,270	2,846	21,949	+671.22
Recyclables	9,020	9,151	8,119	-11.28
Organic waste	23,395	18,412	18,513	+0.55
Hazardous waste (kg/year)	**900**	**5,593**	**1,220**	**-78.19**
Special waste	900	966	1,220	+26.29
Electrical/electronic waste	0	4,627	0	-

Munich control centre	2021	2022	2023	+/- % year-on-year
Non-hazardous waste (kg/year)	**32,404**	**34,436**	**25,004**	**-27.39**
Residual waste (commercial)	1,960	1,300	2,670	+105.38
Paper / cardboard / cardboard packaging	3,570	5,830	4,985	-14.49
Recyclables	13,234	8,870	15,310	+72.60
Organic waste	13,640	18,436	2,039	-88.94
Hazardous waste (kg/year)	**2,247**	**1,849**	**10,414**	**+463.22**
Special waste	1,577	1,813	8,154	+349.75
Electrical/electronic waste	670	36	2260	+6177.78

Use of land

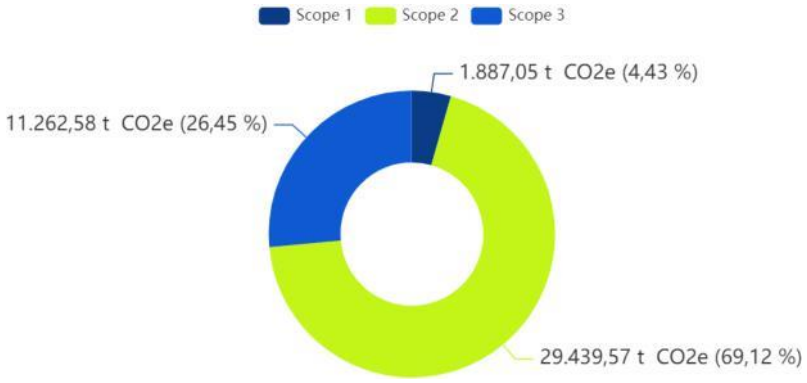
2023 (m^2)	Total area	Sealed	of which green roofs (%)	Unsealed	of which near-natural state	Level of sealed land
DFS (parent entity)	**1,274,653**	**348,489**	**15,895**	**926,165**	**74,981**	**27**
Langen Campus	192,563	109,972	11,177	82,591	34,464	57
Bremen control centre	8,053	6,972	200	1,081	195	87
Karlsruhe control	36,720	17,399	737	9,432	18,050	47
Munich control centre	29,576	20,365	3,781	9,211	2,455	69
15 control towers	59,892	28,610	--	31,282	--	48
Technical facilities	947,849	165,171	--	782,678	19,817	17

In 2023, the roof of the Bremen control centre was greened. Areas around some technical facilities were also re-naturalised. This led to an increase in the proportion of near-natural areas by 10 percent compared to 2022.

2022 (m^2)	Total area	Sealed	of which green roofs (%)	Unsealed	of which near-natural state	Level of sealed land
DFS (parent entity)	**1,274,653**	**348,489**	**15,695**	**926,165**	**68,164**	**27**
Langen Campus	192,563	109,972	11,177	82,591	34,464	57
Bremen control centre	8,053	6,972	--	1,081	195	87
Karlsruhe control	36,720	17,399	737	9,432	18,050	47
Munich control centre	29,576	20,365	3,781	9,211	2,455	69
15 control towers	59,892	28,610	--	31,282	--	48
Technical facilities	947,849	165,171	--	782,678	13,000	17

2021 (m^2)	Total area	Sealed	of which green roofs (%)	Unsealed	of which near-natural state	Level of sealed land
DFS (parent entity)	**1,264,624**	**348,348**	**15,695**	**916,275**	**44,664**	**28**
Langen Campus	192,563	109,972	11,177	82,591	34,464	57
Bremen control centre	8,053	6,972	--	1,081	195	87
Karlsruhe control centre	36,720	17,399	737	9,432	7,550	65
Munich control centre	29,576	20,365	3,781	9,211	2,455	69
15 control towers	59,892	28,610	--	31,282	--	48
Technical facilities	947,849	165,171	--	782,678	--	17

CO_2 balance (Scope 1-3)



DFS (parent company) (t of CO_2-eq / year)	2021	2022	2023	+/-% year-on-year
Scope 1	**2,237.06**	**2,155.53**	**1,887.05**	-16.03
Vehicle fleet	575.06	583.67	832.13	+42.71
Stationary combustion	1,662	1,528.76	1,042.32	-37.22
Refrigerant losses	-	43.1	12.60	-72.16
Scope 2	**29,871.66**	**30,556.83**	**29,439.57**	**-3.66**
Electricity, electrical power	23,396.95	24,026.22	23,584.50	-1.84
District heating	3,389.15	2,927.29	2,884.13	-1.47
Other (chilled water, steam)	3,085.56	3,603.32	3,197.61	-11.27
Scope 3	**9,088.28**	**9,605.4**	**11,338.17**	**+18.04**
3.1 Catering	145.03	210.29	264.42	+25.71
3.1 Paper and printed materials	17.83	14.82	14.09	-4.93
3.1 Water	19.1	19.91	22.06	+10.50
3.1 External data centre	-	17.74	19.80	+11.61
3.2 Electronics	345.5	345.5	232.00	-32.75
3.3 Upstream (Scope 1 and 2)	512.16	472.61	2,797.40	+492.35
3.4 Inbound logistics	0.03	0.03	0.03	0.00
3.5 Waste	328.8	408.03	531.26	+30.15
3.6 Business trips	640.6	1,163.14	1,525.13	+31.13
3.7 Commuting	7,079.23	6,953.33	5,931.98	-14.70
Total (Scope 1 and 2)	**32,108.72**	**32,712.36**	**31,326.62**	**-4.24**
Total (Scopes 1-3)	**41,197**	**42,317.76**	**42,589.2**	**+0.64**

The slight reduction in CO_2 emissions in Scope 2 is due to lower energy consumption and a reduced emissions factor for the German electricity mix. The increase in Scope 3 is mainly due to more business trips.

Greenhouse gas impact (according to the Kyoto Protocol)

DFS (parent company) (t/year)	2021	2022	2023	+/-% year-on-year
Underlying volume (t CO_2-eq / year)	2,650.48	2,461.05	1,836.51	-25.40
CO_2	2,459.59	2,289.17	1,724.96	-22.97
CH_4	7.28	5.41	3.61	-40.30
N_2O	4.19	4.18	6.60	+57.89
HFC	-	27.50	12.60	-56.36
PFC	-	-	-	-
SF_6	-	-	-	-
NF_3	-	-	-	-

Langen Campus (t of CO_2-eq / year)	2021	2022	2023	+/-% year-on-year
Scope 1	322.48	338.46	209.37	-38.17
Scope 2	11,996.62	11,639.93	10,912.63	-6.25
Scope 3	406.41	426.64	620.96	+45.54
Total (Scope 1 and 2)	**12,319.10**	**11,978.39**	**11,122.00**	**-7.15**
Total (Scopes 1-3)	**12,725.51**	**12,405.03**	**11,742.96**	**-5.34**

Bremen control centre (t of CO_2-eq / year)	2021	2022	2023	+/-% year-on-year
Scope 1	498.82	576.58	441.22	-23.44
Scope 2	2,004.90	2,360.09	2,352.32	-0.34
Scope 3	138.53	159.69	454.71	+185.53
Total (Scope 1 and 2)	**2,503.72**	**2,936.67**	**2,793.54**	**-4.87**
Total (Scopes 1-3)	**2,637.25**	**3,096.36**	**3,248.25**	**+4.91**

Karlsruhe control centre (t of CO_2-eq / year)	2021	2022	2023	+/-% year-on-year
Scope 1	320.78	194.28	34.81	-82.47
Scope 2	2,018.02	2,158.28	2,223.65	+3.01
Scope 3	101.51	204.81	356.28	+73.96
Total (Scope 1 and 2)	**2,338.80**	**2,352.56**	**2,258.46**	**-4.00**
Total (Scopes 1-3)	**2,440.31**	**2,557.37**	**2,614.74**	**+2.23**

Munich control centre (t of CO_2-eq / year)	2021	2022	2023	+/-% year-on-year
Scope 1	14.21	12.39	73.66	+503.88
Scope 2	3,794.12	4,015.31	3,626.57	-9.69
Scope 3	37.93	29.09	513.23	+1663.29
Total (Scope 1 and 2)	**3,808.33**	**4,027.70**	**3,700.23**	**-8.13**
Total (Scopes 1-3)	**3,846.26**	**4,056.79**	**4,213.46**	**+3.87**

Pollutant emissions

DFS (parent company) (kg/year)	2021	2022	2023	+/-% year-on-year
SO_2	326	686*	426	-37.90
NOx	1639	1,635*	1158	-29.17
Particulate matter	93	126*	87	-30.95

The lower pollutant emissions are due to a reduction in gas and heating oil consumption. *Values were added retrospectively due to the very late delivery of operating cost statements from some airports.

Langen Campus (kg/year)	2021	2022	2023	+/-% year-on-year
SO_2	131	77	87	+12.99
NOx	149	88	99	+12.50
Particulate matter	21	12	14	+16.67

Bremen control centre (kg/year)	2021	2022	2023	+/-% year-on-year
SO_2	29	201	36	-82.09
NOx	447	542	385	-28.97
Particulate matter	20	37	18	-51.35

Karlsruhe control centre (kg/year)	2021	2022	2023	+/-% year-on-year
SO_2	41	24	24	0.00
NOx	291	180	27	-85.00
Particulate matter	15	9	3	-66.67

Munich control centre (kg/year)	2021	2022	2023	+/-% year-on-year
SO_2	12	35	28	-20.00
NOx	13	40	32	-20.00
Particulate matter	1	5	5	0.00

1.2.7. Indicators

Indicators of environmental performance

Master data for calculating indicators

Site	Master data 2021	2021	2022	2023	+/-% year-on-year
DFS (parent entity)	Employees	5,584	5,612	5,687	+1.34
	Gross floor area (m^2)	251,738	251,738	251,738	0.00
Langen Campus	Employees	3,066	3047	3,040	-0.23
	Gross floor area (m^2)	159,711	159,711	159,711	0.00
Bremen control centre	Employees	467	476	489	+2.73
	Gross floor area (m^2)	20,291	20,291	20,291	0.00
Karlsruhe control centre	Employees	706	704	730	+3.69
	Gross floor area (m^2)	17,949	17,949	17,949	0.00
Munich control centre	Employees	499	491	481	-2.04
	Gross floor area (m^2)	29,039	29,039	29,039	0.00

Energy efficiency

Site	Performance indicator (kWh/year)	2021	2022	2023	+/-% year-on-year
DFS (parent entity)	Consumption of energy for heating and cooling (excluding electricity)	143	125	114	-10.24
	Electricity consumption / m^2	260	259	249	-3.86
Langen Campus	Consumption of energy for heating and cooling (excluding electricity)	162	150	141	-6.00
	Electricity consumption / m^2	145	142	136	-4.32
Bremen control centre	Consumption of energy for heating and cooling (excluding electricity)	121	93	101	+8.60
	Electricity consumption / m^2	241	268	262	-2.62
Karlsruhe control centre	Consumption of energy for heating and cooling (excluding electricity)	81	51	44	-13.73
	Electricity consumption / m^2	274	277	273	-1.44
Munich control centre	Consumption of energy for heating and cooling (excluding electricity)	47	46	37	-19.57
	Electricity consumption / m^2	299	301	268	-10.96

Material efficiency

Site	Performance indicator (kg/year)	2021	2022	2023	+/-% year-on-year
DFS (parent entity)	Paper consumption / employee	3.13	2.87	2.69	-6.27
Langen Campus	Paper consumption / employee	3.70	3.69	3.70	+0.27
Bremen control centre	Paper consumption / employee	1.63	1.88	1.62	-13.83
Karlsruhe control centre	Paper consumption / employee	1.45	1.31	1.21	-7.63
Munich control centre	Paper consumption / employee	2.32	2.35	1.27	-45.96

Water consumption

Site	Performance indicator (m^3/year)	2021	2022	2023	+/-% year-on-year
DFS (parent entity)	Water consumption / employee	10.66	12.63*	11.75	-6.97
Langen Campus	Water consumption / employee	8.95	9.41	10.43	+10.84
Bremen control centre	Water consumption / employee	22.85	19.70	17.24	-12.49
Karlsruhe control centre	Water consumption / employee	7.36	10.46	8.75	-16.35
Munich control centre	Water consumption / employee	14.73	17.08	14.49	-15.16

Waste volume

Site	Performance indicator (kg/year)	2021	2022	2023	+/-% year-on-year
DFS (parent entity)	Non-hazardous waste / employee	97	95	74	-22.11
	Hazardous waste / employee	23	22	21	-4.55
Langen Campus	Non-hazardous waste / employee	74	65	63	-3.08
	Hazardous waste / employee	31	36	35	-2.78
Bremen control centre	Non-hazardous waste / employee	138	127	123	-3.15
	Hazardous waste / employee	10	5	4	-20.00
Karlsruhe control centre	Non-hazardous waste / employee	88	75	91	+21.33
	Hazardous waste / employee	1	8	2	-75.00
Munich control centre	Non-hazardous waste / employee	65	70	52	-25.71
	Hazardous waste / employee	5	4	22	+450.00

CO_2 emissions (Scope 1 and 2)

Site	Performance indicator (t of CO_2-eq / year)	2021	2022	2023	+/-% year-on-year
DFS (parent entity)	CO_2 emissions / employee	5.74	5.82	5.18	-10.84
Langen Campus	CO_2 emissions / employee	4.02	3.93	3.66	-5.43
Bremen control centre	CO_2 emissions / employee	5.36	6.17	5.71	-8.49
Karlsruhe control centre	CO_2 emissions / employee	3.31	3.34	3.05	-8.96
Munich control centre	CO_2 emissions / employee	5.39	5.72	5.01	-12.41

CO_2 emissions (Scope 3)

Site	Performance indicator (t of CO_2-eq / year)	2021	2022	2023	+/-% year-on-year
DFS (parent entity)	CO_2 emissions / employee	1.63	1.71	1.99	+16.37
Langen Campus	CO_2 emissions / employee	0.13	0.14	0.20	+42.86
Bremen control centre	CO_2 emissions / employee	0.30	0.34	0.93	+173.53
Karlsruhe control centre	CO_2 emissions / employee	0.14	0.29	0.53	+82.76
Munich control centre	CO_2 emissions / employee	0.08	0.06	1.07	+1683.33

Pollutant emissions

Site	Indicator (g/year)	2021	2022	2023	+/-% year-on-year
DFS (parent entity)	SO_2 emissions / employee	58	122	75	-38.52
	NO_x emissions / employee	294	291	204	-29.90
	Particulate matter emissions / employee	17	22	15	-31.82
Langen Campus	SO_2 emissions / employee	43	25	29	+16.00
	NO_x emissions / employee	49	29	33	+13.79
	Particulate matter emissions / employee	7	4	5	+25.00
Bremen control centre	SO_2 emissions / employee	62	422	74	-82.46
	NO_x emissions / employee	957	1139	787	-30.90
	Particulate matter emissions / employee	43	78	37	-52.56
Karlsruhe control centre	SO_2 emissions / employee	58	34	33	-2.94
	NO_x emissions / employee	412	256	37	-85.55
	Particulate matter emissions / employee	21	13	4	-69.23
Munich control centre	SO_2 emissions / employee	24	71	58	-18.31
	NO_x emissions / employee	26	81	67	-17.28
	Particulate matter emissions / employee	2	10	10	-

1.2.8. Explanation of data boundaries and calculation methodology

Calculation of CO_2 emissions

This corporate carbon footprint shows all emissions as CO2 equivalents (CO2-eq). CO2 emissions are calculated using data on consumption and emission factors for conversion into CO2-eq. DFS uses primary and secondary data in its data collection. Primary data are directly related to consumption (such as energy supplier billing), secondary data are obtained by processing and modelling primary data (such as Scope 3 data). In Scope 3, data are presented both at company level (business trips, commuting, electronics, external data centre, logistics) and at site level (upstream emissions, water, waste, vehicle fleet, refrigerants, paper). DFS uses the following sources to convert the consumption data into CO_2: ecoinvent, German Federal Environment Agency (UBA), Defra, ifeu, OeKO-Institut, German Federal Office for Economic Affairs and Export Control (BAFA). The degree of uncertainty in the calculation is +/- 3 percent. In addition to CO_2, the calculations also take into account the six other greenhouse gases regulated by the Kyoto Protocol (CH_4, N_2O, HFCs, PFCs, SF6, NF3) and are presented in CO_2 equivalents.

The software used to prepare the greenhouse gas balance is certified in accordance with the GHG Protocol and ISO 14064-1 (structure, algorithm and functionality of the software).

Calculation of pollutant emissions

Conversion factors for calculating pollutant emissions (SO_2, NO_X, particulate matter) were taken from the ProBas database of the German Federal Environment Agency (UBA) and the GEMIS database of the International Institute for Sustainability Analysis and Strategy (IINAS).

Waste volume

The DFS waste account is made up of the sub-accounts of the four EMAS-certified sites and the reports from the remaining branches. Waste for which DFS does not actually have 'material control' (*Sachherrschaft*) in accordance with Section 3(9) of the German Circular Economy Act (KrWG), and for which the primary waste producer obligations lie with the relevant companies, is not included in the accounts because there is no decisive influence on the way in which the waste is generated and disposed of. For disposal processes where no weighing takes place for process-related reasons, the waste quantities were extrapolated based on information provided by the disposal companies, determined using conversion factors or estimated based on past experience.

Paper consumption

For technical reasons, only the printers in the office environment are analysed; those in operations cannot be evaluated for technical reasons. However, the quantities produced there are estimated to be very low.

Calculation of the gross floor area

When calculating the gross floor area of DFS and the designated sites, only the heated areas equipped with permanent working positions were taken into account. Accordingly, technical sites, such as those for radio, navigation or radar, are not included in the gross floor area.

Supplement to consumption (heat and water) of DFS towers

Due to the late provision of the operating cost statements from some airports (Cologne Bonn, Düsseldorf, Nürnberg, Stuttgart, Berlin, Erfurt), the consumption of these DFS towers (heat and water) can only be accounted for retrospectively and added to the environmental account.

1.2.9. Declaration on verification [courtesy translation]

Environmental verifier's declaration on verification and validation activities

The *Institut für Umwelttechnik Dr. Kühnemann und Partner GmbH* with registration number DE-V-0133,

represented by Ulrich Schmidt with the registration number DE-V-0366,

certified to provide service activities incidental to air transportation NACE Code 52.23,

declares to have verified that DFS Deutsche Flugsicherung GmbH (DFS),

as indicated in the environmental statement meets all requirements of Regulation (EC) No 1221/2009 of the European Parliament and of the Council of 25 November 2009 on the voluntary participation by organisations in a community eco-management and audit scheme (EMAS), amended by the amending regulations (EU) 2017/1505 of 28 August 2017 and (EU) 2018/2026 of 19 December 2018.

By signing this declaration, it is declared that:

- the verification and validation has been carried out in full compliance with the requirements of Regulation (EC) No 1221/2009,
- the outcome of the verification and validation confirms that there is no evidence of non-compliance with applicable legal requirements relating to the environment,
- the data and information of the environmental statement of the organisation reflect a reliable, credible and correct image of all the organisation's activities, within the scope mentioned in the environmental statement.

This document is not equivalent to EMAS registration. EMAS registration can only be granted by a Competent Body under Regulation (EC) No 1221/2009. This document shall not be used as a stand-alone piece of public communication.

Dr. Kühnemann und Partner Institut für Umwelt technik

Hannover, 7 October 2024