

/Environmental Statement 2023

The environment at Munich Airport

Living ideas – Connecting lives





Contents

- 4** Foreword
- 6** Brief profile of Munich Airport
- 12** Environmental management system
- 14** Strategy and sustainability
- 16** Conservation and biodiversity
- 18** Climate protection
- 25** Air quality
- 31** Aircraft noise and aircraft noise control
- 35** Water management
- 43** Waste management
- 44** Hazardous substances
- 45** Airport fire service and on-site emergency service
- 47** Construction and planning
- 48** Environmental objectives and measures
- 50** Environmental figures
- 53** Key indicators
- 57** Greenhouse gas emissions
- 58** Environmental auditor's statement

/Foreword

Dear Readers,

The years 2020, 2021 and 2022 were influenced by the effects of the global coronavirus crisis. Nevertheless, following the dramatic slump in traffic in 2020, the past fiscal year showed a positive turnaround. We are once again looking ahead with confidence. The desire for travel and personal encounters is great, perhaps greater than ever.

We have used the past two years to work on developing the company and to adapt to the changed environment with new objectives, a leaner organization and an updated strategy. We are moving into new times. We sense a strong team spirit within the Group, have pooled forces across our divisions and have closed ranks. Everyone can and wants to make a contribution so that we are able to maintain our leading position among European airport hubs.

In 2022, the Special Energy Task Force coordinated the energy-saving measures prescribed by law at Munich Airport. In total, more than 70 measures were taken, such as switching off 7,000 light points, including the Munich Airport Center roof and the large M logos on the airport access roads. The parking lot interior lighting was reduced to the minimum illuminance required by the building permit, the set room temperature was lowered and the operating mode of the ventilation systems was adjusted. All this resulted in savings of around 2,500 metric tons of CO₂ per year. At the same time, the Special Energy Task Force developed a step-by-step plan to maintain flight operations despite the strained gas supply situation.

Munich Airport is aiming to build additional photovoltaic systems atop parking garages, cargo modules and in suitable open spaces from 2023 onward. The primary energy supply for the combined heat and power plant will be switched to biogas. In addition to climate protection, high energy prices and dependence on Russian natural gas are a further argument for promoting self-sufficiency with regard to the energy supply.

Munich Airport has already tested various alternative drive concepts for its vehicle fleet. These include opening the world's first public hydrogen refueling station as well as trials with biogas, bioethanol, biodiesel and C.A.R.E. diesel. As things stand, we also have 131 electric-powered cars and vans as well as 304 pieces of electric-powered ground-handling and special equipment. By 2030, the aim is for electric vehicles to make up the majority of the fleet. Because barely any new vehicles were procured in 2022 due to the pandemic, their share is still just over 30%. Given technological advancement, the vehicle mix is set to be even more diversified by 2030 on the basis of better batteries, green hydrogen, synthetic fuels and other alternative drive concepts.

At the same time, we are pursuing a policy of transparent communication. Since 2005, we have operated an environmental management system that is certified to the environmental standards of the EMAS Regulation (EC) No. 1221/2009 [Eco-Management and Audit Scheme] and the ISO 14001:2015 standard. This means that the environmentally friendly development of the airport is systematically documented, optimized and communicated to all stakeholders. The key indicators published in accordance with the EMAS Regulation show the environment-related specific consumption of energy sources and resources in relation to growth in traffic.

We welcome your interest in the Environmental Statement 2023, our company and its environmental management.



Jost Lammers
President and Chief Executive
Officer, Personnel Industrial Rela-
tions Director



Nathalie Leroy
Chief Financial Officer,
Chief Infrastructure Officer



Jan-Henrik Andersson
Chief Commercial and Security
Officer

/Brief profile of Munich Airport

Munich Airport is one of Europe's most important air transportation hubs and offers attractive flight connections to destinations worldwide. The renowned London-based Skytrax Institute regularly recognizes Munich Airport as one of the best airports in Europe and has also awarded it the quality seal of «5 Star Airport», making it the first European airport to receive the rating. Founded in 1949, Flughafen München GmbH (FMG) operates Munich Airport, which has been at its current location since 1992. FMG's shareholders are the Free State of Bavaria with 51%, the Federal Republic of Germany with 26% and the state capital Munich with 23%. Around 9,000 people are employed across the Group.

A busy summer has gifted Munich Airport massive growth in all traffic figures in 2022. Passenger numbers rose by 19 million year-on-year to a total of 31.7 million. The airport has thus regained two-thirds of its record-breaking pre-pandemic result from 2019. The number of aircraft movements nearly doubled compared with 2021 to more than 285,000 take-offs and landings.

The dynamic traffic development also led to a much improved financial result, with revenue almost doubling year-on-year to around EUR 1.2 billion in 2022. Earnings before interest and taxes (EBIT) amounted to EUR -28 million, an improvement of EUR 258 million on the previous year. FMG posted earnings after taxes (EAT) of EUR -59 million, thus reducing the previous year's loss by around EUR 200 million.

Subsidiaries of the Munich Airport Group

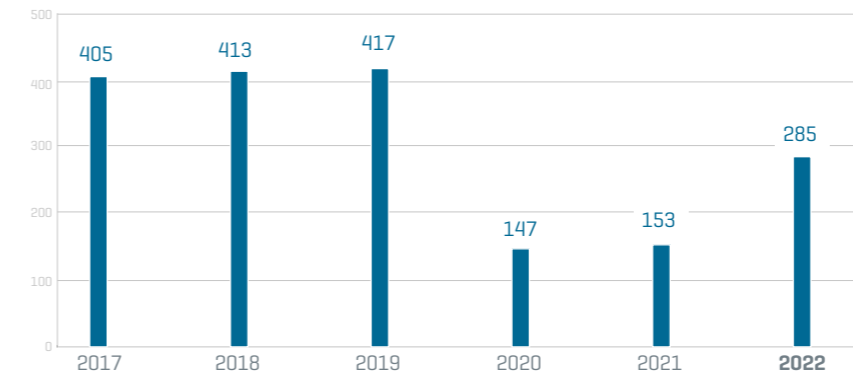
The Munich Airport Group consists of the parent company Flughafen München GmbH and its subsidiaries and affiliated companies.

Allresto Flughafen München Hotel und Gaststätten GmbH was certified to the EMAS Regulation and ISO 14001 in 2007. It operates around 85% of the catering outlets on the airport grounds, including restaurants and bars, as well as its own brewery in the Airbräu restaurant.

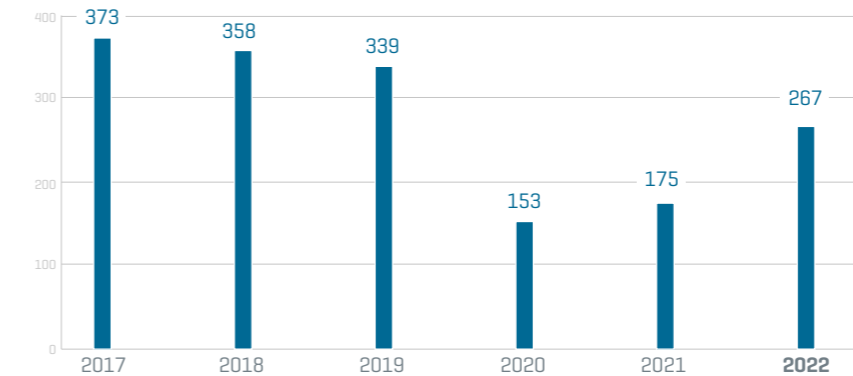
The companies aerogate, Cargogate and eurotrade were also audited by an independent environmental auditor for the first time in 2012 – with eurotrade audited again in 2021 – and certified in line with the requirements of the European EMAS Regulation and ISO 14001.

AeroGround Flughafen München GmbH is aiming for EMAS Regulation and ISO 14001 certification for the first time in 2023.

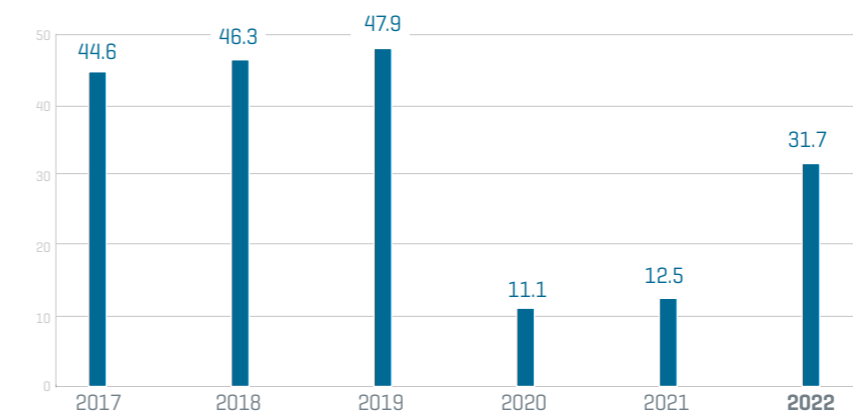
✈️ Development of aircraft movements (in thousands)



🚚 Development of air freight volume (in thousands of metric tons)



👤 Development of passenger numbers (in millions)



Selected highlights

Renewable energy concept

Munich Airport is aiming to make almost its entire energy supply carbon-neutral by 2030, using as many available resources as possible from the local region. To this end, additional photovoltaic systems atop parking garages, cargo modules and in suitable open spaces will be put into operation from 2023 onward. The primary energy supply for the combined heat and power plant will be switched to biogas. In addition to climate protection, high energy prices and dependence on Russian natural gas are a further argument for promoting self-sufficiency with regard to the energy supply.

Objective: Expansion of photovoltaic systems

- 20 MW on roof areas
- 30 MW in open spaces
- Over 50,000 MWh of solar power
- Equivalent to the energy used by almost 15,000 households
- Over 19,000 metric tons of CO₂ savings per year

Effective protection against flooding

The existing water system protects Munich Airport from flooding, which occurs on average once every hundred years. In recent years, climate change has led to more frequent flash floods throughout Germany, some of which have had devastating consequences. This trend has prompted Flughafen München GmbH to review flood protection at the airport. An initial study in 2019 showed that Munich Airport is well protected against extreme flooding, even in the event of flash floods.

The second step involved reviewing drainage performance within the airport in 2021 and 2022, accounting for a possible overload of the sewer system. Experts examined the hydraulic performance of the drainage system during rare occurrences of extreme precipitation and evaluated the results. These experts also carry out regular performance checks on the sewer system to ensure proper drainage. In new buildings, the wastewater pipes and infiltration systems are generously designed to account for rainfall with a recurrence interval of ten years. Decentralized rainwater management and flood-proof site planning are equally important measures to minimize the impact of flooding.

In 2019, the Munich State Office of Water Management remeasured the Isar river and calculated the flood runoff. The experts found that the existing flood protection dikes along the Isar river within the impact area of the airport are also capable of holding back extreme flood waters.

Energy crisis: making savings wherever possible

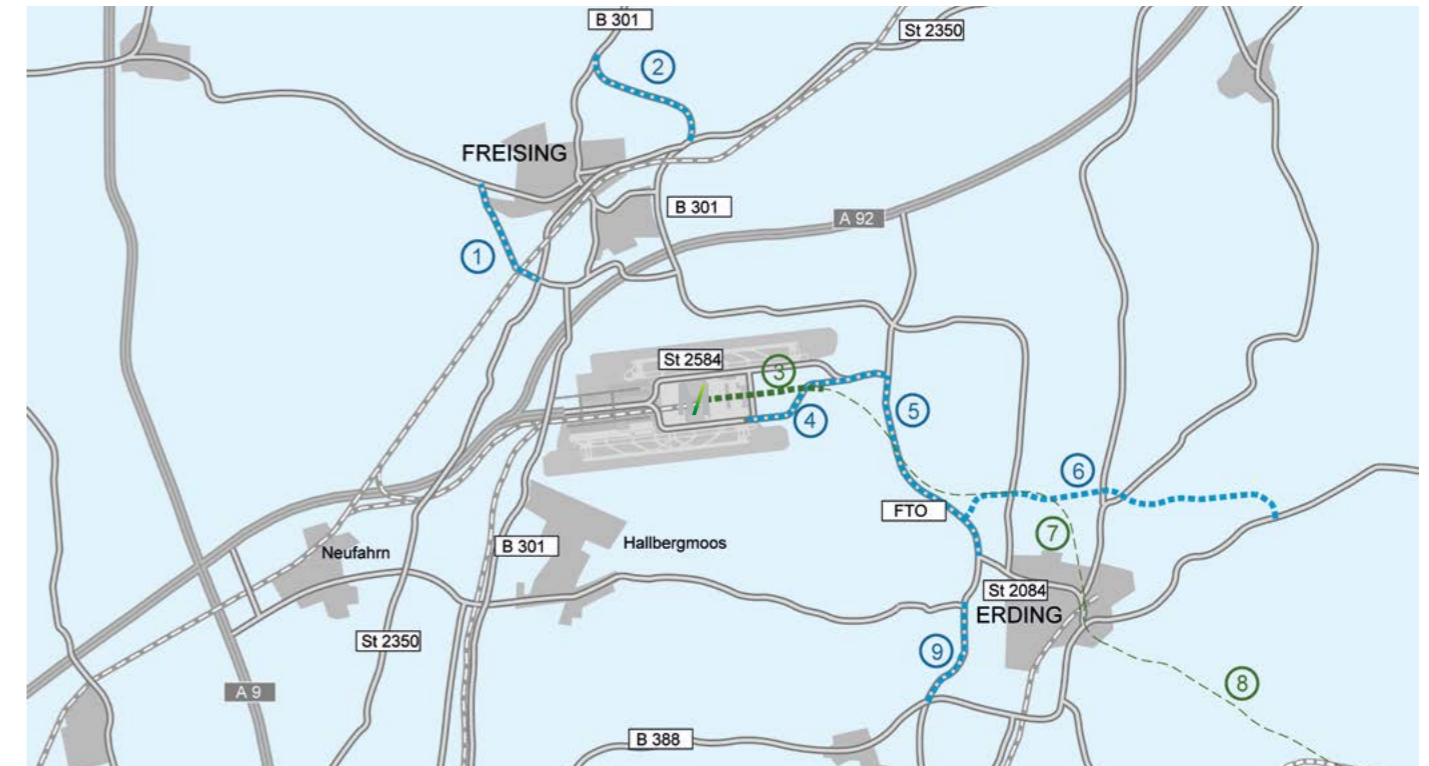
In 2022, the Special Energy Task Force coordinated the energy-saving measures prescribed by law at Munich Airport. In total, more than 70 measures were taken, such as switching off 7,000 light points, including the Munich Airport Center roof and the large M logos on the airport access roads. The parking lot interior lighting was reduced to the minimum illuminance required by the building permit, the set room temperature was minimized and the operating mode of the ventilation systems was adjusted. All this resulted in savings of around 2,500 metric tons of CO₂ per year. At the same time, the Special Energy Task Force developed a step-by-step plan to maintain flight operations despite the strained gas supply situation.

The airport and overland transportation

As an intermodal transportation hub, Munich Airport is a core element of integrated mobility concepts. And as a major European hub airport, it is reliant on attractive and efficient road links and, particularly, rail links. To make a contribution to sustainable transport mobility and fulfill its role as a European gateway to the world, Munich Airport is focusing its efforts on expanding customer-based connectivity with rail passenger transport.

In 2022, around 39% of passengers used public transport to get to and from the airport, with 34% preferring to use the S-Bahn. Roughly 40% opted to use their own cars, a rental car or car sharing. Although the share of public transport is high by national comparison, the stated aim is to make greater use of rail transport for national feeder traffic and thus to significantly improve the accessibility of Munich Airport. This will make it possible to maintain and expand the airport's catchment area and significantly reduce the CO₂ emissions caused by landside traffic.

New routes to the airport



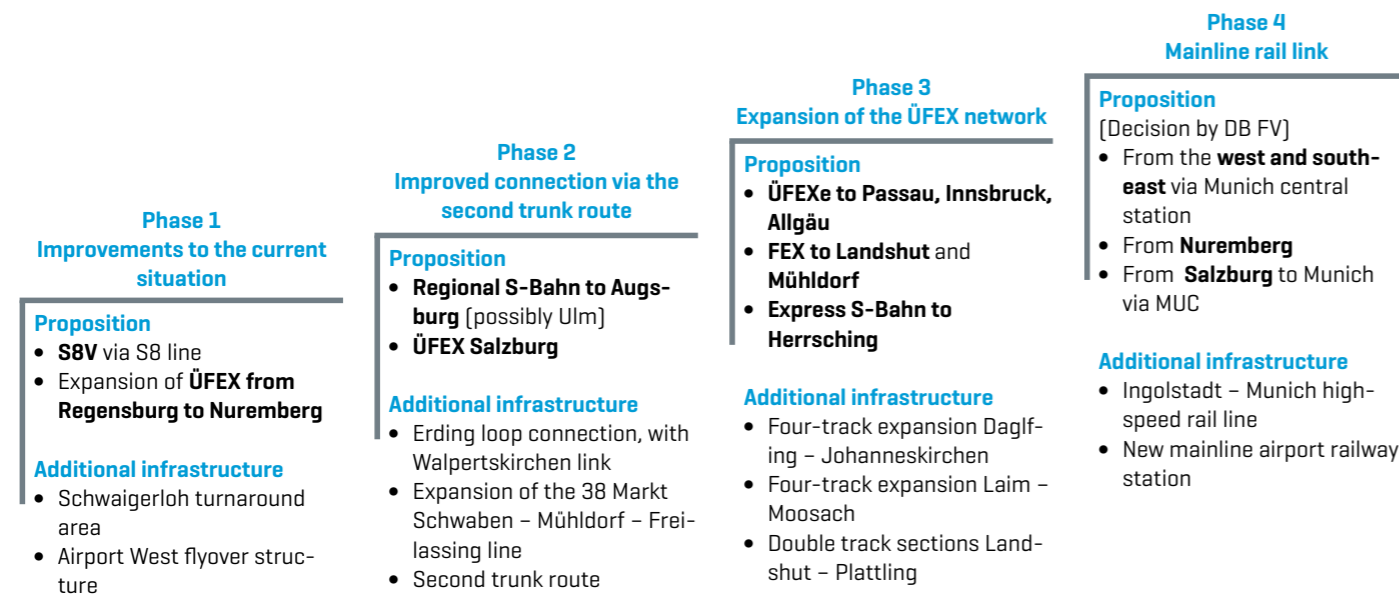
[1] Freising western bypass – open to traffic; [2] B 301, Freising north-eastern bypass – open to traffic; [3] Erding loop connection, Airport – Schwaigerloh section – construction started; [4] Expansion of Erdinger Allee/connection to Airport Connector Road – open to traffic; [5] Airport Connector Road, four-lane expansion – planning approval; [6] Erding northern bypass – planning approval; [7] Erding loop connection, Erding area – planning approval; [8] Walpertskirchen link – planning approval; [9] Airport Connector Road, three-lane expansion – open to traffic

Rail links

Since the Neufahrn Curve rail link went into operation in December 2018, there has been a direct train from Freising/Landshut and Regensburg, the ÜFEX (= Airport Express Train), alongside the two S-Bahn lines S1 and S8, which connect the airport with Munich city center. The planned Erding loop connection and Walpertskirchen link are intended to close the missing rail link to southeastern Bavaria. This will make it possible for more passengers and airport employees to switch to using public transport. The groundbreaking ceremony for the first section of the Erding loop connection (Airport – Schwaigerloh) took place in November 2022. This section is scheduled to be put into operation at the end of 2028.

The planning approval procedure has been initiated for the second section of the Erding loop connection, which includes the Erding city area. The same applies to the Walpertskirchen link, which creates a connection to the Munich – Mühldorf – Freilassing/Salzburg railroad line. The expansion of this route, which is classified as an urgent need in the current Federal Transport Infrastructure Plan 2030 and forms part of the Trans-European Networks (TEN), is intended to offer passengers and employees from southeastern Bavaria and Austria an attractive connection. In order to sustainably link air and rail transport and, at the same time, strengthen the airport's role as a hub, better rail links to the airport are required, specifically direct links to long-distance passenger rail services. Munich Airport published a four-stage concept for this in June 2022 in cooperation with the Bavarian State Ministry for Housing, Construction and Transport (StMB).

Four-stage concept for the national rail link to the airport



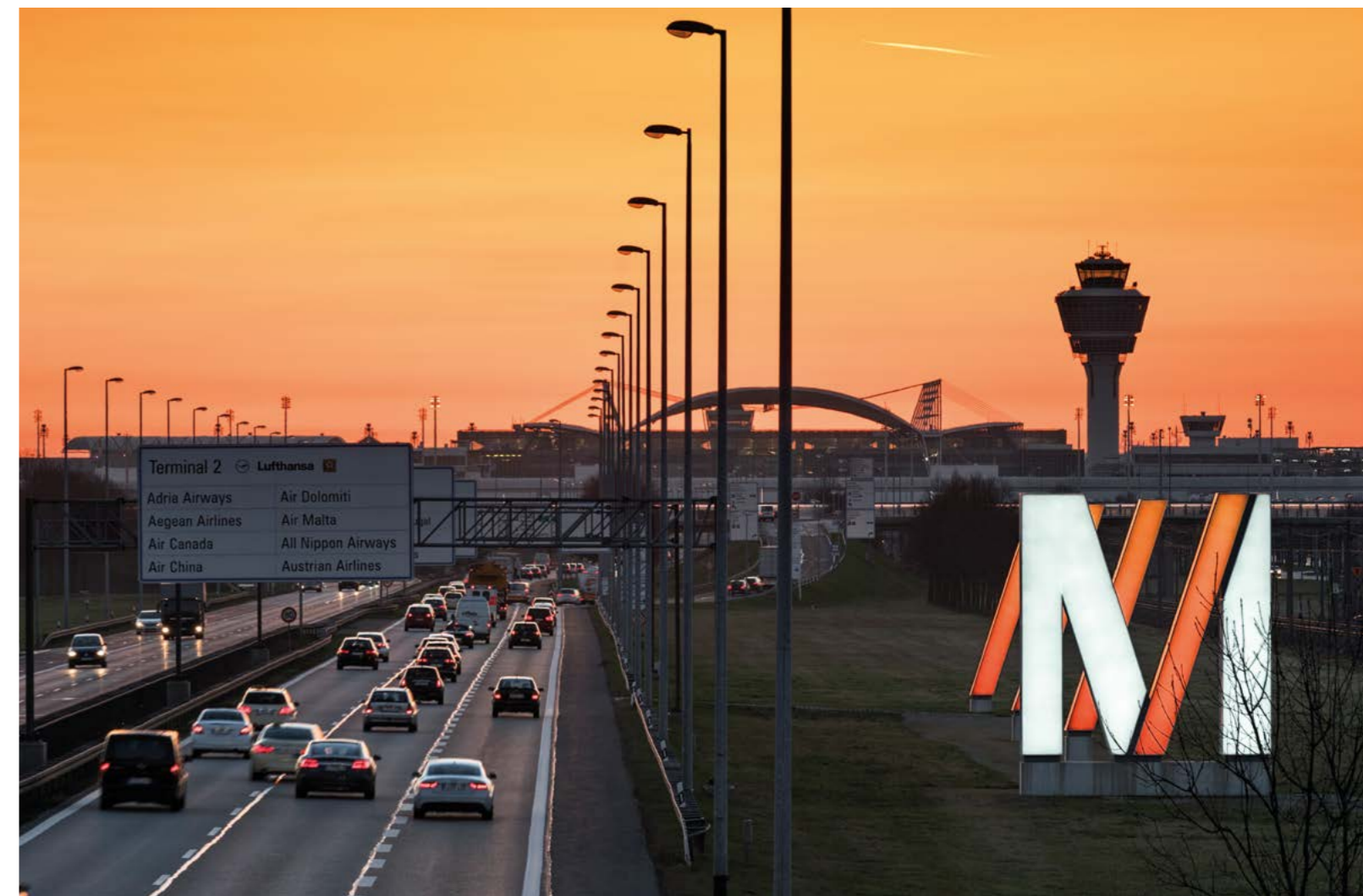
A traffic study is currently being carried out with DB Netz, DB Fernverkehr, StMB and Deutsche Lufthansa regarding the mainline rail link [phase 4]. This study will form the basis for the project application to the Federal Ministry for Digital and Transport to upgrade the nationwide timetable for Germany.

Road links

As the main feeder road, the A92 freeway between Munich and Deggendorf ensures the airport is connected to the national road network. This and the A9 freeway linking Munich and Nuremberg and the A99 freeway ring road mean there are a number of highly efficient freeways leading to the state capital of Munich and the regions around Nuremberg, Stuttgart, Salzburg and Lindau. The opening of the Freising western bypass in January 2022 has significantly improved accessibility to the airport on the regional road network in the west. In addition, the Freising north-eastern bypass along the B301, another important feeder road from the north, was opened to traffic in November 2020. In the east, the Airport Connector Road (Flughafentangente Ost, FTO) and the Erding northern bypass provide links to the region and the higher-level road network. On the Airport Connector Road, the three-lane expansion of the section between Erding Center and Erding South was opened to traffic in October 2021.

Planning approval procedures are underway for the four-lane expansion of the Airport Connector Road between Erding North and the airport feeder road as well as the Erding northern bypass.

The airport has also expanded its eastern road access along Erdinger Allee and the Südring to link up with the Airport Connector Road.



/Environmental management system

This environmental statement in accordance with EMAS Regulation [EC] No. 1221/2009 relates to Flughafen München GmbH [FMG] as the operator of the Munich Airport infrastructure facilities.

Environmental policy

The environmental policy is a binding guideline for all areas of the company and underscores the importance of environmental protection at the company.

Flughafen München GmbH operates a modern commercial airport while at the same time assuming responsibility for protecting the environment by using resources and energy responsibly, efficiently and with foresight.

- In 2005, FMG introduced an environmental management system certified to Regulation [EC] No. 1221/2009 [EMAS] and ISO 14001, and is thus committed to continuously improving its environmental performance.
- FMG reduces and monitors the company's environmental impact as far as possible. The main focal points of this are aircraft noise, air quality, climate protection, energy efficiency, mobility, water management, waste management, conservation and biodiversity as well as protection of resources.
- The respective data and consumption are monitored through the taking of regular measurements and the results are analyzed, a process that is also aided by suitable key figures. On this basis, the company formulates ambitious environmental objectives. FMG takes innovative measures, including the use of future-proof and sustainable technology, to achieve these objectives.
- FMG is involved in a number of associations and committees as well as other initiatives aimed at continually minimizing the impact of air traffic on the environment, not only at Munich Airport but throughout the aviation industry, and making a contribution to sustainable aviation for the future.
- The company complies with legal requirements to ensure responsible environmental protection. FMG also goes way beyond the legal requirements with a large number of voluntary measures and other binding commitments.
- To protect the climate, FMG has voluntarily set itself the objective of operating Munich Airport on a carbon-neutral basis from 2030 onward. In addition, Munich Airport was one of the first airports in Europe to sign the «Net Zero Carbon» resolution of ACI Europe [the European umbrella association for airports]. The aim is to reduce carbon emissions to net zero by 2050.
- The company strives to deliver comprehensive information and transparency. FMG values dialog and, in addition to the annual environmental statement, provides a wide range of other information on environmental activities and measurement results to stakeholders within and outside the Munich Airport Group. The company also contributes to target-group-oriented environmental education with a range of different measures.

Environmental impacts

Munich Airport records and evaluates all direct and indirect environmental impacts. **Direct environmental impacts** arise as a direct consequence of Flughafen München GmbH's activities at the airport and can be influenced by the company. **Indirect environmental impacts** arise indirectly as a result of Flughafen München GmbH's activities and the company does not have complete control over these. In order to classify the environmental impacts in a ranking, they are assessed annually according to the two criteria of significance and potential influence.

Direct environmental impacts

- Energy consumption
- Fuel consumption
- Purchasing/procurement
- Wastewater disposal
- Waste management
- Land use
- Water consumption
- Light emissions

- Groundwater and soil protection [on the airport grounds]
- Conservation and biodiversity
- Exposure to legionella

Indirect environmental impacts

- Aircraft noise, active and passive noise control
- Emissions from external companies on the campus
- Emissions from air traffic
- Emissions from the subsidiaries
- Groundwater and soil protection [outside the airport grounds]
- Journeys of passengers
- Journeys of FMG employees and external companies
- Electrosmog
- Odor emissions from aircraft exhaust fumes
- Microclimate change

Organization

Company management is fundamentally responsible for compliance with the requirements of the environmental management system. It is responsible for

- the formulation, perception and implementation of the company's environmental policy,
- the provision of sufficient personnel, technical and organizational support to maintain the environmental management system and
- the performance of regular reviews of the effectiveness of the environmental management system.

An environmental management officer appointed by the company management is responsible for ensuring the long-term functionality and effectiveness of the environmental management system.

/Strategy and sustainability

Efficient and needs-based action – always taking into account the impact on the Group as a whole – is what will lead the company to long-term, value-generating growth rather than short-term, one-off profits. Munich Airport's business model and strategic positioning have a significant impact on Munich, Bavaria and Germany as business locations, the region surrounding the airport and its inhabitants, employees, travelers and the businesses based at the airport and in the surrounding area. The resulting market requirements are front and center of the Group's business activities.

Shaping the future

The strategic mission statement of the Group Strategy 2030 outlines Munich Airport's pathway into the future within the leading group of European and global hub airports. As the operator of a premium hub, Flughafen München GmbH runs efficient operations and aspires to become a role model for sustainable aviation throughout the industry. With a partner-based approach, this will give rise to a modern company with sustainable connections that is an innovative competitor and trustworthy brand that keeps its stakeholders in mind.

The Group Strategy 2030 comprises economic, environmental and social objectives that aim to meet the demands of all the Group's stakeholder groups. Taking into account the key stakeholder groups and the market, FMG must focus on consistent actions and sustainable growth in order to be successful in the long term. Economic efficiency is just as crucial as social and environmental responsibility. At the same time, mounting social pressure and tougher competitive conditions are making their presence felt in the industry.

The objectives and measures arising from the sustainability program make a significant contribution to the implementation of the Group strategy and thus to the continued development of Munich Airport. FMG uses defined key figures to measure the success of its strategy implementation.

Sustainable Development Goals – SDGs

The sustainability strategy also contributes to the Sustainable Development Goals (SDGs) of the United Nations. Munich Airport supports the implementation of the SDGs and has identified twelve SDGs that are relevant to it and that it can

have some influence on, and it intends to continue working toward these with its strategic projects between now and 2030.

Twelve selected Sustainable Development Goals (SDGs):



Code of Conduct

The Munich Airport Group stands for integrity, compliance and sustainability. Compliance with national and international laws, government regulations and official requirements, as well as internal company regulations, is part of our ethos as a company. The Code of Conduct is based on this corporate culture and contains guidelines and principles for conduct that is conducive to these values and compliant with the law. The Code of Conduct is a standard of behavior that applies to everyone within the company and to external third parties in a national and international context.

Membership of associations

Munich Airport is a partner of national and international airport associations. Through close cooperation with industry associations, in particular the German Airports Association (ADV), the German Aviation Association (BDL) and the Airports Council International (ACI) Europe, Flughafen München GmbH has access to the latest information from the aviation industry and is thus involved in the combined representation of interests. FMG representatives are involved in environmental protection working groups at both German and European level. Topics of discussion range from settlement management in the vicinity of airports and the evaluation of environmental regulations through to recommendations for noise control and climate protection measures.

Demands on suppliers and the supply chain

Munich Airport takes an economically efficient and sustainable approach to the awarding of contracts. This includes greater involvement of the specialist departments, which already set environmental, economic and social standards, in the procurement process. The goal of becoming a carbon-neutral airport is already reflected in the requirements of users. For example, durable, resource-preserving materials and environmentally friendly manufacturing processes are stipulated in specifications for the goods and services required. Potential suppliers must meet environmental standards, including special certificates and sustainability requirements.

Bidders must confirm compliance with legal requirements and provide evidence of quality assurance and environmental management in order to participate in tenders. Sustainability criteria are increasingly being integrated into the assessment of economic efficiency. This includes the use of environmentally friendly products and efficient vehicles and the consideration of life cycle costs for capital goods. The primary objective when awarding contracts is to reach agreements that fulfill environmental, social and economic criteria.

This illustrates the considerable importance of environmental standards for the selection of suppliers at Munich Airport. Suppliers were assessed back in 2005 and additional envi-

ronmental criteria have been incorporated into the existing supplier assessment system since 2007. Environmental criteria such as EMAS or ISO 14001 certification are taken into account in the assessment. There is a procurement guideline in place for sustainable purchasing criteria.

The Munich Airport Group is mainly supplied by business partners from the local region in order to shorten transportation distances and reduce carbon emissions. The company's administration made an important contribution to resource conservation in 2022 by introducing a digital signature process.

The airport assumes responsibility throughout its entire supply chain and expects its suppliers to comply with environmental and human rights standards. It strives to avoid any risks relating to human rights and the environment. Suppliers receive training material to help them meet these expectations. As part of the German Supply Chain Act (Lieferkettensorgfaltspflichtengesetz, LkSG), the obligations are recorded in contractual documents and case-by-case reviews are carried out in the event of risks or suspected cases. Should violations nevertheless occur, the complaints procedure outlined in the Rules of Procedure provides a professional solution.

More detailed information can be found at: <https://www.munich-airport.com/responsible-supply-chain-15731950>

/ Conservation and biodiversity

An airport in a bird sanctuary

To optimally integrate the airport into its surroundings, Flughafen München GmbH created structures during the construction of the airport to improve and connect the surrounding ecosystem. The concept divides the area in Erdinger Moos and Freisinger Moos into three zones:

- Zone I: The airport grounds including runways, buildings and roads. Undeveloped or sealed areas were transformed into high-quality green spaces and planted with over 5,000 trees. Targeted maintenance has resulted in species-rich vegetation, and even precious calcareous grassland in some places.
- Zone II: A green belt with wooded areas and diverse structures. This is the area surrounding the airport grounds, which fulfills a buffer function for settlements and agriculture and integrates the airport infrastructure into the surrounding landscape.
- Zone III: A planning area for environmental compensatory and replacement measures. Current legislation including the impact regulation under nature conservation law, species protection law, European site protection for the Natura 2000 network and forestry law form the basis for this. The compensatory areas and replacement measures connect the nature conservation areas and watercourses via biotope corridors, for example.

Munich Airport is part of the 4,525-hectare Nördliches Erdinger Moos European bird sanctuary. The more than 650 hectares of grassland in Zone I and the adjoining parts of Erdinger Moos to the north and east are an important habitat for rare species of meadow-breeding birds as well as numerous species of bees and wasps. The more meager airport meadows next to the runways offer birds ideal breeding and rearing conditions, as they still have short grass when these birds arrive in spring. The airport fence also protects the breeding grounds from predators. The meadow-breeding birds were a key factor behind the designation of the Nördliches Erdinger Moos bird sanctuary in 2008. Many meadow-breeding bird species in Bavaria are highly endangered. The Eurasian curlew even falls into category I of the Red List of Threatened Species. In 2022, 94 breeding pairs were counted within the airport fence on the airport grounds.

According to the state-wide meadow-breeding bird mapping carried out by the Bavarian State Office for the Environment (LfU), the airport grounds alongside the runways are the most important breeding area for the Eurasian curlew in the whole of Bavaria.¹

The airport is conscious of its special responsibility for bird protection. For this reason, mowing, construction and maintenance work is only conducted outside the breeding season. In addition to curlews, the airport grounds are also home to other rare species such as corn buntings, black-tailed godwits, skylarks, lapwings, quails and partridges.



Black-tailed godwit (*Limosa limosa*)

The meadow-breeding bird species, which mainly stay close to the ground during their breeding season, do not interfere with flight operations. Conversely, flight operations do not interfere with the birds' breeding activities either. The breaks between noise events give the birds enough time to find breeding partners and raise their broods in peace. Current studies on the effects of the coronavirus pandemic confirm this, with the restricted air traffic having no proven impact on the population development of breeding bird species on the airport meadows.

The Nördliches Erdinger Moos bird sanctuary is home to a total of 40 of the most endangered bird species, including the bittern and various species of harrier and reed warbler. This makes the area an important part of the «Natura 2000» pro-

tected areas network, which covers the whole of Europe and promotes the protection of biodiversity.

Biodiversity

Flughafen München GmbH is pursuing the vital goal of increasing biodiversity. A large number of environmental management projects contribute to this.



On June 24, 2019, the Bavarian State Ministry of the Environment and Consumer Protection recognized Flughafen München GmbH as one of the first companies to be named a «blooming business». This award was extended for a further three years on June 24, 2022. The award, presented as part of the «Blühpakt Bayern,» is proof that Flughafen München GmbH fulfills the following criteria:

- At least 20% of the open spaces on the company premises are designated as near-natural flowering areas.

- No chemical pesticides are used anywhere on the premises.
- Certain parts of the flowering areas remain unmown in winter in order to preserve reproduction and hibernation sites for insects.
- No peat-containing substrate is used in the design and maintenance of open spaces.

Airport meadows: «A biodiversity hotspot»

FMG has redesigned six areas covering a total of around five hectares in the Freisinger Moos flora and fauna habitat area (FFH) to help eight selected species of butterflies, some of which are highly endangered. As part of the Bavarian Environmental Pact, a comprehensive and protected habitat for the meadow butterfly, the bog fritillary and both the scarce and dusky large blue has been created using a concept that is specially tailored to the needs of the butterflies.

More information on conservation, biodiversity and the Munich Airport bird sanctuary is available at: <https://www.munich-airport.com/nature-conservation-264296>



¹ Lossow, G., Rudolph, G.-U., et al (2023) 7. landesweite Wiesenbrüterkartierung in Bayern 2021 – Bestand, Trends und Ursachenanalyse (Seventh State-Wide Meadow-Breeding Bird Mapping in Bavaria 2021 – Population, Trends and Cause Analysis): 37–47

/Climate protection



MUC Climate Forest

Munich Airport has developed and implemented a range of measures to reduce carbon emissions. Numerous optimization programs are in place to reduce energy demand on campus and, by association, carbon emissions. Highly efficient and innovative technologies are being used, such as energy-saving LED lighting and preconditioned air (PCA) systems. PCA systems supply the aircraft at the gates with preconditioned air. This eliminates the need to operate the auxiliary power units on the aircraft, which generate significant emissions of CO₂ and other air pollutants. FMG is also gradually switching to renewable energies. Photovoltaic systems have already been installed on top of various airport buildings.

MUC Climate Forest

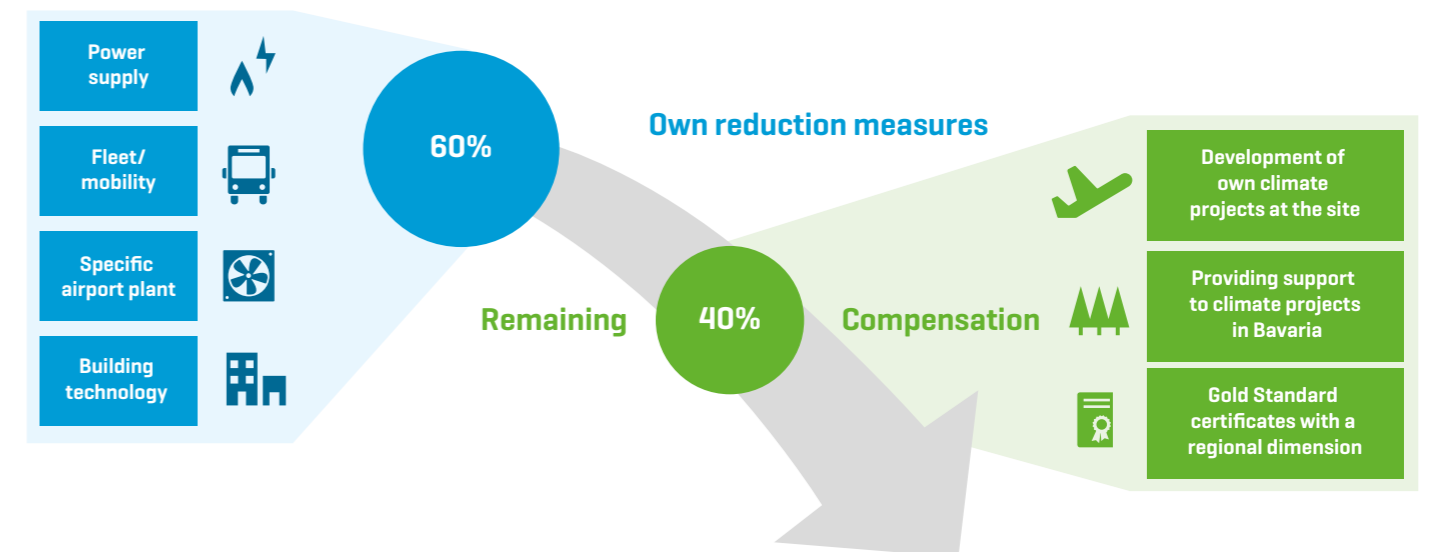
Flughafen München GmbH has launched a long-term, regional climate protection project: the MUC Climate Forest. In cooperation with the Gräfllich von Arco'schen forestry administration, existing forest areas in Lower Bavaria and the Upper Palatinate are being converted into climate forests, which are more resistant to the consequences of climate change and capture more CO₂ from the atmosphere over time than conventional commercial forests. The wood from the climate forests is used as a building material, for furniture in particular, and in this form acts as a carbon store for as long

as possible. Around 90,000 metric tons of CO₂ will be captured over the course of the 30-year project, which runs until 2049. The MUC Climate Forest also promotes biodiversity and serves as an attractive recreational area in the region.

Sustainable aviation fuels (SAF)

The Munich Airport fuel depot for sustainable aviation fuels (SAF) has been open since June 2021. This means that SAF can now be delivered, stored and used for refueling at Munich Airport. SAF will play a pivotal role in the decarbonization of aviation, as they can be used with current engine technology. The SAF used to date are obtained from sustainable biomass and used fats and oils (biomass to liquid, BtL), among other things. Synthetically produced kerosene (power to liquid, PtL) will also be available on the market in future. PtL fuels are produced using water, CO₂ and renewable electricity. Munich Airport supports the development of PtL fuels by participating in industry collaborations such as the «Cleantech in Aviation» working group.

Reduction of carbon emissions at FMG



The carbon footprint of Munich Airport



* LTO = Landing and take-off cycle
 APU = Auxiliary power units
 ET = Engine tests

Airport remains on course for optimization

In 2022, Flughafen München GmbH once again received certification at the «Level 3 – Optimization» assessment level as part of the Airport Carbon Accreditation initiative of Airport Council International (ACI) Europe. ACI Europe is the umbrella association for European airports and, with its global program, is committed to reducing carbon emissions at airports. Munich Airport was awarded the certificate in recognition of its effective and sustainable measures to reduce carbon emissions and the involvement of other airport partners in these efforts.

Promoting a sense of responsibility

Climate protection requires a concerted effort and all employees are encouraged to get involved and contribute their ideas. A conscious approach to resources and environmental protection not only helps to preserve the environment but can also be cost-efficient. Managers and employees are regularly informed about and are actively involved in climate and environmental protection activities.

Carbon neutrality by 2030

Munich Airport is aiming to be carbon neutral by 2030. To achieve this, the company is reducing directly attributable greenhouse gas emissions by at least 60% through technical measures. The remaining 40% will be offset. The Munich Airport Group plans to invest around EUR 150 million in this between now and 2030. Reliable and internationally comparable recording of all carbon emissions forms the basis for all climate protection measures. This data is used to determine the carbon footprint, which enables a detailed breakdown of the airport's greenhouse gas emissions. Munich Airport is implementing a range of carbon-saving measures in an effort to continuously reduce carbon emissions. Flughafen München GmbH is also involved in other projects in cooperation with various partners to promote greenhouse gas reduction in aviation.

In 2018, guidelines were set out in the form of a CO₂ charter as part of the aforementioned carbon objective in order to define the ongoing path of development. Among other things, the company's executive and senior management agreed on a set of measures to avoid energy consumption, increase energy efficiency and expand renewable energies. In detail, this means constructing new buildings as energy-efficiently as possible, gradually converting the energy supply to renewable energies, upgrading the vehicle fleet with environmentally friendly drive types, and taking both energy efficiency and life cycles into account in procurement processes.

Signing the Net Zero Carbon Resolution 2050

Munich Airport aims to achieve operations that are technically completely carbon-free by 2050 at the latest. In contrast to the voluntary carbon-neutral target, the net zero carbon target requires the airport to reduce its own carbon emissions technically to almost zero and to remove the unavoidable remainder of emissions from the atmosphere using technological measures. In June 2019, Munich Airport signed the European Net Zero 2050 Resolution of ACI Europe, the umbrella association of European airports, and pledged to participate in this climate initiative together with over 190 airports.

Additional information on climate protection at Munich Airport is available at: <https://www.munich-airport.com/net-zero-19071587>

Energy management

A modern commercial airport needs a reliable, innovative, economical and environmentally friendly energy supply as a basic prerequisite for its operation and successful development. The smooth functioning of all supply and disposal services is a crucial factor in determining the attractiveness of the airport location and the satisfaction of passengers, airlines, visitors, tenants and employees. It also contributes to the acceptance of the airport in the local region. Since July 8, 1988, Flughafen München GmbH (FMG) has held the status of an energy supply company in accordance with Sections 3 and 4 of the German Energy Industry Act (Energiewirtschaftsgesetz). It supplies itself, its subsidiaries and its affiliated companies, as well as its tenants and other customers on the airport campus, with energy. FMG operates generation plants for electricity, heating and cooling as well as the corresponding distribution networks for electricity, heating, cooling and gas on the airport site.

Munich Airport obtains its energy primarily from its own combined heat and power plant (CHP). Using natural gas as fuel, the CHP plant generates around 80% of the airport's electricity. The waste heat generated during electricity production in turn covers around 80% of the heating demand and all of the cooling demand without the need for additional energy. In 2022, the six engines of the CHP plant generated a total of 25 megawatts of electrical power and 25.4 megawatts of thermal power. This generated 142,699 megawatt hours of electricity (total electricity consumption in 2019 excluding transit customers: 179,957 megawatt hours) and 143,758 megawatt hours of heat (total heat consumption in 2019: 181,495 megawatt hours including the heat used for cooling). The airport obtains the remaining heating it requires from Fernwärmeversorgung Freising GmbH. 75% of this purchased district heating (around 21,000 megawatt hours) comes from the biomass-powered municipal thermal power plant in Zolling. This renewable biomass-powered district heating reduces carbon emissions by around 4,000 metric tons per year.

As part of the general climate debate and its climate protection strategy, Munich Airport is pursuing the EKON 2035 energy concept, which is based on renewable energy sources. The aim is to supply Munich Airport with almost completely carbon-neutral energy by 2035.

Vehicle fleet

Flughafen München GmbH consistently relies on environmentally friendly and sustainable energy sources for its vehicle fleet. Munich Airport currently operates around 300 electric ground-handling vehicles, including special vehicles such as baggage tugs, lifters and passenger stairs. In addition, 131 cars/vans are electric-powered and 26 cars are fueled by bio-gas.

Millions in funding for the purchase of electric buses

The Federal Ministry of Transport and Digital Infrastructure has awarded Munich Airport funding of almost EUR 24 million. This financial support will enable the purchase of as many as 72 electric-powered passenger buses and the expansion of the necessary charging infrastructure at Munich Airport. The new bus fleet will make a significant contribution to achieving carbon-neutral operations at the airport.

Go electric – powered by AeroGround Flughafen München GmbH

AeroGround Flughafen München GmbH is pursuing the strategy of operating all ground-handling equipment in a carbon-neutral manner by 2030. Around 700 motorized devices are currently in use, over 280 of which are already equipped with electric drives. During the course of 2023, a further 91 electric vehicles replaced the diesel-powered equipment. This included not only small vehicles such as baggage tugs, but also large equipment such as passenger stairs and large lifters for the cargo area.

Go electric – powered by EFM

EFM (Gesellschaft für Enteisen und Flugzeugschleppen am Flughafen München) specializes in the maneuvering (push-back and towing), de-icing and air conditioning of aircraft. As a subsidiary of Lufthansa and Flughafen München GmbH, EFM is committed to quality and environmental compatibility. EFM has already successfully undertaken measures to reduce the engine running times of the towing vehicles. This has led to a reduction in wear and tear, maintenance costs and diesel consumption of the vehicles and, in the process, to lower levels of pollution. As a contribution to carbon neutrality, EFM is planning a rollover strategy, with existing vehicles to be replaced by fully electric (or at least hybrid) models.

A fully electric aircraft tower (Kalmar FB600 Electric) is set to be put into operation in the near future. In addition, electric or hybrid aircraft towers and de-icers have already been ordered.

Campus transportation for employees of Flughafen München GmbH

Flughafen München GmbH has launched a campus mobility app that offers employees centralized and mobile access to company vehicles. After several weeks of testing various usage scenarios in the fall of 2022, the app replaced the previous company vehicle pool on November 1, 2022. In contrast to the previous system, booking is now based on journeys instead of vehicles. The location of the vehicle is selected first followed by the vehicle type. The system optimizes capacity utilization and usage and ensures that resources are used efficiently.

Additional activities to save CO₂

- Testing of sustainable fuels (HVO – hydrotreated vegetable oil) was already underway at the airport in 2018 within the winter maintenance, fire service and municipal vehicle fleet. The airport is currently assessing whether to use HVO in regular operations.
- AdBlue is an additional fuel for diesel vehicles that converts the environmentally harmful nitrogen oxides produced during diesel combustion into water vapor and harmless atmospheric nitrogen using a selective catalytic reduction (SCR) catalytic converter. AdBlue is automatically injected into the exhaust gas flow and almost completely neutralizes the nitrogen oxides. This also significantly reduces particulate emissions and lowers fuel consumption by as much as 5%. This environmentally friendly fuel, which consists of one-third urea and two-thirds distilled water, has been available at Munich Airport's refueling stations since 2013. AdBlue is used at Munich Airport in buses and trucks equipped with a separate AdBlue tank and SCR catalytic converter.

- Munich Airport aims to operate its vehicle fleet on a carbon-neutral basis by 2030. Because barely any new vehicles were procured in 2022 due to the pandemic, the proportion of electric vehicles is still just over 30%. At the same time, the airport is also pushing ahead with the expansion of the public charging infrastructure. There are now over 140 charging stations available for company vehicles. Passengers and visitors will currently find over 80 charging stations in various airport parking areas, with more in the pipeline.

The overall CO₂ savings potential in the area of fuel consumption is around 8,500 metric tons of CO₂ per year.

/Air quality



The all-electric Kalmar FB600 Electric

Air quality measurements

Air pollutants are measured at two Munich Airport locations based on the aviation permit issued on May 9, 1974. The measuring stations are in continuous operation and are positioned in agreement with the responsible authority so as to record the impact of airport operations in a representative manner. The main area of focus is on the air pollutants emitted and dispersed by aircraft during take-off and landing. Some of the exhaust gases are subject to conversion and degradation processes. Only the air pollutants emitted close to the ground have the ability to influence air quality in the vicinity of the airport. Although local traffic, industry, agriculture and domestic heating systems also have an impact on air quality. In order to determine and monitor the impact of airport operations, the company measures emissions at the boundaries of the airport grounds.

The east of the airport grounds is more heavily impacted by airport operations than the west due to frequent westerly winds. Munich Airport therefore installed an air quality measuring station to the east of the grounds in 1991 – one year before operations began at the new site. Due to various construction measures and expansions, the measuring station has been relocated several times. Since January 2012, it has been located at the eastern end of the southern runway and named LHY7. It provides continuous information on the air quality situation based on physiochemical measurements. An additional air quality measuring station named LHY4 was set up to the west of the airport grounds. Together with LHY7, it enables a leeward vs. windward comparison of the air quality situation for nitrogen oxides, which are considered a typical pollutant of road and air traffic. Both air quality measuring stations are operated by an external expert on behalf of Flughafen München GmbH. The selection of parameters and the measurement methods at the measuring stations are based on the specifications of the 39th Federal Emission Control Ordinance [Bundesimmissionsschutz-Verordnung, BImSchV]. The air quality measurements record the cumulative effect of all pollutant sources from road and air traffic and other airport operations. They are overlaid onto the background pollution of the Munich metropolitan area and the normal background concentrations in the atmosphere.

The concentrations shown below are measured:

- Dust (PM₁₀ and PM_{2.5})
- Carbon monoxide
- Nitrogen monoxide and nitrogen dioxide
- Ozone
- Sulfur dioxide
- Benzo(a)pyrene
- Hydrocarbons, specifically benzene, toluene, ethyl benzene and xylenes (BTEX)

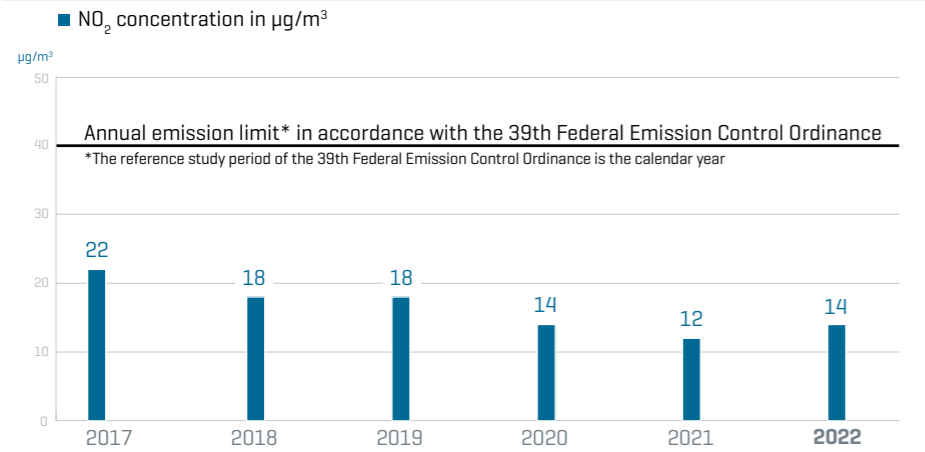
Mobile air quality measuring station

Since 2014, in addition to the two stationary air quality measuring stations, Flughafen München GmbH has also had a mobile measuring station that is able to measure air quality in the airport's neighboring communities, for example at the request of interested municipalities. The measurement results show that the limits of the 39th Federal Emission Control Ordinance for the protection of human health are met or significantly undershot for all parameters. The results of the air quality measurements and the measurement reports can be accessed at: <https://www.munich-airport.com/air-quality-measurements-4910011>.



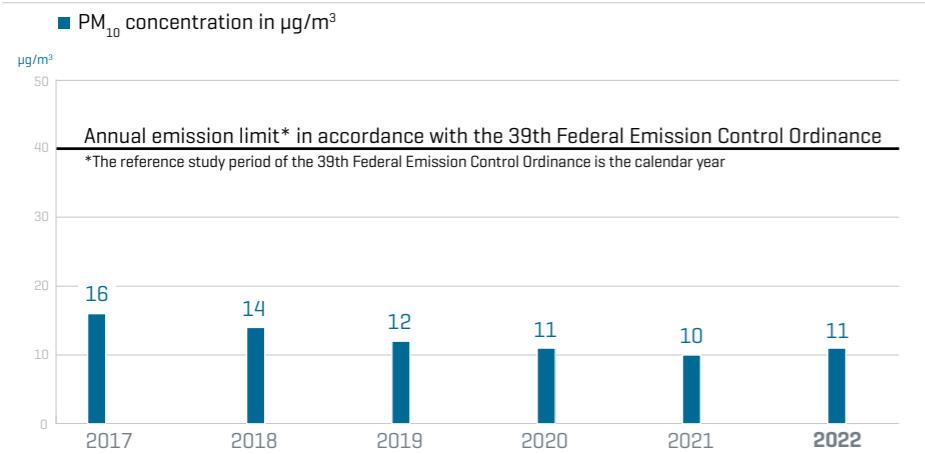
Development of nitrogen dioxide concentration

NO₂ concentration (nitrogen dioxide)



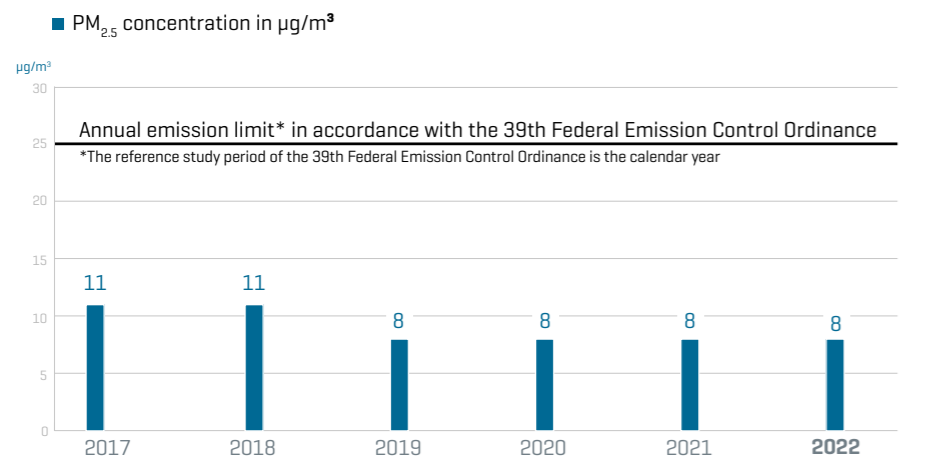
Development of particulate matter concentration (PM₁₀)

PM₁₀ concentration (particulate matter)



Development of particulate matter concentration (PM_{2.5})

PM_{2.5} concentration (particulate matter)



Causes of air pollutants

Air traffic

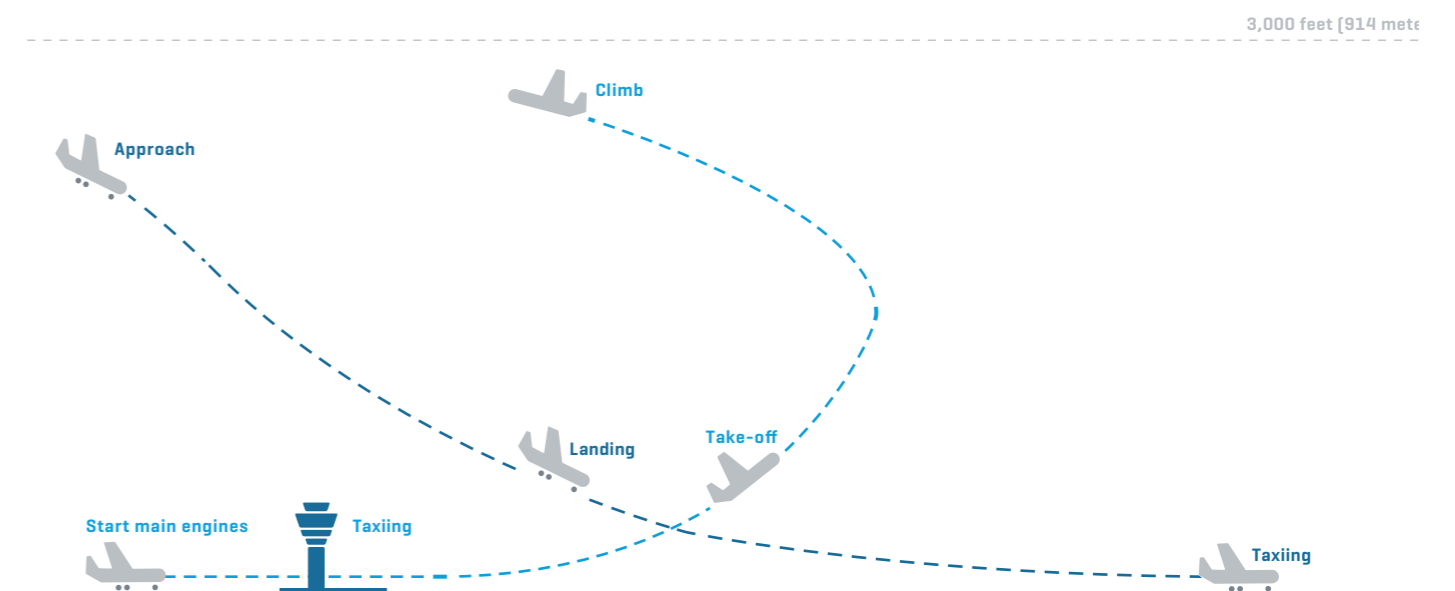
In addition to Scope 1 and Scope 2 emissions that can be directly attributed to Munich Airport, users and employees of the airport also release emissions. These are primarily emissions from air traffic during the various operating states of the take-off and landing cycle (LTO cycle) and emissions from road traffic on the feeder roads and public service roads. The LTO cycle consists of the operating phases taxi in/taxi out, take-off, climb and approach and refers to the range up to an altitude of 3,000 feet (914 meters) above ground level.

The International Civil Aviation Organization (ICAO) has defined limits for engine emissions that must be complied with during engine certification. The standard times of the LTO cycle and the resulting emissions are important for this.

The aircraft engines run at different levels of propulsion in each operating phase. As a result, fuel consumption and the amount of air pollutants emitted can vary.

The total quantity of a pollutant emitted from the engines is therefore the sum of the emissions released per operating phase. This can be calculated from the sum of the phase duration, fuel consumption per phase and emission index per phase. The ICAO publishes the emission index and fuel consumption for the individual operating phases of the LTO cycle for each engine in the ICAO Engine Exhaust Emission Database. Using this information and factoring in the number of engines, it is possible to calculate the total emissions of a particular pollutant for the LTO cycle according to ICAO for each aircraft. The data is evaluated using the LASPORT simulation model. The taxiing times on the ground and additional parameters are taken into account to represent the operating conditions as realistically as possible.

LTO cycle in accordance with ICAO 9889



Road traffic

Road traffic emissions can be calculated using information from the Handbook Emission Factors for Road Transport (HBEFA) together with the traffic figures and the lengths of the stretches of road. The current HBEFA version 4.2 contains separate emission factors for pollutants for each year as well as various traffic scenarios, which are further differentiated according to cars, trucks and light commercial vehicles. For calculation purposes, they are recorded in the LASPORT model together with the traffic figures for the publicly accessible road network between the A92/FS44 in the west and the St2580 (Airport Connector Road) in the east in order to compile the emissions of the various substances.

Reduction of air pollutants

Emission-based landing fees

When calculating takeoff and landing fees, Flughafen München GmbH takes into account not only noise emissions but also pollutant emissions. The aim is to limit emissions of nitrogen oxides (NO_x) and hydrocarbons from aircraft engines. This measure motivates engine manufacturers and aircraft manufacturers to invest in the development of lower-emission aircraft. In turn, airlines make an effort to ensure that low-emission and state-of-the-art aircraft are stationed in Munich. The pollutant-dependent proportion of the landing fees equating to around EUR 9 per nitrogen oxide equivalent (= emission value) can amount to several hundred euros per landing for a single aircraft. However, this does not generate any additional income for the airports. The additional expenses incurred by airlines for the emission-based fee are offset by a corresponding reduction in the fixed charges for all airlines, which depend on the maximum take-off mass (MTOM) of the aircraft type used. The emission-based landing fees are levied for each individual engine according to the standard conditions of the LTO cycle. This means that engine information is available for all flights, providing more differentiated initial data for determining total air traffic emissions. The results also take into account technical advancement with lower-emission engines.

Optimized flight operations

Airport collaborative decision-making (A-CDM) is a process in which stakeholders such as airport operators, airlines and air traffic control work closely together to ensure that air traffic operations run as smoothly and energy-efficiently as possible. The departure airport ensures a timely take-off, thus enabling air traffic control to allocate the most direct flight route possible. Thanks to this cooperation, the destination airport is given the most accurate possible estimate as to when the aircraft will land and is able to plan its services in the most efficient manner to ensure a punctual take-off at its end. Short and punctual ground times avoid idling, waiting times on the runway and holding patterns in the air. This not only minimizes energy consumption, but also reduces air pollutant emissions.

Biomonitoring

Munich Airport has been carrying out monitoring using bio-indicators in the local region since 2006. The aim of this program is to promptly identify contamination from air traffic in animal feed and foodstuffs. The use of standardized crops makes it possible to compare different locations, as the soil used in all the plant pots does not influence the results of the measurements. In 2022, plant pots containing perennial ryegrass and kale were set up at five measuring points on the airport site and in the surrounding area. They were harvested one by one every few weeks and analyzed in the laboratory to detect traces of polycyclic aromatic hydrocarbons (PAHs) and 18 selected metals. The legally permissible maximum levels for agricultural feed and plant-based foodstuffs and the limits and guideline values for soil protection were not exceeded at any of the measuring points in 2022. From a consumer protection perspective, no health-threatening contamination from agricultural use and food production has been inferred in the area surrounding the airport.

Honey monitoring

Honey is a foodstuff produced in the wild that is exposed to various environmental influences during its production. The raw material for blossom honey is blossom nectar, which bees also collect in the flower-rich grounds in and around Munich Airport. They fly 40 to 60 times a day to their collection area, which extends within a radius of two to three kilometers of the hive. Each bee visits 1,000 flowers a day on average, fertilizing the various plants with the pollen they pick up. The bees process the nectar by extracting water from it and adding enzymes and active ingredients. Finally, the honey is stored in the honeycombs in the beehive. A colony of 40,000 to 60,000 bees produces around 20 to 30 kilograms of honey per year. Bees are extremely sensitive to environmental influences. During their foraging flights, they come into contact with pollutants in the air, in the rain and on the flowers. These pollutants can harm the bees or accumulate as residues in the pollen, wax and honey. Concerns had repeatedly been raised about the possible contamination by aircraft exhaust fumes of the honey from the area around the airport.

In an attempt to investigate these concerns, in 2008 Munich Airport began testing the quality of the honey produced in the region. In 2022, 30 bee colonies at four locations in the immediate vicinity of the airport produced around 640 kilograms of honey. The locations of the beehives were carefully selected to ensure that the flight routes of the bees covered the airport site in a representative manner. The beekeepers also monitor the vitality of the bees on a regular basis.

Honey monitoring involves highly specialized laboratories, which use state-of-the-art analysis techniques to examine samples of honey, wax and pollen for the presence of ten metals, inorganic trace substances and 16 polycyclic aromatic hydrocarbons (PAHs). The results are evaluated in accordance with the applicable food regulations and compared with tests from the control area of Aichach, which is a long way from the airport. The results are evaluated by experts and summarized in a detailed report. Flughafen München GmbH publishes this report annually on its website.



The results of the honey monitoring show that the vitality, development and honey production of the bee colonies at Munich Airport are as good as in the control area of Aichach, far away from the airport.

The honey from the airport region is of excellent quality and is safe to eat. There was no discernible influence of airport operations on the pollen, wax and honey. Furthermore, the decline in aircraft movements due to the coronavirus pandemic had no apparent effect on the test results.

Additional information on honey monitoring, air quality and biomonitoring at Munich Airport can be found at: <https://www.munich-airport.com/honey-monitoring-264528> and <https://www.munich-airport.com/air-quality-264266>.



/Aircraft noise and aircraft noise control

Aircraft noise monitoring: stationary and mobile

According to Section 19a of the German Air Traffic Act, the operator of an airport must «set up and operate facilities for the continuous recording of noise generated by arriving and departing aircraft in the vicinity of the airport.»

Flughafen München GmbH (FMG) monitors aircraft noise within a radius of around 20 kilometers using 16 fixed measuring stations. In addition, municipalities can request mobile aircraft noise measurements to be taken beyond the stationary measuring stations as a voluntary service. In 2022, values were recorded at five mobile aircraft noise measuring stations on a total of 185 days in Haimhausen-Oberndorf, Schweitenkirchen-Reisdorf, Poing, Unterschleißheim and Marzling.

The results of these mobile measurements are clearly displayed on a map at: <https://lx-travisrp01.munich-airport.de/data/WRMobile/index.html>.

Noise measurements with solar energy

FMG has developed an aircraft noise measuring station that can operate independently of a local power supply using photovoltaics. The solar module has a total output of 285 watts and surplus energy is stored temporarily. If this storage unit ever runs empty, a methanol-powered fuel cell is switched on to provide the required energy for the measuring station.



The data from the aircraft noise measuring stations is subject to multiple quality assurance measures. Both the fixed and mobile measuring stations meet the highest electro-acoustic performance requirements with their sound level meters and microphones designated accuracy class 1. The devices are checked regularly and the measuring components are calibrated by independent, accredited laboratories. In addition, extraneous noise, including from tractors, trains or cars, is filtered out of all measurement results.

Transparent information on aircraft noise

The «Flumo» [aircraft noise monitoring at Munich Airport] information platform provides access to the latest measurements from the 16 stationary aircraft noise measuring stations (<https://www.munich-airport.com/noise-protection-264207>). In addition to the noise measurement data, it also covers important information on flight patterns and aircraft types. «Flumo Live» displays the noise measurement and flight pattern data almost in real time.

Reduction of aircraft noise

The permissible noise emissions for aircraft are outlined in the aviation agreement of the International Civil Aviation Organization (ICAO). This agreement contains detailed provisions for the noise measurement and noise certification of aircraft. Noise certification is based on a standardized procedure in which the aircraft's noise emissions are measured at three defined measuring points during a flyover. In 2022, 44% of all aircraft movements at Munich Airport already met the strictest requirements of the ICAO's Chapter 14.

FMG is committed to continuously reducing noise pollution for residents living near the airport beyond the legal requirements. Active noise abatement measures are aimed at reducing or avoiding noise at source.

New engine architecture halves the noise-affected area

Quieter aircraft types with innovative engine technology reduce not only fuel consumption and carbon dioxide emissions but also noise levels. The Airbus A350-900 is considered the most environmentally friendly long-haul aircraft in the world. Compared with its predecessor, the Airbus A340, it produces significantly lower noise levels: up to 7 dB(A) lower on take-off and up to 3 dB(A) lower on landing. In comparison with the A340, the A350-900 has a 40% to 50% smaller noise

Locations of the fixed measuring stations operated by Flughafen München GmbH



contour and does not exceed a noise level of 85 dB(A) outside the airport grounds. This results in a direct reduction of aircraft noise pollution in the vicinity of the airport. In 2022, Lufthansa increased its fleet at Munich Airport with four more A350s, taking the total number of these state-of-the-art, low-emission long-haul aircraft to 21.

Noise charges: the quieter, the cheaper

In order to make the use of quieter aircraft even more attractive, FMG has further developed the concept of noise-related charges and has significantly increased their share as a percentage of total charges since June 1, 2021. The new charging schedule now includes 13 noise classes instead of the previous 11 and makes an even greater distinction between quiet and loud aircraft types. FMG places particular emphasis on the use of quiet and modern aircraft at night. For this reason, surcharges are levied on the basic noise charge for flights during this time. The surcharges increase incrementally from 10 p.m. and reach their highest level of 120% between midnight and 5 a.m.

Noise action plan for Munich Airport

In 2021, the government of Upper Bavaria drew up a noise action plan for Munich Airport with the involvement of the general public and the affected communities. This plan involves both the continuation of measures that have already been taken and future actions to reduce aircraft noise in the area surrounding the airport. The noise action plan represents the concerted effort of the government of Upper

Bavaria to implement the EU directive on the assessment and management of environmental noise at Munich Airport. FMG has responded to the feedback it received as part of the public participation process. Following consultation with the affected municipalities, the noise action plan was published by the government of Upper Bavaria at the end of 2021. In 2023, the government of Upper Bavaria reviewed the noise action plan again and came to the conclusion that it does not yet need updating. The noise action plan for Munich Airport is published at the following link: https://www.regierung.oberbayern.bayern.de/service/planfeststellung/oeffentlichkeit/umwelt_gesundheit_verbraucherschutz/lap/lap_flughafen_mue/index.html

Night flight regulations

Since March 23, 2001, night flight traffic at Munich Airport has been regulated by a new ruling by the government of Upper Bavaria amending the aviation permit of May 9, 1974.

During the core period from midnight to 5 a.m., as a general rule only nighttime airmail and aerial survey flights operated by Deutsche Flugsicherung GmbH (DFS) are permitted. There are exceptions for emergency and assistance flights, landings for flight safety reasons and flights in justified individual cases that have been approved by the Bavarian State Ministry for Housing, Construction and Transport (BayStMB) in the special public interest. In the off-peak hours between 10 p.m. and midnight and between 5 a.m. and 6 a.m., aircraft movements must meet one of the following requirements:



- Scheduled aircraft movements in scheduled and charter traffic [maximum 28 per night]
- Flights operated by airlines that maintain a home base in Munich
- Aircraft that do not generate an average individual noise level higher than 75 dB(A) at the noise measurement stations in the vicinity of Munich Airport
- Training and practice flights

Furthermore, night flight operations at Munich Airport are limited to an annual noise quota. The equivalent continuous sound level of $L_{eq} = 50$ dB(A) must not be exceeded at the intersections of the flight corridors with the outer boundary line of the combined day/night protection area. Exceptions to this are possible if no residential areas or residential construction areas are affected. Compliance with the noise quota and the continuous sound level must be demonstrated annually to the aviation authorities and the Aircraft Noise Commission.

Passive noise control

Since Munich Airport opened in 1992, FMG has invested a total of around EUR 62 million in noise abatement. When the night flight regulations were amended on March 23, 2001, the night protection area was also extended and a combined day and night protection area was defined. Residents were able to claim noise abatement measures for living rooms and bedrooms so that, as a general rule, no individual noise level of more than 55 dB(A) occurs inside the rooms with the windows closed. FMG has installed around 21,000 soundproof windows altogether in the area surrounding the airport and also assists residents with the care and maintenance of the soundproofing measures. As part of a voluntary service program, this also includes replacing the highly sound-insulating cast resin panes in the event of visual impairments.

Commission for protection against aircraft noise

The commission for protection against aircraft noise and air pollution from aircraft for Munich Airport is an important body regarding aircraft noise matters. Various parties attend the meetings, including:

- Municipalities and districts affected by aircraft noise in the vicinity of the airport
- Flughafen München GmbH
- Deutsche Flugsicherung GmbH (DFS)
- Deutsche Lufthansa AG
- The government of Upper Bavaria
- Bundesvereinigung gegen Fluglärm e.V.
- The Bavarian State Ministry of the Environment and Consumer Protection [BayStMUV]
- The Bavarian State Ministry for Housing, Construction and Transport [BayStMB]

The Aircraft Noise Commission is entrusted with the task of advising the licensing authority, the Federal Supervisory Authority for Air Navigation Services and the air navigation service provider on issues relating to protection against aircraft noise and air pollution caused by aircraft in accordance with Section 32b of the German Air Traffic Act. It is authorized to propose measures to protect the population from aircraft noise and to reduce air pollution from aircraft in the vicinity of the airport.

Dialog on aircraft noise

FMG's «noise control service hotline» gives residents the opportunity to raise concerns about aircraft noise with FMG. FMG employees are available to answer individual questions at 089/975-404 10.

Additional information on aircraft noise at Munich Airport can be found at:

<https://www.munich-airport.com/noise-protection-264207>

/Water management

Management of surface water and groundwater

Watercourse rerouting

The construction of the airport led to the streams and ditches in Erdinger Moos running from west to east being cut. The Goldach coming from the south is diverted west around the airport until it flows into its original stream bed. The other streams that meet the airport on the south side are connected to the southern catchwater drain. The water, together with any precipitation, is routed through the airport via the “south-north connection” to the northern diversion channel, and from there is distributed back into existing ditches. Flughafen München GmbH operates a telecontrol system to monitor the water discharge. In particular, it monitors, controls and documents the water discharge from the northern diversion channel into the Süssgraben, Mittelgraben and Grüselgraben watercourses.

Ecological watercourse design as part of nature conservation compensatory and replacement measures

A variety of structures were created during the watercourse rerouting: winding river courses, shallower spots and deeper pools, fast-flowing areas and calm bays, supplemented by higher dry sand or gravel areas. The planting of suitable shrubs and trees completes this natural design, protects the banks and prevents substances from entering the water. At the same time, these riverbanks are an important habitat for a variety of animals and plants, including some endangered species. Ecologically stable and low-maintenance habitats have developed over the years whose role in the ecosystem as irreplaceable refuges for rare species is becoming increasingly important.

Groundwater regulation

The groundwater level must be regulated to ensure that the runways and taxiways in particular are protected against frost and that the terrain next to the paved areas can be used by emergency vehicles. At Munich Airport, the drainage ditches running along the two runways maintain a specific

water level. To limit the impact of this groundwater regulation on the airport grounds, the groundwater that is extracted is allowed to seep back into the ground along the northern boundary of the site. The water management telecontrol system regulates, monitors and documents the summer and winter water levels in the drainage ditches, records the water levels and discharge volumes, and controls the system for reinfiltrating the groundwater to the north of the airport.

Protection against heavy rainfall and flooding

As part of the watercourse rerouting, flood protection measures were also implemented, verified and evaluated. According to the results, the airport is adequately protected against flooding with a recurrence interval of 100 years (including a climate allowance of 15%). In order to also assess the effects of climate change and extreme precipitation on the operation and infrastructure of the airport, FMG commissioned a multi-phase study based on the Integral Concept for Municipal Flash Flood Risk Management of the Bavarian State Ministry of the Environment and Consumer Protection [No. 2.4 RZWas 2018]. In collaboration with qualified engineering firms, a 2D surface model was developed for the airport grounds, the adjacent watercourses and their catchment areas.

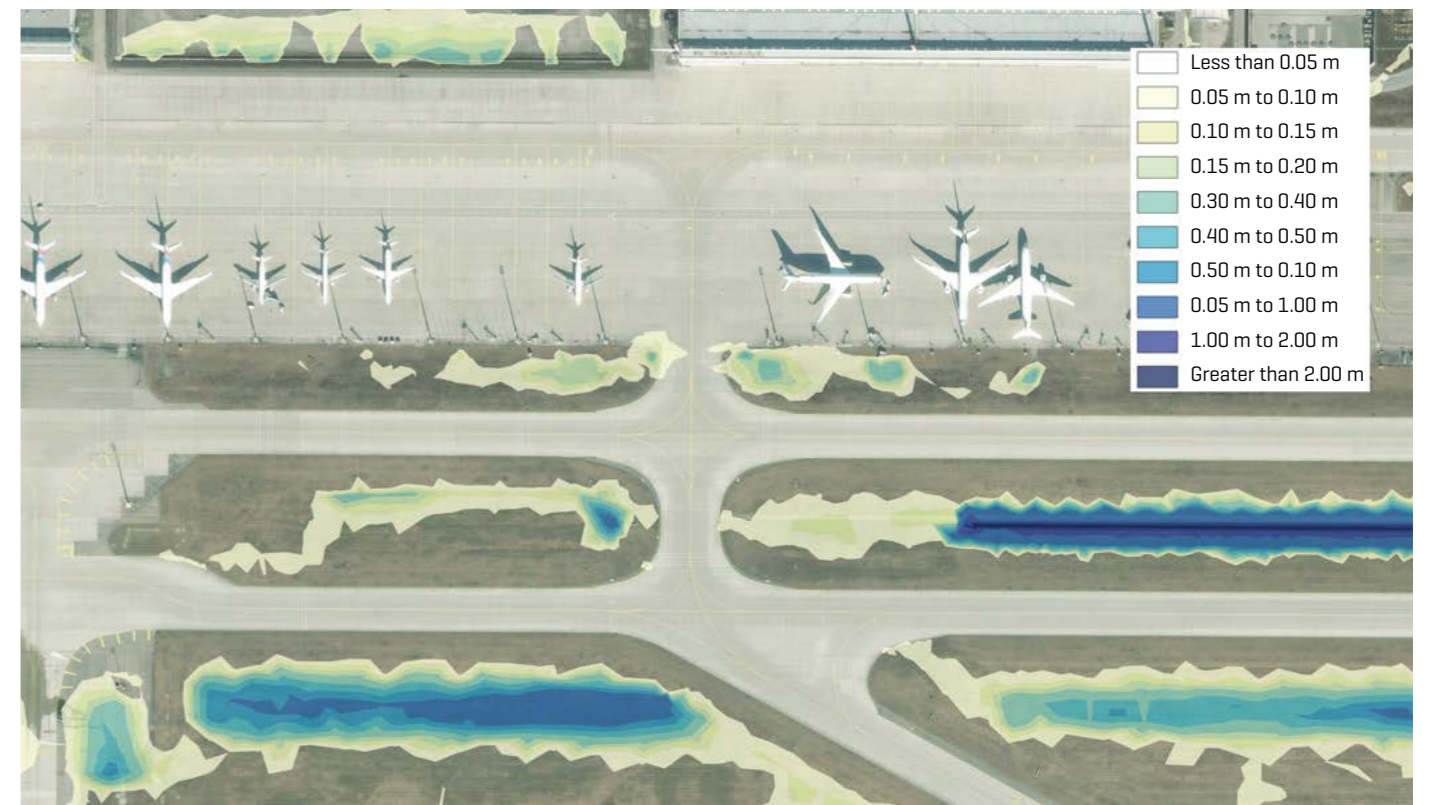
Phase 1 [2019]: The flood protection review revealed that the airport's water system is easily able to discharge even extremely rare flooding from the southern surface waters with a recurrence interval of 1,000 years [HQ 1,000]. Extensive flooding at the airport is therefore not to be expected.

Phase 2 [2022]: In order to hydraulically check and evaluate drainage performance within the airport, the existing 2D surface model was expanded to include the results of a sewer network calculation. It was determined that localized flooding due to surface runoff and backwater from the sewer system is to be expected in isolated cases.



Phase 3 [from 2023 onward]: Based on these findings, the effects of the identified flooding are being investigated further. Where necessary, conceptual measures will be developed to ensure the operational performance of the airport, minimize potential damage to buildings and infrastructure, and meet the requirements for a flood inspection in accordance with the objectives of the Bavarian state government in the long term.

The Technical Services department continuously checks the performance of the existing sewer system. Sewage pipes and infiltration systems are designed to withstand frequent heavy rainfall. «Flooding verification» ensures that sufficient retention space is available so that no damage occurs in the event of surface flooding.

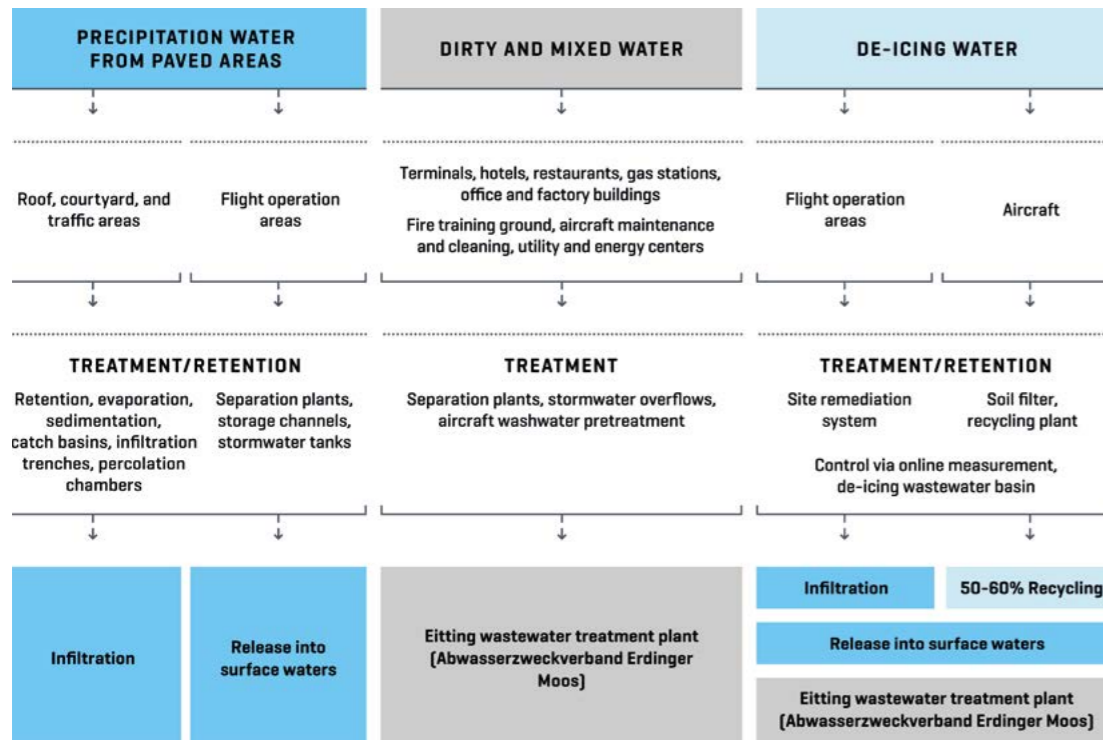


Extract from the hydrodynamic drainage simulation model showing the calculated flooding in the event of heavy rainfall [60 mm/h].

Water protection and drainage

Multiple sewer systems with a total length of 300 kilometers collect wastewater at the airport, which is produced in different qualities and is taken along different routes depending on the level of contamination:

- Rainwater from paved areas
- Wastewater and mixed water
- De-icing wastewater from flight operation areas and aircraft [in winter]



Rainwater from paved areas

Measures such as [rooftop] greenery, surface retention and seepage aim to reduce the burden on the sewer system and reduce surface water when rainwater runs off roofs, courtyards and traffic areas. The feasibility of this method of evaporation, retention and seepage of rainwater is being examined for both new construction and renovation work. At Munich Airport, there are various ways of treating contaminated rainwater and preventing contamination of soil and bodies of water. These include:

- **Mechanical treatment systems** to separate settleable particulates or light liquids, such as rain purifiers, sedimentation systems, light liquid separators
- **Biological treatment** to break down organic compounds, for example through the use of soil filter systems or vegetated topsoil

The telecontrol system installed at Munich Airport detects water-polluting substances such as oil or kerosene in the drainage network of the rain purification basins and in the draining waters. In the event of irregularities or emergencies, the necessary control units can be closed immediately.

Wastewater and mixed water

Wastewater and mixed water, particularly from the terminals, offices, maintenance halls and supply centers, is diverted to the Eitting treatment plant for purification before being discharged into the Central Isar Canal. As a member of the Erdinger Moos wastewater association, Flughafen München GmbH contributes to the wastewater treatment and investment costs for the maintenance of orderly operations at the treatment plant. Wastewater from aircraft maintenance and cleaning is pre-treated depending on the level of contamination and then fed into the wastewater system for further treatment at the Erdinger Moos wastewater association's treatment plant. Regular sampling of the wastewater before it is released into the sewer system provides evidence that the specified monitoring values are not only met but, for the most part, are significantly undershot.

Wastewater from de-icing

To ensure smooth flight operations in the winter, snow plows and/or sweepers remove snow and ice from the flight operation areas. The snow is stored in landfills equipped with a drain that leads to the de-icing sewer system. If the weather conditions dictate, chemical de-icing agents are used in addition to grit. Flughafen München GmbH is required to have the safety of the chemical de-icing agents it uses verified by the Bavarian State Office for the Environment. Only biodegradable surface de-icing agents such as sodium and potassium formate are permitted at Munich Airport. The wastewater from de-icing is collected, temporarily stored in the de-icing wastewater basin and channeled from there to the Eitting treatment plant in regulated quantities.

More and more areas are being drained in winter using total organic carbon [TOC] points. This involves continuously analyzing run-off rainwater to check if it contains de-icing agents [online TOC measurement]. If there is little or no contamination, the water is allowed to enter the surface waters via the rain purification basins. As a result:

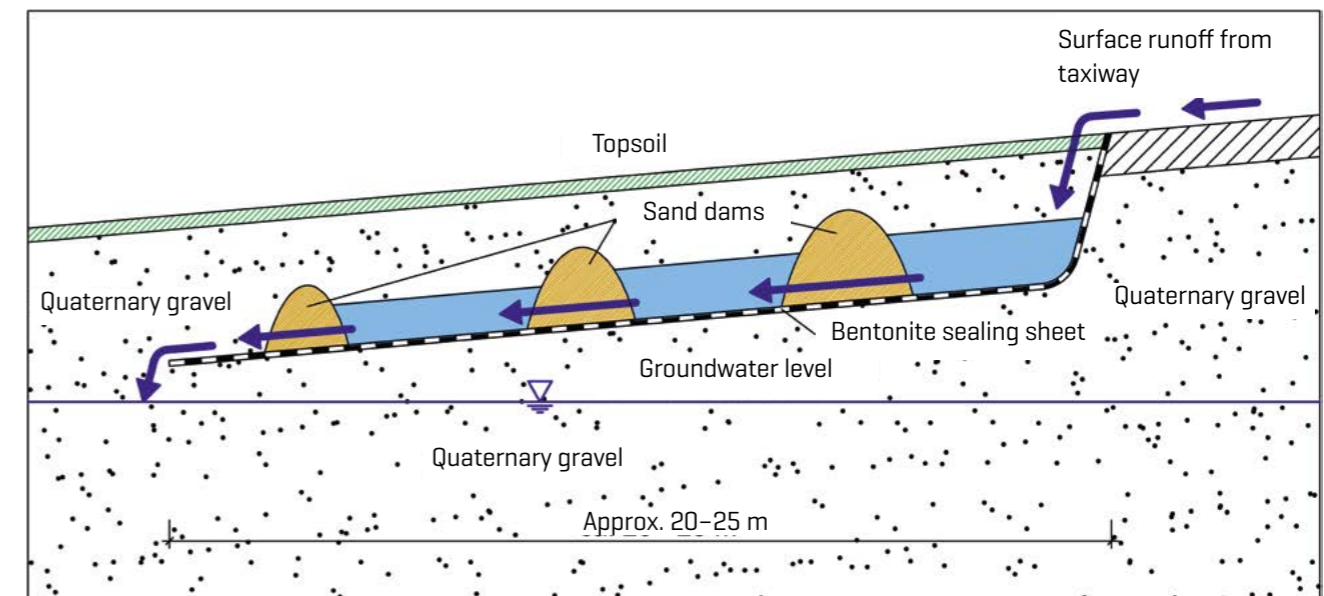
- clean rainwater is not mixed with contaminated de-icing wastewater and polluted

- the capacity of the de-icing wastewater basin is conserved
- the capacity utilization of the wastewater treatment plant is reduced [around 300,000 cubic meters of wastewater per year that does not need to be treated]
- the impact on the water balance is reduced

Terrain breakdown system

The de-icing agents applied to the taxiways during winter maintenance run off together with any rainwater over the side edge of the taxiways and seep into the ground. The terrain breakdown system cleans the de-icing wastewater in this area. It consists of a watertight sealing sheet at a depth of 1 to 1.5 meters, which prevents direct seepage into the groundwater. On top of this is sandy gravel, interrupted by sand dams that run parallel to the taxiways. This arrangement allows rainwater that is contaminated with de-icing agents to run off more slowly and evenly. The soil bacteria contained in the gravel and sand use oxygen to biochemically convert the de-icing wastewater into water and carbon dioxide. The treated de-icing wastewater then seeps into the groundwater without causing any damage. The terrain breakdown system has a purification performance of around 95% to 98%.

Cross-section of the terrain breakdown system

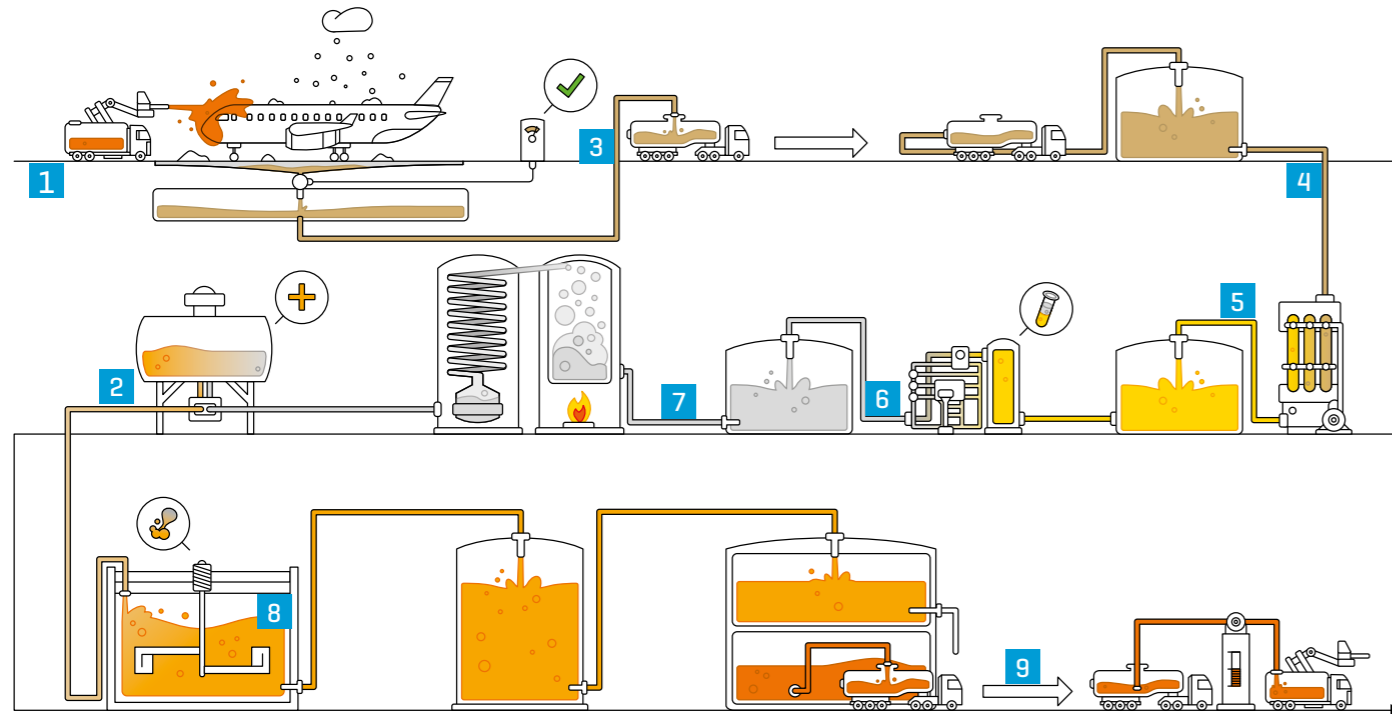


Aircraft de-icing

Where required, de-icing vehicles spray aircraft with de-icing agents in twelve specially designated areas [de-icing areas] in the immediate vicinity of the heads of the runways. The resulting wastewater flows into underground collecting tanks via gutters and drains.

Up to 70% of the glycol mixture is reprocessed in a recycling plant and reused for aircraft de-icing. If the glycol content in the de-icing wastewater is very low, for example in the event of precipitation, the wastewater is treated further in the de-icing wastewater basins before being sent to the treatment plant.

Aircraft de-icing cycle



1 Polar bear deployment / The «polar bears» are deployed in winter when the weather conditions are right. They spray the aircraft with specially colored water before take-off.

2 Drop by drop / The liquid that drips to the ground on the de-icing surfaces is collected. The fluid – mixed with melted snow and ice – reaches a measuring station via gutters and drains.

3 Measuring station / If the concentration of the collected mixture is high enough, it can be released for recycling.

4 Transportation / Pump systems and tankers transport the mixture to the reprocessing plant directly on the airport campus.

5 Mechanical purification / The mixture is first purified by mechanical means. Ceramic filter rods can separate the finest particles down to molecular level.

6 Chemical purification / Further undesirable substances are separated in several stages by means of ion exchange.

7 Distillation / The excess water content is removed from the substance by distillation. What remains is the raw material glycol.

8 Additives / To turn the recycled liquid into a fully-fledged de-icing agent, a few more additives and the orange dye have to be added.

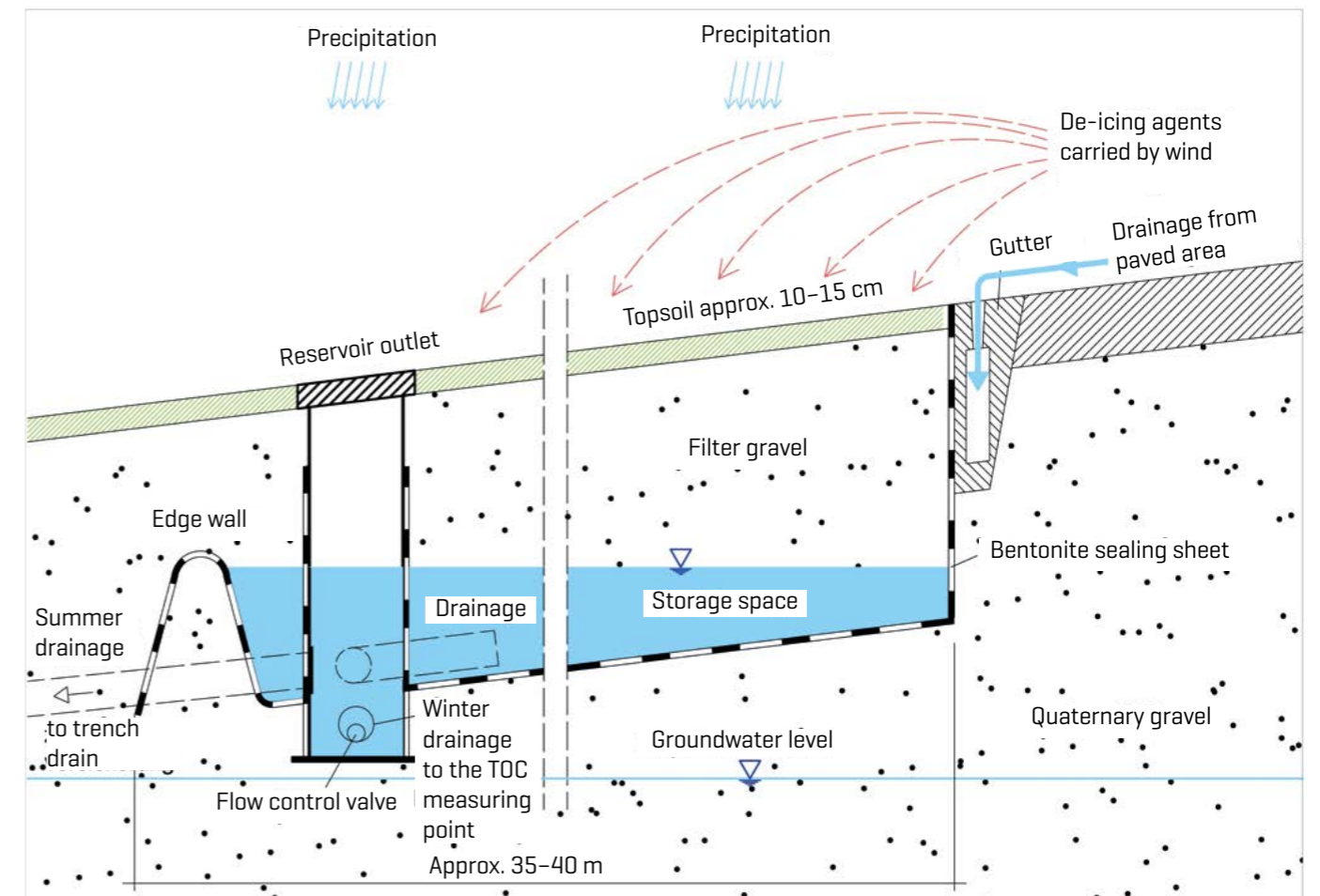
9 The cycle closes / After extensive laboratory analyses, the agent can be released for reuse. The «polar bears» start all over again.

Soil filters

Wind can also carry the aircraft de-icing agent into green areas next to the paved flight operation areas. Soil filter systems around the four heads of the runways prevent de-icing agents from entering the groundwater. These systems consist of underground storage spaces filled with gravel and sealed off from the subsoil.

The soil filter cleans the rainwater and also serves as a retention device. The quality of the water flowing out of the soil filter is determined by an online TOC measurement. Depending on the level of contamination, it is either released into a body of water or is diverted via the sewer system and the de-icing wastewater basins for further treatment at the Eitting treatment plant.

Soil filter cross-section



/Waste management

Water supply

Drinking water and fire extinguishing water

Munich Airport was the first airport in the world to have a separate drinking water and fire extinguishing water network. This eliminates the need for separate, costly extinguishing water storage tanks in all buildings. The fire extinguishing water system, which is arranged redundantly like the drinking water network, covers all possible firefighting scenarios with an extinguishing water demand of up to 380 liters per second.

Service water and geothermal energy

Munich Airport uses drinking water sustainably and sparingly and only where it is really needed. It obtains its drinking water from the Moosrain water supply association and, in emergencies, also from the Freising-Süd water supply association. Water-saving fittings and multi-use systems reduce drinking water consumption in the terminals, buildings and car washes. Service water is used for air conditioning in the airport buildings and also outdoors, for example for road cleaning, sewer flushing, construction site irrigation and watering green spaces. A total of around 500,000 cubic meters of groundwater from near the surface can currently be used to supply service water.

The long-term goal is to cover around 30% of Munich Airport's total water demand with service water.

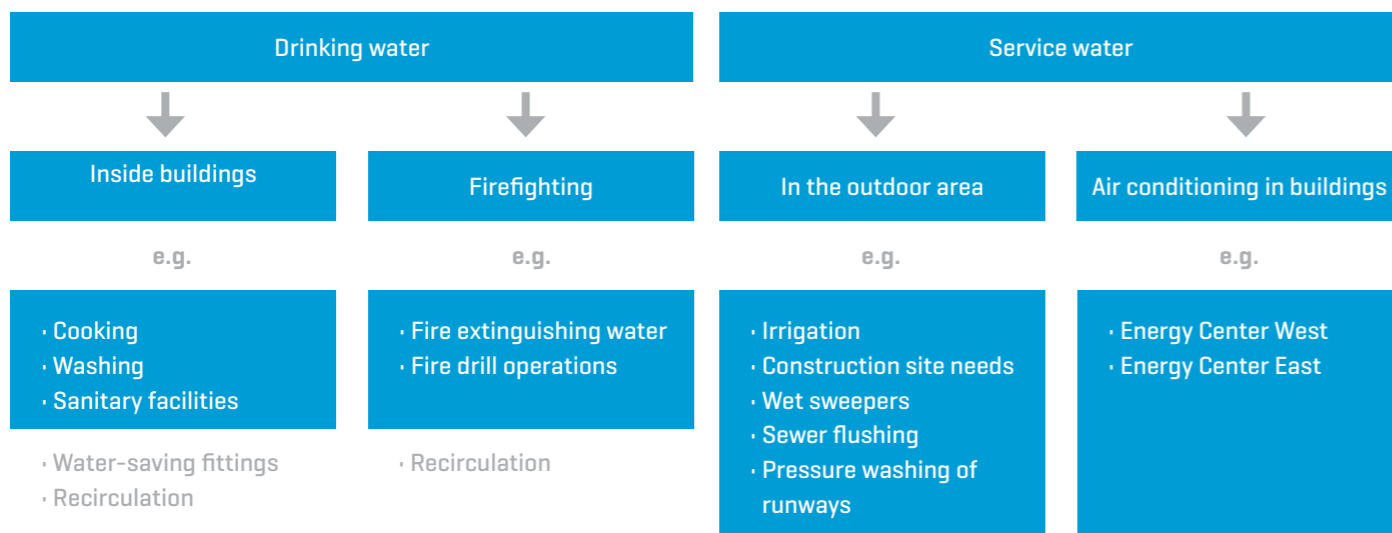
The geothermal use of groundwater from near the surface for heating and cooling in buildings saves further resources. To assess the impact of existing and planned geothermal systems, a transient current and heat transport model was created for the LabCampus innovation site in 2019. This model allows forecast calculations based on specified load scenarios.

The following facilities and buildings are currently supplied with geothermal groundwater from near the surface:

- Energy Centers West and East (evaporative cooling)
- Audi Training Center 4 (ATC), Office Building 1, Airport Academy (building air conditioning)
- In preparation: Budget hotel
- In planning: supplying further buildings in the LabCampus area

The geothermal model enables the calculation of further load scenarios and is constantly being expanded with new findings and, where necessary, applied beyond the existing area.

Service water utilization concept at Munich Airport



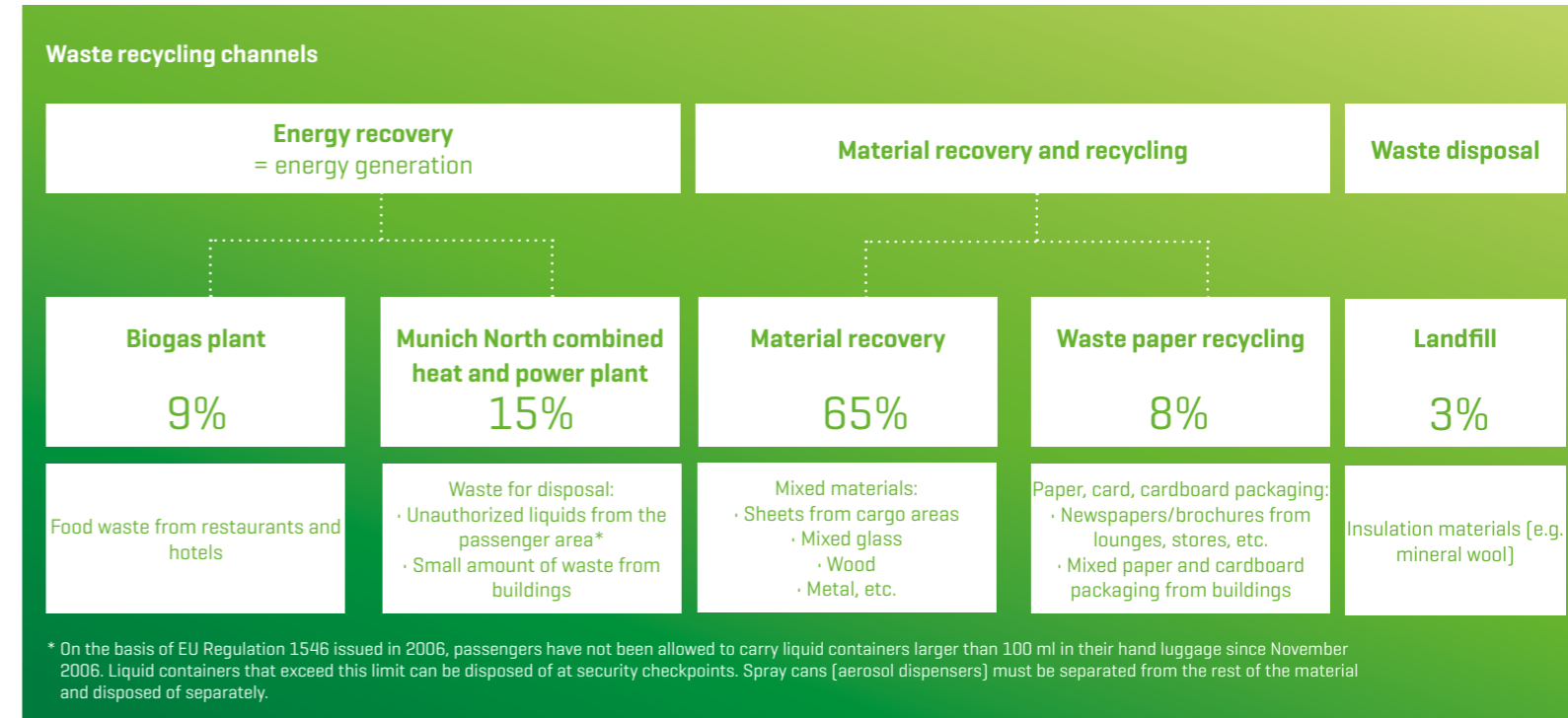
Waste is a valuable raw material. Only by handling it efficiently and in an environmentally conscious manner can natural resources be conserved and environmental pollution reduced. Flughafen München GmbH is authorized to independently carry out waste management on its premises in accordance with the mandatory statutory provisions and regulations. The most important basis for this is the Closed Substance Cycle Waste Management Act (Kreislaufwirtschaftsgesetz, KrWG), which divides the waste hierarchy into five stages: prevention, preparation for reuse, recycling, other recovery and disposal.

Waste and recyclable products are collected at the point of origin in various separation systems, processed in sorting plants and then recycled or recovered. The remaining small amount of non-recyclable residual waste is used to generate district heating and electricity at the Munich North combined heat and power plant. Waste management at the airport works exclusively with certified specialist companies in the local area. This minimizes any carbon emissions generated during transportation.

The largest share of waste and recyclable materials comes from the affiliated companies and the companies based at the airport as well as the airlines. Construction sites, which are present across the entire campus due to the many new construction/reconstruction measures taking place, are also one of the main sources. In view of this dynamic baseline situation, it is crucial to develop a disposal concept that is individually tailored to the respective waste producers.

Flughafen München GmbH is conscious of its considerable responsibility with regard to environmental compatibility across all waste disposal processes. For this reason, experts regularly provide information on current waste issues, offer guidance on environmentally conscious behavior and are on hand to answer questions.

In view of the planned expansion of resource conservation and climate protection at European and international level, Flughafen München GmbH is ready to take on these new challenges, factoring in economic, environmental and social aspects.



/ Hazardous substances

Hazardous substances and prevention of environment-related accidents

At Munich Airport, hazardous substances are used in selected areas of the company, such as in the technical workshops. Hazardous substances include:

- Substances hazardous to water [in accordance with the Federal Water Act (WHG), the Bavarian Water Law (BayWG) and the Ordinance on Installations for Handling Substances Hazardous to Water (AwSV)]
- Hazardous substances [in accordance with the Hazardous Substances Ordinance (GefStoffV)]
- Flammable liquids [in accordance with the Ordinance on Industrial Safety and Health (BetrSichV)]
- Dangerous goods [in accordance with the Ordinance on the Transport of Dangerous Goods by Roads, Rail and Inland Waterways (GGVSEB)]

Hazardous substances are transported within the company either via pipelines or using vehicles that comply with the applicable regulations. The hazardous substances are stored in special warehouses as well as in silo and tank facilities in accordance with the relevant legal regulations. The methods of transportation are randomly checked for compliance with the legal requirements. As the safety and health of employees at Munich Airport is of paramount importance, FMG keeps a constant eye on the availability of alternatives to hazardous substances.

At Munich Airport, substitution decisions within the framework of the Hazardous Substances Ordinance take precedence regarding the safety and health of the workforce. The procurement of substitutes for hazardous substances is therefore reviewed on an ongoing basis. There are currently 399 hazardous substances in use, most of which are used in the technical area.

In 2022, a total of 234 metric tons of hazardous goods [transported hazardous substances] were disposed of. In the same year, there were no reported accidents in connection with the transportation of hazardous goods.

Aircraft fuel supply

Flughafen München GmbH has built a fuel depot for aircraft fuel, which is operated and maintained by Skytanking along with the underground hydrant system. Munich Airport maintains a supply of kerosene to last around three to five days. The six tanks can hold approximately 44,000 cubic meters of kerosene. The kerosene is delivered to the airport via a specially built pipeline and via Flughafen München GmbH's private siding to the Deutsche Bahn rail network. It is pumped to the withdrawal points on the apron [tank pits] via underground pipelines.

The entire fuel supply system was designed to ensure that no kerosene can enter the groundwater at any point. The tanks are double-walled, which means the outer shell tank can absorb the fuel if there is a leak in the inner shell tank. Each tank also has a double bottom, which is backed up by a leak monitoring system. The tanks are also equipped with floating covers to prevent kerosene vapors from escaping. Three independent detection systems check the system for leaks with varying degrees of accuracy and at different times. The large leakage system developed by an airport employee is under patent protection. Company refueling stations also supply service and ground-handling vehicles as well as third-party vehicles at Munich Airport with diesel, premium petrol and Ad-Blue.

/ Airport fire service and on-site emergency service

Mandatory duties and prevention

Accidents or fires can have a negative impact on the environment. Responsible and preventive emergency management is therefore of primary importance. An important component of the emergency plan is the airport's own, recognized fire service, which has a short response time and is divided between two fire stations in the security area. The fire service is integrated into the airport's emergency plan.

The mandatory duties of the airport fire service mainly include:

- Fire protection and technical assistance for air traffic and its facilities in accordance with the applicable EASA [European Aviation Safety Agency] guidelines
- Fire protection for buildings, facilities and installations in the airport area in accordance with the Bavarian Fire Service Act
- Technical assistance in the event of accidents and incidents, including the collection and containment of hazardous substances and dangerous goods and leaking hazardous substances
- Assistance outside the airport grounds upon request in accordance with the Bavarian Fire Service Act
- Fire safety watch duties

The fire service is responsible for both preventive and defensive fire protection in the following areas:

- Terminal 1, Terminal 2, Terminal 2 satellite building
- Apron tower for aprons 1, 2 and 3
- Baggage sorting hall between the aprons
- S-Bahn tunnel, tunnel connection to the satellite building
- Aircraft maintenance hangars
- Cargo terminal
- Fuel depot
- LabCampus

If assistance is required, resources from the surrounding airport area will be made available.

Legal requirements for fire protection

The European Aviation Safety Agency (EASA) issues fire protection guidelines for airports and aircraft. It divides airports into ten categories according to the number and size of aircraft in operation. Munich Airport falls under the biggest category of ten. Specifically, this means that 32,300 liters of water for foam generation with film-forming foaming agents and an output rate of 11,200 liters/minute as well as 450 kilograms of extinguishing powder, spread across three vehicles, must be kept ready around the clock. In an emergency, the fire service must be at the scene and have initiated extinguishing measures within 180 seconds of the alarm being raised under ideal visibility and surface conditions. The response times for tackling incidents involving damage to buildings, plant and equipment are specified in the airport fire service's certificate of approval and are five or eight minutes, depending on the building or object. The airport fire service is equipped with vehicles and equipment to ensure fire protection of buildings and provide technical assistance. Fifty firefighters are on duty around the clock at the two fire stations covering both runways. The emergency services are alerted by the airport's own fire service operations center or via an internal alarm system. Fire protection equipment that is not operated by the fire service – including sprinkler systems, stationary extinguishing equipment and around 60,000 automatic and manually operated fire alarms throughout the airport grounds – helps to ensure comprehensive fire protection.

Environmentally friendly fire service training area

In accordance with EASA guidelines, the ongoing training of firefighters takes place under realistic conditions with real fires. For this purpose, a fire simulation facility modeled on a Boeing 747 is available within the fire service training area. Various scenarios can be realistically rehearsed here, such as engine fires, landing gear fires, and cargo hold and cabin fires. Inside, there are rows of seats and installations such as a galley, toilets and containers. Outside, firefighters can learn how to use the extinguishing boom and the fog nozzle. There is also an area to the rear with variable interior equipment where firefighters can practice fighting fires in buildings including a staircase and a balcony.

Fire simulation facility to the south of the airport

Fires are mainly extinguished using rainwater, which is collected, stored and partially recycled via the paved areas of the training area. Even the extinguishing water that does not evaporate during the fire simulation is collected and reused. In addition, liquid gas rather than kerosene is used for bea-
coning.



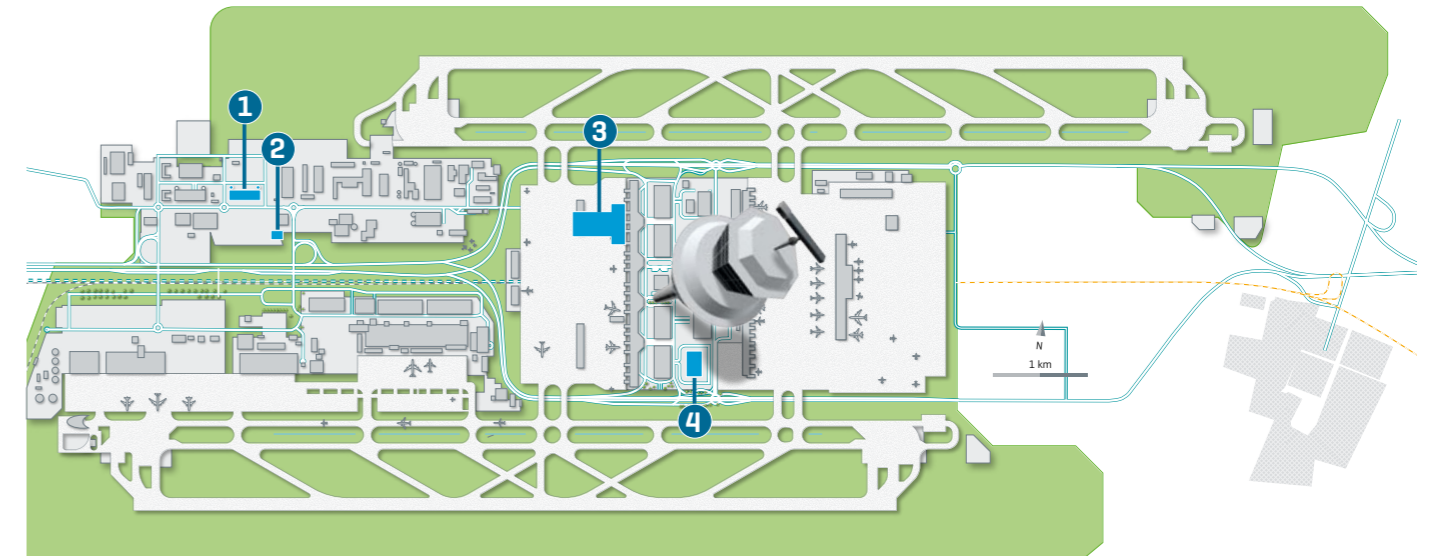
Airport fire service training exercise

/Construction and planning

Overview of construction projects at the airport

Munich Airport has grown considerably since it opened in 1992. To the west (Airsite West), new buildings are currently being constructed around the development areas at the Lab-Campus innovation site. A new transportation hub has been built to open up the area. A new pier is being built at Terminal 1 in the center of the airport. The parking garages are also being expanded.

Planned construction projects



1. Parking garage P43
2. Ibis Styles hotel
3. New Terminal 1 pier
4. Mobility center

/ Environmental objectives and measures

Topic	Measure	Start	End	Status	Remarks
Environmental management system (EMS)					
EMAS and ISO 14001	Re-certification of FMG and ongoing enhancement of the environmental management system	2005	Ongoing		Ongoing since 2005
Monitoring of environmental data	Monitoring of drinking water demand and total energy demand	2011	2015 2020 2025		«Supplementary environmental objectives»
	Monitoring of environment-related developments as a result of the coronavirus pandemic	2021	2023		Impacts and potential from 2020, 2021
Climate protection, energy efficiency and carbon neutrality					
Strategic planning for carbon neutrality by 2030	Planning of individual measures to achieve the objective	2018	2030		
Reduction of lighting energy	LED lighting in P1 and P2	2021	2022		Savings in 2022: 162 metric tons of CO ₂
	LED lighting in parking lot P20	2021	2022		Savings in 2022: 109 metric tons of CO ₂
Green IT	Offsetting of carbon emissions by sending letters and parcels with GoGreen	2011	Ongoing		2022: 626 kg CO ₂ offset
Reduction of greenhouse gas emissions from aircraft	Equipment and operation of pre-conditioned air (PCA) systems at the parking positions close to the building	2011	Ongoing		Savings in 2022: 19,957 metric tons of CO ₂ Utilization: 85%
	Multi-motor ventilation technology in operation in central area	2021	2023		Savings in 2022: 890 metric tons of CO ₂
Reduction of greenhouse gas emissions from buildings	Multi-motor ventilation technology for construction phase 2	2021	2023		Savings in 2022: 433 metric tons of CO ₂
	Multi-motor ventilation technology in Terminal 2	2021	2022		Savings in 2022: 571 metric tons of CO ₂
	Multi-motor ventilation technology in RGS 2	2021	2022		Savings in 2022: 116 metric tons of CO ₂
Vehicle fleet and alternative drive technologies					
Reduction of vehicle fleet fuel consumption and use of alternative drive technologies	New campus mobility app has replaced previous company vehicle pool [fewer vehicles, fewer journeys]	2022	Ongoing		App went into operation in November 2022
	AdBlue to reduce nitrogen oxides	2013	Ongoing		Consumption in 2022: 21,536 liters
	Aircraft tower in use at Gesellschaft für Enteisen und Flugzeugschleppen am Flughafen München mbH [EFM]	2022	2023		All-electric Kalmar FB600 aircraft tower has been put into operation
Conservation and biodiversity					
Protection of species and improvement of biodiversity	Protection of endangered bird species in the Nördliches Erdinger Moos bird sanctuary in the vicinity of the airport through education/information in the form of signs	2021	2024		Installation of signs to go ahead before the start of breeding in 2024
	Insect hotels on the airport grounds	2022	2023		Conversion of «M» branding on administration building in spring 2023
	Promotion and sowing of flower-rich meadows at various locations for different species of wild bees and insects	2017	2023		Including as part of the «blooming business» scheme

Topic	Measure	Start	End	Status	Remarks
Protection of species and improvement of biodiversity	Planting of trees at the Visitors Park	2021	Ongoing		Reference to FMG's climate forest
	«Greening measures» model project in cooperation with the City of Munich	2021	Ongoing		Enhancement and improvement of green structures at Munich Airport
	«Green roof with retention volume and PV system» pilot project	2021	2023		Completion of a model roof on the transit building
Air quality					
Implementation of biomonitoring and honey monitoring	Continuous monitoring with selected plants	2006	Ongoing		2022: No assessment values exceeded at any locations
	Analysis of honey, pollen and wax, among other things	2008	Ongoing		2022: Harvest 640 kg, the legally permissible maximum levels for foodstuffs [EU regulation setting maximum levels for certain contaminants in foodstuffs] are complied with
Aircraft noise					
Optimization of web reporting	Modern, digital and web-based redesign and improved offering of noise/air emission reports	2021	Ongoing		Accessible to the public on the homepage [Lumo/Flumo]
Noise-based basic charge	New noise charging model introduced, increase in the basic noise charge for noisy aircraft types	2020	Ongoing		New charging model came into force in 2021
Water management					
Reduction of drinking water demand	Use of service water instead of drinking water	2015	Ongoing		Savings in 2022: 218,527 m ³
Climate change adaptation	Review of drainage performance in the event of extreme rainfall	2021	2023		Model calculations and simulations of heavy rainfall
Pre-treatment of de-icing water and rainwater	Thanks to TOC points, de-icing wastewater that is not contaminated does not have to be diverted to the treatment plant	2002	Ongoing		From 2003/2004, the water is directed via TOC points and rain purification basins into receiving watercourses at the airport; savings in 2022: approx. 318,600 m ³ , 132,000 kWh, 78 metric tons of CO ₂
Paper and printing					
Reduction of paper consumption	Paperless workflows for time management, business travel and training, among other things	2013	Ongoing		2022: 1,850 business trips, 776 external seminars, 275,523 applications digitalized; savings of around 320,000 sheets of paper
Resource savings					
Resource savings in winter maintenance	Pilot project: De-icing with gherkin brine [industrial wastewater], saving on road salt	2019	2024		Gherkin brine contains 14% salt and, as a result, provides most of the required salt content of 23%, project postponed to 2023/2024 winter season

Traffic light	Status	Traffic light	Status	Traffic light	Status
	Measure stopped		Measure postponed		Measure in progress or completed

/Environmental figures

Traffic figures

In 2022, 285,028 aircraft movements took place at Munich Airport, 86.2% more than in 2021. A total of 31,642,738 passengers were transported in the process, an increase of 153.2% compared with 2021.

Converted into traffic units [one traffic unit corresponds to one passenger or 100 kg of cargo], the figure of 34,290,578 for 2022 has increased by 141.3% compared with 14,211,819 in 2021.

Environmental figures

Area	Key figure	Unit	2021 figure	2022 figure	2021/2022
Traffic data	Aircraft movements	Number	153,097	285,028	+86.2%
	Passengers	Number	12,502,913	31,653,579	+153.2%
	Traffic units	Number	14,211,819	34,290,578	+141.3%
	Air freight and air mail	t	173,307	266,779	+53.9%
Personnel	Airport campus employees	Number	Approx. 33,300	Approx. 33,300	
	FMG employees*	Number	4,202	4,134	-1.6%
	Munich Airport Group employees*	Number	8,596	8,983	+4.5%

Area	Classification	Unit	2021 figure	2022 figure	2021/2022
Areas	Not sealed	m ²	10,463,500	10,310,494	-1.5%
	Sealed	m ²	6,140,500	6,284,545	2.3%
	Degree of sealing (ratio of sealed area to total area)	%	35.4	36.2	+0.8 PP
	Built over	m ²	734,400	742,042	1.0%
	Total area	m ²	17,338,400	17,337,081	0.0%
	Environmental compensatory areas	ha	519	522	+0.6%

*As of December 31 of the respective year

Aircraft noise data (in dB(A))

Aircraft noise is measured at 16 fixed and 3 mobile stations around Munich Airport.

Examples of measurement results from individual measuring stations are shown in the table:

Year	Achering	Attaching	Eitting	Hallbergmoos	Pulling	Schwaig
2018	58	56	55	59	62	63
2019	58	56	54	59	62	62
2020	56	54	50	56	56	56
2021	56	53	52	56	57	59
2022	56	54	53	57	60	60

L_{eq, day}: the energy-equivalent continuous sound level for the daytime hours between 6 a.m. and 10 p.m.

L_{eq, night}
In dB(A)

Year	Achering	Attaching	Eitting	Hallbergmoos	Pulling	Schwaig
2018	52	50	48	52	55	56
2019	52	50	47	51	55	55
2020	48	46	42	47	48	49
2021	48	45	43	47	48	50
2022	50	48	46	50	51	53

L_{eq, night}: the energy-equivalent continuous sound level for the nighttime hours between 10 p.m. and 6 a.m.

Air quality

In accordance with the 39th Federal Emission Control Ordinance

Year	Benzene µg/m ³	PM ₁₀ µg/m ³	NO µg/m ³	NO ₂ µg/m ³	PM _{2.5} µg/m ³	SO ₂ µg/m ³	CO mg/m ³	Ozone O ₃ µg/m ³
2018	0.6	14	5	18	11	2	0.19	51
2019	0.6	12	6	18	8	2	0.2	49
2020	0.5	11	5	14	8	2	0.2	47
2021	0.5	10	3	12	8	2	0.2	49
2022	0.5	11	3	14	8	2	0.2	52

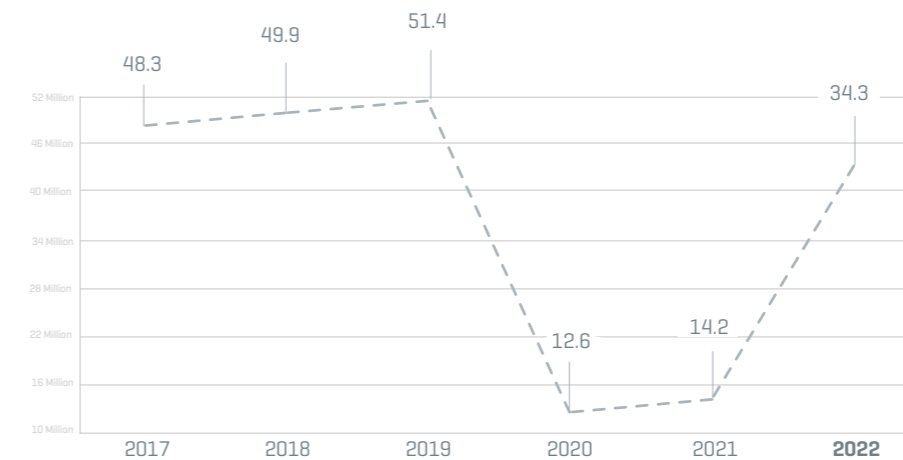
All emitters on the airport grounds and in the local region contribute to these concentrations.

Traffic units

Year	2017	2018	2019	2020	2021	2022
Number	48,334,296	49,906,283	51,406,376	12,610,084	14,211,819	34,290,578

One traffic unit [TU] corresponds to one passenger or 100 kilograms of cargo.

Traffic units



/Key indicators

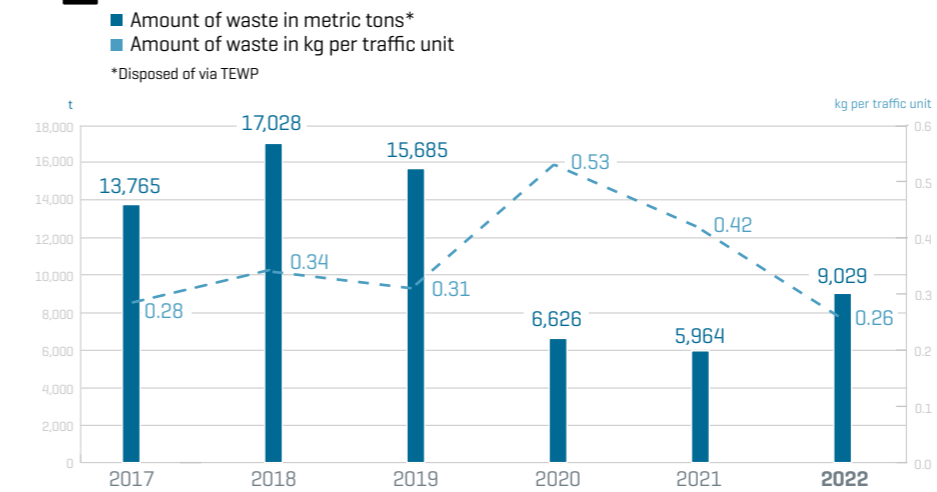
Consumption data

Area	Key figure	Unit	2021 figure	2022 figure	2021/2022	Remark
Energy	Natural gas (including customers)	MWh/LHV*	332,535	364,304	9.6%	*LHV: lower heating value
	Heating oil (CHP and boiler)	MWh/LHV	7,655	11,222	46.6%	
	District heating	MWh	34,380	28,183	-18%	
	Electricity	MWh	30,350	32,898	8.4%	
	Total energy demand	MWh/LHV	404,920	436,607	7.8%	
	Share of renewable energies in total energy demand	%	8.5%	7.5%	-1.0 PP	
Vehicle fuels	Premium petrol	l	225,347	274,139	21.7%	
	Diesel	l	2,170,980	3,895,266	79.4%	
	CNG natural gas	kg	8,630	9,372	8.6%	
	AdBlue	l	18,142	21,536	18.7%	To reduce nitrogen oxides in exhaust gas
Water and waste-water	Drinking water, sourced from Moosrain water supply association	m³	562,510	811,648	44.3%	
	Wastewater volume sent to Eitting treatment plant	m³	1,955,165	2,051,259	4.9%	
	Consumption of service water instead of drinking water	m³	200,064	218,527	9.2%	
Waste	Recycling	t	2,552	4,198	64.5%	
	Recovery	t	3,296	4,522	37.2%	
	Landfill	t	116	309	166.4%	Disposed of via FMG waste management
	Total of all waste	t	5,964	9,029	51.4%	

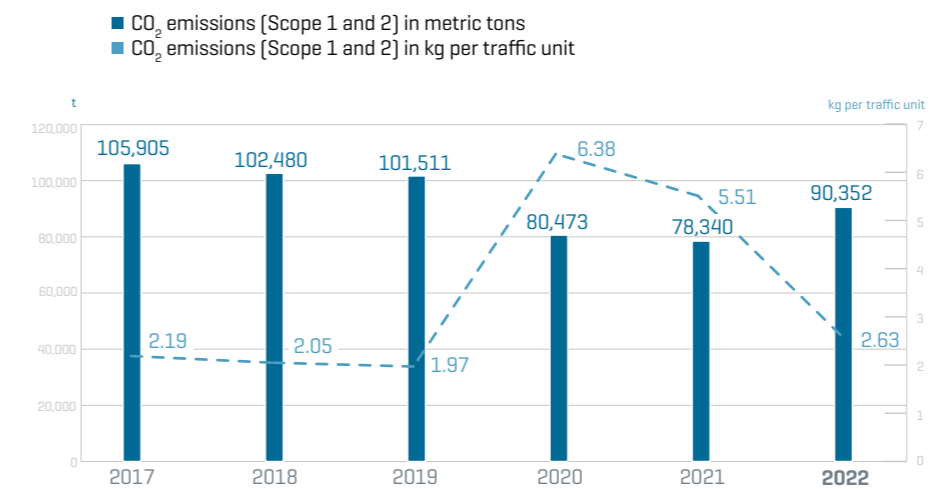
Area	Key figure	Unit	2021/2022 season	2022/2023 season	Remark
Winter maintenance	Aircraft de-icers	Number	6,336	6,048	-4.5%
	Aircraft de-icer type 1	m³	2,563	3,256	27%
	Aircraft de-icer type 4	m³	455	536	17.8%
	Recycling rate type 1	%	68%	69%	1 PP
	Total de-icers in flight operation areas	t	2,558	2,780	8.7%
	Winter maintenance de-icing assignments	Number	56	37	-33.9%

EMAS Regulation EC 1221/2009 requires the reporting of key indicators, i.e. key figures related to the environment that are relevant to the company's activities. At the airport, consumption is primarily attributable to the handling of passengers and cargo. For this reason, the following key figures, the specific consumption figures, are calculated based on arriving and departing passengers and cargo volume (one traffic unit corresponds to one passenger or 100 kg of cargo).

Absolute and specific amount of waste

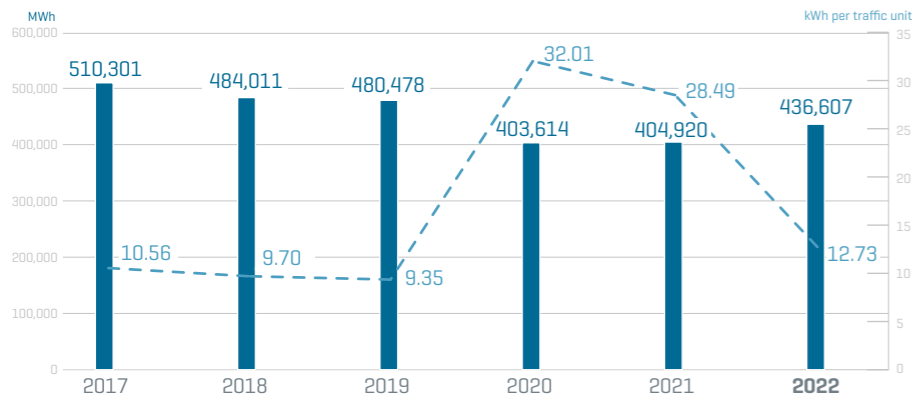


Absolute and specific carbon dioxide emissions



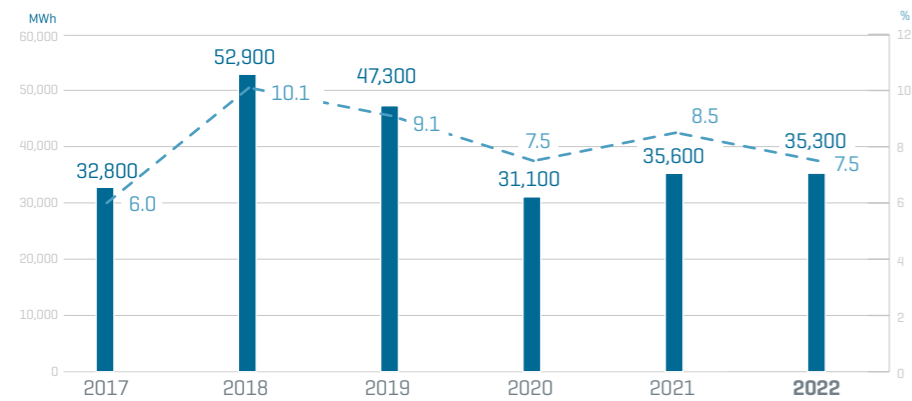
💡 Absolute and specific total energy demand

- Total energy demand in MWh
- Total energy demand in kWh per traffic unit



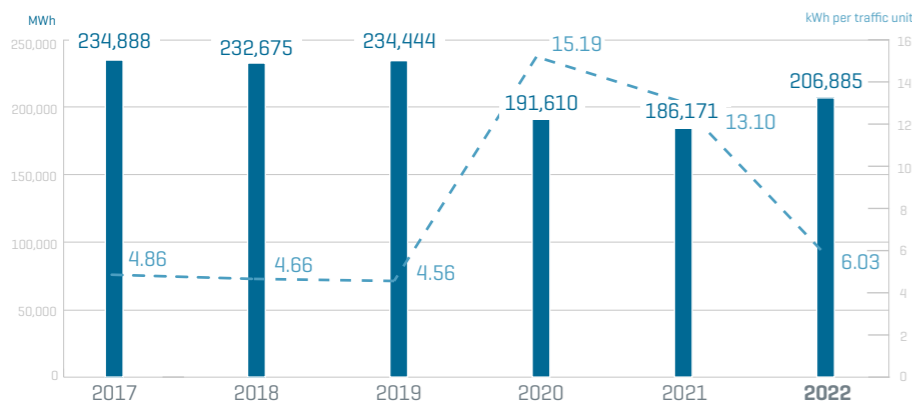
🏠 Renewable energies and their share of total energy demand

- Renewable energies in MWh
- Share of renewable energies in %



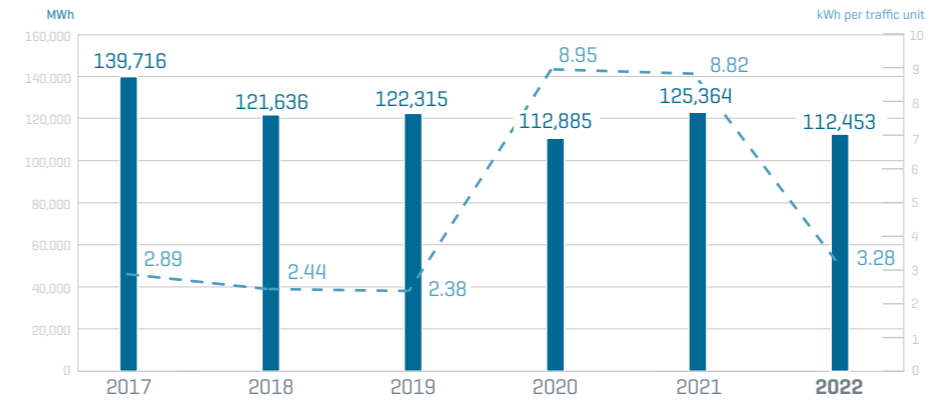
🔌 Absolute and specific electricity demand

- Electricity demand in MWh
- Electricity demand in kWh per traffic unit



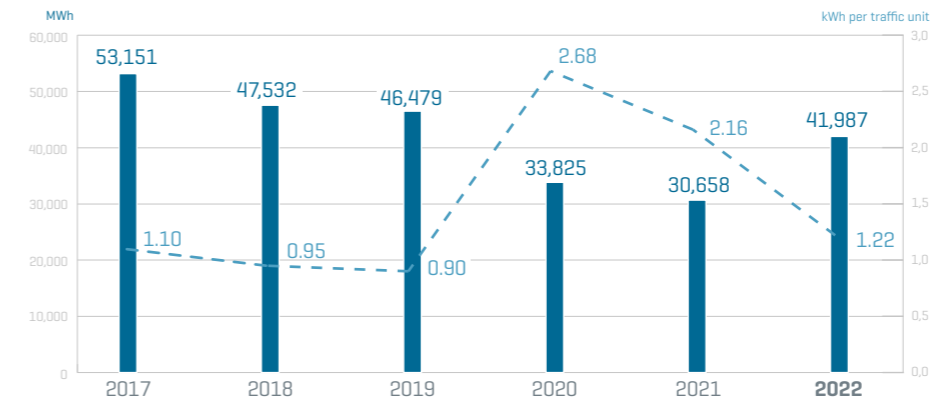
🔥 Absolute and specific heating demand

- Heating demand in MWh
- Heating demand in kWh per traffic unit



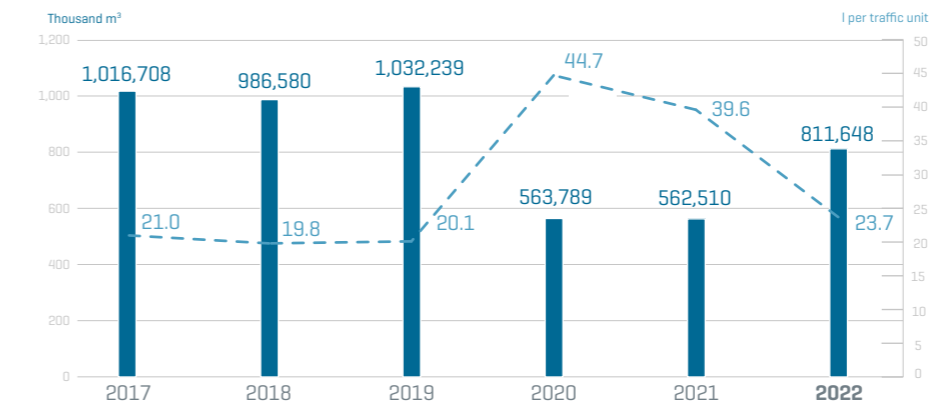
❄️ Absolute and specific cooling demand

- Cooling demand in MWh
- Cooling demand in kWh per traffic unit

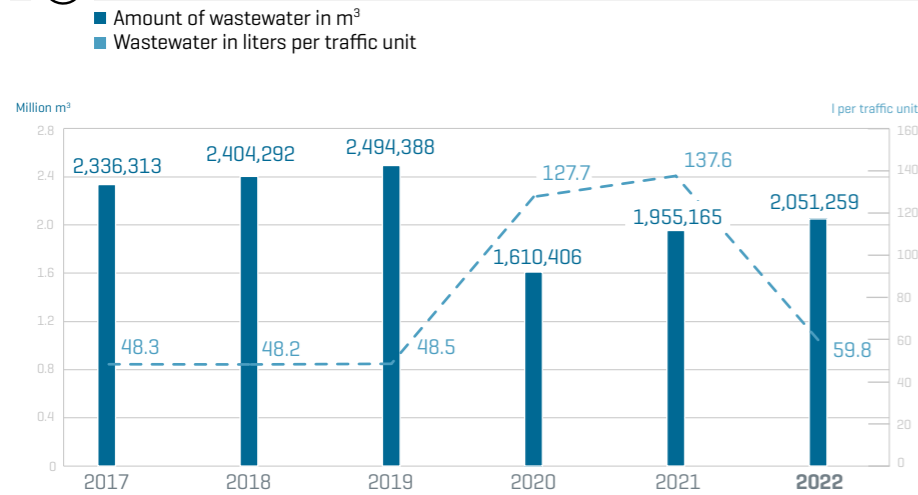


💧 Absolute and specific drinking water demand

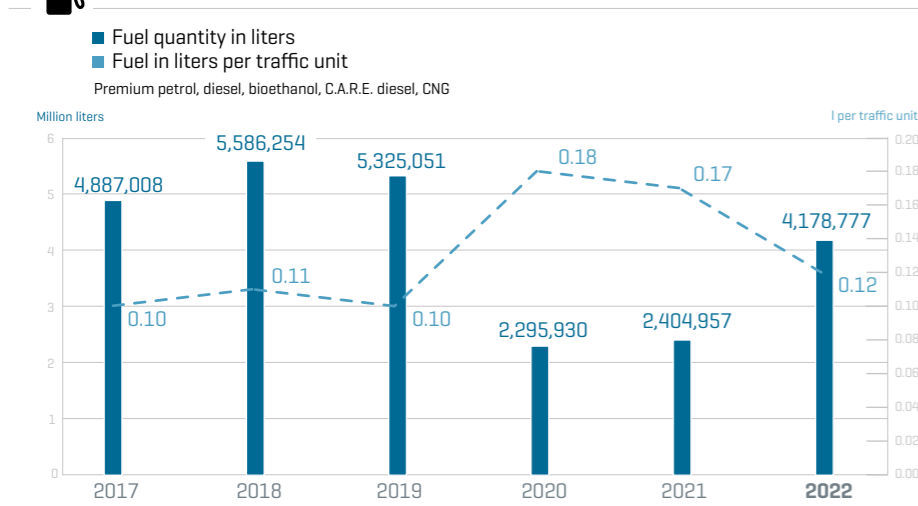
- Water quantity in m³
- Water quantity in liters per traffic unit



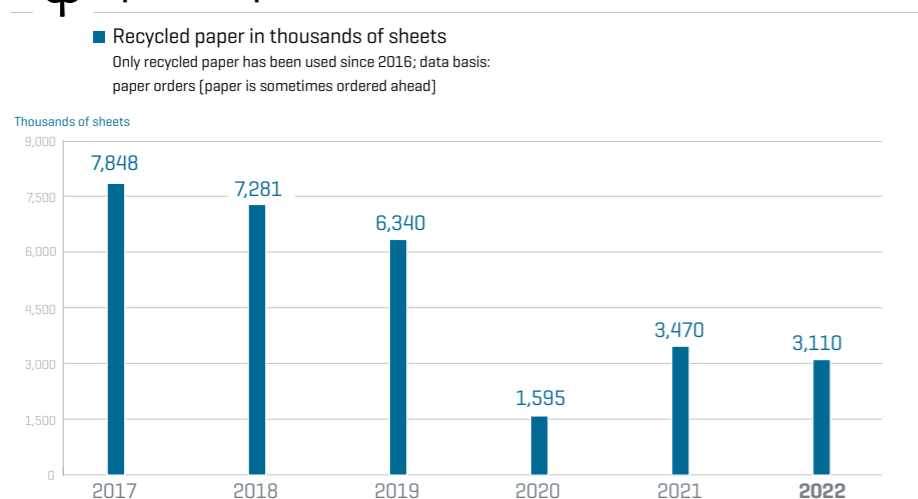
Absolute and specific amount of wastewater



Absolute and specific fuel consumption



Paper consumption at FMG



Greenhouse gas emissions

Carbon dioxide (CO₂) emissions

(according to the Greenhouse Gas Protocol)

Scope 1 includes all emissions from the direct consumption of the Munich Airport Group.

	Unit	2018	2019	2020	2021	2022
Gas/diesel engines	t	0	0	0	0	0
Gas/petrol engines	t	23,286	26,276	21,054	62,375*	68,829*
Gas/petrol engines from 2015	t	48,283	46,053	42,809		
Gas for boiler system	t	1,013	1,139	1,303	2,252	701
Heating oil for gas/diesel engines	t	1,795	1,817	2,185	2,104	2,310
Heating oil for boiler system	t	144	37.7	6.61	2	782
Liquid gas	t	73	7.42	24.3	70	0
Heating oil for emergency generators	t	127	148	102	167	166
Natural gas consumption EFM	t	557	622	208	311	389
Fuel consumption	t	12,063	12,775	5,715	5,794	8,436
Total Scope 1	t	87,341	88,875	73,407	73,075	81,613

*From 2021 onward sum of old and new engines

Scope 2 includes all emissions resulting from the need for purchased energy. This data therefore takes into account all external energy purchases. This is based on the annual balances for all external electricity, district heating and natural gas purchases.

	Unit	2018	2019	2020	2021	2022
Purchased district heating from Freising	t	2,978	3,516	1,173	1,465	1,501
Purchased external electricity	t	33,303	25,602	14,125	11,682	16,172
Electricity transmission	t	13,347	17,570	13,857	11,056	13,269
Purchased natural gas	t	3,565	3,742	1,317	951	3,100
Electricity supply to external companies	t	-29,892	-29,333	-18,409	-15,123	-20,617
Heat supply to external companies	t	-4,576	-4,621	-3,640	-3,773	-1,501
Electricity for cooling supply to external companies	t	-115	-100	-41	-42	-84
Natural gas supply to external companies	t	-3,565	-3,742	-1,317	-951	-3,100
Total Scope 2	t	15,136	12,635	7,065	5,265	8,740

Erklärung des Umweltgutachters zu den Begutachtungs- und Validierungstätigkeiten nach Anhang VII der Verordnung (EG) Nr. 1221/2009 sowie nach Änderungs-VO 2017/1505 und 2018/2026

Der Unterzeichnende, **Dr.-Ing. Reiner Beer**, EMAS-Umweltgutachter mit der Registrierungsnummer DE-V-0007, akkreditiert oder zugelassen für den Bereich 52.23 (NACE-Code Rev. 2), bestätigt, begutachtet zu haben, ob die gesamte Organisation/ wie in der Umwelterklärung der Organisation

FLUGHAFEN MÜNCHEN GMBH

am Standort

Nordallee 25, 85356 München

(mit der Reg.-Nr. DE-155-00248)

angegeben, alle Anforderungen der Verordnung (EG) Nr. 1221/2009 des Europäischen Parlaments und des Rates vom 25.11.2009 und Änderungs-VO 2017/1505 vom 28.08.2017 und 2018/2026 vom 19.12.2018 über die freiwillige Teilnahme von Organisationen an einem Gemeinschaftssystem für Umweltmanagement und Umweltbetriebsprüfung (EMAS) erfüllt.

Mit der Unterzeichnung dieser Erklärung wird bestätigt, dass

- die Begutachtung und Validierung in voller Übereinstimmung mit den Anforderungen der Verordnung (EG) Nr. 1221/2009 und Änderungs-VO 2017/1505 und 2018/2026 durchgeführt wurden,
- das Ergebnis der Begutachtung und Validierung bestätigt, dass keine Belege für die Nichteinhaltung der geltenden Umweltvorschriften vorliegen,
- die Daten und Angaben der konsolidierten Umwelterklärung der Organisation / des Standortes ein verlässliches, glaubhaftes und wahrheitsgetreues Bild sämtlicher Tätigkeiten der Organisation/ des Standortes innerhalb des in der Umwelterklärung angegebenen Bereichs geben.

Diese Erklärung kann nicht mit einer EMAS-Registrierung gleichgesetzt werden. Die EMAS-Registrierung kann nur durch eine zuständige Stelle gemäß der Verordnung (EG) Nr. 1221/2009 erfolgen. Diese Erklärung darf nicht als eigenständige Grundlage für die Unterrichtung der Öffentlichkeit verwendet werden.

Nürnberg, 11.08.2023



Dr.-Ing. Reiner Beer
Umweltgutachter

Legal notice

Published by

Flughafen München GmbH
PO box 23 17 55
85326 Munich, Germany

www.munich-airport.de

Please contact:

Martin Heiss
Environmental Management Officer
Phone: +49 89 975 517 10
E-mail: martin.heiss@munich-airport.de

Melanie Aumüller-Richter
Head of Interdisciplinary Environmental Tasks
Phone: +49 89 975 404 07
E-mail: melanie.aumueller-richter@munich-airport.de

Johannes Haas
Interdisciplinary Environmental Tasks and Climate Protection
Officer
Phone: +49 89 975 404 63
E-mail: johannes.haas@munich-airport.de

Edited by

Corporate Media

Design

Corporate Media

Photos and graphics

Flughafen München GmbH

Printing

Peschke Solutions GmbH, Aschheim

Paper

Enviro Top [certified in accordance with Blue Angel]

Production

Munich Airport wants to keep its impact on the environment as low as possible – and this also includes its print products. This publication has been printed in accordance with an eco-efficient standard. Environmentally friendly ink, additives and paper as well as optimal recyclability while maintaining the highest quality are integral elements of the individual «formula» for the airport's printing standard.

October 2023



The environmental statement and lots more information on environmental protection at Munich Airport are available online at: <https://www.munich-airport.com/climate-and-environmental-protection-264103>



