# ENVIRONMENTAL REPORT 2006

# A MODERN FLEET SAVES THE ENVIRONMENT

Finnair takes environmental perspectives into account in all its activities. In this way, the company ensures sustainable, profitable growth also from an ecological standpoint. Finnair operates within the fragile, unique nature of the North, which requires a high standard of environmental activity.

In 2006 the international debate on climate change gained impetus. EU has presented a proposal on extending emissions trade to air transport. The calculation model for the presented emissions trading system is a step in the right direction as it takes into account fuel consumption in relation to the produced effect. Due to the global nature of air transport and to ensure common game rules for operating, Finnair considers it important that targets and measures to reduce air transport emissions should apply to airlines all over the world.

The average age of the Finnair European fleet is less than four years. As a result of its advanced technology and light structures, a modern fleet saves fuel and reduces emissions. Economic flying methods and direct route selection mean that the environment is being taken into account better than ever before.

## International guidelines and cooperation

In all its activities Finnair adheres to current environmental legislation and the environmental protection principles of the International Civil Aviation Organisation ICAO. As a member of the International Air Transport Association IATA, the company is also committed to reducing the environmental effects of its operations in an economically reasonable way without jeopardising air safety. In addition to legislation and international commitments, the well-being of the environment requires, even so, that the airline engage in its own active work.

## Towards Europe's most eco-efficient fleet

International air traffic is forecast to grow further in the future. In terms of competitiveness and the environment, it is therefore important to operate with a fleet that loads the environment to the minimum possible extent. A modern fleet is the fastest, most effective way to reduce environmental impacts. The artificial taxes and fees proposed in the public debate would impose a burden on airlines and in reality would put a brake on environmentally positive investments.

Finnair has systematically continued its fleet modernisation programme. The company will replace its present Boeing MD-11 long-haul fleet with Airbus A340 and A350 aircraft latest by 2014, likely even before. The fuel consumption of modern technology A350 aircraft is nearly 30 per cent lower than on the Boeing MD-11s. The emissions from the new aircraft will naturally be lower.

Finnair has one the most modern fleets in Europe. The old Boeing MD-80 fleet was retired in summer 2006 and the Embraer 170 and 190 aircraft have taken its place. Of the Airbus A320 series aircraft used on European trunk routes, most were built during the current decade and their engines also fulfil future emissions criteria. The fleet's economic fuel consumption and low carbon dioxide emissions support Finnair's efforts to meet the emissions targets set for air transport.

## FINNAIR FLEET - NOISE VALUES

### Fleet renewal enables noise prevention

The Finnish Civil Aviation Administration is in charge of noise management at Finnish airports. The goal is for the smallest possible number of people to be affected by aircraft noise, and central to reaching this goal is to plan land use close to airports so that as little housing as possible exists in the vicinity of takeoff and approach routes.

For its own part, Finnair is responsible for decreasing the effects of noise by renewing its fleet and optimizing its takeoffs and approaches from a noise perspective. The newest members of the Finnair fleet, the Embraer 170s and 190s already meet the stricter noise limits set for the future. Finnair's first Airbus A340, which joined the fleet in June 2006 has similar noise levels to the Boeing MD-11s.

Noise certification standards for aircraft are determined by the International Civil Aviation Administration ICAO. Noise measuring points are located beneath the takeoff and landing routes as well as at specific locations on the side of the runway. Noise limits for each measuring point are determined on the basis of the aircraft's maximum takeoff weight.

| Aircraft type | Engine type | Noise category | Takeoff noise/ ICAO noise limit | Sideline noise/ ICAO noise limit | Approach noise/ ICAO noise limit |
|---|---|---|---|---|---|
| MD-11 | GE CF6-80C2D1F | chapter 3 | 94.7 / 102.3 | 96.2/1018 | 104.1 / 105.0 |
| A340-311 | CFM56-5C2 | chapter 3 | 95.0 / 103.7 | 94.7 /101.4 | 97.2 / 104.7 |
| B757-200 | P&W 2040 | chapter 3 | 87.3 / 93.7 | 94.4 / 98.2 | 98.1 / 101.8 |
| B757-200 | P&W 2040 | chapter 3 | 89.7 / 94.1 | 94.2 / 98.4 | 98.1 / 102.0 |
| A319-112 | CFM56-5B6/2P | chapter 3 | 83.4 / 90.9 | 93.0 / 96.4 | 94.7 / 100.2 |
| A320-214 | CFM56-5B4/2P | chapter 3 | 83.6 / 91.3 | 94.1 / 96.7 | 96.0 / 100.4 |
| A320-214 | CFM56-5B4/2P | chapter 3 | 84.9 / 91.6 | 93.9 / 96.9 | 96.0 / 100.6 |
| A321-211 | CFM56-5B3/2P | chapter 3 | 86.4 / 92.2 | 97.9 / 97.2 | 97.0 / 100.9 |
| A321-211 | CFM56-5B3/2P | chapter 3 | 88.3 / 92.6 | 97.6 / 97.5 | 97.0 / 101.1 |
| MD-82/83 | P&W JT8D-219 | chapter 3 | 90.8 / 91.4 | 97.2 / 96.7 | 93.7 / 100.5 |
| Embraer 170 | GE CF34-10E | chapter 3 | 86.1 / 89.3 | 91.9 / 95.4 | 92.7 / 99.2 |
| Embraer 170 | GE CF34-8E5 | chapter 3 | 84.1 / 89.0 | 92.3 / 94.2 | 94.9 / 98.2 |
| ATR 72 | P&W124B | chapter 3 | 86.5 / 89.0 | 84.7 / 94.0 | 94.1 / 98.0 |

**Table 1**. Finnair's aircraft types, engine types, noise certification classes, noise certification values and ICAO noise certification limits at different measuring points. Values in EPNdB (effective perceived noise). The noise values of the same aircraft type may differ due to different take-off weights.

## AIR TRAFFIC EMISSIONS

### Fleet renewal continues

In 2006 Finnair's fleet green house gas emissions, especially for nitrogen oxides and carbon dioxide increased as the long-haul traffic, operated with Boeing MD-11s, increased by 13% compared with 2005. Fuel consumption in relation to revenue tonne kilometres increased by 6 per cent.

Finnair is replacing the MD-11 fleet with new Airbus A340s and A350s starting at the end of the decade. The first A340 joined the fleet in June 2006. Towards the end of spring 2007, Finnair will acquire two new Airbus A340s. Fuel consumption and carbon dioxide emissions of the A340 are 13% lower than that of Boeing MD-11s on Finnair long-haul routes.

Emissions reporting has changed in 2006 as now for the first time, the data include all Finnair Group aircraft emissions. Finnair Group's Estonian airline Aero operates and ATR 72 fleet while flyNordic in Sweden operates Boeing MD-80s. For this reason, especially the number of operations and flight hours has increased in 2006 compared with the previous year.

In aircraft engine emissions, figures for nitrogen oxides, unburned hydrocarbons, carbon monoxide and carbon dioxide are reported. Fuel consumption, number of operations as well as performance in revenue passenger kilometres (RPK) and revenue tonne kilometres (RTK) are also reported. Revenue tonne kilometres include the combined mass of passengers, baggage and cargo as well as the distance travelled. The figures are calculated for Finnair Group aircraft starting 2006. The figures for 2004 and 2005 only include Finnair Scheduled Passenger Traffic and Leisure Traffic fleets.

| | Number of operations | Nitrogen oxides tonnes | Unburned hydrocarbons tonnes | Carbon monoxide tonnes | Carbon dioxide tonnes | Fuel consumption tonnes | Flight time hours |
|---|---|---|---|---|---|---|---|
| **Year 2006** | 74 000 | 8 300 | 500 | 4 310 | 1 960 000 | 627 000 | 194 000 |
| **Year 2005** | 71 000 | 7 800 | 540 | 4 250 | 1 860 000 | 594 000 | 167 000 |
| **Year 2004** | 79 000 | 7 200 | 500 | 4 020 | 1 730 000 | 552 000 | 171 000 |
| **Change 05/06** | 32.2% | 6.0% | -7.9% | 1.5% | 5.7% | 5.7% | 14.9% |

**Table 2**. Number of flights, engine emissions, fuel consumption and total flight time from 2004 through 2006 including relative change from previous year. Figures for 2006 include the entire Finnair Group fleet.

| | Million passenger kilometres | Nitrogen oxides g/RPK | Unburned hydrocarbons g/RPK | Carbon monoxide g/RPK | Carbon Dioxide g/RPK | Fuel consumption g/RPK |
|---|---|---|---|---|---|---|
| **Year 2006** | 15 577 | 0.53 | 0.032 | 0.28 | 126 | 40 |
| **Year 2005** | 15 600 | 0.50 | 0.034 | 0.27 | 119 | 43 |
| **Year 2004** | 15 000 | 0.48 | 0.033 | 0.27 | 115 | 37 |
| **Change 05/06** | -0.4% | 6.4% | -7.5% | 2.0% | 6.1% | 6.2% |
| | **Million tonne kilometres** | **Nitrogen oxides g/RTK** | **Unburned hydrocarbons g/RTK** | **Carbon monoxide g/RTK** | **Carbon dioxide g/RTK** | **Fuel consumption g/RTK** |
| **Year 2006** | 1 816 | 4.6 | 0.27 | 2.37 | 1 080 | 345 |
| **Year 2005** | 1 767 | 4.4 | 0.30 | 2.4 | 1 050 | 336 |
| **Year 2004** | 1 682 | 4.3 | 0.29 | 2.4 | 1 030 | 324 |
| **Change 05/06** | 2.8% | 3.1% | -10.4% | -1.2% | 2.8% | 2.3% |

**Table 3**. Emissions from air traffic compared with revenue passenger kilometres (rpk) and with revenue tonne kilometres (rtk) from 2004 through 2006:

## VOLATILE SOLVENT EMISSIONS

In 2006 a record number of paint removals for aircraft were done in Finnair Technical Services, a total of nine. This can be seen as an increase in the amounts of chemicals used, compared with 2005. The paint of six aircraft were removed using traditional methods which include using methylene chloride based pain removal chemicals. Environmentally friendlier chemicals were used on three aircraft. These same types of chemicals were also used to chemically strip paint from smaller parts.

| | Aliphatic hydro-carbons kg | Aromatic hydro-carbons kg | Ketones kg | Alcohols kg | Halogenated hydrocarbons kg | Misc. solvents kg | Total Year 2006 kg | Total Year 2005 kg | Total Year 2004 kg |
|---|---|---|---|---|---|---|---|---|---|
| **Paints** | | | | | | 5 180 | 6 630 | 5 180 | 5 000 |
| **Paint removers** | | | | | 3 000 | | 7 000 | 3 000 | 6 000 |
| **Adhesives** | | | | | | 360 | 250 | 360 | 400 |
| **Solvents** | | 190 | 670 | 1 680 | | 4 320 | 8 610 | 6 860 | 7 650 |
| **Anticorrosion agents** | 800 | | | | | | 490 | 800 | 750 |
| **Cleaning agents** | 400 | | | | | 500 | 440 | 900 | 300 |
| **Mineral oil solvents** | 2 910 | 200 | | | 260 | | 1910 | 3 370 | 3 430 |
| **Trichloroethylene** | | | | | 3 256 | | 3360 | 3 256 | 2 050 |
| **Total** | 4 110 | 390 | 670 | 1 680 | 6 516 | 10 360 | 28 600 | 23 726 | 25 580 |

**Table 4**. Solvent emissions in the Finnair technical area in 2006 and the respective figures for 2004, 2005 and 2006. The table shows both the type of solvent and the source of emissions.

## GROUND EQUIPMENT FUEL EMISSIONS

**Table 5**. The emissions from Finnair's ground equipment at Helsinki-Vantaa Airport from 2004 through 2006 in tonnes. The carbon dioxide emissions have been calculated directly from fuel consumption on the basis of rates give by fuel suppliers. Finnair has approximately 900 ground equipment vehicles.

Ground support equipment at other domestic stations produced about 4% emissions.

| | 2006 / tonnes | 2005 / tonnes | 2004 / tonnes |
|---|---|---|---|
| **Carbon dioxide ($CO_2$)** | 4 560 | 1 458 | 1 448 |
| **Carbon monoxide (CO)** | 28 | 28 | 27 |
| **Hydrocarbons (HC)** | 7.5 | 7.5 | 7.4 |
| **Nitrogen oxides ($NO_x$)** | 23 | 23 | 23 |

## WASTE

### FINNAIR CATERING AND CABIN SERVICE

Waste from catering and cabin services is managed by Finnair Catering. On flights to Helsinki, aluminium, glass and some plastics are sorted in the cabin. Starting in November 2006, Finnair started collecting energy waste on domestic flights. Thanks to this, the amount of energy waste increased by four tonnes in the last quarter of 2006 compared with the previous one. Finnair Catering implements the ISO 14001 environmental management system.

The amount of unsorted waste decreased slightly in 2006 and the amount of energy waste rose by approximately ten tonnes. The amount of biodegradable waste decreased by about five tonnes. Waste from outside the EU is classified as problem waste which must be either burned or dug deep underground.

| | **Total 2006 tonnes** | **Total 2005 tonnes** | **Total 2004 tonnes** |
|---|---|---|---|
| **Unsorted Waste** | 1 228 | 1 265 | 1 198 |
| **Biodegradable waste** | 61 | 66 | 61 |
| **Energy waste** | 211 | 199 | 210 |
| **Glass** | 153 | 253 | 258 |
| **Cardboard** | 125 | 107 | 203 |
| **Paper** | 472 | 282 | 305 |
| **Plastic (recyclable)** | 10 | 13 | 4 |
| **Aluminium (total)** | 18 | 31 | 33 |
| **Metals** | 9 | 25 | 15 |
| **Exploitable waste total** | 1092 | 980 | 1 089 |
| **Total** | 2286 | 2 251 | 2 287 |
| **Exploitability %** | 47.2 | 43.5 | 47.6 |

**Table 6**. Waste volumes from Finnair cabin services and Finnair Catering by category from 2004 through 2006.

### WASTE FROM AIRCRAFT MAINTENANCE

Finnair Technical Services maintains not only the Finnair fleet but also their customer airlines' aircraft. The target is to keep the sorting and recycling rate of waste at a high level.

A large amount of problem waste is produced in aircraft maintenance. The collection and disposal of this waste is done responsibly by the Technical Services storage organisation. These activities are also controlled by strict environmental authority permits.

| Waste | Waste in 2006 tonnes | Waste in 2005 tonnes | Waste in 2004 tonnes |
|---|---|---|---|
| **Ultrafiltration concentrate** | 16.1 | 19.0 | 22.9 |
| **Metallic hydroxide sediment** | 2.0 | 2.5 | 1.4 |
| **Cleaning solvent** | 23.8 | 19.5 | 19.2 |
| **Waste oil** | 89.3 | 105.5 | 105.7 |
| **Waste adhesives and paint** | 23.7 | 23.0 | 13.2 |
| **Paint thinner** | 2.4 | 1.72 | 10 |
| **Other waste solvent** | 3.7 | 3.0 | 16.4 |
| **Items containing heavy metals, such as batteries** | 18.7 | 16.9 | 18.9 |
| **Dust from plastic blasting equipment** | 8.2 | 6.3 | 8.0 |
| **Electronics waste** | 2.2 | 2.0 | 1.1 |
| **Scrap metal** | 85.3 | 83.0 | 86.5 |
| **Tires** | 7.9 | 11 | 17.8 |
| **Cardboard** | 24.2 | 26.6 | 26.0 |
| **Paper** | 5.4 | 5.2 | 5.0 |
| **Biodegradable waste from personnel canteens** | 77.1 | 74.8 | 59.8 |
| **Energy waste** | 97.5 | 85.7 | |
| **Unsorted waste** | 86.5 | 84.0 | |
| **Packaging material waste** | 28.9 | 11.6 | |
| **Construction waste** | 0 | 29.9 | |
| **Municipal waste** | | | 306.6 |

**Table 7**. Waste produced in aircraft repair and maintenance from 2004 through 2006.

## CONSUMPTION

## WATER COMSUMPTION

Finnair aims to contribute to the decrease in water consumption by training and giving guidelines to personnel. Wastewater quality is regularly monitored and is controlled by environmental authority permits.

Finnair Technical Services are responsible for approximately 45% of the water consumption described in table 9. The share of Finnair Catering has dropped to about 22%. This is because working methods at Finnair Catering's dish washing department have been rationalised in 2005 and the good work has continued in 2006. Catering equipment from aircraft is now washed with one big dish washing machine instead of the previous two. The use of only one machine has significantly reduced water, electricity and detergent consumption.

Aircraft de-/anti-icing fluids create a dominant share of the wastewater burden at Finnair. This consumption can be seen from table 12.

The quality of wastewater is controlled by samples taken from three different points. In addition, the treatment quality of wastewater containing cadmium is controlled separately.

| Year | Water consumption (m3/a) |
|---|---|
| 2006 | 118 000 |
| 2005 | 108 000 |
| 2004 | 115 000 |

**Table 8**. Water consumption by Finnair facilities at Helsinki-Vantaa Airport from 2004 through 2006.

## GROUND EQUIPMENT FUEL CONSUMPTION

The use of heating oil has increased because the use of machinery using this type of fuel has been increased. Heating oil causes fewer carbon dioxide and nitrogen oxide emissions than equipment using diesel fuel.

| | 2006 / litres | 2005 / litres | 2004 / litres |
|---|---|---|---|
| **95E gasoline** | 51 000 | 48 000 | 48 600 |
| **Diesel** | 374 000 | 352 000 | 356 400 |
| **Heating oil** | 1 275 000 | 1 260 000 | 1 250 000 |

**Table 9**. The volumes of liquid fuels used by Finnair's ground support equipment from 2004 through 2006.

## HEATING FACILITIES

Thermal energy consumption at Finnair facilities is greatly affected by the heating of large aircraft hangars in the winter. Finnair Technical Division heat consumption accounts for about 70% of the total usage. Opening the doors of the hangars makes a great impact on thermal energy consumption. A significant amount of energy can be saved if several aircraft can be moved in to the hangar at one time. Outside temperature also greatly influences consumption figures.

| Year | Consumption of thermal energy in Finnair facilities MWh |
|---|---|
| 2006 | 60 000 |
| 2005 | 55 000 |
| 2004 | 59 000 |

**Table 10**. Consumption of thermal energy in Finnair facilities from 2004 through 2006.

## ELECTRICITY CONSUMPTION

Finnair Catering's subsidiary Finncatering moved onto premises owned by the Finnair Retirement fund in May 2006. Due to this, their electricity, heat and water consumption figures are now included in the Finnair figures. This accounts, for its part, for the increases in all three categories.

| Year | Electrical Energy Consumption at Finnair, MWh |
|---|---|
| 2006 | 57 500 |
| 2005 | 54 800 |
| 2004 | 58 200 |

**Table 11**. Electrical energy consumption at Finnair from 2004 through 2006.

## INCOMING MATERIAL FLOWS

In 2005 a very strong environmental viewpoint was taken into the assessment de-/anti-icing fluids. The emphasis has been on the Nonylphenol polyethoxylates (NPE) contained in many thickened (Type IV) fluids. New, NPE-free Type IV fluids were tested in 2006 and were taken into use in the winter of 2006-2007. NPEs have been shown to have a disruptive effect on the reproduction of water animals if NPEs enter the water system.

Material acquisitions by Finnair Catering as well as purchased equipment, spare parts and metallic materials are not included in the table. The consumption of aircraft fuel is presented in the chapters dealing with engine emissions.

| | 2006 | 2005 | 2004 |
|---|---|---|---|
| **De-icing fluids, total** | 2 244 | 2 884 | 2 905 |
| **Type I** | 1 513 | 2 006 | |
| **Type IV** | 731 | 838 | |
| **Adhesives and sealants** | 3.3 | 2.9 | 3.7 |
| **Paints** | 14.2 | 12.4 | 9.8 |
| **Paint removers** | 25.3 | 7.5 | 23.6 |
| **Wielding filler rods and thermal spray powder** | 0.4 | 0.5 | 0.6 |
| **Chemicals for plating and water treatment** | 2.9 | 4.4 | 2.7 |
| **Anticorrosion agents** | 2.9 | 1.6 | 1.4 |
| **Cleaning agents containing solvents** | 63.0 | 62.7 | 65.7 |
| **Oils and hydraulic fluids** | 82.1 | 88.4 | 64.8 |

**Table 12**. Amounts of environmentally significant raw materials and supplies used by Finnair Technical services from 2004 through 2006.