Abridged

Environmental Statement 2022

Air navigation services and climate protection

EMAS
GEPRÜFTES UMWELTMANAGEMENT
DE-160-00018

DFS Deutsche Flugsicherung

Contents

Environmental Statement 2022

1.1. Preface

The year 2022 was one of positive and negative news for the aviation sector. Traffic growth was positive. After two years in the doldrums due to COVID-19, 2.64 million controlled flights were logged in German airspace – one million more than in the previous year. In contrast, horizontal en-route flight efficiency – the average deviation from the direct route – experienced a slightly negative trend. This was due to traffic growth, but also to the war in Ukraine with the associated airspace closures and an increase in military air traffic. With an average deviation of 1.04 percent (3.6 kilometres) per flight, DFS is still well below the European benchmark of 1.6 percent.

DFS also significantly reduced the radius of the protection zones around navigation facilities from 15 to 7 kilometres. This freed up an area equivalent to the size of the German State of Hesse which can now be used for the construction of new wind turbines.

The return to normality also had a positive impact on environmental protection in operations. We were able to roll back the hygiene measures implemented during the pandemic, such as an increased proportion of fresh air needed in buildings. This roll-back significantly reduced gas consumption at a number of locations.

In addition, we as a company have now set our sights more sharply on the goal of climate neutrality. In 2022, we prepared the way to source all of our electricity from renewable sources for the first time. This switch alone will enable DFS to halve its CO_2 footprint. Two locations have been converted from gas to district heating, with more to follow by 2029. In this way, we will gradually make DFS independent of fossil fuels. We also began integrating photovoltaic systems into the energy supply of our buildings and facilities in 2022. Given the necessity of ensuring supply security and the permanent availability of our services, this is quite a challenging task, especially at the Langen Campus.

In 2022, we also took a closer look at all indirect CO_2 emissions caused by our company. For the first time, DFS is reporting these in Scope 3 in accordance with the Green House Protocol, also retrospectively for 2021 for reasons of comparison. We have also set ourselves binding reduction targets in other areas such as energy, water, raw materials and land use, which we aim to achieve by 2025.

Arndt Schoenemann

Chairman and Chief Executive Officer (CEO)

EMAS

GEPRÜFTES UMWELTMANAGEMENT

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1.2. Account of environmental contributions

The DFS Campus in Langen is home to rare sand lizards, for which suitable habitats have been specially created. (Photo: DFS)

1.2.1. The year 2022

The year in figures

Size of the airspace controlled by DFS:

390,000 square kilometres

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

2.636 million

IFR take-offs and landings:

1.622 million

Horizontal en-route flight efficiency (deviation from the direct route):

1.04% (corresponds to around 3.6km)

Staff:

5,612 staff members (DFS)

1.2.2. Measures 2022

Decarbonisation & energy efficiency

The protection zones around Doppler omnidirectional radio beacons, such as the DVOR Ottersberg, have been reduced from 15 to 7 kilometres. (Photo: DFS)

DFS frees up more than 21,000 square kilometres for wind power

Based on a joint initiative of DFS and the German Federal Ministry for Economic Affairs and Climate Action (BMWK) and the Ministry for Digital and Transport (BMDV), the protection zones around a total of 40 ground-based navigation facilities were reassessed. As a result, DFS was able to reduce the radius of 39 out of 40 omnidirectional radio beacons (DVOR) from 15 to 7 kilometres. This means less than a quarter of the original area is now required for protection.

In Germany, a total of 50 ground-based omnidirectional radio beacons are currently in operation, comprising the 40 DVORs mentioned above and a further 10 conventional radio beacons (CVOR).

These CVORs, which are more susceptible to interference from wind turbines, are being converted to less sensitive DVORs or dismantled entirely with the support of the German Federal Government. The only exception is the facility on the island of Heligoland. With the introduction of modern, increasingly satellite-based navigation procedures, 20 (of 70) omnidirectional radio beacons have already been decommissioned since 2002. From 2030 onwards, only about 30 facilities will be needed. The rest will be completely dismantled. The CVOR sites in Roding, Erlangen and Bayreuth were decommissioned in 2022.

DFS is now trialling a new work concept at the LAB Campus for a period of five years. (Photo: FMG)

District heating instead of natural gas

The gas heating systems at the Karlsruhe control centre and at the tower at Nürnberg Airport were replaced in 2022. DFS made a conscious decision in favour of a more ecological technology by connecting to the public district heating network. Together, these two measures will save around 2,000 MWh of natural gas in future and reduce direct CO_2 emissions.

Energy-efficient lighting in Karlsruhe

The lighting at the Karlsruhe control centre has been converted to energy-saving LEDs with the exception of the basement and technical areas. The car park and pathway lighting, which is permanently in operation, switches to an insect-friendly yellowish light at night.

Concept for Green COM successfully completed

To utilise self-generated electricity at external facilities as well, a concept was developed using the Bremen Brinkum transmitter as an example of how the site can be supplied with energy via a photovoltaic system. The concept proved the economic, ecological and technical feasibility of the Green COM pilot project. Implementation is planned for 2023.

Decommissioning of the old building at the Munich control centre

Due to its very poor energy efficiency, DFS decommissioned the old building at the Munich control centre in 2022. It mainly housed the equipment rooms and offices of administrative staff, who moved to rented space in the nearby LAB Campus at the end of 2022. The special feature of the LAB Campus is the first use of modern working environments. There include co-working spaces, telephone booths, libraries and collaboration areas. All technical systems are also being gradually relocated from the old building. After demolition, a new building is to be erected by 2027.

Climate-friendly mobility

In the underground car park at DFS Headquarters, several parking spaces are designated exclusively for cargo bikes (Photo: DFS)

Climate-friendly commute to work

DFS allows its administrative employees to work up to 50 percent remotely in what is known at DFS as FlexOffice. This arrangement has been maintained even after the pandemic. DFS has also installed e-charging facilities for employees' private vehicles. Ten charging points have been available in Langen since 2022 in cooperation with a local utility company, Stadtwerke Langen, and eight charging points were installed on the company premises at the Munich control centre. Further e-charging infrastructure is also being planned for our own company cars and pool vehicles, which are to be 100 percent (pool vehicles: 50%) electrified by 2025.

In addition, DFS has been offering all employees a 'job bike' using a tax-incentivised leasing scheme since 2020. This offer is very popular, with over 1,000 DFS job bikes now on the road. DFS supports cycling by providing sufficient bike stands, showers and changing rooms.

Promotion of rail use for business trips

In 2022, the number of business trips increased significantly year-on-year, with around being made across DFS (2019: approx. 18,000; 2021: approx. 7,000). Around a third of these trips were made by train, with the remainder by aeroplane or car. To make travelling by train more attractive, DFS offers employees a free BahnCard Business, a railcard for business travellers. A total of over 40 BahnCards were issued in 2022.

Resource efficiency

The new DFS herb bed offers a wide range of herbs and wildflowers for insects and interested passers-by. (Photo: DFS)

Promoting insect diversity in the Rhine-Main region

A herb bed was created at DFS Headquarters in Langen and planted with natural and long-flowering herbs. Both insects and employees enjoy these plants. In addition, volunteers planted over 2,000 colourful flower bulbs, which were provided by an environmental organisation, NABU Langen-Egelsbach.

For the first time, DFS also re-naturalised areas that had become vacant at its external technical facilities. At the Dreieich-Götzenhain radar facility, there used to be a meadow measuring around 13,000 square metres which was no longer used for operational purposes and had long lain fallow. A DFS Forest for the Future was planted here in November 2022. This consists of 44 climate-resistant trees such as hazel, field maple, torminalis (wild service tree) and wild cherry. These tree species have proven to be particularly resistant to long periods of heat and drought.

In the long term, the forest will provide shade, prevent soil erosion and naturally ensure a healthy climate. The Forest for the Future is surrounded by around 60 shrubs, such as cornelian cherry, black cohosh, blackthorn and hawthorn. They provide food for birds and insects in particular.

Targeted re-naturalisation at the Karlsruhe site

The Karlsruhe control centre site includes a wooded area of around 1,800 square metres. Due to heat and drought, the pine trees growing there are in poor condition. An eco-concept was developed in 2022 with targeted reforestation of native species and measures to promote birds and bats. As an initial measure, around 40 nesting boxes were hung on the site and dried trees were gathered together as deadwood piles for insects.

The DFS Forest for the Future consists of 44 climate-resistant trees. They ecologically enhance the unused area. (Photo: DFS)

Paper consumption continues its downward trend

Less and less is being printed due to ongoing digitalisation – in 2022, the print volume fell again by 7.7 percent to 3.23 million pages. Theoretical training for air traffic control personnel used to be a paper-intensive process. Instead of folders, air traffic controller trainees now receive a tablet and can access the teaching materials online. This saves around 300,000 pages a year, equivalent to 1.5 tonnes of paper. The digital signing of contracts was also broadened – 2,979 contracts were signed digitally in 2022, which corresponds to a saving of around 60,000 sheets of paper. In addition, DFS only uses recycled paper that complies with the Blue Angel standard.

Criteria for sustainable procurement

Environmental and sustainability considerations have been incorporated into the internal evaluation criteria for the procurement of products and services. Such considerations must be taken into account to a substantial extent when selecting and evaluating suppliers.

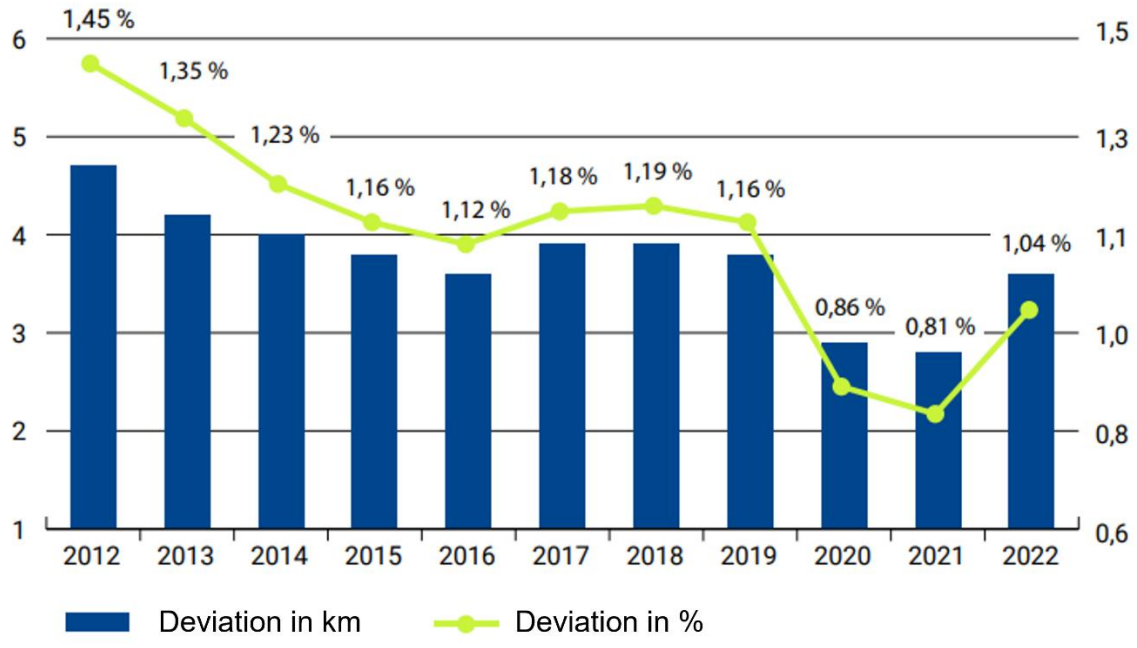
Improved waste separation

Waste separation was improved and harmonised at the tower at Hannover Airport, the Karlsruhe control centre and the operations room of the Langen control centre in 2022. As part of the introduction of EMAS, DFS defined a waste separation standard that is now being gradually implemented at all DFS sites. For this purpose, high-quality recycling stations were procured to ensure optimal waste separation, especially in the control rooms, which are staffed around the clock.

Environmentally friendly give-aways

Environmental criteria relating to materials, durability and origin have been defined for advertising materials and give-aways that are used to recruit young staff, for example. The products must be made from renewable raw materials or recycled materials and may only be produced within the EU, for instance.

Helping to promote climate-friendly flying



Higher air traffic volumes and complexity in the airspace led to a slight deterioration in horizontal en-route flight efficiency in 2022. (Visual: DFS)

Direct flights

In 2022, German air traffic volumes recovered markedly from their COVID-19-related slump. A total of 2.64 million flights under instrument flight rules were controlled in German airspace in 2022. Compared with the previous year, this was an increase of more than 50 percent (2021: 1.669 million flights).

A rise in the number of flights increases the complexity of airspace and makes direct flying more difficult. Increased military air traffic and the associated airspace closures due to the war in Ukraine are also significantly restricting the capacity for civil air traffic in German airspace.

Both effects led to a slight deterioration in horizontal en-route flight efficiency. However, with an average deviation of 1.04 percent from the ideal line in 2022 (corresponding to a deviation of 3.6 km per flight), DFS is still below the European benchmark of 1.6 percent and the 2019 level (1.16%).

Expansion of cross-border free airspace

Two functional airspace blocks, FAB CE and FABEC, have now agreed to introduce cross-border operations for free route airspace. This follows the signing of a joint declaration in summer 2021 to deepen the cooperation between them. This allows airlines to plan optimal routes across large areas of European airspace. It is precisely this possibility of being able to plan the shortest, most economical and thus potentially also the most climate-friendly route in advance that is the greatest advantage of free route airspace.

Airlines can freely plan their routes between defined entry and exit points independent of national airspace boundaries. This will enable them to reduce flight miles in the future, take advantage of favourable wind conditions or optimise flight paths around military training areas. Implementation began in stages from 24 March 2022. Cross-border free route operations between Austria and Germany are to be started gradually.

Research into non-CO_2 effects launched

Emissions from aviation that have an impact on the climate include not only CO_2 emissions, but also non-CO_2 effects, which, according to research to date, contribute significantly more to climate change than CO_2.

Condensation trails (contrails) are usually formed at higher flight levels (in the tropopause and lower stratosphere) by the condensation of the water vapour emitted from engines around soot particles. They only last from a few seconds to a few minutes, which is why they have no noticeable influence on climate change. However, contrails which form in ice-saturated areas (air layers with high humidity) can persist for up to several hours.

Winds and diffusion effects can then cause these contrails to spread into cirrus clouds. These cirrus clouds have an impact on global warming as they reduce the cooling of the earth at night. On the other hand, if the cirrus clouds form in the morning hours, they have a cooling effect as they reflect the sun's rays back into space. However, research considers the overall effect to be warming. The generation of long-lasting condensation trails can be prevented if aeroplanes fly around ice-covered areas horizontally, by changing their route, or vertically, by changing their altitude.

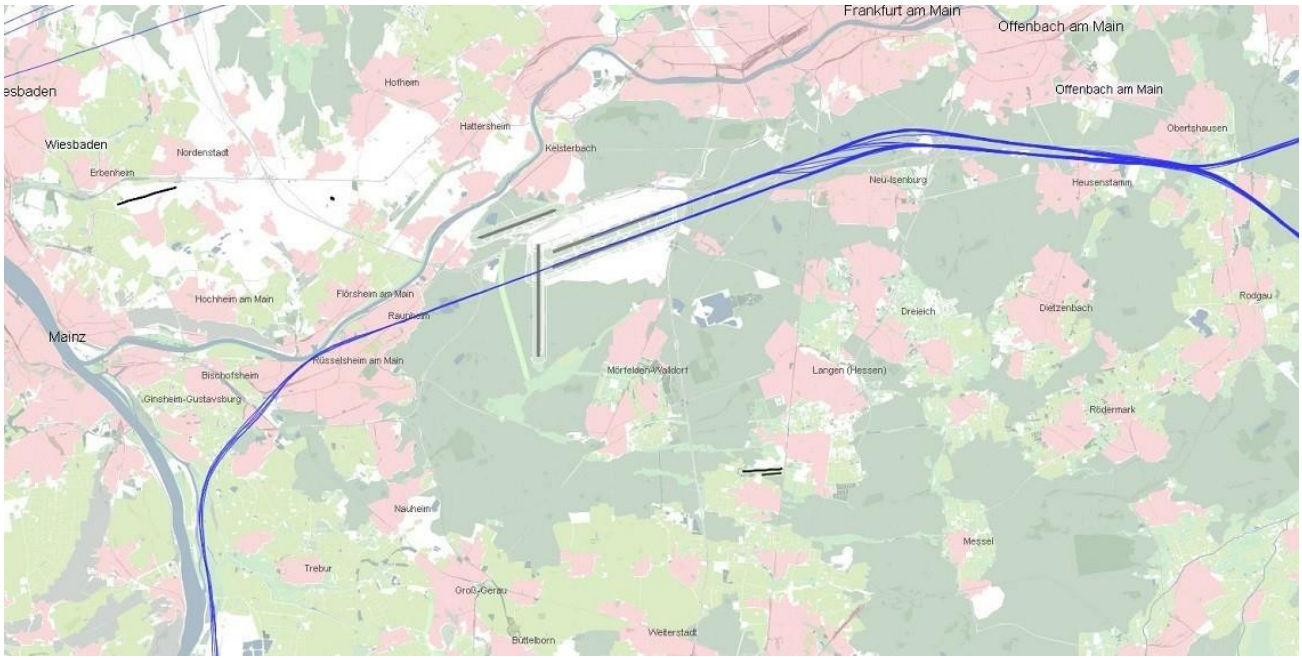
The research project known as D-KULT (demonstrator for climate and environmentally friendly air transport), which was launched in June 2022 and will run until May 2025, is funded by the German Federal Ministry for Economic Affairs and Climate Action (BMWK) and aims to investigate exactly how this could be done. The project focuses on conducting a trial operation in the upper airspace of DFS (2024) and on simulations to calculate the resulting climate effects of the flight.

From High Transition Operations (HTO) to Optimised Profile Descent (OPD)

DFS bundles all 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 2022, various approach routes were identified in the approach area of Frankfurt and Cologne/Düsseldorf airports, which were refined into an Optimised Profile Descent (OPD). By dispensing with the vertical separation on a procedural basis envisaged under HTO, continuous descent through level windows above certain waypoints (flying through 'airspace tubes') is to be standardised in OPD and thus used more frequently.

In addition, various tools for analysing vertical flight efficiency (efficiency of the climb and descent profiles of flights) and for assessing CO_2 emissions of new/modified flight procedures were reviewed and subjected to an initial review. Various practical examples of their application are to be carried out in 2023.

Noise abatement procedures for arrivals and departures



The RNP-X approach procedure reduces noise in built-up areas in the Rhine-Main region and saves fuel. (Visual: DFS)

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. After a long test phase, trial operations for this procedure were brought forward by one hour in 2022 (running from 22:00 to 05:00 hrs). This will extend the noise respite period for cities and municipalities by one hour. Initial findings indicate that the application rate of this procedure is high.

Stuttgart: TEDGO in trial operations

At Stuttgart Airport, the Noise Abatement Commission approved a one-year trial operation of the TEDGO departure procedure in 2022. A comprehensive evaluation of the noise impact is to be presented in 2024. With TEDGO, eastbound aircraft with primarily southern destinations can initiate a right turn earlier than before and reduce noise emissions and fuel consumption. The new route passes largely over uninhabited areas and has the potential to reduce the number of citizens highly affected by aircraft noise by around half.

Berlin: Hoffmann Curve

One of the most prominent noise abatement endeavours in the vicinity of Berlin Airport is the so-called Hoffmann Curve. This refers to a departure procedure that turns southwards when runway 07 is in use (easterly wind) 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 of the procedure as high as possible. The Hoffmann Curve is being monitored and continuously analysed so that it can be adjusted if necessary.

1.2.3. Outlook 2023-2026

Decarbonisation

DFS-wide use of green electricity

Currently, the electricity sourced by DFS reflects the regular electricity mix in Germany. Switching to green electricity has the potential to halve the CO_2 footprint of DFS. Green electricity procurement using power purchase agreements (PPAs) was identified as an ecologically and economically sensible tool. A PPA is a direct contract with a renewable energy producer. Customers use it to purchase electricity directly or indirectly at a pre-agreed price over a long-term period. This ensures price stability for the customer and planning reliability for the producer. The guaranteed electricity purchase volumes over a long period of time also support the creation of new renewable energy facilities and the expansion of renewable energy in Germany. DFS plans to switch to green electricity for all sites except the Langen Campus from 2024.

In-house generation of electricity from renewable sources

DFS is currently analysing the installation of photovoltaic (PV) systems at suitable locations. As the permanent provision of air navigation services is the top priority, practicable concepts must be developed as to how self-generated electricity can be integrated in an ecologically, technically and economically sensible manner without jeopardising the principle of security of supply. The installation of PV systems is already being considered, particularly as part of refurbishment and construction projects (already planned for the Langen and Munich control centres).

Energy efficiency

Operation of cloud-based data centres for air traffic control technology

In the long term, DFS plans to operate its air traffic control systems in the cloud in keeping with modern IT principles. Based on current estimates, the consolidation into two data centres will save around 2.6 million kWh annually when the data centres are fully operational from 2029. The cooling requirements for server rooms will also be reduced accordingly.

Systematic start-up and shutdown of test and reference systems

DFS maintains reference systems for all air traffic control systems in Langen. These correspond exactly to the systems in operational use and serve, for example, as a test environment for new system updates. DFS also operates various test environments for the development of new air traffic control systems. With the help of a 'power manager' developed in-house, these systems, which are otherwise always switched on, are to be systematically shut down at night and at weekends.

Resource efficiency

Systematic analysis of all paper-based processes

As part of a digitalisation offensive, all paper-based processes are being examined and converted step by step. Examples include travel expense claims or the provision of documents for people drawing a pension or other retirement payment.

Long-term reduction of hazardous waste

DFS generates comparatively large quantities of hazardous waste every year, primarily electrical and electronic waste. The company wants to reduce these in a targeted manner - for example by extending the utilisation phases.

Helping to promote climate-friendly flying

Development of environmental indicators for operations

Fuel consumption and CO_2 emissions are to be calculated continuously at the individual flight level. These calculations will be based on the flight trajectories recorded by DFS and general models for 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.

Research into non-CO_2 effects launched

To investigate the extent to which air traffic control can keep aircraft out of critical air layers (ice-saturated areas with cirrus formation) without disrupting other traffic, DFS is participating in research projects to reduce non-CO_2 emissions (project D-KULT, demonstrator for climate and environmentally friendly air transport). The main focus here is on carrying out and analysing specific flights in air layers saturated with ice.

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 2030.

This is intended to ensure Europe-wide standards in flight guidance, for example to enable more airspace capacity and greater compliance of aircraft with the defined flight procedures.

1.2.4. Environmental programme

Measures and targets 2022-2030

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	The outdated gas heating system at the Karlsruhe control centre will be dismantled and an ecologically friendly district heating connection will be put into operation.	2022	Completed
Conversion from natural gas to district heating at the tower at Nürnberg Airport	The outdated gas heating system at Nürnberg tower will be dismantled and an ecologically friendly district heating connection will be put into operation.	2022	Completed
Concept, planning and implementation for Green COM at the SST Brinkum pilot site (radio)	The COM sites (radiotelephony) are being standardised and therefore 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 on site.	2023	In implementation
Construction of a photovoltaic (PV) facility at the Bremen site	As part of the roof renovation of the Bremen control centre, a PV system will be installed to generate our own electricity (output: 99 kWp). Large parts of the roof will also be designed as a green roof.	2023	In implementation
Sourcing electricity from renewable sources via direct procurement	By concluding a PPA (power purchase agreement), DFS will use green electricity (except for DFS Campus Langen) exclusively from defined plants (solar, wind power).	2024	In implementation
Construction of PV systems at the Karlsruhe site	PV modules will be installed on suitable areas on the façade or roof of the adjoining buildings at the Karlsruhe control centre.	2024	Open
Achieving a quota of 50% 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 low-emission pool vehicles (max. 50g CO_2/km).	2025	In implementation
Replacement of gas heating systems at the towers in Hannover, Düsseldorf and Leipzig	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. The waste heat from IT systems will also be used for heating.	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	The car park lighting that is permanently in operation at night and the other outdoor lighting will be converted 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 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 more than halve 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
Converting CVOR to DVOR omnidirectional radio beacons and decommissioning of 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 systems will also be decommissioned during this period.	2025	In implementation

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 hours 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	By subsidising the Deutschland-Ticket from May 2023, DFS is creating an incentive for the entire workforce to use public transport to commute to work.	2023	In implementation
Launch of e-charging infrastructure for employee vehicles at major DFS sites	DFS is installing e-charging facilities at DFS locations where there is a high demand for e-charging among the workforce. This will be carried out in accordance with DFS standards regarding the 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 use	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 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 passenger pool vehicles	For personal vehicles (company cars and employee vehicles), DFS is aiming for a company-wide quota of 100 percent low-emission company cars and employee vehicles (max. 50 g CO_2/km).	2025	In implementation

Reduction of waste generation 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	A DFS standard is the prerequisite for collecting waste with the greatest possible separation rate. Waste separation at the control centre is also being revised. To demonstrate success and effectiveness, DFS reports a recycling and waste separation rate.	2022	Completed
Development of a Waste Guide	To raise staff awareness of the need to separate waste by type as far as possible, a waste guide will be created containing the key regulations, contacts and disposal options.	2022	In implementation
Improving waste separation at all towers	At all DFS towers, the DFS standard for waste separation will be implemented where it is not yet in place. This applies to the Cologne Bonn, Düsseldorf, Leipzig, Dresden and Nürnberg towers.	2023	In implementation
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, options for the systematic reuse of these batteries, which are generally still in good working order, are to be examined.	2023	In implementation

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 communications 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 air traffic control equipment and systems are tested and kept in stock as spare parts. Repairs/replacements are carried out internally at DFS wherever possible.	2022	Ongoing
Expansion of the evaluation matrix for procurement processes to include environmental aspects	Environmental and sustainability aspects are increasingly taken into account in the selection and evaluation of suppliers in the tendering/procurement process.	2022	Completed
DFS-wide use of recycled paper for printing and copying	The paper standard will be changed to recycled paper (ISO 20494, Blue Angel) throughout DFS. DFS corporate stationery (with imprinted DFS logo) will also no longer be procured.	2022	Completed
Selection and procurement of advertising materials in line with environmental criteria	Advertising materials and give-aways should always meet environmental criteria in terms of material, durability and origin; products are only included 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 facilities	On the 13,000 square metre meadow at the radar facility in Dreieich-Götzenhain, a Forest for the Future (climate-resistant trees) as well as areas for ground nesting birds and nesting aids for wild bees have been created in cooperation with local nature conservation organisations.	2022	Completed
Development and implementation of an ecological tree and planting concept for the external facilities at the Karlsruhe site	To promote biodiversity on the DFS site, an overall concept is to be developed and implemented in cooperation with local nature conservation experts. The plan is to plant only native and climate-appropriate tree species on the company's premises and its own woodland.	2023	In implementation
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 will 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, water consumption is to be displayed much more accurately and consumption can be better analysed.	2024	Open
Widespread installation of water-saving aerators on hand basins	To reduce water consumption, water-saving aerators will be installed at all hand wash basins where technically possible. 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	The number of devices in DFS Headquarters in particular will be greatly reduced in the next tender for multifunctional devices (currently over 100 devices). Similarly, single-user printers in the office environment will be further scaled back due to their very negative economic and ecological characteristics.	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 from air traffic that can be indirectly influenced (CO_2 and non-CO_2)

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
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 (vertical and horizontal) of the Earth's atmosphere may have a much more negative impact on the climate than previously assumed, depending on weather conditions. DFS is therefore participating in research projects to reduce non-CO_2 effects (project D-KULT).	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 altitude to approach control. Further potential for CDOs at Frankfurt, Cologne Bonn and Düsseldorf airports is to be analysed together with airlines.	2025	In implementation
Development of 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 histories and a flight performance model.	2026	In implementation
Consideration of climate protection criteria in new/modified flight procedures	Definition of a method/process for taking CO_2 emissions into account in the course of procedure changes/new developments and provision of a corresponding tool.	2026	Open
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 procedure with the aim of reducing inefficiencies at the interfaces between the system partners.	2027	Open

Reduction of aircraft noise emissions that can be indirectly influenced by DFS in the vicinity 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 compliance of aircraft with the defined flight procedures.	2030	In implementation

1.2.5. Environmental account

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

Traffic development & horizontal en-route flight efficiency

DFS	2020	2021	2022	+/-% year-on-year
Flights under instrument flight rules (million)	1.461	1.669	2.636	+57.94
Average deviation (%)	0.86	0.81	1.04	+28.40
Average deviation (km)	2.9	2.8	3.6	+28.57

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 large circle with a radius of 40 nautical miles (NM), in which flexible approach and departure control and noise abatement concerns are prioritised. Due to the post-pandemic increase in flight volumes as well as increased military traffic and the associated airspace closures, horizontal en-route flight efficiency deteriorated slightly in 2022.

Total energy consumption

DFS	2020	2021	2022	+/-% year-on-year
Electricity (MWh/year)	66,540	65,484	65,167	-0.48
Natural gas (MWh/year)	5,016	7,547	5,287	-29.95
Heating oil (l/year)	131,932	53,986	175,108	+224.36
Fuel (diesel) (l/year)	90,101	112,493	184,502	+64.01
Heating water (MWh/year)	11,291	13,962	12,236	-12.36
Steam (MWh/year)	614	508	435	-14.37
Chilled water (MWh/year)	12,762	13,955	13,592	-2.60

The pandemic-related hygiene measures were scaled back again in 2022, which led to a reduction in the consumption of electricity, gas and heating. Heating oil use increased at an above-average rate in 2022 due to annual fluctuations in filling up the tanks of the emergency power systems of technical facilities. When recording fuel consumption, the scope of the analysis was expanded, which also led to an absolute increase in consumption.

Campus Langen	2020	2021	2022	+/-% year-on-year
Electricity (MWh/year)	23,003	23,208	22,717	-2.12
Heating oil (l/year)	6,600	6,830	3,958	-41.65
Heating water (MWh/year)	9,179	11,390	9,957	-12.58
Steam (MWh/year)	614	508	435	-14.37
Chilled water (MWh/year)	12,762	13,955	13,592	-2.60

Bremen control centre	2020	2021	2022	+/-% year-on-year
Electricity (MWh/year)	5,095	4,890	5,438	+11.21
Natural gas (MWh/year)	1,969	2,454	1,886	-23.15
Heating oil (l/year)	18,347	18,347	74,233	+304.61

Karlsruhe control centre	2020	2021	2022	+/-% year-on-year
Electricity (MWh/year)	4,976	4,922	4,973	+1.04
Natural gas (MWh/year)	1,232	1,449	908	-37.34
Heating oil (l/year)	9,792	11,000	4,355	-60.41

Munich control centre	2020	2021	2022	+/-% year-on-year
Electricity (MWh/year)	8,647	8,688	8,732	+0.51
Heating water (MWh/year)	1,216	1,373	1,335	-2.77
Heating oil (l/year)	5,960	5,354	4,666	-12.83

Fuel (diesel)

Diesel (l)	2020	2021	2022	+/-% year-on-year
DFS	90,101	112,493	184,502	+64.01
Campus Langen	90,101	112,493	65,996	-
Bremen control centre	-	-	155,500	-
Karlsruhe control centre	-	-	3,052	-
Munich control centre	-	-	23,946	-

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 location. This is based on the kilometres travelled per vehicle stationed at the location. As recording was also extended to technical vehicles and company cars in 2022 (previously only pool vehicles), absolute consumption has increased significantly.

Fuel (electricity)

MWh/year	2020	2021	2022	+/-% year-on-year
DFS	1.91	1.55	2.86	+84.51
Campus Langen	1.91	1.55	2.86	+84.51

There are three fully electric pool vehicles at the Langen site. Their charging electricity is shown separately here but is included in the total electricity consumption of the Langen Campus.

Total generation of renewable energies

MWh/year	2020	2021	2022	+/-% year-on-year
DFS	101	95	103	+8.42
Campus Langen	101	95	103	+8.42
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	2020	2021	2022	+/-% year-on-year
DFS	0	0	0	0
Campus Langen	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	2020	2021	2022	+/-% year-on-year
Paper consumption (kg/year)	25,796	17,464	16,116	-7.72

Paper consumption continued to fall significantly in 2022. This was mainly due to the digitalisation of previously paper-based processes and the continued increase in remote working.

Campus Langen	2020	2021	2022	+/-% year-on-year
Paper consumption (kg/year)	16,451	11,346	11,242	-0.91

Bremen control centre	2020	2021	2022	+/-% year-on-year
Paper consumption (kg/year)	1,028	763	893	+17.04

Karlsruhe control centre	2020	2021	2022	+/-% year-on-year
Paper consumption (kg/year)	1,188	1,023	923	-9.78

Munich control centre	2020	2021	2022	+/-% year-on-year
Paper consumption (kg/year)	1,352	1,158	1,153	-0.43

Water consumption

DFS	2020	2021	2022	+/-% year-on-year
Fresh water consumption (m^3/year)	73,919	59,541	60,802	+2.12

The consumption of fresh water rose slightly again in 2022 due to the higher number of people returning from remote working.

Campus Langen	2020	2021	2022	+/-% year-on-year
Fresh water consumption (m^3/year)	28,784	27,450	28,671	+4.45

Bremen control centre	2020	2021	2022	+/-% year-on-year
Fresh water consumption (m^3/year)	10,582	10,757	9,379	+17.04

Karlsruhe control centre	2020	2021	2022	+/-% year-on-year
Fresh water consumption (m^3/year)	7,533	5,193	7,364	+41.81

Munich control centre	2020	2021	2022	+/-% year-on-year
Fresh water consumption (m^3/year)	6,134	7,348	8,384	+14.10

Waste volume

DFS	2020	2021	2022	+/-% year-on-year
Non-hazardous waste (kg/year)	**601,881**	**541,416**	**533,630**	**-1,44**
Residual waste (commercial)	198,666	149,412	163,913	+9.71
Paper/cardboard/cardboard packaging	136,984	117,434	106,681	-9.16
Recyclables	198,603	220,555	153,075	-30.60
Organic waste	67,628	54,015	109,961	+103.57
Hazardous waste (kg/year)	**102,804**	**127,401**	**121,167**	**-4.89**
Special waste	25,935	51,156	53,842	+5.25
Electrical/electronic waste	76,869	76,245	67,325	-11.70

The volume of hazardous and non-hazardous waste has continued to fall across DFS. The increased proportion of organic waste is due to more precise waste separation (an organic waste bin was introduced at some locations in 2022).

Waste utilisation

DFS	2020	2021	2022	+/-% year-on-year
Total waste volume (kg/year)	**704,685**	**668,817**	**654,797**	**-2.10**
Proportion separated (kg/year)	-	-	490,884	-
Percentage separated (%)	-	-	74.97	-
Disposal (%)	-	-	3	-
Material recycling (%)	-	-	78	-
Thermal utilisation (%)	-	-	19	-
Investigation and administrative fine proceedings under waste law	-	-	0	-

The percentage of waste separated (separately collected waste components) was surveyed for the first time in 2022. 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.

Campus Langen	2020	2021	2022	+/-% year-on-year
Non-hazardous waste (kg/year)	**221,910**	**225,916**	**198,396**	**-11.94**
Residual waste (commercial)	32,352	46,865	28,357	-39.49
Paper/cardboard/cardboard packaging	47,980	42,719	462,163	+45.52
Recyclables	121,498	124,602	92,151	-26.04
Organic waste	20,080	11,730	16,265	+38.66
Hazardous waste (kg/year)	**86,788**	**93,897**	**108,608**	**+15.67**
Special waste	17,268	29,242	49,648	+69.78
Electrical/electronic waste	69,520	64,655	58,960	-8.81

Bremen control centre	2020	2021	2022	+/-% year-on-year
Non-hazardous waste (kg/year)	**77,189**	**64,655**	**60,500**	**-6.43**
Residual waste (commercial)	45,510	38,400	37,600	-2.08
Paper/cardboard/cardboard packaging	7,360	5,420	6,210	+14.58
Recyclables	12,899	16,835	14,290	-15.12
Organic waste	11,420	4,000	2,400	-40.00
Hazardous waste (kg/year)	**7,958**	**4,850**	**2,317**	**-52.23**
Special waste	3,839	3,490	466	-86.65
Electrical/electronic waste	4,119	1,360	1,851	+36.10

Karlsruhe control centre	2020	2021	2022	+/-% year-on-year
Non-hazardous waste (kg/year)	**39,868**	**62,385**	**52,749**	**-15.45**
Residual waste (commercial)	11,210	15,700	22,340	+42.29
Paper/cardboard/cardboard packaging	10,880	14,270	2,846	-80.06
Recyclables	9,090	9,020	9,151	+1.45
Organic waste	8,688	23,395	18,412	-21.30
Hazardous waste (kg/year)	**3,111**	**900**	**5,593**	**+521.44**
Special waste	3,111	900	966	+7.33
Electrical/electronic waste	0	0	4,627	-

Munich control centre	2020	2021	2022	+/-% year-on-year
Non-hazardous waste (kg/year)	**42,510**	**32,404**	**34,436**	**+6.27**
Residual waste (commercial)	1,210	1,960	1,300	-33.67
Paper/cardboard/cardboard packaging	5,860	3,570	5,830	+63.31
Recyclables	13,760	13,234	8,870	-32.98
Organic waste	21,680	13,640	18,436	+35.16
Hazardous waste (kg/year)	**3,920**	**2,247**	**1,849**	**-17.71**
Special waste	1,190	1,577	1,813	+14.97
Electrical/electronic waste	2,730	670	36	-94.63

Use of land

2022 (m^2)	Total area	Sealed	of which green roofs	Unsealed	of which near-natural state	Level of sealed land (%)
DFS	1,274,653	348,489	15,695	**926,165**	**68,164**	**27**
Campus Langen	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	18,050	47
Munich control centre	29,576	20,365	3,781	9,211	2,455	69
15 towers	59,892	28,610	--	31,282	--	48
Technical facilities	947,849	165,171	--	782,678	13,000	17

In 2022, large areas at the Karlsruhe control centre and at a radar facility were re-naturalised and specifically designed to be in a near-natural state. This led to a 52.62 percent rise in the near-natural area.

2021 (m^2)	Total area	Sealed	of which green roofs	Unsealed	of which near-natural state	Level of sealed land (%)
DFS	1,264,624	348,348	15,695	916,275	44,664	28
Campus Langen	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	26,691	17,259	737	9,432	7,550	65
Munich control centre	29,576	20,365	3,781	9,211	2,455	69
15 towers	59,892	28,610	--	31,282	--	48
Technical facilities	947,849	165,171	--	782,678	--	17

CO_2 balance (Scopes 1-3)

DFS (t CO_2-eq/year)	2020	2021	2022	+/-% year-on-year
Scope 1	**1,284**	**2,237.06**	**2,155.53**	**-3.67**
Vehicle fleet	-	575.06	583.67	+1.57
Stationary combustion	-	1,662	1,528.76	-8.06
Refrigerant losses	-	-	43.1	-
Scope 2	**28,394**	**29,871.66**	**30,556.83**	**+2.30**
Electricity, electrical power	21,995	23,396.95	24,026.22	+2.69
District heating	2,709	3,389.15	2,927.29	-13.63
Other (chilled water, steam)	3,690	3,085.56	3,603.32	+16.79
Scope 3	**-**	**9,088.28**	**9,605.4**	**+5.62**
3.1 Catering	-	145.03	210.29	+44.83
3.1 Paper and printed materials	-	17.83	14.82	-17.65
3.1 Water	-	19.1	19.91	0.00
3.1 External data centre	-	-	17.74	-
3.2 Electronics	-	345.5	345.5	0.00
3.3 Upstream (Scope 1 and 2)	-	512.16	472.61	-8.70
3.4 Inbound logistics	-	0.03	0.03	
3.5 Waste	-	328.8	408.03	+24.39
3.6 Business trips	-	640.6	1,163.14	+81.72
3.7 Commuting	-	7,079.23	6,953.33	-1.78
Total (Scope 1 and 2)	**29,678**	**32,108.72**	**32,712.36**	**+1.88**
Total (Scopes 1-3)	**-**	**41,197**	**42,317.76**	**+2.72**

The slight increase in CO_2 emissions in Scope 2 is due to an increased emission factor from the German electricity mix. DFS has also been reporting Scope 3 since 2022 (also retroactively for 2021 for comparability). The increase in 2022 in Scope 3 is mainly due to more business trips.

Greenhouse gas impact (according to the Kyoto Protocol)

DFS (t/year)	2021	2022	+/-% year-on-year
Underlying volume (t CO_2-eq/year)	2,650.48	2,461.05	-7.15
CO_2	2,459.59	2,289.17	-6.93
CH_4	7.28	5.41	-25.69
N_2O	4.19	4.18	-0.24
HFC	-	27.50	-
PFC	-	-	-
SF_6	-	-	-
NF_3	-	-	-

Campus Langen (t CO_2-eq/year)	2020	2021	2022	+/-% year-on-year
Scope 1	41	322.48	338.46	+4.97
Scope 2	12,002	11,996.62	11,639.93	-2.98
Scope 3	-	406.41	426.64	+4.93
Total (Scope 1 and 2)	**12,043**	**12,319.10**	**11,978.39**	**-2.77**
Total (Scopes 1-3)	**-**	**12,725.51**	**12,405.03**	**-4.86**

Bremen control centre (t CO_2-eq/year)	2020	2021	2022	+/-% year-on-year
Scope 1	444	498.82	576.58	+15.66
Scope 2	1,865	2,004.90	2,360.09	+17.76
Scope 3	-	138.53	159.69	+15.22
Total (Scope 1 and 2)	**2,309**	**2,503.72**	**2,936.67**	**+17.35**
Total (Scopes 1-3)	**-**	**2,637.25**	**3,096.36**	**+17.23**

Karlsruhe control centre (t CO_2-eq/year)	2020	2021	2022	+/-% year-on-year
Scope 1	274	320.78	194.28	-39.38
Scope 2	1,821	2,018.02	2,158.28	+6.94
Scope 3	-	101.51	204.81	+101.98
Total (Scope 1 and 2)	**2,095**	**2,338.80**	**2,352.56**	**+0.60**
Total (Scopes 1-3)	**-**	**2,440.31**	**2,557.37**	**+9.28**

Munich control centre (t CO_2-eq/year)	2020	2021	2022	+/-% year-on-year
Scope 1	16	14.21	12.39	-14.29
Scope 2	3,371	3,794.12	4,015.31	+12.72
Scope 3	-	37.93	29.09	-21.62
Total (Scope 1 and 2)	**3,387**	**3,808.33**	**4,027.70**	**+12.90**
Total (Scopes 1-3)	**-**	**3,846.26**	**4,056.79**	**+12.26**

Pollutant emissions

DFS	2020	2021	2022	+/-% year-on-year
SO_2 (kg/year)	364	326	641	+96.63
NO_x (kg/year)	1,255	1,639	1,622	-1.04
Particulate matter (kg/year)	81	93	122	+31.18

The higher pollutant emissions are due to fuel restocking processes at some facilities during the year and thus extremely high heating oil consumption, as well as an extension of the coverage of company vehicles from 2022.

Campus Langen	2020	2021	2022	+/-% year-on-year
SO_2 (kg/year)	108	131	77	-41.22
NO_x (kg/year)	122	149	88	-40.94
Particulate matter (kg/year)	217	21	12	-42.86

In 2020 and 2021, the entire DFS vehicle fleet was assigned to the Langen Campus, as it was not feasible to assign the refuelling processes to the individual locations. This exact assignment was carried out with the 2022 report, which is why the pollutant emissions from fuels for the Langen Campus fell in 2022 irrespective of actual consumption.

Bremen control centre	2020	2021	2022	+/-% year-on-year
SO_2 (kg/year)	64	29	201	+593.10
NO_x (kg/year)	403	447	542	+21.25
Particulate matter (kg/year)	21	20	37	+85.00

Karlsruhe control centre	2020	2021	2022	+/-% year-on-year
SO_2 (kg/year)	37	41	24	-41.46
NO_x (kg/year)	248	291	180	-38.14
Particulate matter (kg/year)	13	15	9	-40.00

Munich control centre	2020	2021	2022	+/-% year-on-year
SO_2 (kg/year)	13	12	35	+191.67
NO_x (kg/year)	15	13	40	+207.69
Particulate matter (kg/year)	2	1	5	+400.00

1.2.6. Indicators

Indicators of environmental performance

Master data for calculating the indicators

Location	Master data	2020	2021	2022	+/-% year-on-year
DFS	Employees	5,659	5,584	5,612	+0.50
	Gross floor area (m^2)	251,738	251,738	251,738	0.00
Campus Langen	Employees	3,116	3,066	3,047	-0.62
	Gross floor area (m^2)	159,711	159,711	159,711	0.00
Bremen control centre	Employees	480	467	476	+1.93
	Gross floor area (m^2)	20,291	20,291	20,291	0.00
Karlsruhe control centre	Employees	715	706	704	-0.28
	Gross floor area (m^2)	17,949	17,949	17,949	0.00
Munich control centre	Employees	499	499	491	-1.60
	Gross floor area (m^2)	29,039	29,039	29,039	0.00

Energy efficiency

Location	Indicator (kWh/year)	2020	2021	2022	+/-% year-on-year
DFS	Consumption of energy for heating and cooling (excluding electricity) / m^2	118	143	125	-12.59
	Electricity consumption / m^2	264	260	259	-0.38
Campus Langen	Consumption of energy for heating and cooling (excluding electricity) / m^2	141	162	150	-7.41
	Electricity consumption / m^2	144	145	142	-2.07
Bremen control centre	Consumption of energy for heating and cooling (excluding electricity) / m^2	97	121	93	-23.14
	Electricity consumption / m^2	251	241	268	+11.20
Karlsruhe control centre	Consumption of energy for heating and cooling (excluding electricity) / m^2	69	81	51	-37.04
	Electricity consumption / m^2	277	274	277	+1.09
Munich control centre	Consumption of energy for heating and cooling (excluding electricity) / m^2	42	47	46	-2.13
	Electricity consumption / m^2	298	299	301	+0.67

Material efficiency

Location	Indicator (kg/year)	2020	2021	2022	+/-% year-on-year
DFS	Paper consumption / employee	4.56	3.13	2.87	-8.31
Campus Langen	Paper consumption / employee	5.28	3.70	3.69	-0.27
Bremen control centre	Paper consumption / employee	2.14	1.63	1.88	+15.34
Karlsruhe control centre	Paper consumption / employee	1.66	1.45	1.31	-9.66
Munich control centre	Paper consumption / employee	2.71	2.32	2.35	+1.29

Water consumption

Location	Indicator (m3/year)	2020	2021	2022	+/-% year-on-year
DFS	Water consumption / employee	10.84	10.66	10.83	+1.59
Campus Langen	Water consumption / employee	9.24	8.95	9.41	+5.14
Bremen control centre	Water consumption / employee	22.141	22.85	19.70	-13.79
Karlsruhe control centre	Water consumption / employee	10.54	7.36	10.46	+42.14
Munich control centre	Water consumption / employee	12.29	14.73	17.08	+15.95

Waste consumption

Location	Indicator (kWh/year)	2020	2021	2022	+/-% year-on-year
DFS	Non-hazardous waste / employee	106	97	95	-2,06
	Hazardous waste / employee	18	23	22	-4.35
Campus Langen	Non-hazardous waste / employee	71	74	65	-12.16
	Hazardous waste / employee	28	31	36	+16.13
Bremen control centre	Non-hazardous waste / employee	161	138	127	-7.97
	Hazardous waste / employee	17	10	5	-50.00
Karlsruhe control centre	Non-hazardous waste / employee	56	88	75	-14.77
	Hazardous waste / employee	4	1	8	+700.00
Munich control centre	Non-hazardous waste / employee	85	65	70	+7.69
	Hazardous waste / employee	8	5	4	-20.00

CO_2 emissions (Scopes 1-2)

Location	Indicator (kg/year)	2020	2021	2022	+/-% year-on-year
DFS	CO_2 emissions / employee	5.24	5.74	5.82	+1.37
Campus Langen	CO_2 emissions / employee	3.86	4.02	3.93	-2.16
Bremen control centre	CO_2 emissions / employee	4.81	5.36	6.17	+15.13
Karlsruhe control centre	CO_2 emissions / employee	2.93	3.31	3.34	+0.88
Munich control centre	CO_2 emissions / employee	6.60	7.15	8.07	+12.90

CO_2 emissions (Scope 3)

Location	Indicator (kg/year)	2020	2021	2022	+/-% year-on-year
DFS	CO_2 emissions / employee	-	1.63	1.71	+4.91
Campus Langen	CO_2 emissions / employee	-	0.13	0.14	+7.69
Bremen control centre	CO_2 emissions / employee	-	0.30	0.34	+13.33
Karlsruhe control centre	CO_2 emissions / employee	-	0.14	0.29	+107.14
Munich control centre	CO_2 emissions / employee	-	0.08	0.06	-25.00

Pollutant emissions

Location	Indicator (g/year)	2020	2021	2022	+/-% year-on-year
DFS	SO_2 emissions / employee	82	58	114	+96.55
	NO_x emissions / employee	270	294	289	-1.70
	Particulate matter emissions / employee	17	17	22	+29.41
Campus Langen	SO_2 emissions / employee	35	43	25	-41.86
	NO_x emissions / employee	39	49	29	-40.82
	Particulate matter emissions / employee	5	7	4	-42.86
Bremen control centre	SO_2 emissions / employee	137	62	422	+580.65
	NO_x emissions / employee	840	957	1,139	+19.02
	Particulate matter emissions / employee	44	43	78	+81.40
Karlsruhe control centre	SO_2 emissions / employee	52	58	34	-41.38
	NO_x emissions / employee	347	412	256	-37.86
	Particulate matter emissions / employee	18	21	13	-38.10
Munich control centre	SO_2 emissions / employee	26	24	71	+195.83
	NO_x emissions / employee	30	26	81	+211.54
	Particulate matter emissions / employee	4	2	10	+400.00

1.2.7. Explanation of data boundaries and calculation methodology

Calculation of CO_2 emissions

This corporate carbon footprint shows all emissions as CO_2 equivalents (CO_2-eq). CO_2 emissions are calculated using data on consumption and emission factors for conversion into CO_2-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, Federal Environment Agency (UBA), Defra, ifeu, OeKO-Institut, Federal Office of Economics 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.

Retroactive adjustment of environmentally relevant consumption and indicators 2021

For reasons of transparency, some environmentally relevant consumption figures and indicators were adjusted retrospectively compared to the Environmental Statement 2021. Individual verifications for the energy consumption of some DFS towers (natural gas, district heating and heating oil) were provided with delay and taken into account retroactively. Water consumption was also corrected retrospectively in 2022; it was erroneously documented twice at some locations.

1.2.8. Declaration on verification [courtesy translation]

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, 29 November 2023