SAS

Environmental Report 1997

SAS's vision is to be a forerunner in finding a place for the airline industry within the framework of society's striving for environmentally sustainable development.

The SAS Group | SAS Denmark A/S SAS Norway ASA SAS Sweden AB

SAS'S ENVIRONMENTAL REPORT IS ALSO AVAILABLE ON THE INTERNET (WWW.SAS.SE).

THE NEXT ENVIRONMENTAL REPORT IS PLANNED FOR APRIL 1999.

WORD AND ABBREVIATIONS ARE EXPLAINED AT THE END OF THIS REPORT.

The SAS Group in Brief

OPERATIONS

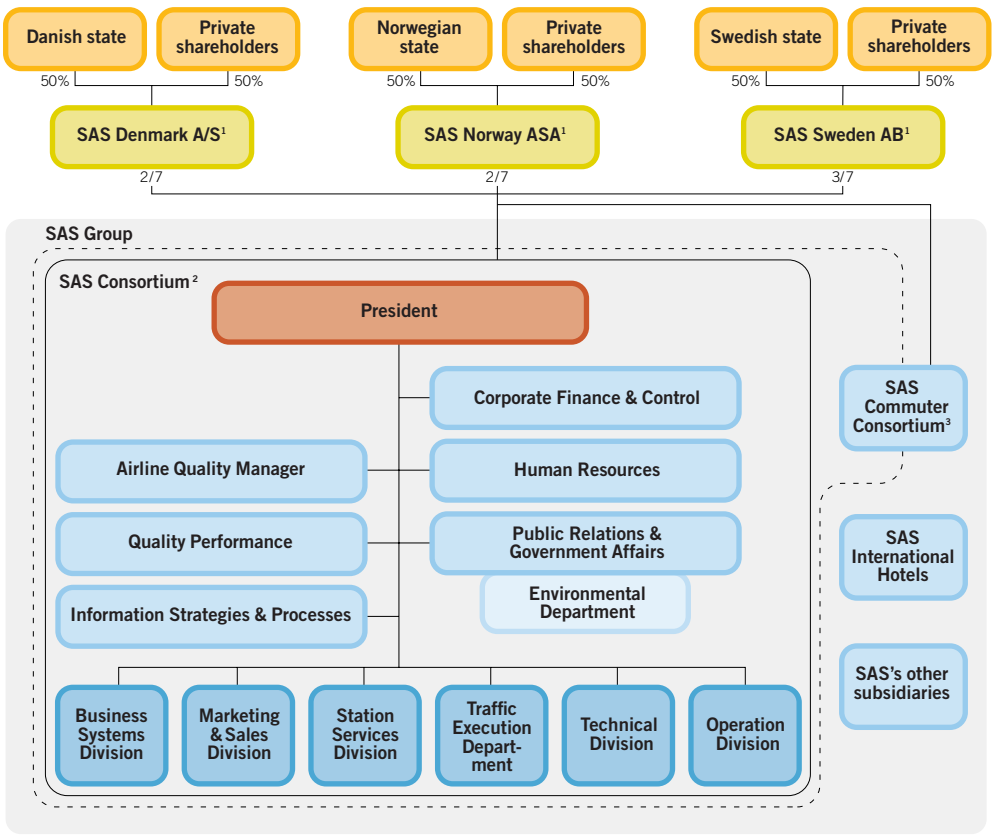
AREAS OF OPERATION

The SAS Group conducts passenger transportation, cargo services (SAS Cargo), sales of goods on board aircraft and at airports (SAS Trading), and hotel operations through SAS International Hotels under the SAS Hotels Worldwide trademark. SAS offers Scandinavian air routes at the domestic, intra-Scandinavia, European and intercontinental levels.

SCOPE OF OPERATIONS

During 1997 SAS carried 20,797,000 (19,828,000) paying passengers to 98 destinations in Scandinavia and the rest of the world, and SAS Cargo transported 278,369 (247,000) tonnes of cargo. The SAS Group's aggregate turnover in 1997 was 38,928 MSEK.

OWNERSHIP AND ORGANIZATION



[1] *Listed companies.*
[2] *The SAS Consortium comprises SAS airline operations and SAS Trading, and is owned by the three national airlines SAS Denmark A/S, SAS Norway ASA and SAS Sweden AB.*
[3] *The SAS Commuter Consortium is strictly a production company which supports SAS Airline with feeder traffic in competition with other regional companies.*

The SAS Environmental Report for 1997 includes the SAS Consortium and those parts of SAS Commuter where SAS conducts ground services and technical maintenance. However, the other operations within SAS Commuter, hotel operations and other subsidiaries, which conduct their own environmental work, are excluded.

KEY INSTALLATIONS[1]

SAS's main airports are in Copenhagen, Oslo and Stockholm, where the company conducts extensive operations with close to 12,000 employees. The bulk of maintenance work on SAS's aircraft fleet takes place in the company's workshops in Oslo, where there are some 1,000 employees. In addition, SAS has its own staff at 34 line stations in Scandinavia and another 43 in the rest of the world. The head office, with about 1,400 employees, is located in Frösundavik, Stockholm. Altogether, SAS employs more than 22,000 people, of whom approx. 8,100 work in Denmark, 5,200 in Norway and 7,600 in Sweden.

[1] *Figures for the average number of employees in 1997 include SAS Commuter (see also p. iii).*

PRODUCTION AND TRAFFIC [1]

	Available Tonne Kilometers (ATK)								
1997	**[Mtonkm]**	**Change [%]**	**Share [%]**	**RTK [Mtonkm]**	**ASK x10³**	**RPK**	**Change [%]**	**Cabin factor 1997**	**(1996)**
Intercontinental	1,492	0	33	1,173	9,446	7,502	0.8	79.4	(76.5)
Europe+Intra-Scandinavian	1,793	7	40	799	15,522	9,079	9.8	58.5	(56.9)
Denmark	100	5	2	50	809	471	–1.6	58.2	(60.9)
Norway	313	2	7	173	3,005	1,832	3.9	60.9	(59.2)
Sweden	311	4	7	164	3,021	1,819	–1.1	60.2	(61.1)
TOTAL	**4,483**	**5.8**	**100**	**2,651**	**31,842**	**20,703**	**4.6**	**64.9**	**(63.6)**

[1] *Incl. SAS Commuter (see also p. iii).*

KEY FINANCIAL STATISTICS [1]

	1991	1992	1993	1994	1995	1996	**1997**
Operating revenue [MSEK]	23,471	24,560	29,723	32,365	33,819	33,480	**36,769**
Income before taxes [MSEK]	1,133	–883	–865	428	2,592	1,746	**2,067**
Investments [MSEK]	4,344	2,731	702	1,256	1 289	4,132	**2,938**
Return on capital employed [%]	12	10	5	7	15	10	**11**
Number of employees	21,850	21,890	21,352	20,888	20,384	21,348	**22,524**

[1] *Incl. SAS Commuter (see also p. iii).*

IN THE ENVIRONMENT

KEY ENVIRONMENTAL STATISTICS

	1994	1995	1996	**1997**
Environmental index	100	98	100	**104**
Proportion of Chapter II aircraft (%)	67	71	81	**88**
Fuel efficiency (kg/RPK)	0.058	0.058	0.061	**0.062**
Cabin factor (%)	65.5	65.0	63.6	**64.9**
Emissions of carbon dioxide (CO_2) [1,000 tonnes]	3,397	3,528	3,815	**4,021**
[g/RTK]	1,540	1,559	1,540	**1,517**
Emissions of nitrogen oxides (NO_x) [tonnes]	– [1]	13,400	14,400	**14,835**
[g/RTK]	– [1]	6.0	5.8	**5.6**
Packaging in cabin operations (g/passenger)	– [1]	60	59	**58**
Newspapers/magazines in cabin operations [g/passenger]	– [1]	222	239	**210**
Collected [tonnes]	– [1]	– [1]	1.038	**1,437**
Proportion collected [%]	– [1]	– [1]	22	**36**
Energy efficiency of installations managed [kWh/m²]	– [1]	458	452	**409**
Environmentally related taxes and charges [MSEK]	approx. 200	approx. 480	approx. 600	**approx. 532**

[1] *Not available.*

THE INS AND OUTS OF OUR OPERATIONS

For the sake of clarity, this environmental balance sheet includes only items with a significant environmental impact. For a more detailed account, see the environmental balance sheets for the different areas of operation on pp. 20, 27 and 33.

In	Operations & production	Out	See page
FLIGHTS			
• Fuel • Engine oil	Number of ATK (available tonne kilometers) 1997: 4,483,070,000 Number of RPK (revenue passenger kilometers) 1997: 20,703,000,000	• Carbon dioxide (CO_2) • Nitrogen oxides (NO_x) • Hydrocarbons (HC)/VOC • Water vapor • Oil aerosols • Jettisoned fuel • Noise	22, 23 22, 23 23 23 26 20–22
CABIN			
• Food • Beverages • Packaging • Disposables • Semi-disposable articles • Goods for sale • Newspapers, magazines • Chlorinated water • Germicides	Number of passengers in 1997: 20,797,000 Number of meals served in 1997: 12,624,000 [1]	• Organic waste (food residue) • Packaging (glass, plastic, cardboard, aluminum, paper) • Unopened beverages • Sold/unsold articles • Waste (plastic, paper, cotton, aluminum) Waste water: • Drainage and transport ○ Treatment Lavatory waste: • Drainage and transport ○ Treatment	29 30 29 28 28
GROUND			
• Glycol ○ Urea/acetate • Water • Halons • Freon • Maintenance materials (components, etc., chemicals) • Energy (oil, LPG, electricity, biofuel, gas) • Office supplies	Managed installations in 1997 [2]: 672,005 m^2	○ Glycol ○ Urea/acetate • Waste • Hazardous waste Waste water: • Drainage and transport ○ Treatment • Halons • Freon • Sulfur dioxide (SO_2) • Carbon dioxide (CO_2) • Hydrocarbons (HC)/VOC • Nitrogen oxides (NO_x) • Soot/particles • Noise	38 37 36 36 35 35 35 35 35 34
GROUND VEHICLES			
• Fuel (diesel, gasoline, biofuel, gas) • Oil • Electricity	Number of ground vehicles in 1997: 2,531	• Carbon dioxide (CO_2) • Nitrogen oxides (NO_x) • Hydrocarbons (HC)/VOC • Hazardous waste • Noise	 36

• *SAS's responsibility*
○ *Airport operator's responsibility*
[1] *Refers to within and from Scandinavia.*
[2] *Refers to Copenhagen, Oslo and Stockholm.*

How to find the right information

This Environmental Report was written to be read at different levels – as the comprehensive summary of facts it strives to be, or as individual sections, depending on special areas of interest.

When SAS published its first environmental report in 1995, we vowed that in three years time it would be possible to carry out an external review of the reported data. That day has arrived, and this year's report has been reviewed as planned by our external auditors Deloitte & Touche (see p. 7).

We have also worked on other quality aspects, such as compiling this vast collection of data and information in the most easily accessible manner. Our basic approach is open, and both our own ambition and society demand that all essential details surrounding our environmental efforts be included, which makes the volume of information unavoidably large. We will increasingly adapt this information to different target groups with the help of more specialized units and will successively develop new distribution channels, such as the Internet. This year we have attempted to streamline the structure of the contents so that you can concentrate on certain sections depending on your primary area of interest, and then proceed when you need supplementary or more in-depth information:

- **General summary** For those primarily interested in a very general overview we have created a compact summary, the SAS Group in Brief, on pp. iii–1, and a summary of the most significant key statistics for environment and economy on pp. 18–19.
- **Full report** For an in-depth look at SAS's environmental strategies and activities, you will find the details we consider important in the President's comments, the Board of Directors' environmental report and the first section of the environmental data on pp. 3–19.
- **Environment and economy** If you seek information on the current and future effects of SAS's environmental impact and environmental efforts on our finances, you can find a helpful overview on pp. 18–19. Supplementary information can be found in the Board of Directors' Environmental Report on pp. 8–14 (particularly the sections on strategies and environmental debts). The scope for advancing the company's business position through far-sighted environmental efforts is covered in the President's Statement on pp. 3–5.
- **Environmental management** Decision-makers with an influence on the regulatory framework for the airline industry should find the article on pp. 43–46 of interest – as a basis for discussion on an effective and competitively neutral model for environmental management in the airline industry.
- **Facts and figures** Those interested taking in a closer look at the quantitative data on which the environmental report is based will find extensive information on pp. 18-41.
- **Background** For information on how SAS and the airline industry are working to reduce their impact on the greenhouse effect, see our summary on pp. 48–49.
- **Terms and abbreviations** Definitions of the terminology, expressions and abbreviations used in the running text are listed on pp. 61–63.

CONTINUOUS IMPROVEMENTS

Other new features in this year's environmental report at the general level are:

- The table for the Group's overall energy and resource consumption on p. 1 has been supplemented with a more detailed breakdown for flight, cabin and ground operations.
- The Group's environmental index has been supplemented with sub-indexes for flight, cabin and ground operations.
- In the environmental data section we have added several comparisons of SAS's data with the market's, and have formulated a number of quantitative goals.
- In the environmental data for cabin operations, a new structure has been applied to provide a better perspective over resource consumption, now also in relation to production.

Additional changes and supplements to our quantitative environmental data are described in the introductions to, and comments within, the environmental data for each respective area of operation on pp. 18–41.

But our efforts to improve will naturally not end here. In the past two years we have received predominantly positive comments from the readers and several awards for our environmental report. And although the actual environmental work is obviously more important than how we report it, we take these expressions as an encouragement to continue developing the environmental report as well.

NIELS EIRIK NERTUN
DIRECTOR ENVIRONMENTAL DEPT.

SAS's Environmental Report is also published on the Internet (www.sas.se)

More factors are influencing results

SAS's environmental efforts are fueled by the ambition to conduct operations in an ethically acceptable manner, the knowledge that this has a tangible effect on results and the conviction that the entire sector deserves a better environmental image.

As we all know, national boundaries are not visible from the sky. And even in other senses, few operations are as patently borderless as the airline business.
At least that is true now, in the final phase of European deregulation of the sky. Particularly for SAS, which has been jointly owned by Danish, Norwegian and Swedish interests since its formation more than 50 years ago and has always been considered a model of successful multinational cooperation.

Today the entire global trend is characterized by vanishing borders, not only in geographic terms. Over the past few years, the area in which companies must operate to ensure long-term sustainable development has gradually expanded. From having been strictly limited to efficient large-scale production in the early industrial period, the prerequisites for sustainable business and financial profit have come to include first employee health and welfare and later also environmental accountability. In the business sector there is a growing awareness of the relationship between a company's overall conduct as a good corporate citizen and its success in everything from competition for human resources to cooperation with authorities and the local community.

THE INCREASED IMPORTANCE OF ENVIRONMENTAL WORK

Of that which can be considered the responsibility of a good corporate citizen, environmental efforts are probably the aspect which has crystallized most clearly during the 1990s. This is a mutual process where customers and other stakeholders make environmental demands on the companies, after which the most resourceful compete by setting their sights a little higher.

This interplay between the market and companies inevitably has a tangible effect on business, and in recent years I have seen more and more examples of this on SAS's part. Credible environmental information is now a vital component of most major customer agreements and far-sighted environmental efforts can even be the deciding factor, such as in 1997 when SAS was able to develop its cooperation with ABB, Norsk Hydro and Ericsson. Today individual passengers are also making the environment one of the many quality criteria for their choice of airline. Financiers are increasingly integrating environmental aspects as a natural part of their credit assessment, which was clearly demonstrated in our renegotiation of a billion kronor loan with a European bank group in 1997. And last but not least, improved environmental conditions virtually always lead to lower costs, often already in the short term. For example, countries and airports within the EU are increasingly applying environmentally related taxes and charges and a few attempts have even been made to introduce operative restrictions on aircraft types with the most environmental impact. SAS sees this as a development in wrong direction, and we instead advocate a system for environmental regulation of airline operations which we believe is more effective (for more details see pp. 43-46). But as long as the current environmentally related landing charges nonetheless exist, SAS's investments in the best available technology when replacing the aircraft fleet are reducing environmental charges and taxes – by several hundred million kronor in the long term – compared with if we had settled for just any Chapter III aircraft. And in the fierce competition in a deregulated aviation market, low costs are crucial for success.

But SAS is naturally not alone in noticing and reacting to this trend. In both the IATA and AEA, where I represent SAS as a member of the general assemblies, environmental aspects account for a growing share of the agenda. My expressed ambition in these forums is to act on behalf of SAS as a driving force in environmental issues, to ensure that SAS and the Scandinavian aviation industry are perceived as a forerunner in the international effort. Our weight in this context is further increased through cooperation within the Star Alliance, particularly with Lufthansa, which like SAS is among the sector's forerunners in the environmental area.

The image-enhancing effect of SAS's environmental efforts should not be underestimated. We have no intention of glossing over the fact that air transport will consume fossil fuels and impact the environment even in the foreseeable future – even more so if the sector's expansion proceeds as anticipated. But it has long been our opinion that not only SAS, but the entire airline industry, has a less flattering environmental image than current environmental data actually warrants. Consequently, both our environmental efforts and our information about them are strategically important for promoting an understanding of the airline industry's role in modern society, and highlighting both the improvements which particularly in the past decade have made air travel a competitive transport alternative even from an environmental standpoint, and ongoing product development for the future.

If we fail in this task, there is a risk that we and other airlines will be punished with measures based on misleading comparisons between the total environmental impact of dif-

ferent types of transportation. We believe that sustainable development in society is better served by just comparisons which form an accurate basis for concentrating environmental efforts where they provide the greatest benefits.

OUR FOCUS AT SAS

Thus, there are several motives for active environmental efforts – an ambition to conduct operations in an ethically acceptable manner from all aspects, the knowledge that this has a tangible effect on results and the conviction that the entire industry deserves a better environmental image. Together these motivate the contents of SAS's environmental strategy *[fig.1]*, which was adopted by the SAS Management Team in 1995 with the undivided support of the Board and which expresses a wholehearted dedication to environmental adaptation of the Group's operations.

We have chosen to integrate our environmental work with overall operations. One example of this is that environmental work is included in a module at the same level as other key areas for business development in the model which governs the Group's total quality management (TQM). Another is that environmental aspects are routinely incorporated in decision data in the line organization, such as purchasing. This integration also creates a natural link to health and safety measures.

One key concept is "continuous improvement" – in the TQM model, in SAS's environmental work and in the Star Alliance's joint environmental statement. This work is coordinated by an environmental department which answers directly to SAS's Information Director, who has special responsibility for environmental issues in the SAS Management Team. The head of the environmental department, in turn, directs activities within the SAS Environmental Forum, a cross-divisional group with an advisory, coordinating and activating role in environmental issues. In addition, special environmental coordinators have been appointed in the three Scandinavian countries.

In our environmental efforts we invest considerable resources in flight operations, where the overwhelming majority of environmental effects arise. The measure with the strongest effect on our overall environmental impact is upgrading of the aircraft fleet to more modern aircraft with increasingly fuel-efficient engines and therefore also lower emissions, in addition to reduced noise levels. Our goal is an aircraft fleet with only low-noise Chapter III aircraft by the end of 1999 and our policy is to choose the best available technology in all new purchases. Accordingly, in the past few years we have ordered and begun introducing new short and mediumhaul aircraft with the best available environmental performance (McDonnell Douglas MD-90-30, de Havilland Dash 8-400 and Boeing 737-600), and have recently initiated a pilot study in preparation for the possible replacement of the longhaul fleet which is also guided by high environmental ambitions.

Although cabin operations are generally less significant for SAS's total environmental impact than flight operations, this is the aspect our customers and cabin staff have the most tangible contact with. Here we are working primarily to reduce consumption of resources and waste volumes and improve waste handling. In one major project started in 1996, some 80 environmental projects were being conducted under our own management and more than 200 initiated in cooperation with SAS were being carried by our suppliers at the end of 1997. SAS's own projects include closer cooperation with our suppliers, a gate buffet on shorthaul routes, environmental adaptation of packaging, pre-sorting of waste in the cabin and recycling of newspapers. Our goals for the year 2001 are to reduce water and energy consumption per passenger by 20% and waste volumes by 30% per passenger compared with 1997, and when possible to always offer products with environmental data.

SAS's third area of activity, ground operations, covers such widely differing areas as workshop activities, the vehi-

***[FIG. 1]* SAS'S ENVIRONMENTAL STRATEGY**

Goals

- SAS shall develop one of the airline industry's most ambitious environmental programs.
- SAS shall have an environmental standard on par with the leading competitors in the industry.
- SAS's environmental goals and measures shall be coordinated and harmonized with the other goals for production, quality and financial results.

Strategies

- Within the framework of SAS's financial and qualitative goals, all operations shall be conducted in such as way as to cause the least possible environmental impact.
- SAS will develop into one of the airline industry's leading companies in the environmental sphere.
- Environmental efforts shall be conducted at all levels and within all units of SAS, thus creating increased environmental awareness throughout the organization.
- Environmental aspects shall be included in all decision data in the line organization.
- SAS shall utilize/introduce methods that minimize the environmental impact of production, characterized by low energy consumption, maximal recycling potential and minimal emissions.
- SAS shall issue an account of its environmental work in a separate annual report.
- SAS shall promote understanding among external stakeholders of the role and environmental impact of air transport.

Originally adopted by the SAS Management Team in June 1995 and thereafter revised annually according to plan. SAS's Board has studied the environmental strategy in considering this Environmental Report in March 1998.

cle fleet, station operations, office work and property management. On the workshop side we are focusing on phasing out and reducing the number of chemicals and decreasing waste volumes (particularly hazardous waste). The move to Oslo's new Gardermoen Airport in late 1998 will lead to additional environmental improvements thanks to modern workshop facilities with the highest possible level of environmental adaptation. In vehicle and station operations we are striving for lower fuel consumption in both our ground vehicles and airport shuttle activities in Oslo, and higher energy efficiency in general. In office operations we are concentrating on energy efficiency, pre-sorting and recycling. Energy efficiency is the top priority in property management, where we have also carried out a comprehensive inventory of all buildings SAS owns to ensure that the environmental data we report is complete and accurate. Furthermore, we have placed high demands on environmental adaptation of the building projects we are involved in, particularly the extensive new construction projects at SAS's three main bases in Copenhagen, Oslo and Stockholm. Ground operations' goal for the year 2001 is a 10 percent reduction in energy consumption per square meter for electricity and heating in the premises where we conduct operations compared with 1997.

The entire Group is permeated by a sharper focus on environmental information and training and close cooperation with our suppliers, among other things in the form of environmental aspects as a required element of our supplier agreements. And as I mentioned earlier we are striving to play a dynamic role in various national and international industry forums and to actively participate in spreading information about the airline industry's actual environmental performance. This annual report, an expression of our belief in open and thorough information about our environmental development, is also one of the priority areas for SAS's environmental work.

EXTERNAL INSPECTION AND ADHERENCE TO ENVIRONMENTAL MANAGEMENT STANDARDS

I personally believe that in most contexts, various types of inspections and reports from a credible third party are a valuable mark of quality and a concrete competitive advantage. SAS's flight operations therefore underwent quality certification according to ISO 9001 in 1997 (making SAS first in the airline business to have ISO certified flight operations) and we are planning to begin ISO 9001 certification of the SAS Management Team's work in 1998. Since corresponding certification systems exist for environmental performance, SAS intends to apply these and has set a goal for 1998-99 to adapt the environmental management system to ISO 14001 with opportunities to register the significant aspects of operations according to EMAS.

External inspection of the year's environmental report, in accordance with the plan established when we produced the first report three years ago, is also part of the effort to ensure quality in our environmental work – in this case by guaranteeing quality in collection of the environmental data we report and confirming that they provide an accurate picture of SAS's environmental impact and efforts.

Here I have presented the strategic grounds for SAS's environmental work. My vision is for us to lead the way in finding a place for the airline industry within the framework of society's striving for environmentally sustainable development (i.e. for humanity to satisfy its needs without limiting future generations' opportunities to satisfy theirs). However, as long as aircraft engine technology is based on combustion of fossil fuels (i.e. in the foreseeable future) it is not possible for the airline industry to meet the requirement for sustainable development on its own. Instead the industry must be content to reduce its environmental impact as far as this technology permits. In the mean time, SAS will take part in development of alternative aviation fuels, and when they are available on commercially feasible terms – probably several aircraft generations and decades into the future – we will be at the forefront of the technological shift.

And now I am back where I started my discussion, by emphasizing the commercial and ethical necessity of being at the leading edge in the environmental area. But not only in this area – within the Group we have begun formulating an overall ethical policy for systematizing our efforts to attain high, and therefore profitable, quality goals in all aspects of our operations.

On the following pages you will find a report on how far SAS has progressed in this work – historical data, development in 1997 and ambitions for coming years – together with some hopefully interesting background descriptions. I welcome your comments on our environmental efforts and report, for example by using the reply card on the last page.

JAN STENBERG
PRESIDENT AND CHIEF EXECUTIVE OFFICER

Auditors' Statement

To readers of SAS's Environmental Report for the 1997 financial year:

We have reviewed the contents of SAS's Environmental Report for the 1997 financial year.

The Environmental Report has been presented to SAS's Board of Directors in April 1998. The Group's executive management (SAS Management Team, SMT) is responsible for organizing and integrating environmental work with the day-to-day operations of the Group. Our task has been to review the environmental data and reporting of the Group's environmental work.

The audit was conducted during the period January–March 1998 and was carried out simultaneously with production of the Environmental Report. Since there are no generally accepted standards governing the contents and structure of an environmental report, in Scandinavia or internationally, SAS has maintained a continuous dialogue with us on the information to be disclosed. As a basis for selecting this information we have used Deloitte & Touche's "Manual for analysis and evaluation of 'Environmental reports in listed companies 1996'", November 1997 edition.

Our audit has included:

- Discussions with SMT on the environmentally related operational risks and disclosure of these.
- Discussions with SMT on the contents of the Environmental Report and the results of our review.
- A review of the report on completed, ongoing and planned environmentally related projects.
- A review of the report on environmentally related taxes, charges and investments.
- A review of the report on goal fulfillment in relation to established action plans.
- A review of the Group's systems and routines for registration, accounting and reporting of environmental data.
- A review of the documentation in order to ensure that the information in the Environmental Report is based on this.
- A review of the report on adherence to laws, permits, terms and conditions.
- A review of the report on the scope and delimitations of the Environmental Report.
- Interviews and collection of opinions with comments from the personnel responsible for data collection and other affected staffs with regard to the reliability and consistency of the collected data.
- A review to ensure that the contents of the Environmental Report are not contradictory to the information in SAS's audited financial annual report for the 1997 financial year.

Based on the above reviews, we believe that the information in the Environmental Report is based on data which has been obtained with due care from the operating units, and that the reports on environmental conditions and goal fulfillment in relation to established action plans provide an in all material aspects true and fair view of the aspects of the Company's operations covered here.

Stockholm, April 9, 1998
Deloitte & Touche AB

SVANTE FORSBERG
AUTHORIZED PUBLIC ACCOUNTANT

NILS-HOLGER JANSSON
M.SC.ENG.

Board of Directors' Environmental Report

All quantitative data in this Board of Directors' Environmental Report is also reported in the form of summary tables and graphs in the environmental data on pp. 18–41.

FLIGHT OPERATIONS

In 1997 SAS's total production increased by 6.9% to 2,651 (2,479) MRTK – and for passenger traffic alone by 5.8% to 20,703 (19,788) MRPK.

In contrast to production in RPK, SAS increased its fuel consumption and emissions as a result of expanding cargo operations (since pure cargo traffic consumes fuel without transporting passengers, including it negatively affects all comparisons of fuel consumption per passenger).

In relation to production in RTK, fuel consumption and emissions decreased as a result of ongoing modernization of the aircraft fleet.

Expressed in absolute figures, fuel consumption and emissions increased due to a traffic development which more than offset the relative improvements.

Fuel consumption and emissions

With the continuing expansion of operations, SAS's total fuel consumption in 1997 rose by 5.4% to 1,615,683 (1,533,191) m^3 of fuel. In relation to the number of passengers transported and distances flown, SAS's fuel efficiency deteriorated slightly to 6.2 (6.1) kg/100 RPK, corresponding to 7.44 (7.32) l/100 RPK – despite an improved cabin factor of 64.9 (63.6)%. This deterioration is explained by higher fuel consumption in pure cargo traffic. In relation to the number of tonnes transported and distances flown, i.e. including cargo traffic, fuel efficiency improved by 1.6% to 4.8 (4.9) kg/100 RTK, corresponding to 5.8 (5.9) l/100 RTK. This is attributable to increased volumes of cargo goods, such as mail, which are carried on passenger flights, in contrast to pure cargo traffic.

SAS's fuel consumption and distance flown in 1997 correspond to emissions of 4.0 (3.8) Mtonnes of carbon dioxide, 14,835 (14,350) tonnes of nitrogen oxides and 2,069 (2,083) tonnes of hydrocarbons. Through conversion to engines with lower emissions in the aircraft fleet, emissions of nitrogen oxides have risen proportionately less than the total distance flown and emissions of hydrocarbons have decreased.

Noise levels in SAS's aircraft fleet fell further through the continued phase-in of the new MD-90 aircraft and the hushkitting of DC-9s which was completed during the year.

The proportion of Chapter II aircraft in the SAS fleet fell during the year from 19% to 12%. SAS's target is to operate only Chapter III aircraft from year-end 1999, well before April 1, 2002, when Chapter II aircraft are banned within the EU. This will reduce costs and increase flexibility in deployment of the SAS fleet, since the majority of airports used by SAS already apply some form of noise restrictions and/or charges.

Aircraft fleet development

The total number of aircraft in the SAS fleet at year-end 1997 amounted to 163 both at the beginning of the year and at year-end. Two new MD-90s were phased in and four leased aircraft were added, while six older aircraft were phased out.

The last two of SAS's total of eight ordered McDonnell Douglas MD-90s for a total of 3,000 MSEK were delivered in 1997. They are among the aircraft with the best environmental performance in their class (141 seats in SAS's version), particularly in terms of noise. SAS uses this aircraft on intra-Scandinavian flights and heavily trafficked routes in Europe.

In 1997 McDonnell Douglas was acquired by Boeing. As a result of this transaction, Boeing decided to discontinue production of the aircraft models McDonnell Douglas MD-80 and MD-90, of which 63 and 8, respectively, were included in the SAS fleet at year-end. However, since Boeing will continue to offer support for operation and maintenance, SAS does not anticipate any higher costs as a consequence of the discontinuation. Furthermore, in the current market scenario with high general demand for aircraft, the decision will not affect the aircrafts' resale value.

At the end of the year, SAS had ordered 42 of the new Boeing 737-600 aircraft model (an investment of over 9,000 MSEK). The first aircraft is scheduled for deployment in August 1998, and will successively replace SAS's older Fokker F-28s and McDonnell Douglas DC-9-41s by the year 2002. The Boeing 737-600 consumes 20% less fuel and therefore also produces 20% lower carbon dioxide emissions than the DC-9. SAS, as the only airline to date, has also equipped these new aircraft with engines featuring double annular combusters (at an additional total cost of 150–200 MSEK) which reduce emissions of nitrogen oxides by 40% compared with the DC-9. This gives the aircraft a favorable position in the charge system at airports which have imposed nitrogen oxide-based environmental charges, above all Sweden and Switzerland, and is expected to lengthen the service lives of the aircraft over future more stringent environmental regulations. The aircraft are also fitted with quieter auxiliary power units (APU) for power supply and air conditioning when the aircraft are on the ground

In 1997 hushkitting of SAS's older McDonnell Douglas DC-9s was completed so that all of the owned aircraft now meet Chapter III noise limits and can continue to fly after April 1, 2002 when the EU ban on use of Chapter II aircraft goes into force. (In 1997 SAS also operated four leased DC-9-41s which have already been, or will be, returned and were therefore not hushkitted). The hushkitting program has entailed an overall investment of 400 MSEK, of which 165 MSEK in 1997.

During the year four Saab 2000s were leased in for flights to Finland and on Swedish domestic routes. Saab 2000 is a turboprop aircraft which accommodates 47 passengers and offers the flight performance of a jet aircraft, but with 20% lower fuel consumption and carbon dioxide emissions than the Fokker F-28s they replace in SAS's fleet. The Saab 2000 also has excellent noise characteristics, with certification values that exceed the current requirements by more than 10 EPNdB.

In 1997 SAS ordered 15 turbo prop aircraft of the Bombardier de Havilland Dash 8-400 model for SAS Commuter. The aircraft, which seats 72–76 passengers, is the fastest propeller aircraft after the Saab 2000, and therefore offers high productivity. Fuel consumption at a cabin factor of 65% is 4.2–5.2 l/100 RPK and the noise contour (85 db(A) on takeoff) is 0.5 km^2, which are low values in comparison with similar aircraft. Furthermore, like the Saab 2000, the Dash 8-400 is equipped with active dampening of noise and vibrations in the cabin. SAS's first Dash 8-400 is scheduled for delivery in July 1999, and deliveries will be proceed until the second half of 2000. The aircraft will complement both jet operations and feeder flights using the Fokker F-50 in northern European feeder traffic to Copenhagen and Swedish domestic traffic on routes with low capacity utilization within SAS Commuter.

In 1997 SAS made a decision to purchase a total of 16 new aircraft, and at year-end there were 57 aircraft on firm order.

Furthermore, studies were initiated during the year to evaluate the possible replacement of Boeing 767-300s in SAS's longhaul fleet in the beginning of the 2000s.

Preparedness for radioactive contamination

SAS has a special work group – the Radioactive Contamination Group (RCG) – whose task is to initiate measures when radioactive contamination of aircraft and/or cargo has occurred. RGC is also responsible for ensuring SAS's preparedness in the event of a nuclear power incident. RCG cooperates with the other airlines in the AEA in order to exchange information, and with the national and international authorities responsible for air traffic to ensure that the necessary measures can be taken quickly when the need arises.

CABIN OPERATIONS

The overall environmental goal in cabin operations is to continuously decrease consumption of natural resources and reduce environmental impact.

In 1996 an ambitious environmental project was initiated in cabin operations with the aim of ecologically adapting the overall service concept through reduced energy and water consumption, and decreasing waste volumes and emissions into the air. In 1997 the scope of the project was extended to over 300 subprojects, including projects conducted by SAS's suppliers as part of their collaboration with SAS. For follow-up and evaluations of the project, a number of key statistics were established so that with effect from 1997 SAS measures resource consumption and waste volumes both in total and per meal served. Furthermore, the central key statistics are compiled in a subindex which is also used for development of supplier collaborations. Activity plans were formulated for the project's continuation in 1998-99, with a focus on future environmental audits, environmental labeling of flights and registration/certification according to EMAS/ISO 14001. An overview of the subprojects and a closer description of those which are most significant for SAS's environmental impact in cabin operations are presented on p. 32.

In February 1998 SAS's product department arranged an environmental seminar for the major suppliers in cabin operations. An action plan for future environmental work was drawn up for the seminar, and was distributed among other things in the form of a brochure. At the seminar, Gate Gourmet (Arlanda Airport), Select Service Partner (Norway), the Swedish newspaper Göteborgs-Posten, Domain Laroche Wine and Beijing Air Catering were presented with SAS's environmental award for extraordinary progress in the environmental area.

During the year, SAS formulated a goal for cabin operations by the year 2001 to reduce energy and water consumption per meal served by 20% and waste volumes by 30% per meal served compared with 1997, and in all possible areas to offer products with environmental data.

Protection from cosmic radiation

For many years the airline industry has applied rules for protection from radiation. In 1996 the EU adopted a directive for calculation of, and protection from, the natural radiation the flight staff are exposed to due to the fact that cosmic radiation in the upper stratosphere is twice as high as at ground level. The authorities will draw up a joint-Scandinavian directive which SAS will integrate with its own safety regulations during 1998. The authorities also carried out measurement and calculation of radiation doses on certain routes in cooperation with SAS.

GROUND OPERATIONS

Ground operations' overall environmental goal is to achieve more efficient energy utilization, minimize resource consumption and waste volumes, and increase the level of presorting.

The total waste volume in ground operation rose to 4,359 (3,382) tonnes, because new areas were included in the calculation for the first time in 1997. Pre-sorting of paper and cardboard has continued to increase steadily. In 1997 the collected volume amounted to 784 (510) tonnes, or 54%, whereby the volume of unsorted waste was reduced to an equal degree.

SAS's energy consumption in ground operations during 1997 was 409 (452) kWh/m^2. The decrease of close to 10% is explained by the ongoing energy efficiency program. During the year SAS formulated a goal by the year 2001 to reduce energy consumption for electricity and heating to the premises where operations are conducted by 10% compared with 1997.

SAS's water consumption fell to 200,928 (222,719) m^3 thanks to a continued conservation campaign, above all in the maintenance workshops in Oslo, SAS's largest consumers of water.

SAS utilized a total of 2,531 (1,721) ground vehicles within, as well as to and from, the airport areas in the traffic network. In 1997 SAS increased its consumption of diesel for these vehicles to 3,264 (2,868) m^3, due to higher production particularly in airport shuttle operations in Oslo. Consumption of gasoline rose to 2,467 (2,307) m^3 through increased consumption in the Swedish company car fleet. In addition, during the year more than 15 m^3 of gas were consumed by a number of ground vehicles in Norway. In the trials now underway at Arlanda Airport to replace the diesel used in ground vehicles with biofuel extracted from rapeseed oil, 47 m^3 of biofuel was consumed.

In 1997 SAS sold its airport shuttle operations in Copenhagen. In Oslo, SAS won a bid for an airport shuttle concession at the new Gardermoen Airport, which after opening in late 1998 will lead to a significant expansion of operations. At year-end 1997 SAS owned a total of 24 buses, of which 18 are equipped to meet the EU's most stringent environmental standards (the remaining six buses are used only on the airport grounds in Oslo, representing relatively short total driving distances). During the year SAS ordered an additional ten buses of the highest environmental standard for delivery in June 1998.

In 1997 SAS was involved in large-scale construction projects, mainly at Oslo's new Gardermoen Airport where SAS is building its own premises covering over 90,000 m^2, and extension of Copenhagen Airport with new terminals. In both projects, environmental requirements have been integrated as a natural aspect of activities at both the planning & design and construction phases. SAS and the airport operators are collaborating during the construction phase to ensure preparedness for environmental incidents.

The environmentally related projects in ground operations with the most significance for SAS's environmental impact are presented on p. 41.

In the year's environmental report, the quality of data from the main airports in Copenhagen, Oslo and Stockholm has been further enhanced through continuous improvement in collection routines. In addition, with effect from this year data from all Scandinavian line stations (i.e. the entire SAS Station Service Division) is included, in accordance with one of the goals stated in SAS's first Environmental Report in 1995. However, since these represent only a marginal share of the ground operations' overall environmental impact, the earlier environmental reports were already largely accurate.

INFRINGEMENTS, INCIDENTS, DISPUTES

Infringements

In 1997 the Danish Civil Aviation Administration reported SAS for suspected infringement of local regulations on braking with the help of jet engines in connection with landing on some 15 occasions. This matter is under police investigation. In other respects, SAS complied with the applicable concession stipulations in 1997.

In 1996 SAS exceeded its share of the concession for glycol emissions in connection with deicing of aircraft at Bergen airport in Norway, which is shared with the Norwegian Civil Aviation Administration. Follow-up of this incident in 1997 led to the establishment of new routines in collaboration with the Norwegian Civil Aviation Administration, and corresponding reviews were carried out at the other line stations.

Incidents

The environmental expenses in the Group's 1997 income statement include 9 MSEK for the cost of cleaning up a contaminated site at Copenhagen Airport. The total cost of the cleanup amounted to 16 MSEK, of which Copenhagen Airport has paid 7 MSEK. Both parties adhere to the "Polluter Pays Principle", which dictates that the polluter is liable for the costs of measures to remedy environmental damage. Since in this case there is uncertainty about the extent to which each party has contributed to the damage, and how the concept of "operator" should be interpreted, the division of costs has been determined in negotiation between the parties.

There is a risk that similar damage has occurred in connection with filling of fuel and maintenance work on the properties which are used, or have been used, by SAS at other airports. However, the possible existence of any such damage has not yet been investigated and SAS has not been subject to any claims for damages.

In March 1997 SAS's electroplating workshop in Oslo matched the concession limit for cadmium emissions, and in January 1998 for chromium emissions. In neither case was the current limit exceeded. The incidents were reported routinely to the Norwegian supervisory authority.

Disputes

In 1997 the new airport in Karlstad introduced a ban on Chapter II aircraft, which forced SAS to restructure the traffic program for a cost which could be in the range of 20-40 MSEK. Since this restriction was imposed before the EU's ban goes into effect on April 1, 2002, SAS reported the matter to the European Commission (EC) and it is now being handled as a dispute between the EU and the Swedish authorities. The outcome of this may also affect the environmental restrictions at other airports which plan to introduce bans on Chapter II aircraft before the year 2002.

SAS is in disagreement with the former owner of the site at Copenhagen Airport where SAS has built a new component workshop about responsibility for the necessary environmental decontamination. This dispute, representing total costs of 16 MSEK, is expected to be resolved in a court of law during 1998.

Apart from the above, no environmentally related disputes connected with SAS's operations are underway.

WASTE

Altered environmental regulations

The question of liability for environmental damage is currently under discussion within the European Commission (DG XI). The EC's intention is to present a "white paper" dealing with this issue in April 1998. According to a proposal from the EC which was discussed at a meeting of national experts in November 1997, it is the polluter who bears responsibility. If several polluters are responsible they have joint and several responsibility, though with a possibility for those who can prove they have only contributed to part of the damage to

WHAT HAPPENED IN 1997?

Priority areas	Progress in 1997	Economic consequences for SAS
Development of an aircraft fleet with less environmental impact, through replacement and modification of older aircraft.	SAS's noise impact and relative emissions of nitrogen oxides and hydrocarbons decreased thanks to hushkitting of older, and phasing-in of new, aircraft. The increase in fuel consumption and carbon dioxide emissions as a result of higher productivity were limited through higher fuel efficiency in the new aircraft.	• The charges for use of Chapter II aircraft fell by approx. 25 MSEK. • Each percentage point of improved fuel efficiency reduces fuel costs by around 30 MSEK.
Lower consumption of resources, reduced emissions and waste volumes and improved waste management in cabin operations.	The large-scale collaboration with SAS's suppliers was advanced through a unified strategy, quantitative targets, a revised purchasing manual, a set of key statistics for measurement and follow-up and a total of 300 ongoing environmental subprojects.	• The share of aluminum cans returned on Norwegian domestic flights provided a reduction in charges of 9 MSEK. • The collaboration with suppliers led to both reduced environmental impact and lower costs for SAS. • The share of returned magazines/newspapers in lounges and on board aircraft, 50%, resulted in a cost reduction of more than 1 MSEK.
Lower consumption of resources, reduced emissions and waste volumes and improved waste management in ground operations.	Continued improvement in energy-efficiency and waste management. Attempts to replace diesel with rapeseed oil in ground vehicles. A gradual shift from oil-based to biofuel-based heat production.	• The 10% decrease in energy consumption in 1997 led to cost reductions of more than 10 MSEK. • Lower waste volumes, increased pre-sorting and better quality in hazardous waste reduced SAS's costs by more than 1 MSEK. • The extent of the cost reductions resulting from SAS's conversion to biofuel is dependent on the charge policy in the Scandinavian countries.
Environmental adaptation of the construction projects SAS is involved in.	Extensive integration of environmental aspects in the large-scale construction projects, particularly at Copenhagen Airport and Oslo's new Gardermoen Airport.	• Environmental investments at Gardermoen Airport of approx. 25 MSEK are expected to provide cost reductions of several MSEK per year.
Intensified internal environmental information.	Continued development of environmental aspects in the internal training programs.	
Involvement in developing the environmental requirements imposed on commercial airline operations through participation in central industry, national and international forums.	SAS took action in connection with controversial proposals for environmental restrictions in London, Zurich, Oslo, Karlstad and Umeå. SAS participated in the Swedish Civil Aviation Administration's work group for noise and emissions-related landing charges and participated in work on the regulatory framework for the airline industry through the Star Alliance.	• For SAS, the total volume of taxes and charges included as part of the regulatory framework of the airline industry will amount to nearly 1,000 MSEK per year during 1999–2000.
Work on improving SAS's environmental image so that it corresponds to the actual environmental data.	Participation in environmental expos, seminars, debates and conferences. Lectures at universities and colleges. New sponsorship collaborations (Save the Children, Bellona). Establishment of an environmental fund in association with Coca-Cola.	• SAS's environmental image shows steady improvement in various surveys. • A better environmental image creates greater potential for SAS to take action in issues related to development of the airline industry's regulatory framework (see above).
Further development of the Environmental Report to meet external requirements.	The Environmental Report was reviewed by external accountants. The Group's overall environmental balance sheet and environmental index were supplemented with separate versions for each area of operation. Data from all the Scandinavian line stations was included.	• Quality-assured environmental data is a prerequisite for taking part in discussion of the airline industry's regulatory framework (see above). • An environmental policy and an environmental report are required in the majority of agreements with major customers and for EMAS registration.

bear responsibility only for that part. Since no directive on the division of responsibility for environmental damage has yet been drawn up and no decision on this matter has therefore been made, at present it is not possible to comment on how regulation of this matter within the EU would affect SAS. However, against the background of current environmental legislation in the three Scandinavian countries, the EC's proposal is expected to alter the existing division of responsibility to only a limited extent.

The proposed noise restrictions at Oslo's new Gardermoen Airport conflict with the ICAO principle of not imposing different restrictions on various Chapter III aircraft. SAS believes that the proposal could have future consequences for other environmental regulations.

Based on SAS's knowledge, no other changes in environmental regulations, such as concessions, permits and dispensations, are expected to have any significance for SAS's operations.

Insurance, preparedness, preventive measures

SAS's insurance covers the company's liability for environmental impact in the event of accidents and sudden occurrences. SAS has contingency plans and preparedness for crashes, accidents and incidents which could lead to contamination, in certain cases in collaboration with the airport operator. SAS conducts operations and carries out systematic maintenance in a manner designed to prevent and limit the risks for contamination.

ENVIRONMENT AND ECONOMY

The general trend is towards rising environmental charges and taxes and more stringent environmentally related traffic restrictions. SAS is active in both national and international forums to create a framework of long-term predictable and internationally competitively neutral conditions. SAS's basic philosophy is that all types of transport should cover their share of costs for infrastructure and environmental impact based on the polluter pays principle.

SAS's total environmental charges and taxes amounted to 484 (600) MSEK in 1997 (see p. 19). However, this decrease is not expected to last since it is entirely attributable to the fact that Sweden did not levy any domestic emissions tax in 1997 pending this year's replacement of the emissions tax which in 1996 was found to conflict with EU rules.

For an account of the additional increases in charges and taxes which will be imposed on 1998, as well as the other ongoing efforts to change the regulatory framework for the airline industry with possible economic consequences for SAS, see p. 19.

TQM AND ENVIRONMENTAL MANAGEMENT

Environmental efforts at SAS form a natural part of the overall work on Total Quality Management – TQM. In 1997 this work proceeded according to the plan which was adopted by SAS Management Team in 1995 and has been continuously revised thereafter. SAS has set a target within the framework of TQM to achieve the highest European level of quality in 1998, and in 1997 a new Group Staff function was created for this purpose. To further strengthen the link between strategic environmental goals and operative activities, in 1998 environmental issues will be more strongly emphasized at the middle management level. For a detailed description of SAS's TQM work, see p. 51.

As part of the efforts to adhere to an international standard for environmental management and accounting, in 1997 a gap analysis was carried out in parts of station operations at Arlanda Airport. Gap analyses were also started in the cargo operations and vehicle workshops at Copenhagen Airport, where development of a certifiable environmental management system was also initiated.

Although the audit of health, environmental and safety conditions in SAS's facilities at Oslo's new Gardermoen Airport, which was carried out in January 1998 did not find any deviations, it contributed to highlighting the potential for further improvement in certain areas.

During the year a decision was made to increase SAS's central resources for environmental work through a position with special responsibility for environmental management and concession matters. With effect from 1998, the Environmental Department's budget has also been raised, primarily to provide scope for a stronger focus on training and development of the environmental management system.

For a more in-depth description of SAS's environmental management system, see p. 51.

INTERNAL INFORMATION AND EXPERTISE DEVELOPMENT

The members of the SAS Environmental Forum make yearly study visits to other companies to share experience within the environmental field. In 1997 Volvo and PLM were visited.

Last autumn a brochure with a summary of SAS's strategies was distributed to all employees which also contained a section on SAS's environmental activities.

The Environmental Report also served as a vital internal information channel. Additional environmental information was conveyed to SAS employees through articles in SAS's staff magazine Inside and features in SAS's internal video Fokus. (A recycling system was implemented for the Fokus video in which the cassettes are returned to the manufacturer for 100% recycling).

For an account of the continuous training activities, see p. 55.

PROFILE/IMAGE

In the various surveys which are made regularly, SAS's overall environmental image improved somewhat.

SAS worked to enhance its environmental image in several ways, mainly by participating in environmental exhibitions, seminars, debates and open conferences in both Scandinavia and Europe. SAS was also invited to lecture on environmental issues at several Scandinavian universities and colleges, and was interviewed for a number of academic dissertations on environmental themes. The environmental

characteristics of SAS's new MD-90 aircraft were featured in a report on regional TV4 and an interview on the Discovery Channel's "World in Action". SAS published profile advertisements with environmental themes and provided environmental information in the inflight magazine Scanorama.

Like the year before, SAS's Environmental Report for 1996 was widely distributed internationally. In various evaluations of the 1996 Environmental Report, SAS was consistently given a high ranking in comparisons – by the international accounting firms Deloitte & Touche and Coopers & Lybrand, by British SustainAbility on behalf of the UN Environmental Agency and by the English accountants' association ACCA. SAS won the daily newspaper Börsen's 1996 Environmental Report of the Year award in Denmark. After having won comparable awards in Norway and Sweden for the 1995 Environmental Report, SAS's 1996 report was given honorable mention in both countries – in Norway as one of five equally ranked companies and in Sweden as the best in its field of business.

For an account of SAS's sponsorship commitments, see p. 58.

COLLABORATIONS

During the year SAS collaborated with partners in the Star Alliance and other partner airlines, was actively involved in various international forums and conducted dialogues with national authorities, suppliers and other interested parties. For a detailed description of SAS's collaborations, see p. 56.

HEALTH AND SAFETY

Development of a safe and sound work environment is carried out within the framework of SAS's business strategies and the national legislation in the countries where SAS operates. This work is governed by a special work environment strategy and is integrated with the line manager's responsibilities.

In 1997 the health, environmental and safety departments in Copenhagen, Oslo and Stockholm conducted a project aimed at harmonizing and streamlining procedures for health, environment and safety activities in Scandinavia. Several groupwide projects were initiated as a result of the increased inter-Scandinavian coordination in this area, such as a review of SAS's work apparel which includes implementation of the new EU regulations for safety markings on clothing worn in work on the platform.

One of SAS's operative goals is for all managers to inspect the work environment – both physical and psychological – and draw up action plans. In Norway and Sweden this is carried out as part of the internal audit process, and in Denmark through the system for workplace evaluation.

In construction of Oslo's new airport and the new cargo terminal in Copenhagen, one central task has been to create a good work environment, as well as in designing new products, equipment and service concepts in cabin operations. The proposed evaluation of SAS longhaul fleet also incorporates a number of health, environmental and safety aspects.

For a complete account of SAS's work in the area of health, work environment and safety, see p. 50 of the Annual Report.

SCOPE OF THE ENVIRONMENTAL REPORT

Like last year, the 1997 environmental data includes the SAS Consortium as well as the part of SAS Commuter's operations in which SAS carries out ground services and technical maintenance. Consequently, the Environmental Report includes all significant parts of SAS's operations except hotel operations, which conduct their own environmental work. SAS Commuter's other environmental impact has not been included in the description of the SAS Consortium's environmental management system, since they have an independent legal responsibility and conduct their own environmental work as a separate consortium in the SAS Group. Both SAS Commuter and SAS International Hotels publish their own environmental reports.

In the jointly owned companies where SAS has board representation (such as SAS International Hotels), SAS directs its board members to influence the respective company's environmental work to be conducted and documented in accordance with SAS's environmental policy and strategy.

As of this year, the Environmental Report includes data from all of SAS's line stations (i.e. the entire Station Services Division).

Like in previous years, rough estimates have been avoided and SAS judges the reported data to be of a high quality. In order to provide perspective on SAS's environmental data, in certain cases external reference data has been included – from other companies, regional averages, etc. It is naturally not possible for SAS to vouch for the reliability of other actors' data with the same degree of certainty as for its own.

SAS's ambition is for the Environmental Report to include all conditions with reasonable relevance for SAS's environmental impact. Starting with this Environmental Report, the representativeness and quality of the reported environmental data are reviewed by an external party (see p. 7) in accordance with the goal set in SAS's first environmental report in 1995.

SAS's Board of Directors has studied the following environmental report in April 1998.

»SAS advocates long-term predictable and internationally competetively neutral environmental control through increasingly stringent ICAO standards in pace with technological development.«

"BY THE YEAR 2001 SAS WILL HAVE REDUCED WASTE VOLUMES IN CABIN OPERATIONS PER MEAL SERVED BY 30% COMPARED WITH 1997."

1997 Environmental Data

COMPLETE SET OF KEY STATISTICS

When we began collecting data for SAS's first Environmental Report in 1995 our ambition was, within three years, to be able to report a set of quantitative environmental data which covers all significant environmental impact in our operations. After the first two years' successive build-up we consider this goal to have been met this year, since we now include data from all Scandinavian line stations (i.e. the entire Station Services Division). Our data therefore includes all volumes pertaining to Scandinavian operations. The only factor we have no viable possibility of weighing in is the waste unloaded from the aircraft at stations outside Scandinavia – presumably around one third based on the share of passengers on these routes.

Furthermore, we are confident that the key statistics are of a reasonably certifiable quality, since each year we have consistently confined ourselves to reporting only the relatively reliable data and have refrained from making more or less rough estimates. This naturally also applies to the data which was added this year and which thereby augmented the key statistics.

This year, both of these aspects – the representativeness of the selection and quality of reported environmental data – have been reviewed by an external party, in accordance with the goal set in SAS's first environmental report in 1995 (see p. 7).

GOALS AND REFERENCE LEVELS

In pace with development of our environmental work according to SAS's environmental strategy from 1995, we have gained a growing awareness of which improvements should be strived for based on an assessment of which measures could provide a yield for our various stakeholders. This year we have come so far that we are able to quantify a concrete objective for SAS's environmental work for a few additional key statistics, and our ambition is to add more of these in the coming years.

Furthermore, each year our goal has been to compare SAS's environmental impact with other companies', regional averages, etc., to help the reader to judge the quality of SAS's environmental work. However, it has proven to be very difficult to find external environmental data which is sufficiently advanced to enable accurate and meaningful comparisons. While awaiting a standard for benchmarking in the industry, we have nonetheless chosen a few expressly for the purpose of providing some reference levels for the reader. In these cases, we can naturally not vouch for other parties' data and grounds for calculation with the same degree of certainty as for our own.

We encourage a trend towards increased benchmarking in the airline industry and are among other things working actively in the Star Alliance partner forum to reach consensus on possible measurement methods and key statistics. In the mean time, we present as many alternatives as possible (total, per RPK, per RTK, per ATK, per meal, per m^2, etc.) in order to provide opportunities for others to compare themselves with us.

ENVIRONMENTAL INDICES AND ENVIRONMENTAL BALANCE SHEETS BY AREA OF OPERATION

One new feature in 1997 for all of SAS's three areas of operation is development of the overall environmental balance sheet (see p. 1) and the overall environmental index (see p. 18) into more detailed charts and indices for separate areas of operation. The objective is to give our readers, not least SAS's own staff, a better overview of SAS's environmental impact and the results of our environmental efforts.

ENVIRONMENTAL PROJECTS

In previous years, the environmental data for each area of operation were concluded with a summary of all ongoing environmentally related projects with a significant impact on the environment. In the first year this was a viable ambition, but already by last year we could note a dramatic increase in the number of environmental projects, with around 50 underway in cabin operations alone. This year their environmental activities include over 300 concrete environmental projects, and in ground operations the number of projects is far beyond what anyone could foresee when we started our work according to the new environmental strategy in 1995! Consequently, we no longer feel that it is meaningful to strive for a complete account according to the earlier model. Starting from this year, we instead chose to summarize the projects with the greatest strategic and environmental importance in each respective area of operation.

The environmental conditions *on a flight are of major importance for both passengers and cabin crew, and SAS therefore conducts environmental work in cooperation with them and our suppliers. One example is how passengers are helping to pre-sort discarded magazines and newspapers on all domestic routes by placing them in a receptacle as they exit the aircraft. Another example is the special waste collection cart which has been developed to enable the crew to pre-sort on board, such as collecting aluminum cans for recycling. In SAS's Gate Buffet concept in Copenhagen, Oslo and Stockholm (with trials also at some other Swedish domestic stations), the passengers select food and beverages before boarding the aircraft, thereby eliminating substantial packaging and organic waste. And in cooperation with our suppliers we are working to replace various packaging with more environmentally adapted alternatives, such as aluminum-free coffee packaging and wine bottles without sleeves on the bottle necks. Close to 300 such environmental projects were conducted in SAS's cabin operations in cooperation with suppliers during 1997!*

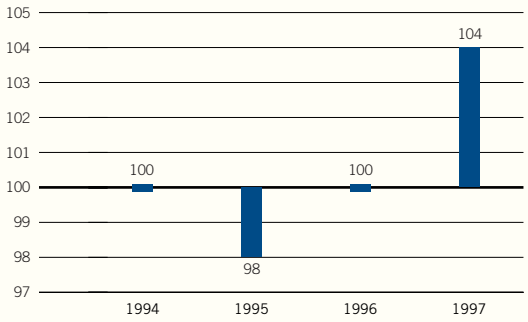
JANNE SØDRING
ENVIRONMENTAL COORDINATOR, CABIN OPERATIONS, COPENHAGEN

Total SAS

ENVIRONMENTAL INDEX

Total SAS

[1994=100] The higher the index figure, the better the resource utilization and the lower the relative environmental impact.



BACKGROUND: SAS's environmental productivity index expresses resource consumption in relation to production, thereby indicating SAS's ecoefficiency. The formula used is (SAS's data in brackets):

$$\frac{\text{Number of tonne kilometers (2,651,120,000)} + \text{no. of baggage items (22,660,000)} + \text{kg of cargo and mail} + \text{dm}^2\text{ managed floor area (48,000,000)}}{\text{Liters of aviation fuel (1,615,700,000)} + \text{liters of fuel for ground vehicles in Copenhagen (1,705,000)} + \text{kWh energy for SAS buildings (194,200,000)}}$$

SAS'S DEVELOPMENT: The base year used is 1994, with an index of 100. The improvement in 1997 is due to two main factors – an increase in fuel efficiency per tonne kilometer (i.e. including passengers, baggage and cargo) by close to 2%, and further improvement in energy efficiency in SAS's properties by approx. 10% per m^2.

The calculation formula for SAS's environmental index was developed between 1995 and 1996, and the index was recalculated retroactively to facilitate comparability between the years. The formula for 1997 is unchanged compared with 1996. The fundamental idea is to give flight operations a weighting which corresponds to its share of SAS's aggregate environmental impact. This has been achieved by giving the number of tonne kilometers and liters of aviation fuel weightings which are 10 and 100 times higher, respectively, than other elements in the formula, whereby they comprise approx. 90% of the total index value.

EMISSIONS AND RESOURCE CONSUMPTION

Green bars refer to improvements, red bars to deterioration.

Key statistics	Change *1996–97 [%]*	1996	**1997**		*For comments see page:*
Fuel consumption	+5.4	1,533	**1,615**	[1,000 m^3]	24
Carbon dioxide	+5.4	3,815	**4,021**	[1,000 tonnes]	22
Nitrogen oxides	+3.2	14.4	**14.8**	[1,000 tonnes]	22
Hydrocarbons	–0.7	2.1	**2.1**	[1,000 tonnes]	23
Water vapor	+5.2	1,502	**1,580**	[1,000 tonnes]	23
Glycol consumption	+0.3	3,200	**3,211**	[m^3]	38
SO_2, NO_x, CO_2 from heating plants	–77.0	13,838	**3,180**	[tonnes]	35
Diesel, ground vehicles	+13.8	2,868	**3,264**	[m^3]	39
Gasoline, ground vehicles	+6.9	2,307	**2,467**	[m^3]	39
Emissions of heavy metals (cadmium, chromium)	+39.1	4.6	**6.4**	[kg]	36
Packaging in cabin operations	+3.4	1,164	**1,204**	[tonnes]	30
Newspapers/magazines in cabin operations	–7.8	4,729	**4,362**	[tonnes]	29
Collected newspapers/magazines	+51.5	1,038	**1,573**	[tonnes]	29
Waste paper/cardboard	+53.7	510	**784**	[tonnes]	37
Garbage	+10.9	2,829	**3,140**	[tonnes]	37
Hazardous waste[1]	–15.4	514	**435**	[tonnes]	36
Water consumption, buildings	–9.8	223	**201**	[1,000 m^3]	37
Energy consumption, buildings	–9.8	215	**194**	[GWh]	38
Relative energy consumption	–9.5	452	**409**	[kWh/m^2]	40
····· *Comparative figure: RTK*	+6.9	2,478	**2,651**	[x10^6]	

[1] *Aggregate of the many fractions included (see p. 36) and adjusted to comparable values.*

ENVIRONMENT AND ECONOMY

Environmentally related earnings and/or cost reductions[1]

[MSEK]	1995	1996	**1997**
Decrease in landing charges due to phase-out of Chapter II aircraft	–[5]	–[5] approx.	**25**
Decrease in costs due to reduction in waste volumes, improved pre-sorting and increased recycling[4]	13–18	14–19	**15**

Environmentally related charges and taxes[2]

[MSEK]	1995	1996	**1997**
Seat and passenger charges (Norway)[6]	353	469	**475**
Of which:			
Seat charges	127	145	139
Passenger charges, international	183	221	250
Passenger charges, domestic	43	103	86
Environmental tax on emissions (Swedish domestic)[7]	102	116	**–**
Noise charges (Norway and Sweden)[8]	30	15	**6.5**

Environmentally related investments and costs[3]

[MSEK]	1995	1996	**1997**
McDonnell Douglas MD-90[9]	–	60	**20**
Hushkitting of Douglas DC-9s[10]	83	35	**165**
Extra cost for use of remaining Chapter II aircraft	–[5]	–[5]	**50**
Investments and costs in construction and ground operations – environmentally related share	n/a	5	**25**[11]
Management of waste and hazardous waste, operation of treatment plants, oil separators, etc. – environmentally related share	10–20	10–20	**17**
Environmental clean-up at Copenhagen Airport	–	–	**9**
Environmental Report, environmental profiling, environmental sponsorship	n/a	3	**3**

[1] *Environmentally related earnings and cost reductions connected with operations. Cost reductions are estimated in relation to costs in the preceding year.*

[2] *Costs for environmentally related charges and taxes connected with operations – both extra costs for charges and taxes debited to operations because the environmentally best available process or equipment has been used, and costs incurred even though the environmentally best available process or equipment has been used.*

[3] *Investments in assets to prevent, reduce or repair environmental damage arising from operations which are not profitable on their own financial merits or are aimed at meeting upcoming, more stringent environmental requirements. Costs related to measures to prevent, reduce or repair environmental damage arising from operations.*

[4] *The full agreed charge reduction was made in 1995–97 despite the fact that SAS did not meet the Norwegian authorities' requirement of a 90% return rate for aluminum.*

[5] *With effect from 1997 the calculation method has been altered for this item. There is no comparative data for earlier years.*

[6] *Passenger charges for domestic flights introduced on April 1, 1995, when passenger charges for international flights were raised by 100%.*

[7] *SAS has paid Swedish environmental tax on domestic air traffic in 1995 and 1996. Since the European Commission has found the Swedish legislation to contravene Community law, the imposition of environmental tax lacked legal grounds and is consequently not deemed to represent any cost for SAS during the period from January 1, 1995 through December 31, 1996. While formulating the new emissions tax, which was introduced on January 1, 1998, the Swedish authorities levied no emissions tax during 1997.*

[8] *The cause of this decrease is the continued phase-out of Chapter II aircraft.*

[9] *SAS has purchased eight MD-90s for a total of 3,000 MSEK, of which the last two were delivered in 1996. The environmentally related extra cost is estimated at 10 MSEK per aircraft, i.e. the price difference between the MD-80 and the MD-90.*

[10] *The hushkitting program, which was commenced in 1995, was completed in 1997. The 1996 figure refers to the budgeted amount, part of which has been transferred to 1997. The total investment amounts to 400 MSEK.*

[11] *Refers only to Oslo's new Gardermoen Airport.*

FUTURE DEVELOPMENT: The general trend in the airline industry is towards increased environmental charges and taxes and more stringent environmentally related traffic restrictions. The following increases in environmentally related charges and taxes for 1998 have been announced.

Tax/charge	*Effective from*	*Effect for SAS*
New environmentally based passenger charge in Denmark.	January 1, 1998	Increase in charges of approx. 230 MSEK per year.
Conversion of passenger charges to seat charges in Norway.	April 1, 1998	Increase in charges of 250 MSEK per year.
New emissions tax in Sweden based on emissions of nitrogen oxides.	January 1, 1998	Increase in costs with net amount of 10–20 MSEK per year.
Adjustment of the noise-related charge system for Chapter II and Chapter III aircraft in Sweden.	January 1, 1998	Increase in costs of 15 MSEK per year.

The EU's efforts to adapt the so-called mineral oil directive could result in the imposition of environmental charges on aviation fuel. This could lead to extra costs for all large airlines in the range of several hundred million SEK, if no redistribution of the entire system of taxes and charges is carried out in conjunction with this.

The ECAC is working on a proposal for noise classification of Chapter III aircraft. This classification is intended to be used at airports which apply noise-related charges. This could have consequences for SAS's MD-80s. In the short term other environmental charges and regulations could also lead to decreased flexibility in deployment of the SAS aircraft fleet and rising costs in the traffic network, and could adversely affect resale values in parts of the SAS fleet.

Higher deposition charges in Sweden and packaging charges in Norway are expected to only marginally affect SAS's costs since they are compensated by increased environmental adaptation of SAS's waste management.

The proposed noise restrictions at Oslo's new Gardermoen Airport conflict with the ICAO's principle of not imposing varying operative restrictions on different Chapter III aircraft. SAS deems that the proposal could have consequences for other environmental regulations in the future.

The new concession requirements for SAS's operations at Gardermoen Airport are not deemed to have any significant consequences for SAS.

The EU is currently working on a proposal to introduce even more stringent requirements for nitrogen oxide emissions from aircraft engines. Based on what is known about the proposal, SAS judges the aircraft fleet to already be adapted for the eventuality of more stringent regulations.

Based on SAS's knowledge on the publishing date for this Environmental Report, no further changes in environmental regulations such as concessions, dispensations or permits are judged to have any significant effect on the company's operations.

Flight operations

Flight operations are where the absolute bulk of SAS's environmental impact arises. For example, flight operations alone account for more than 95% of SAS's total emissions into the air.

The significant environmental impact in flight operations are consumption of non-renewable fuel, emissions of carbon dioxide and nitrogen oxides and noise. The reported emissions and resource consumption should be seen in relation to a production increase of 6.9% to 2,651 (2,479) MRTK.

The changes compared with the 1996 Environmental Report are a new structure for reporting development of the aircraft fleet and an index for SAS's aggregate noise impact.

ENVIRONMENTAL BALANCE SHEET

The environmental balance sheet includes only the environmental impact within SAS systems – the suppliers' environmental impact, such as own transports, should be added to the overall picture.

IN	SAS transports	Operation/ use	OUT	Activity	Final treatment/ environmental aspect	Significant environmental impact
Aviation fuel Supplier: – Oil company	– [1]	Flight – Combustion in engine	**Carbon dioxide** **Water vapor** **Carbon dioxide** **Nitrogen oxides**	–	Emissions into air	Greenhouse effect Greenhouse effect Greenhouse effect, low level ozone Greenhouse effect, acidification, low level ozone, depletion of the ozone layer, overfertilization Consumption of non-renewable resources
–	–	– Fuel jettisoning	**Fuel vapor** **– Carbon dioxide** **– Hydrocarbons**	–	Emissions into air (a small portion can reach the ground)	Greenhouse effect Low level ozone
Motor oil, etc. Supplier: – Oil company	From storage to hangar/ramp	Flight – Combustion in engine – Oil drainage (oil mist)	**Carbon dioxide** **Oil aerosols**	– –	Emissions into air Emissions into air	Greenhouse effect Greenhouse effect
–	–	Takeoff and landing	**Noise**	–	–	Disruption

[1] *No transports under SAS management.*

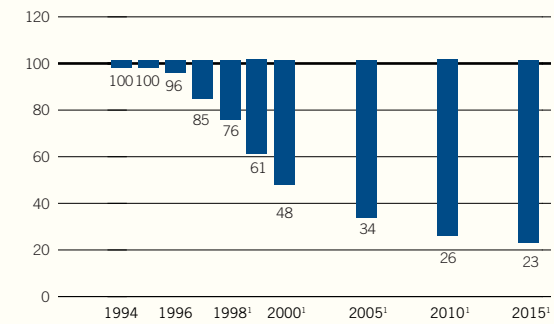
ENVIRONMENTAL INDEX

The ecoefficiency of flight operations is largely equal to that specified in the environmental index for total SAS (see p. 18), of which over 90% comprises fuel consumption and the emissions produced within this area of operation.

NOISE, EMISSIONS INTO THE AIR

Noise index

[1994=100] The lower the index figure, the lower the noise impact.



[1] *Forecast.*

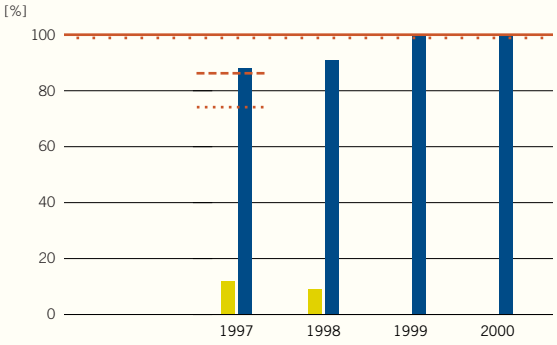
BACKGROUND: The calculation formula used is (with 1997 data reported):

$$\frac{\text{The noise contour for each respective aircraft type [85 dB in takeoff] in km}^2 \text{ x total number of each aircraft type in the SAS aircraft fleet x the number of takeoffs per day for each respective aircraft type}}{\text{Total number of aircraft in the SAS aircraft fleet x the number of takeoffs per day in SAS's traffic network}}$$

The noise index takes into account noise performance for SAS's aircraft types, the number of aircraft of each type in the SAS aircraft fleet and the number of takeoffs per day using these aircraft. In this manner, an index is achieved which should be accurate for flight operations' aggregate noise impact. The base year used is 1994, with an index of 100.

SAS'S DEVELOPMENT: The improvement is attributable to a decreasing number of Chapter II aircraft in the SAS aircraft fleet and the phase-in of SAS's new McDonnell Douglas MD-80, which more than compensates for SAS's expanding aircraft fleet and higher production.

SAS's phase-in of Chapter III aircraft



[number]	1997	1998	1999	2000
Chapter II aircraft	19	16	–	–
Chapter III aircraft	144	158	176	181

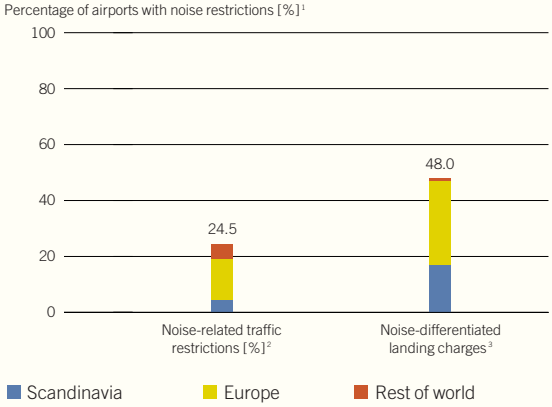
BACKGROUND: Noise levels in the airline industry are controlled by means of the ICAO's certification requirements, supplemented by local traffic restrictions – in SAS's traffic networks for many airports, especially in Europe. As of April 1, 2002 only aircraft with the current certification, Chapter III, will be permitted to fly within the EU. The next generation of certification requirements is expected to reduce noise by a further 2–4 EPNdB for new aircraft.

Development of SAS's aircraft fleet

Aircraft type *Longhaul and cargo*	Fuel consumption [l/ASK]	Max. values under ICAO's certification requirements [g/kN] Nitrogen oxides	 Hydrocarbons	 Carbon dioxide	Noise contour [km²/85 dB(A)][1]	Number of aircraft utilized by SAS in 1997	Planned development 1998	 1999	 2000	 2001
Boeing 747-200BC	0.103[6]	64.3	37.3	99.0	–[2]	**1**				
Boeing 767-300ER	0.038	61.1	3.4	33.3	3.9	**14**				
Total						**15**	**13**	**13**	**14**	**14**
Short and mediumhaul										
Boeing 737-300-QC[4]	0.045	40.3	4.7	72.9	–[2]	**–[4]**				
Boeing 737-600	0.045	35.3[5]	11.8[5]	92.0[5]	1.2[5]	**–**				
Douglas DC-9-21	0.068	57.6	39.5	139.8	–[2]	**4**				
Douglas DC-9-41	0.054	57.6	39.5	139.8	12.1	**3**				
Douglas DC-9-41 [hushkitted]	0.054	57.6	39.5	139.8	–[2]	**20**				
Douglas DC-9-81	0.047	73.4	15.2	41.1	4.7	**8**				
Douglas MD-81[7]	0.045	73.4	15.2	41.1	4.7	**19**				
Douglas MD-82[7]	0.047	73.4	15.2	41.1	5.2	**24**				
Douglas MD-83	0.045	73.4	15.2	41.1	7.9	**2**				
Douglas MD-87	0.047	73.4	15.2	41.1	4.1	**18**				
Douglas MD-90-30	0.041	56.2	0.4	30.6	1.7	**8**				
Fokker F-28	0.063	89.4	8.31	15.0	7.6	**16**				
Total						**122**	**132**	**132**	**135**	**140**
Commuter										
de Havilland Dash 8-400	–[3]	–[3]	–[3]	–[3]	0.5					
Fokker F-50	0.038	–[3]	–[3]	–[3]	0.8	**22**				
Saab 2000	0.051	–[3]	–[3]	–[3]	0.4	**4**				
Total						**26**	**28**	**31**	**32**	**32**
Total fleet						**163**	**173**	**176**	**181**	**186**

[1] *Manufacturer's specification. Relates to takeoff.*
[2] *Data from manufacturer not available.*
[3] *Not subject to certification.*
[4] *On daytime lease from Falcon Aviation.*
[5] *Estimate only.*
[6] *Refers to ATK.*
[7] *Twelve MD-81s were given a higher takeoff weight during the year, which means they can carry more cargo on critical routes. As a consequence of this change, the designation for these aircraft has been changed to MD-82. However, the total number of MD-81s and MD-82s is unchanged.*

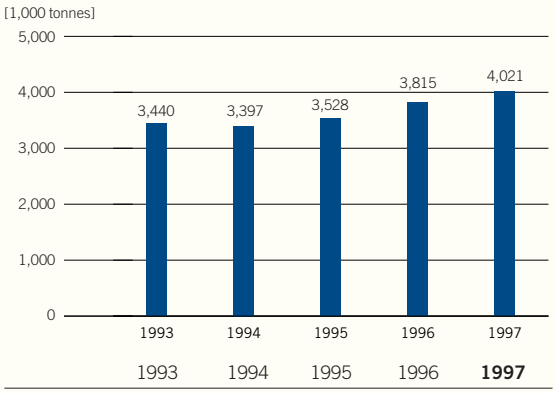
Noise restrictions in SAS's traffic network



[1] *1996 estimate.*
[2] *Ban on operating at certain times of day.*
[3] *Higher for Chapter II than for Chapter III, and/or higher at certain times of day.*

BACKGROUND: Many airports, especially in Europe, already apply noise restrictions of various kinds. In 1997 there was an increased focus on noise charges and more stringent traffic restrictions at several airports, and this development is expected to continue. SAS's policy of utilizing the best available technology, which also leads to low noise levels, results in both reduced costs and increased flexibility in deployment of the aircraft fleet.

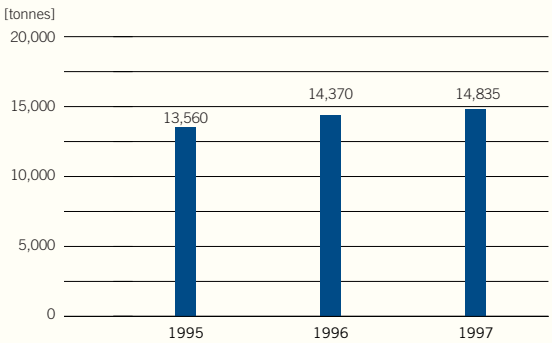
Carbon dioxide (CO_2)



	1993	1994	1995	1996	**1997**
g/RPK	168	180	183	192	**194**
g/RTK	1,619	1,540	1,559	1,540	**1,517**

BACKGROUND: The airline industry's carbon dioxide emissions are estimated based on fuel consumption (3.15 kg carbon dioxide per kg of fuel burnt). Carbon dioxide emissions in the individual countries are subject to national regulations based on the guidelines being reformulated following the climate conference in Kyoto in late 1997. **SAS'S DEVELOPMENT:** SAS works continuously to reduce relative fuel consumption, since fuel is a significant cost item, and carbon dioxide emissions have decreased proportionately. The increase in carbon dioxide emissions per RPK in spite of this is explained by higher fuel consumption in pure cargo traffic, which more than offsets the improved fuel efficiency in passenger traffic – since cargo traffic consumes fuel without carrying passengers and therefore negatively affects all comparisons of fuel consumption per passenger. • As further comparative figures for 1997, 126 g/ASK and 897 g/ATK can also be used. In their respective environmental reports for 1996/97, the figure for British Airways was 800 g/ATK and for KLM 670 g/ATK. The lower values are attributable to the fact that these airlines have younger aircraft fleets and a higher proportion of longhaul flights.

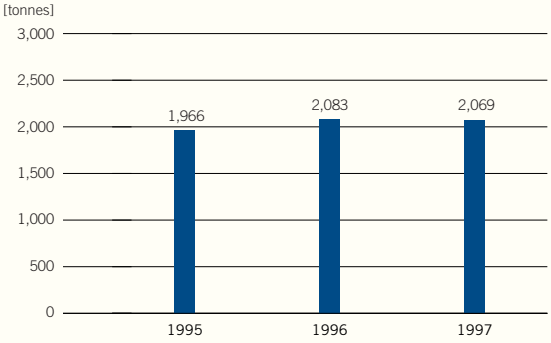
Nitrogen oxides (NO_x)



	1995	1996	**1997**
g/RTK	6.0	5.8	**5.6**

BACKGROUND: The aircraft engines' nitrogen oxide emissions are limited through the ICAO's certification requirements, which are expected to be made more stringent by the year 2000, and are calculated based on distance flown. **SAS'S DEVELOPMENT:** For 1997 SAS's coefficient has been reduced by 0.0005 kg/km – close to 1% – compared with earlier years to 0.0595 kg/km, due to development of the aircraft fleet towards engines with lower nitrogen oxide emissions . This explains why nitrogen oxide emissions have increased at a lower rate than total distance flown – in 1997 GCD 249 (239) Mkm. As of 1998, SAS is phasing in aircraft with engines using double annular combuster (DAC) technology, which will reduce emissions by 40% compared with older aircraft. • As an additional comparative figure for 1997, 3.3 g/ATK can also be used. In their respective environmental reports for 1996/97, the figure for British Airways was 3.1 g/ATK and for KLM 2.4 g/ATK. The lower values are attributable to the fact that these airlines have younger aircraft fleets.

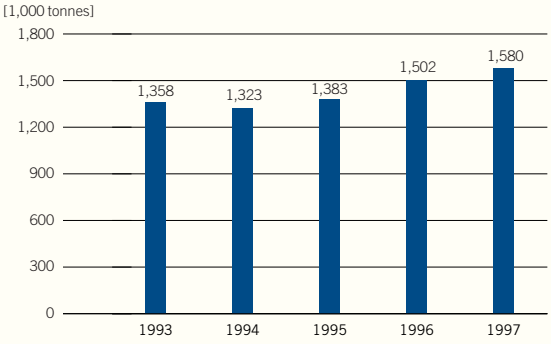
Hydrocarbons (HC)



	1995	1996	**1997**
g/RTK	0.87	0.84	**0.78**

BACKGROUND: The data refers to hydrocarbons (HC), excluding other VOC, on the same scale as in the ICAO's certification. The aircraft engines' hydrocarbon emissions are limited through the ICAO's certification requirements and are estimated on the basis of distance flown. **SAS'S DEVELOPMENT:** SAS's coefficient has been adjusted compared with that used in earlier environmental reports, and 8.7 g/kg is now used for 1995-96 and 8.3 g/km is used for 1997. The values for 1995–96 have thus been significantly reduced compared with those disclosed in earlier environmental reports. The reduction in 1997 is due to development of the aircraft fleet towards engines with lower hydrocarbon emissions, which explains why total emissions of hydrocarbons have been reduced despite an increase in the total distance flown – in 1997 GDC 249 (239) Mkm. The modern aircraft SAS is now phasing in will reduce emissions by more than 90% compared with the older DC-9s. • As an additional comparative figure for 1997, 0.46 g/ATK can also be used. In its environmental report for 1996/97, the figure for British Airways was 0.26 g/ATK. This lower value is attributable to the fact that British Airways has a younger aircraft fleet.

Water vapor (H_2O)



	1993	1994	1995	1996	**1997**
g/RTK	637	606	614	606	**596**

BACKGROUND: Water vapor is formed in proportion to fuel consumption (1,238 kg water vapor per kg of fuel). Vapor condenses under certain conditions, forming the condensation trails that are visible behind the aircraft at high altitudes. Water vapor contributes to the greenhouse effect. **SAS'S DEVELOPMENT:** The increase over the past two years is explained by an increase in fuel consumption in connection with higher production. • As an additional comparative figure for 1997, 352 g/ATK can also be used. In their respective environmental reports for 1996/97, the figure for British Airways was 294 g/ATK and for KLM 219 g/ATK. The lower values are attributable to the fact that these airlines have younger aircraft fleets and a higher proportion of longhaul flights.

Emissions/ATK

[g]	*British Airways*	*KLM*	***SAS***
Carbon dioxide	800	670	**897**
Nitrogen oxides	3.1	2.4	**3.3**
Hydrocarbons	0.26	– [1]	**0.46**
Water vapor	294	219	**352**

[1] *Not reported.*

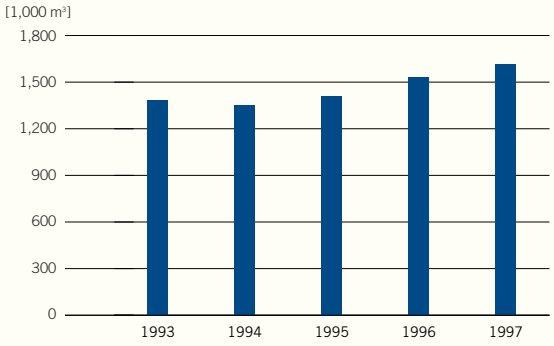
BACKGROUND: The comparative figures for British Airways and KLM come from their environmental reports for 1996/97. Consequently, SAS can not vouch for the quality of this data with the same degree of certainty as for its own data. • The main reason why these airlines can report better statistics is that they have younger aircraft fleets with lower fuel consumption and a higher proportion of longhaul traffic.

ENERGY CONSUMPTION

Fuel efficiency

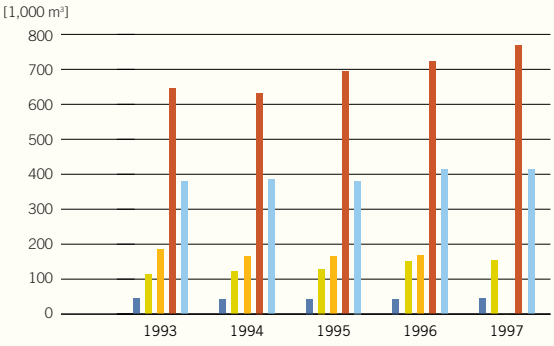
SAS'S DEVELOPMENT: Total fuel consumption has increased more than production in passenger traffic due to increased fuel consumption in cargo traffic, which offsets the relative improvement in passenger traffic.

Fuel consumption · SAS total



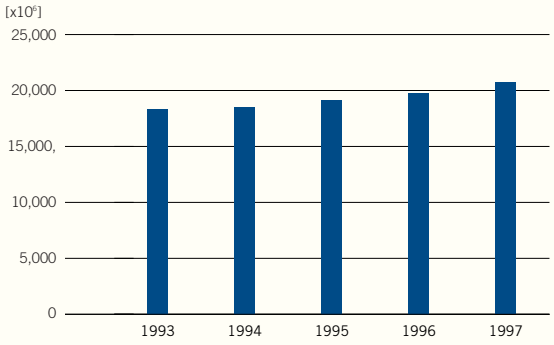
[m³]	1993	1994	1995	1996	**1997**
Total	**1,386,424**	**1,351,027**	**1,411,413**	**1,533,191**	**1,615,683**

Fuel consumption · By business area



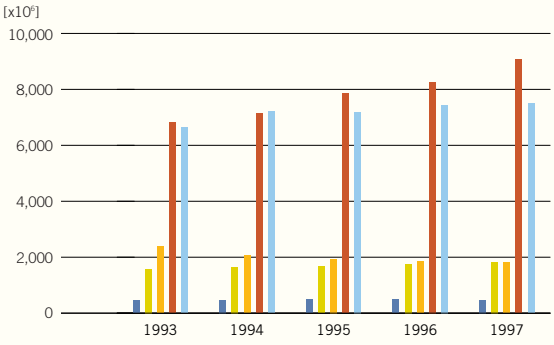
[m³]	1993	1994	1995	1996	**1997**
Denmark	43,879	42,788	43,365	43,107	**44,943**
Norway	112,702	122,861	129,048	149,691	**153,505**
Sweden	184,781	165,357	164,111	166,888	**168,404**
Europe	644,746	632,060	694,276	723,418	**768,510**
Intercont.	379,158	385,035	380,612	412,885	**412,958**

RPK · SAS total



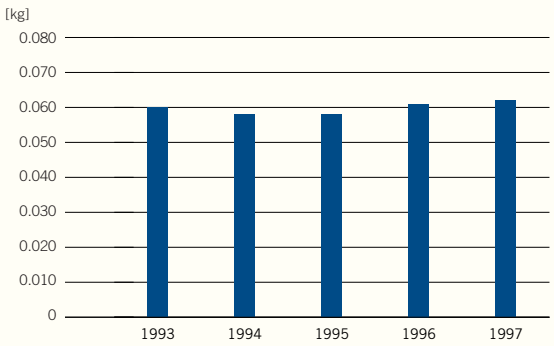
[x106]	1993	1994	1995	1996	**1997**
Total	**18,325**	**18,525**	**19,137**	**19,788**	**20,703**

RPK · By business area



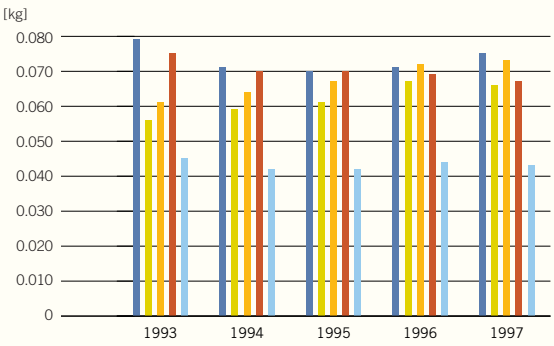
[x106]	1993	1994	1995	1996	**1997**
Denmark	441	475	493	479	**471**
Norway	1,583	1,648	1,660	1,763	**1,832**
Sweden	2,381	2,052	1,938	1,839	**1,819**
Europe	6,811	7,137	7,857	8,266	**9,079**
Intercont.	6,634	7,213	7,189	7,442	**7,502**

Fuel consumption/RPK · SAS total



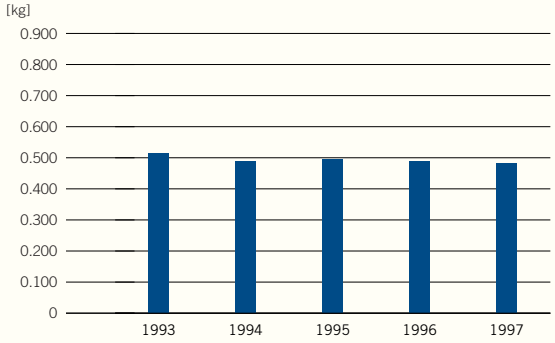
[kg]	1993	1994	1995	1996	**1997**
Total	**0.060**	**0.058**	**0.058**	**0.061**	**0.062**

Fuel consumption/RPK · By business area



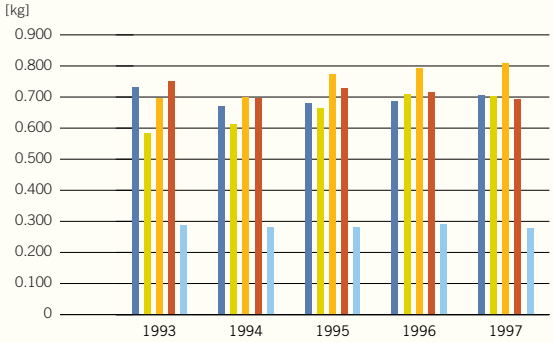
[kg]	1993	1994	1995	1996	**1997**
Denmark	0.079	0.071	0.070	0.071	**0.075**
Norway	0.056	0.059	0.061	0.067	**0.066**
Sweden	0.061	0.064	0.067	0.072	**0.073**
Europe	0.075	0.070	0.070	0.069	**0.067**
Intercont.	0.045	0.042	0.042	0.044	**0.043**

Fuel consumption/RPK · SAS total



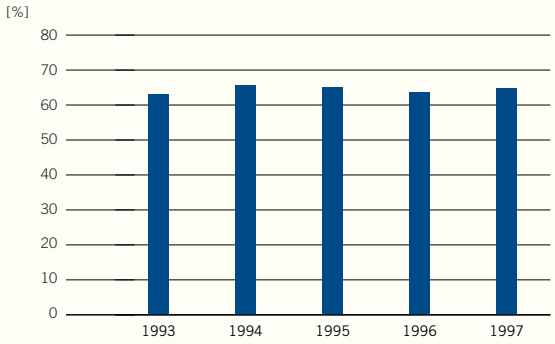
[kg]	1993	1994	1995	1996	**1997**
Total	**0.514**	**0.489**	**0.495**	**0.489**	**0.481**

Fuel consumption/RPK · By business area



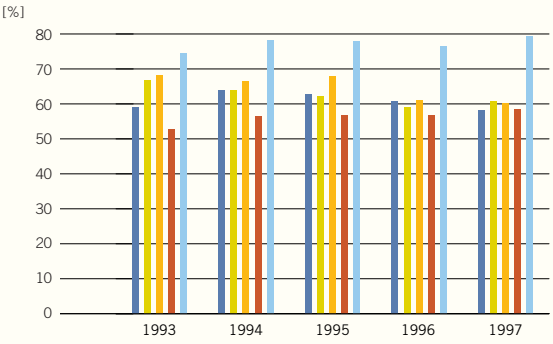
[kg]	1993	1994	1995	1996	**1997**
Denmark	0.732	0.671	0.682	0.687	**0.705**
Norway	0.583	0.614	0.665	0.709	**0.702**
Sweden	0.697	0.699	0.774	0.793	**0.810**
Europe	0.752	0.698	0.730	0.715	**0.694**
Intercont.	0.287	0.283	0.280	0.292	**0.278**

Cabin factor · SAS total



[%]	1993	1994	1995	1996	**1997**
Total	**63.2**	**65.5**	**65.0**	**63.6**	**64.9**

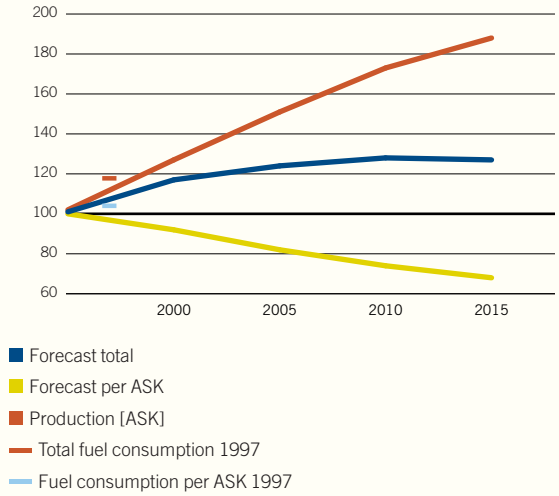
Cabin factor · By business area



[%]	1993	1994	1995	1996	**1997**
Denmark	59.1	63.9	62.7	60.9	**58.2**
Norway	66.8	63.8	62.1	59.2	**60.9**
Sweden	68.1	66.4	67.9	61.1	**60.2**
Europe	52.7	56.6	56.7	56.9	**58.5**
Intercont.	74.6	78.1	77.8	76.5	**79.4**

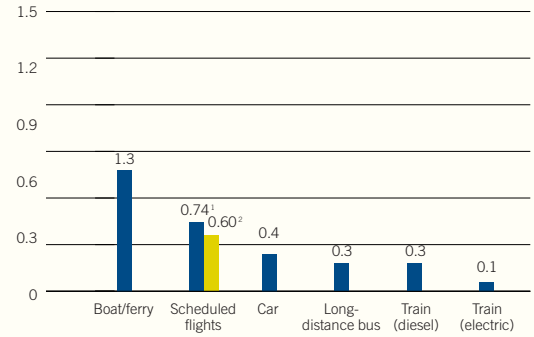
Fuel consumption and production · Forecast 1997

[index 1994=100] Short and mediumhaul flights



Comparison of various types of transport

[kWh/passenger kilometer]



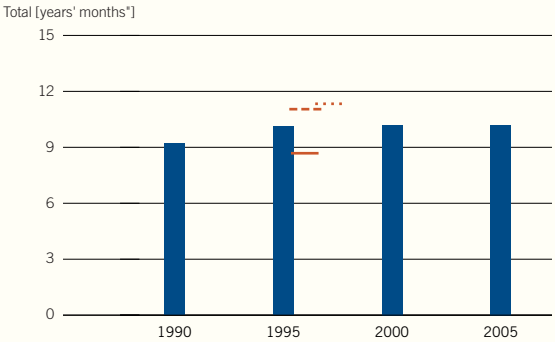
[1] *SAS total 1997.*

[2] *SAS's new short and mediumhaul McDonnell Douglas MD-90-30 in SAS's version and with SAS's cabin factor for 1997.*

Source: The Central Norwegian Statistics Agency (SSB), Bellona 1997

OTHER INFORMATION

Average age of fleet



[years' months"]	1990	1995	2000[1]	2005[2]
Total	**9' 2"**	**10' 1"**	**10' 2"**	**10' 2"**

SAS 1997: 11'5"
AEA 1997: 8' 8"
IATA 1996: 11' 4"

[1] *Planned development.*
[2] *Forecast.*

Fuel jettisoning

Ten of SAS's fourteen Boeing 767s are equipped with a system for jettisoning of fuel in the event of an emergency, so that the aircraft's weight can be more rapidly reduced to the permitted landing weight (the other four aircraft were purchased before this technology was available). The regulations for such jettisoning of fuel require that it is carried out over nonresidential areas and above a certain altitude, so that only a small percentage of the fuel reaches the ground in such a situation – and, moreover, in concentrations as low as a few hundredths of a gram per square meter. SAS had no need to use this emergency system in 1997.

PROJECTS

Development of the aircraft fleet

The measures with the greatest potential for influencing SAS's environmental impact are those connected with development of the aircraft fleet. A special department in SAS is responsible for ensuring that the aircraft fulfill not only safety and commercial requirements, but also environmental requirements. After completing the purchase of SAS's new mediumhaul aircraft (MD-90) and the next short and mediumhaul aircraft (Boeing 737-600), both of which show environmental data that are among the best in the industry, and a new commuter aircraft (de Havilland Dash 8-400), SAS has now embarked on preliminary studies prior to the purchase of the next generation of longhaul aircraft (a decision is expectedto be made during 1998).

Quieter aircraft

SAS is working on modification of maneuvering capabilities in the MD-80 fleet which will enable noise restrictions for approach and climb-out to be followed with greater precision. By doing so, SAS expects to be able to achieve quieter flights at certain airports.

Cabin operations

Although cabin operations are generally less significant for SAS's total environmental impact than flight operations, this is the aspect our customers and cabin staff have the most tangible contact with.

The significant environmental impact in cabin operations consist of waste in the form of paper, aluminum, glass, plastic and organic waste. Furthermore, the weight of the items served and sold on board leads to increased fuel consumption and therefore also emissions of carbon dioxide, hydrocarbons and nitrogen oxides. The reported emissions and resource consumption should be compared with a production increase of 1% to 12,624 (12,498) million meals served on board flights within and from Scandinavia.

The changes compared with the preceding year's environmental report are a more complete and easy-to-grasp account of waste in the various fractions and the recycling rate, also reported in relation to the production volume in the area of operation.

ENVIRONMENTAL BALANCE SHEET

The environmental balance sheet includes only environmental impact within SAS systems – the suppliers' environmental impact, such as own transports, should be added to the overall picture.

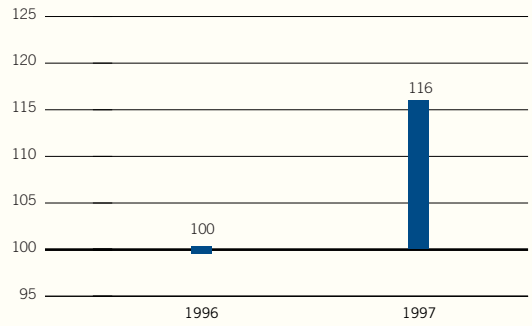
IN	SAS transports	Operation/ use	OUT	Activity	Final treatment/ environmental aspect	Significant environmental impact
Food (incl. packaging) Supplier: – Catering companies	–[3]	Consumption	**Organic waste (leftover food)** **Packaging:** – Paper – Plastic – Aluminum	Pre-sorting (partly) Transports	Burning/ energy extraction, Deposition	Greenhouse effect, acidification, low level ozone, use of land, overfertilization
Beverages (incl. packaging) Supplier: – Dairies – Breweries – Wine & spirits importers	–[3]	Consumption	**Packaging, unopened beverages** – Glass – Plastic – Cardboard – Aluminum	Pre-sorting (partly) Transports	Burning/ energy extraction Deposition Reuse Recycling	Greenhouse effect, acidification, low level ozone, overfertilization, use of land
Disposables Misc. suppliers	–[3]	Cabin service	**Waste** – Plastic – Paper – Cotton – Aluminum	Pre-sorting Transports	Burning/ energy extraction Deposition	Greenhouse effect, acidification, low level ozone, use of land, overfertilization
Semi-disposable articles – Plastic and textile producers – Tableware manufacturers – Packaging suppliers	–[3]	Cabin service	**Used semi-disposable articles** – Porcelain – Melamine plastic – Glass – Stainless steel – Cotton	Washing/ laundering	Reuse	Water consumption, contamination of water and land, overfertilization
Goods for sale Misc. suppliers	From storage to aircraft	Sales to customers	**Sold goods** **Unsold articles**	[1] Transport to storage Repackaging	[1] Return to sales	[1]
Magazines/ newspapers Supplier: – Publishers/ distributors	From transit warehouse to aircraft/ lounges	Cabin service	**Paper waste**	Sorting	Reuse Recycling Burning/ energy extraction Deposition	Greenhouse effect, acidification, low level ozone, use of land
Chlorinated water Supplier: – Municipal water treatment plants – Chlorine supplier	From storage to aircraft	Consumption – In lavatories – In aircraft kitchens	**Waste water**	Drainage Transport	Municipal waste water treatment	–
Germicides[2] From supplier	From filling site to aircraft	Added to sanitizing fluid in lavatories	**Lavatory waste**	Drainage Transport	Municipal waste water treatment	–

[1] *Depending on customer handling*
[2] *Antibacterial and antiviral substance*
[3] *No transports under SAS's management*

Responsibility/concession of airport operator

ENVIRONMENTAL INDEX

[1996=100]
The higher the index figure, the better the resource consumption and the smaller the relative environmental impact.



The environmental productivity index for cabin operations expresses resource consumption in relation to production, thereby indicating the operations' ecoefficiency. The formula used is (with 1997 data):

$$\frac{\text{12,624,000 meals produced}^{3} + \text{20,797,000 passengers}^{1}}{\begin{array}{c}(\text{1,204,000 kg packaging}^{1} - \text{30,500 kg collected aluminum}) + \\ \text{4,362,000 kg loaded magazines/newspapers}^{1} - \\ \text{1,573,000 kg collected magazines/newspapers}^{2}) + \\ (\text{5,979,000 kg catering waste}^{3} - \text{1,408,000 kg recycled}) + \\ (\text{5,321,000 kg cleaning waste}^{2} - \text{1,437,000 kg recycled}) + \\ \text{162,224 m}^{3}\text{ water consumption in catering} + \\ \text{30,085 x10 MWh of energy consumption in catering}\end{array}}$$

[1] *Throughout the traffic network.*
[2] *Scandinavia only.*
[3] *Copenhagen, Oslo and Stockholm only.*

By giving a higher weighting to production and a lower weighting to aluminum recovery and resource consumption than other measures of resource consumption and waste, a weighting is achieved for waste, recycling and water and energy consumption which should be accurate for cabin operations' aggregate environmental impact. The base year used is 1996, with an index of 100.

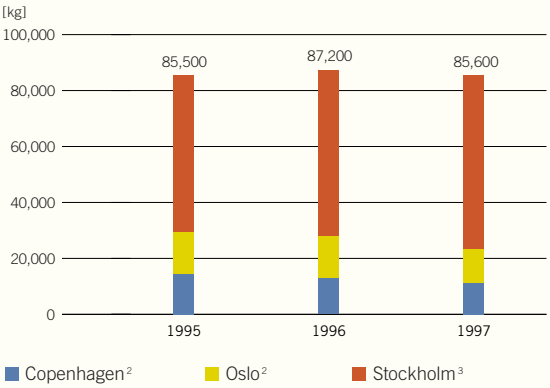
The improvement in 1997 is explained by a recycling rate which increased while waste volumes decreased in certain areas, which more than compensates for the increase in water consumption.

EMISSIONS INTO WATER

Germicides[1]

Consumption

[kg]



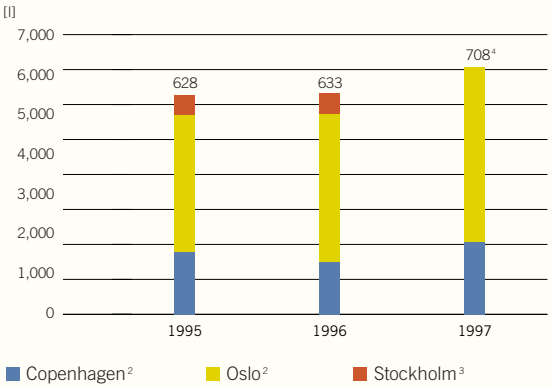
[1] *Handled by SAS in Copenhagen and Oslo (quadrivalent ammonia compound) and by the Swedish Civil Aviation Administration in Stockholm (sodium hydroximethane sulfonate).*
[2] *SAS's own consumption and SAS's deliveries to other airlines.*
[3] *The volume SAS purchases from the Swedish Civil Aviation Administration at Arlanda Airport.*

BACKGROUND: Germicides are added to sanitizing fluid in aircraft lavatories to minimize the risk of infection among both the passengers and staff. The concentration of active ingredients is optimized so that on one hand it has an antibacterial and antiviral effect on the lavatory waste, while on the other hand it eliminates this effect after several dilutions in order to protect the bacterial flora in the waste treatment plants.

Chlorine[1]

Consumption

[l]



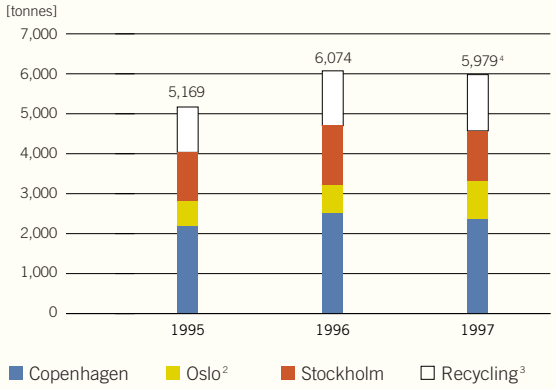
[1] *Chlorine compounds (sodium hypochlorite in a maximum concentration of 3 mg/l, depending on the existing chlorine content in the municipal water at the respective filling sites), – a certain dilution may also take place when filling the aircraft and through normal decomposition of the hydrochlorite).*
[2] *SAS's own consumption and SAS's deliveries to other airlines.*
[3] *The volume SAS purchases from the Swedish Civil Aviation Administration at Arlanda Airport.*
[4] *Due to disruptions in operating routines in Stockholm, during which the Swedish Civil Aviation Administration discontinued deliveries for an extended period and SAS was forced to temporarily take over filling of chlorine, it is impossible to provide data from Stockholm for 1997. During 1998 SAS will set up its own stocks at Arlanda Airport.*

BACKGROUND: Although the water on board the aircraft is classified as drinkable, it is essentially used for washing, dishwashing and brewing of coffee. In order to prevent spreading of water-borne diseases, the water is disinfected by adding a chlorine compound before being pumped into the aircraft. The unused water in the tanks is drained directly into the municipal drains at SAS bases during longer ground stays.

WASTE

Catering[1]

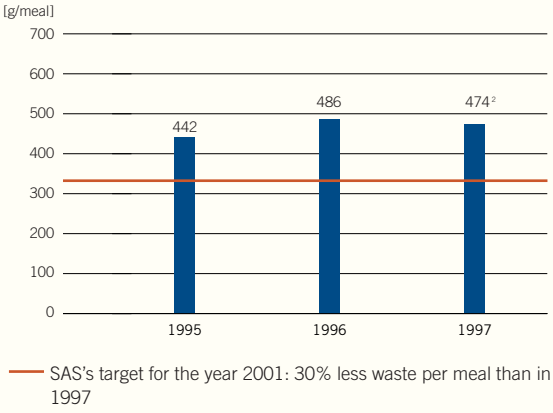
Total cabin operations



[1] *Refers to waste collected by SAS's catering supplier, estimated on the basis of data on SAS's share in its total volume of waste. Since a new calculation was made in 1997, the annual data has been adjusted retroactively to achieve comparability with earlier environmental reports.*
[2] *Excl. paper.*
[3] *Incl. magazines/newspapers.*
[4] *Since a new basis for calculation was used in 1997, the figures for the different years are not directly comparable.*

SAS'S DEVELOPMENT: The waste volumes from catering are largely unchanged despite an increase in production. The recycling rate, including magazines/newspapers, is unchanged at approx. 23%.

Per meal served[1]

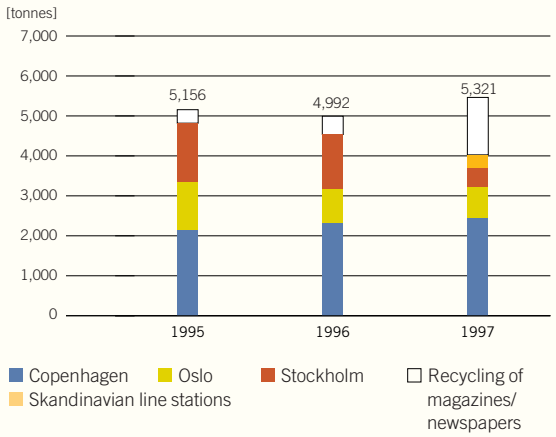


[1] *The meals SAS's receives from its suppliers in Copenhagen, Oslo and Stockholm.*
[2] *New grounds for calculation were used in 1997, which means that the figures for the different years are not directly comparable.*

SAS'S DEVELOPMENT: The figures include recycled waste, which has risen in proportion over the years. In 1998 SAS is taking a number of measures to significantly reduce catering waste per meal.

Aircraft cleaning[1]

Total cabin operations

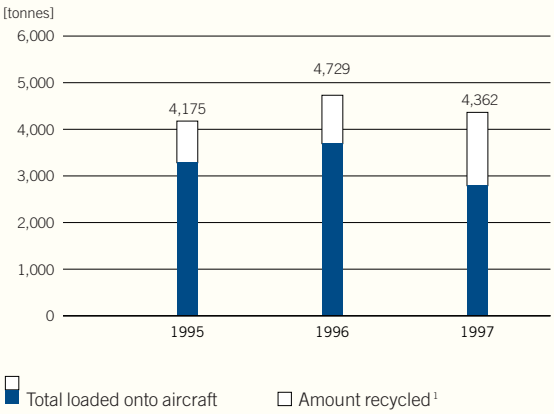


[1] *Refers to waste collected by SAS or SAS's supplier when cleaning the aircraft.*

SAS'S DEVELOPMENT: The increase in waste volumes from aircraft cleaning in 1997 is attributable to increased collection of magazines/newspapers on Swedish and Norwegian international routes. In Oslo and Stockholm, a total of 941 (457) tonnes of magazines/newspapers were collected for recycling. In Copenhagen magazine/newspaper collection will be started in 1998.

Magazines/newspapers

Total cabin operations

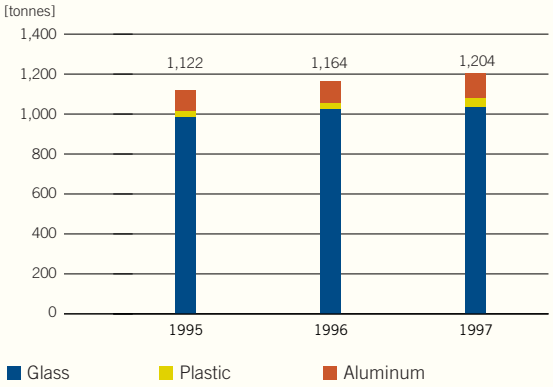


[1] *1997 including a certain proportion of other types of paper.*

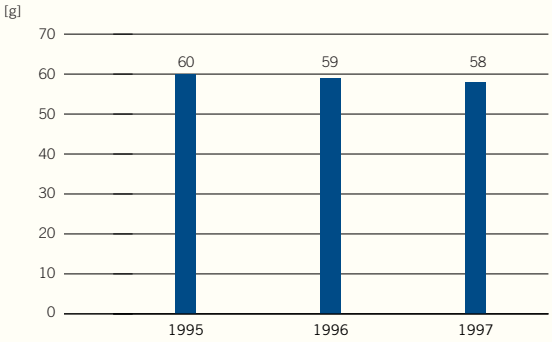
SAS'S DEVELOPMENT: In total, an average of 212 (239) g of magazines/newspapers per passenger were loaded on board SAS flights in 1997. The recycling rate was 36 (22)%, which is explained by a certain proportion of other types of paper. Recycling of magazines/newspapers is expected to increase when Copenhagen also starts collection in 1998.

Packaging

Total cabin operations



Per passenger

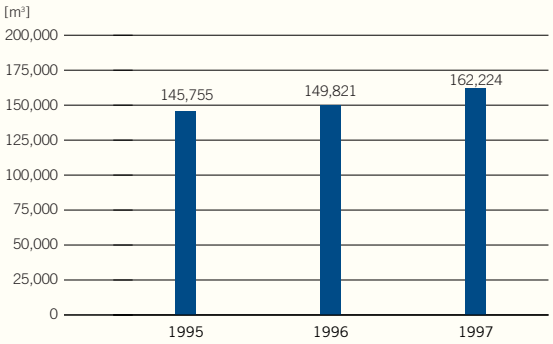


SAS'S DEVELOPMENT: Of the total amount of packaging loaded onto SAS flights, 2.5 (2.8)% is recycled. Collection of aluminum packaging on domestic routes for recycling is carried out in Norway (statutory) and in Sweden (aluminum beverage packaging is prohibited in Denmark). In Norway 18.5 tonnes of aluminum were collected, and in Sweden 12 tonnes during 1997. In Norway this represents a collection rate of 87% (72%) for aluminum, which means that SAS is nearing the target of 90% which is contracted with the authorities. In Sweden this meant that the collection rate for aluminum decreased to 55% (65%). The Swedish public's recycling rate for aluminum beverage containers, 92%, can be used as a reference level.

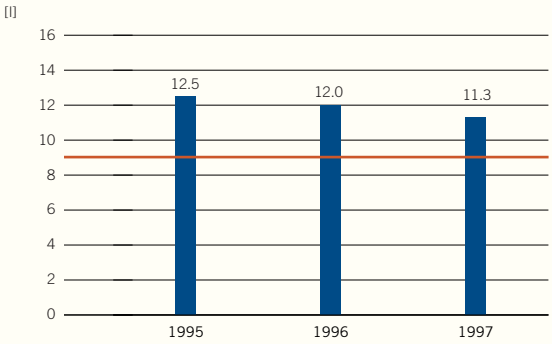
CONSUMPTION OF RAW MATERIALS

Water

Total catering



Per meal served [1]



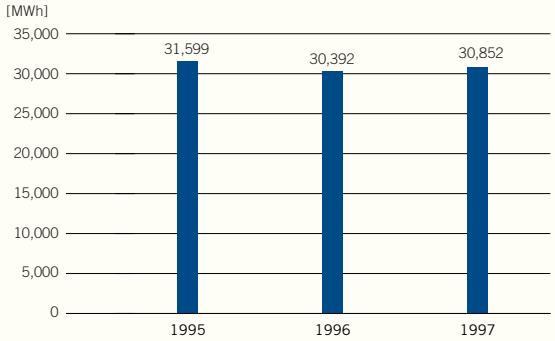
[1] *The meals SAS receives from its suppliers in Copenhagen, Oslo and Stockholm.*

SAS'S DEVELOPMENT: The increase in water consumption in catering operations is attributable to the fact that SAS's routes in northern Norway changed over from serving meals on board with disposable materials to semi-disposable materials which are washed for reuse. Furthermore, an increase in water consumption was noted in one dishwasher, which will be more closely examined.

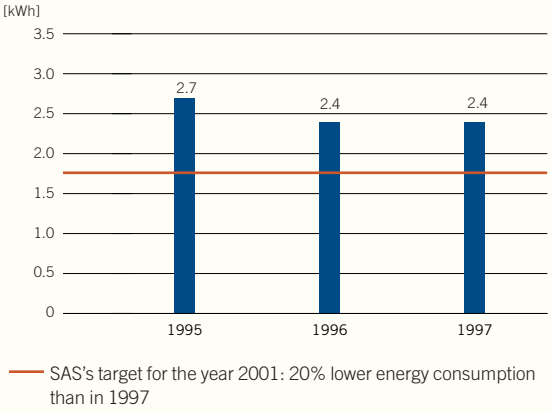
ENERGY CONSUMPTION

Electricity, gas and heating

Total catering



Per meal served [1]



[1] *The meals SAS receives from its suppliers in Copenhagen, Oslo and Stockholm.*

SAS'S DEVELOPMENT: That energy consumption in catering operations did not continue to decrease in 1997 is attributable to the fact that SAS's routes in northern Norway changed over from serving meals on board with disposable materials to semi-disposable materials which are washed for reuse, as well as increased consumption in dishwashers.

PROJECTS

Environmental projects – Overview

Environmental projects in collaboration between SAS and suppliers

[number of projects]	*Energy*	*Water*	*Waste*	*Air*	*Noise*
Food	22	23	24	22	
Beverages	22	22	22	22	
Packaging	42	24	45	26	
Transports	15	13	13	16	12
Equipment	15	14	16	13	13
Materials	28	20	34	25	
Magazines/ newspapers	17	15	18	16	
Chemicals	14	15	18	17	

In 1997 a total of 84 environmentally related projects were conducted in collaboration between SAS and suppliers. (Many projects are included in several of the preceding cells, since they have an impact on several environmental areas.)

Environmental projects at suppliers due to agreement with SAS

[number of projects]	*Energy*	*Water*	*Waste*	*Air*	*Noise*
Reported	49	32	83	39	20

In 1997 a total of 223 environmentally related projects had been reported by SAS's suppliers as a result of their agreements with SAS. (Many projects are included in several of the above cells, since they have an impact on several environmental areas.)

Gate buffet

In 1996 meal service via a gate buffet was introduced at three Swedish domestic stations. Instead of being served meals on board, the passengers select food and beverages from a buffet at the entrance to the aircraft and take it with them on board. The advantages are the opportunity to offer a wider selection of food and beverages, with greater freedom of choice for the passengers and reduced waste in the form of leftover goods. The less food, beverages, packaging and equipment that must be loaded onto the aircraft, the lower the fuel consumption and emissions. In 1997 the preliminary trials were extended to additional Scandinavian domestic and intra-Scandinavian routes. This resulted in a waste reduction of up to 40% on the routes included in the trials, and a corresponding reduction has been achieved at the purchasing stage.

SAS Express

In 1996 meal service in the form of a gate café was introduced for EuroClass passengers on the Oslo–Stockholm–Oslo route. The passengers are provided with a wider selection of food and beverages than on board, waste volumes are reduced and the aircraft's takeoff weight is decreased, resulting in lower fuel consumption and emissions. In 1997 this concept was extended to the Copenhagen–Stockholm route.

Pre-sorting on board

In 1996 development of a special pre-sorting cart for service on board was started and a prototype was tested on Norwegian domestic flights in 1997. In assessing of these trials, pre-sorting in the waste collection cart was given a positive evaluation by the cabin crew. The trials will therefore be extended in 1998 to include Swedish domestic flights. A modified waste collection cart is under production and will be in service in early 1998. Collection of aluminum cans on Norwegian domestic routes increased from 72% to 87%, but decreased on Swedish domestic routes from 65% to 55%. The goal is for the new cart to result in a higher collection rate.

Environmentally adapted packaging

In 1997 development of environmentally adapted packaging in cabin operations continued. The objective is to develop products and packages of a single environmentally adapted and recyclable material, unlike earlier composite materials of plastic and aluminum which are both more difficult and more expensive to recycle, and to increase the recycling rate. The new packages are also more lightweight, and therefore reduce both raw material consumption and fuel consumption/emissions. One example is an agreement with six major wine distributors to eliminate the sleeves on the necks of their wine bottles, which contain plastic, aluminum, a pewter alloy and a dye which contains toxic substances. Another example is the new aluminum-free coffee packages, which are expected to reduce SAS's packaging and transport costs by more than 15% at the same time that the environmental impact is reduced at both the production and disposal stages.

Environmental labeling of magazines/newspapers

In 1997 SAS initiated environmental labeling with the Nordic Swan on several of the magazines/newspapers distributed on board, such as the Swedish daily newspapers Expressen, Göteborgs-Posten, Aftonbladet, Dagens Nyheter and Svenska Dagbladet. Environmental labeling includes the entire production chain from editorial work to the printing process and choice of paper.

Environmental foundation

In association with Coca-Cola, as of 1997 SAS manages a foundation which administrates a fund for improved water quality in the Nordic and Baltic region, the SAS/Coca-Cola Environmental Foundation. The fund will award its first grant during 1998.

Ground operations

Like cabin operations, ground operations are less significant than flight operations for SAS's aggregate environmental impact. However, they are of major importance for the airports' local environment, the local community and the work environment for SAS's employees.

The main impact in ground operations is caused by emissions in the form of carbon dioxide, nitrogen oxides and hydrocarbons from the vehicles SAS uses for transports both within and to/from the airports, as well as the related consumption of non-renewable fuel. Other significant impact factors in ground operations are consumption of glycol in deicing of the aircraft, hazardous waste and consumption of chemicals in the maintenance workshops, emissions of sulfur dioxide, carbon dioxide and nitrogen oxides from the heating plants, water and energy consumption and office waste. The reported emissions and resource consumption data should be seen in light of a 4% production increase to 20.6 (19.8) million passengers and expansion of the aircraft fleet with two new aircraft since 1996.

The change compared with last year's environmental report is the addition of data on SAS's consumption of solvents in ground operations.

ENVIRONMENTAL BALANCE SHEET

The environmental balance sheet includes only environmental impact within SAS systems – the suppliers' environmental impact, such as own transports, should be added to the overall picture.

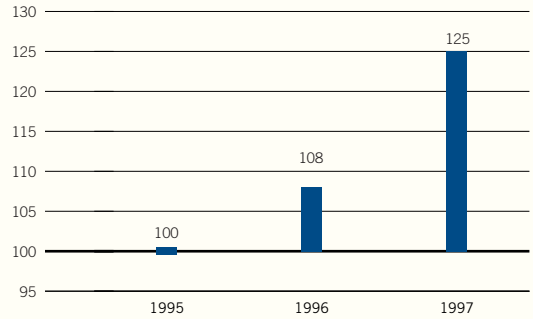
IN	SAS transports	Operation/use	OUT	Activity	Final treatment/ environmental aspect	Significant environmental impact
Glycol From supplier	From storage to aircraft	Deicing of aircraft	**Spillage**	Collection Transport Leakage	Reuse	Overfertilization
Urea/acetate From supplier	–[1]	Deicing of takeoff and landing strips	**Spillage**	Collection (limited) Transport	Emissions into soil and water	Overfertilization
Water From supplier – Municipal waste water treatment plant	–[1]	Washing of aircraft/vehicles Extinguishing of fires Transport of organic waste	**Waste water**	Drainage into municipal waste water Drainage into own drains with separator	Municipal waste water treatment Drainage of own separators (to hazardous waste)	Contamination of water Contamination of water
Halons From own storage	Between stations and from storage to aircraft	Extinguishing of fires on board	**Halons** (consumption)	–	Emission into air	Depletion of the ozone layer, greenhouse effect
Freon[2] From supplier	–[1]	Air conditioning Cooling of machinery	**Freon** (leakage)	–	Emission into air	Depletion of the ozone layer
Maintenance materials • **Components, etc.** • **Chemicals** Misc. suppliers	From storage to place of use	Maintenance of aircraft, machinery, vehicles, equipment, buildings and land	**Special waste**	Pre-sorting (predominant) Transports	Recycling Reuse Destruction Burning Deposition Treatment Emissions	Greenhouse effect, acidification, overfertilization, contamination of soil and water, noise
Energy • **Oil** • **Gasoline, diesel** • **Biofuels** • **Gas** • **LPG gas** • **Electricity**	–[1]	Fuel Heating Cooling Electricity	**Sulfur dioxide** **Carbon dioxide** **Hydrocarbons** **Nitrogen oxides** **Soot/particles**	–	Emissions into air	Greenhouse effect low level ozone, acidification, overfertilization
Office supplies Misc. suppliers	–[1]	Administration	**Waste**	Transport	Recycling Burning Destruction Deposition	Greenhouse effect, contamination of soil and water

[1] *No transports under SAS's management*
[2] *These are being phased out*

Responsibility/concession of airport operator (for water, in Oslo and Stockholm only).

ENVIRONMENTAL INDEX

[1995=100]
The higher the index figure, the better the resource utilization and the lawer the relative environmental impact.



Ground operations' environmental productivity index expresses hazardous waste and resource consumption in relation to production, thereby indicating the operations' ecoefficiency. The formula used is (1997 data in brackets):

$$\frac{\text{Number of takeoffs and landings (320,410) + passengers x10}^3\text{ (20,797) + tonnes of cargo and mail (3,044,617)}}{\text{MWh of energy for electricity and heating (194,248) + m}^3\text{ water (200,928) + kg hazardous waste}^1\text{ (134,703) + m}^3\text{ of fuel for ground vehicles (5,731)}}$$

[1] *Incl. oil and oil sludge, which is changed/drained periodically and is not representative of the successive trend.*

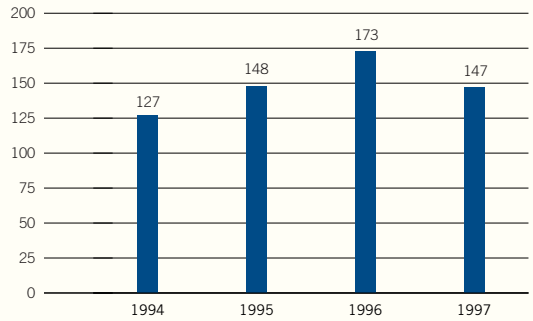
By giving a higher weighting to cargo operations and a lower weighting to passenger traffic and fuel consumption for ground vehicles than other measures of resource consumption, waste and production, a weighting is achieved which should be accurate for ground operations' aggregate environmental impact. The base year used is 1995, with an index of 100.

The improvement, particularly in 1997, is attributable to reduced volumes of hazardous waste and lower energy and water consumption, which more than offset the increase in fuel consumption and production, in the environmental index primarily cargo and mail.

NOISE

Engine tests [1]

[number]



BACKGROUND: Engine tests involve running the aircraft engines with varying thrust, to ensure correct functioning after maintenance. The periods with full engine thrust comprise only a small proportion of the tests, normally a maximum of 4–5 minutes, for example in a 30-minute test sequence. All the engine tests are carried out in special, noise-protected locations. The tests reported are only those carried out in conjunction with engine replacement. Corresponding tests also take place in connection with engine repair and maintenance. **SAS'S DEVELOPMENT:** After an increase 1996, due to the fact that SAS carried out a large number of engine replacements between different aircraft in the MD-80 fleet, the number is once again down to a normal level in relation to production.

[1] *Tests after engine replacement only.*

EMISSIONS INTO SOIL

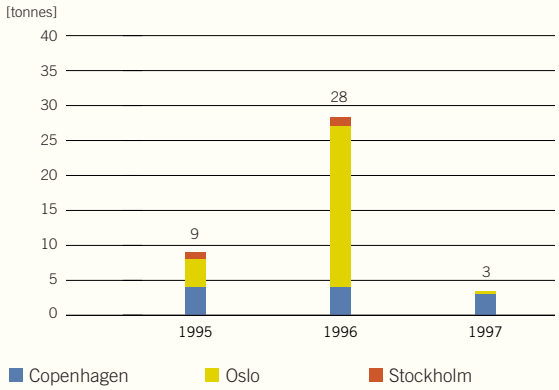
Infringements and incidents

Infringements and incidents in SAS's operations are described in the Board of Directors' Environmental Report on p. 10.

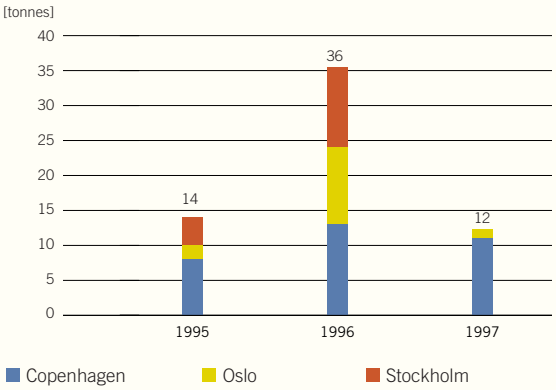
EMISSIONS INTO AIR

Heating production

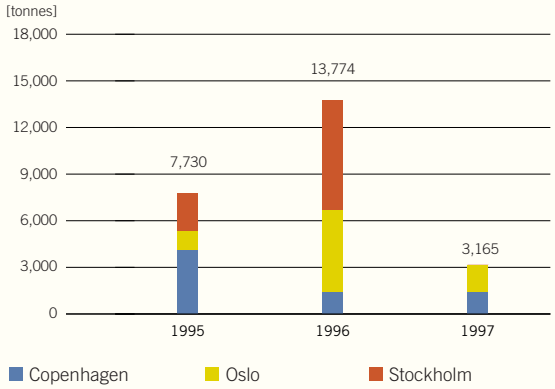
Sulfur dioxide



Nitrogen oxides



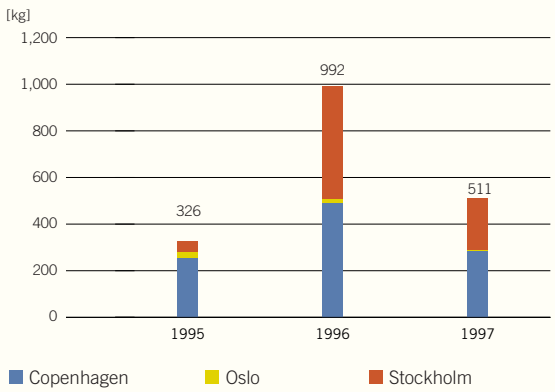
Carbon dioxide



SAS' DEVELOPMENT: Since 1996 SAS has increased the proportion of district heating in Copenhagen, which has resulted in a massive reduction in carbon dioxide emissions. • The maximum emissions in Oslo (oil-firing) are regulated by concessions. After an increase in emissions in Oslo during 1996, caused by a shortage of electricity in Norway which forced SAS to increase the proportion of oil-firing in heating production, emissions are once again down to normal, reduced levels. Oslo's new Gardermoen Airport will utilize biofuel-fired district heating from the day it opens in autumn 1998. • SAS's head office in Stockholm is supplied by a geothermal heating installation which contributed 9,489 MWh in 1997 (77% of the total consumption). This technique supplies energy at a 40% lower cost than district heating and operation of air conditioning installations. • In 1997 SAS at Arlanda Airport changed over to district heating from a new biofuel-fired heating plant, after which carbon dioxide emissions (and thereby also contribution to the greenhouse effect) from heating production were eliminated entirely.

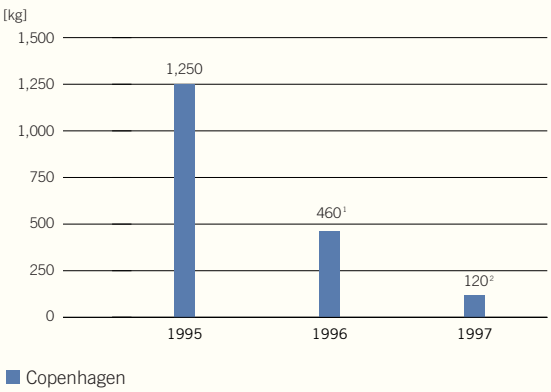
CFC, halons

Consumption of CFC



SAS'S DEVELOPMENT: Freons that contain CFC (air conditioning) are being phased out. The reported consumption is caused by normal leakage during maintenance.

Consumption of halons



[1] *Includes 126 kg from other airlines.*
[2] *Includes 93 kg from other airlines.*

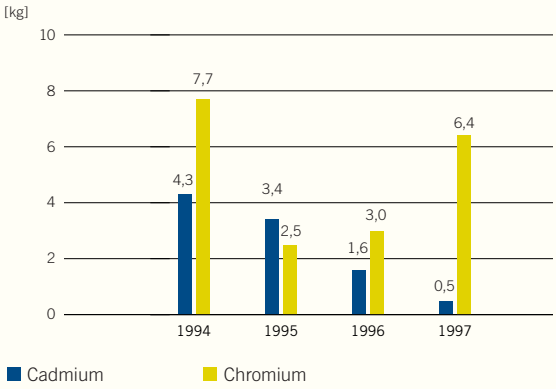
BACKGROUND: The airlines' use of halons for emergency procedures such as extinguishing of fires on board aircraft and in engines are subject to a exception from the Montreal Protocol's general ban on use of halons. **SAS'S DEVELOPMENT:** In Copenhagen SAS has a halon recovery facility that serves SAS as well as 15 other airlines. The facility recovered 853 kg in 1997. SAS's stores of halons amounted to approx. 4,500 kg at year-end. • SAS has otherwise phased out all use of halons in ground operations, with the exception of 15 kg for extinguishing fires in three ground vehicles (these are also being phased out).

Installed volume

1997 [kg]	*Freon R12, R22*	*Freon R134, R502*	*Halons 1301, 1211*
Copenhagen	2,482	86	
Oslo	290	–	15
Stockholm	1,187	121	–
Total	**3,959**	**207**	**15**

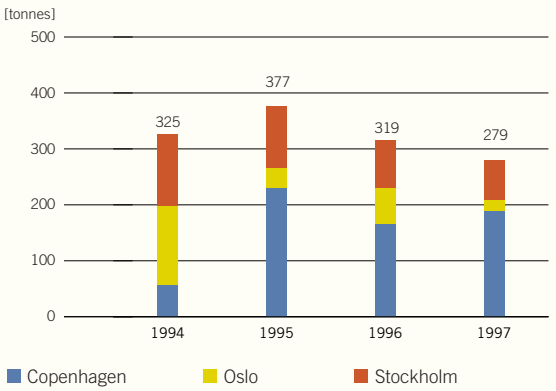
EMISSIONS INTO WATER

Heavy metals



BACKGROUND: SAS's emissions of heavy metals are primarily caused by the air pollutants which adhere to the aircraft during flights and which are then rinsed off in washing of the aircraft and in the electroplating workshop. The maximum permitted emissions are regulated by concessions. **SAS'S DEVELOPMENT:** The higher figure for chromium emissions in 1997 is attributable to Copenhagen, and is presumably due to uncertainty in the measurement method (random measurements taken by the airport operator), which will therefore be changed. • In 1998 SAS will close the water system in the surface treatment workshop at the new Gardermoen Airport in Oslo so that a large share of the water is reused, and will open a new cleaning plant. • A treatment plant for processing water is being built in Stockholm during 1998, and will be taken into operation in spring 1999. These measures will further reduce SAS's emissions of heavy metals.

Oil, oil emulsions



BACKGROUND: All installations are equipped with cleaning plants and/or oil and gasoline separators. Oil tanks and oil separators are inspected yearly to prevent leakage, etc. In Copenhagen the airport operator is responsible for measurement and reporting of data. **SAS'S DEVELOPMENT:** The reported volume changes may depend on whether emptying took place before or after year-end. All oil residues are disposed of by environmentally approved subcontractors.

WASTE

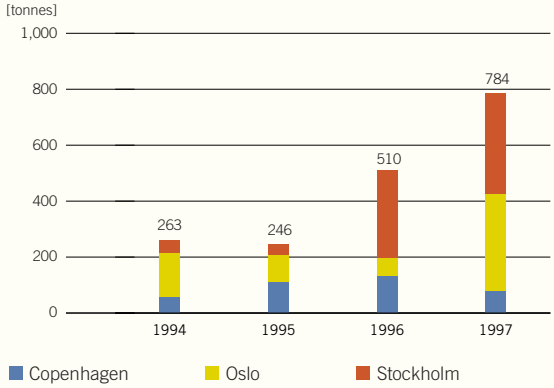
Hazardous waste

[tonnes]	1995	1996	**1997**
Oil/oil sludge	377.0	319.3	**277.0**
Oily waste water	214	161	**185**
Waste oil	57.6	73.1	**65.9**
Waste containing oil	33.4	23.3	**19.4**
Solvents without halogens	11.8	15.8	**7.1**
Solvents with halogens	2.1	2.7	**2.8**
Paint, lacquers, other organic solvents	22.0	25.3	**19.5**
Alodin solvent (contains heavy metals)	4.6	3.8	**1.7**
Acids	0.2	5.4	**0.1**
Alkalis	0,715	2.0	**2.8**
Waste containing heavy metals (sludge)	4.8	0.9	**0.8**
Waste from brake maintenance[2]	4.6	3.7	**7.7**
Waste containing cyanide	2.3	3.8	**6.5**
Waste containing asbestos[2]	–[1]	1.0	**–**
Waste containing mercury	0.002	0.001	**0.196**
Freons, halons	–[1]	0.025	**0.511**
Isocyanates	0.5	0.8	**0.3**
Photochemicals	–[1]	0.2	**0.9**
Batteries	–[1]	7.8	**6.7**
Electronic waste	2.0	25.0	**15.8**
Radioactive waste	–[1]	–[1]	**0.009**
Unspecified hazardous waste	–[1]	–[1]	**10.2**

BACKGROUND: Hazardous waste is generated mainly in workshops and comprises waste from chemicals that cannot be deposited on municipal waste dumps, but must be disposed of in a special manner. SAS delivers all its hazardous waste in Denmark, Norway, and Sweden to approved subcontractors for processing, recycling or destruction, and submits reports on this to the authorities. In the tables, detailed information from each country has been summarized in major groups for the sake of clarity. **SAS'S DEVELOPMENT:** Altogether, the volumes of hazardous waste decreased by approx. 10% in 1997. The reported increase in waste containing cyanide is due to the fact that several of the routine changes of cyanide baths coincided in 1996–97. After the phase-out of acid baths in Oslo during 1996, the volume of acids has now been reduced to normal levels. The volume of electronic waste due to replacement of computer equipment is expected to continue to increase. The increase in waste containing mercury consists of batteries in Copenhagen. With effect from this year, SAS also reports radioactive waste (this year in a fluorescent emergency exit sign), and an unspecified item which includes coal dust from modification and treatment of components for reuse.

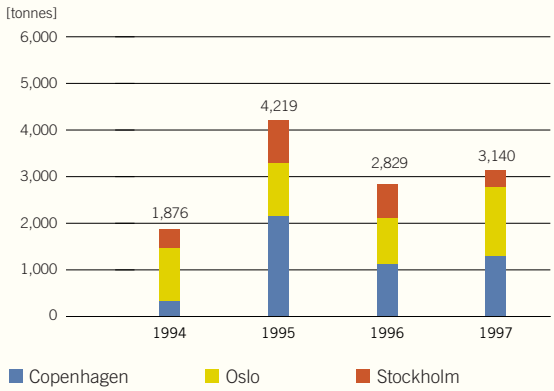
[1] Data not available.
[2] Refers to the wheel and brake workshop in Copenhagen.

Paper, cardboard



BACKGROUND: All paper and cardboard waste is delivered to an approved subcontractor, who sorts the waste for recycling. **SAS'S DEVELOPMENT:** The increase over the past two years is explained by increased pre-sorting – in 1997 by 54%, primarily in Oslo – and is largely offset by a reduction in unsorted waste by more than 350 tonnes.

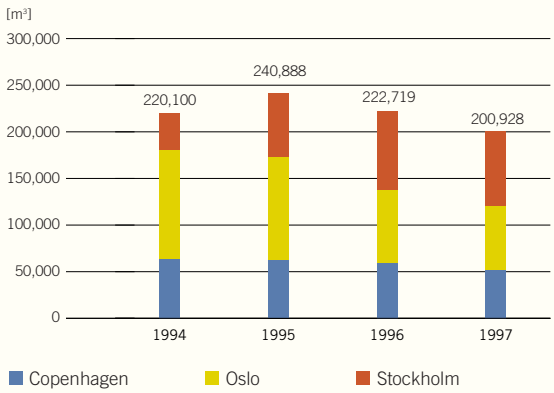
Garbage



BACKGROUND: All garbage is delivered to an approved subcontractor for sorting and partial recycling. **SAS'S DEVELOPMENT:** The major decrease in 1996 was attributable to the measures taken at that time to reduce waste volumes. The slight increase in 1997 is explained by the fact that waste from additional areas within SAS was included for the first time, and by the inclusion of 53 tonnes of iron and 62 tonnes of lumber from Copenhagen and Oslo.

CONSUMPTION OF RAW MATERIALS

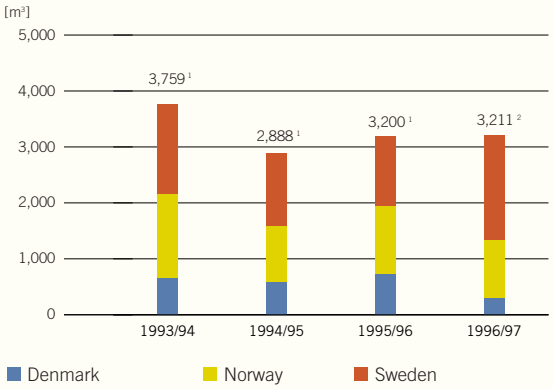
Water



SAS'S DEVELOPMENT: The previous high water consumption in Oslo was due to responsibility for maintenance of all of SAS's DC-9s and MD-80s. In 1996 SAS reduced its water consumption in Oslo by 30%, among other things by replacing water-based cooling equipment with equipment based on other coolants. In 1997 water consumption in Oslo decreased by a further 12%, and in total by close to 10%. SAS anticipates further reductions in water consumption starting in 1998 through the move to new workshop facilities at Oslo's new Gardermoen Airport. • An additional comparative figure for use in 1997 is SAS's water consumption in ground operations excluding catering of 9.8 liters per passenger.

CONSUMPTION OF CHEMICALS

Glycol



[1] *Until 1995/96, domestic line stations were reported only in Norway, while the figures for Denmark and Sweden referred only to Copenhagen and Stockholm*

[2] *As of 1996/97, domestic line stations are reported in all the Scandinavian countries.*

BACKGROUND: Glycol is sprayed on aircraft wings to prevent the formation of ice in cold weather. Two mixtures are used, with varying glycol concentrations for different temperatures – here, these have been recalculated in terms of 100% glycol. • For obvious reasons, glycol consumption is measured per winter, rather than per year. Comparing glycol consumption from one winter to the next is not meaningful, since use is entirely governed by weather conditions and essential safety requirements. • The aspect worth influencing is the collection rate, which in 1996 amounted to approx. 80–90% at the majority of airports. However, this is dealt with by the respective airport operators based on the requirements stipulated in concessions from national authorities, and is therefore not included in SAS's Environmental Report.

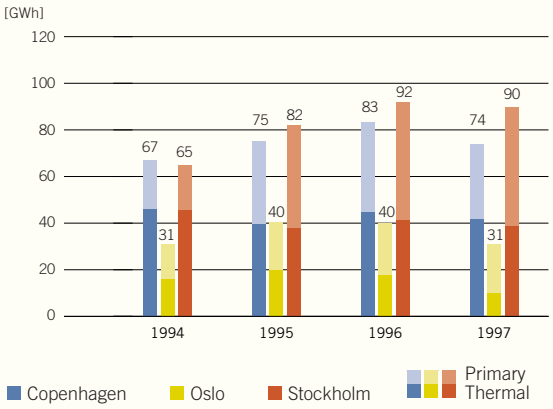
Solvents

1997 [liters]	*With halogens*	*Without halogens*
Copenhagen	480	19,600
Oslo	10,000	28,900
Stockholm	35	11,800
Total	**10,515**	**60,300**

BACKGROUND: The absolute bulk of solvents containing halogens comprise trichloroethylene and 1.1.1 trichlorethane for degreasing and cleaning in Oslo. • The bulk of solvents without halogens consist of cleaning agents, paints and thinners. **SAS'S DEVELOPMENT:** The higher consumption of solvents without halogens in Oslo is explained by the fact that they carry out painting of SAS's DC-9s and MD-80s and use kerosene for technical washing of aircraft and aircraft components, while these procedures are carried out with water-based products in Stockholm.

ENERGY CONSUMPTION

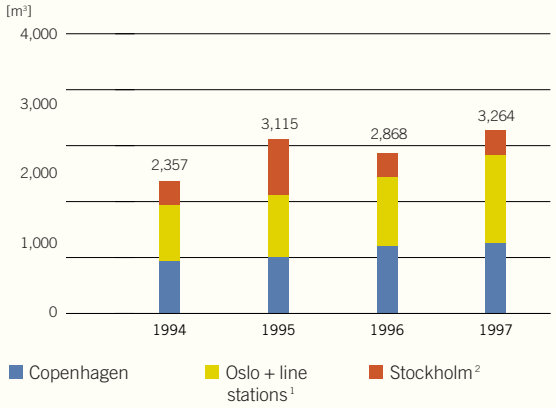
Electricity and heating



[GWh]	1993	1994	1995	1996	**1997**
Total	**152**	**163**	**197**	**215**	**194**

BACKGROUND: SAS uses two forms of energy – primary (electricity for lighting and operating machinery) and thermal (electricity, oil or LPG for heating). The major energy consumers are light and heating for hangars and maintenance workshops, air compressors, electricity for aircraft, electroplating baths and electricity for offices (lighting, heating and computer equipment). • In Copenhagen district heating is used for heating purposes, in Oslo 50% low sulfur oil and 50% electricity, and in Stockholm from 1997 biofuel-fired district heating (previously LPG). As of 1997 SAS in Norway and Sweden also purchase hydro power with an environmental statement. **SAS'S DEVELOPMENT:** SAS conducts energy-saving campaigns at all its bases, and between 1986 and 1994 energy use decreased by 45% at one of SAS biggest energy consumers, the Koksa maintenance workshops in Oslo. • SAS's head office in Stockholm obtains nearly 80% of its energy from a geothermal plant, which produced 9,489 MWh in 1997. • The successive rise in overall use up to 1996 is due to the increasing floor space included in the figures. 1996 and 1997 are the first years that are directly comparable, since they include roughly the same area. In 1997 a continued focus on energy efficiency reduced energy consumption by close to 10% (in Oslo approx. 22%). • Owing to deregulation of the electricity market (in Norway since 1993, in Sweden since 1996), SAS can choose electricity supplier.

Diesel

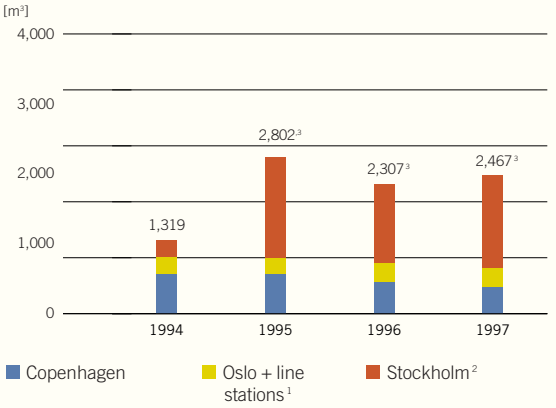


BACKGROUND: SAS strives to use only diesel of the best environmental quality in each country. **SAS'S DEVELOPMENT:** The higher consumption in 1997 is explained primarily by increased production in airport shuttle operations in Oslo. • In Stockholm, SAS has initiated a pilot project for replacing diesel with biofuel, and in 1997 47 m³ of biofuel was used in Stockholm. • In addition to the volumes reported here, SAS's catamarans between Malmö and Copenhagen Airport used 2,148 (1,987) m³ of diesel in 1997. This increase is explained partly by higher production in 1997 and partly by a severe ice situation in early 1996 which forced SAS to cancel many flights, thereby leading to abnormally low consumption in 1996.

Gas

In 1997, a total of 15 m³ of gas was used for a number of ground vehicles in Norway

Gasoline



[1] *Estimates from several sources.*
[2] *1994 from ground operations at Arlanda Airport only. As of 1995, gasoline used for SAS's company cars is also included.*
[3] *The volumes for 1994 and 1995–97 are not directly comparable. See Note 2.*

BACKGROUND: SAS strives to use only unleaded gasoline, which has already been achieved in the majority of locations. **SAS'S DEVELOPMENT:** The rising consumption is primarily attributable to company cars in Sweden.

Ground vehicles

[number]	1995	1996	1997
Denmark	750	800	825
Norway	607	622	976[1]
Sweden	256	299	730[1]
Total	**1,613**	**1,721**	**2,531**

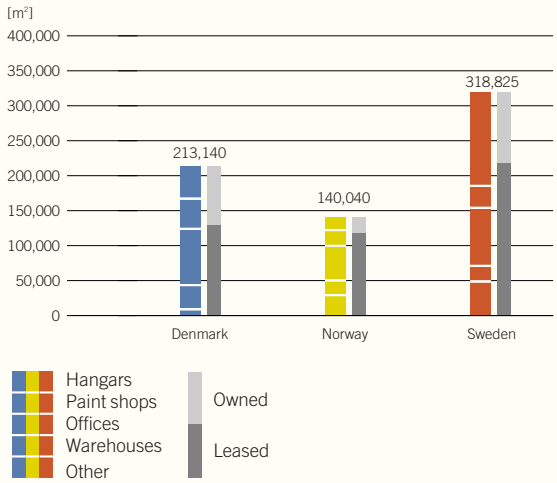
[1] *As of 1997, this includes all of SAS's registered vehicles in Norway and Sweden which are serviced by SAS in its vehicle workshops. The figure is therefore not comparable with previous years. No relevant net increase in the number of vehicles has taken place.*

BACKGROUND: SAS uses ground vehicles for a number of purposes: aircraft towing, baggage transportation and loading, ordinary passenger transportation, airport shuttle services (operated by SAS in Copenhagen and Oslo) and so on. Around 2/3 of vehicles in station operations (around half of the total number within SAS) use gasoline or diesel fuel, while 1/3 use gas, electricity or hybrid fuels. The aim is to continue reducing consumption of fossil fuels and increasingly convert to alternative fuels.

OTHER INFORMATION

Managed installations

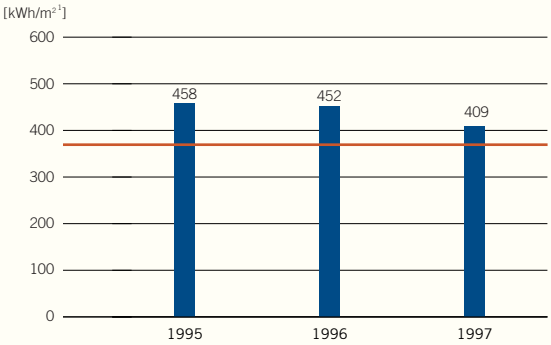
Area utilized



[m²]	*Total area utilized* **1997**	*Total area with registered resource consumption* **1997**
Owned	468,312	
Leased	203,693	
Total	**672,005**	**475,266**
of which		
Denmark	213,140	157,674
Norway	140,040	93,701
Sweden	318,825	223,891

BACKGROUND: In much of the area utilized by SAS, no activities are conducted which lead to resource consumption or environmental impact on SAS's part. Consequently, to indicate SAS's ecoefficiency more environmental data should be compared with the total floor area where registered resource consumption takes place. These figures are from the inventory carried out to obtain complete data in 1996, when some 45,000 m² was added compared with the previous year.

Relative energy use



	1995	1996	**1997**
Electricity and heating [kWh]	197,360	214,821	**194,248**
Area used [m²] [1]	430,767	475,266	**475,266**
Energy efficiency [kWh/m²]	458	452	**409**

[1] *Total area with registered resource consumption.*

SAS'S DEVELOPMENT: In 1997 the ongoing energy efficiency program contributed to reduce SAS's aggregate energy consumption relative to the total area of managed installations by close to 10%. The move to Oslo's new Gardermoen Airport in autumn 1998 will create further potential for efficiency improvement. • An additional comparative figure for use in 1997 is SAS's energy consumption in ground operations excluding catering of 9.4 kWh per passenger.

PROJECTS

New airport (Oslo)

In construction of SAS's facilities for operation, technical maintenance and cargo (a total of 90,000 m^2) at Oslo's new Gardermoen Airport which will be inaugurated in October 1998, the facilities are being environmentally adapted to offer a good work environment, to decrease SAS's environmental impact and to reduce SAS's costs for energy and water consumption and waste management. The environmental requirements have been integrated as a natural part of work at both the planning & design and construction stages. In January 1998 SAS obtained the necessary concessions for operation. In January–February 1998 the Norwegian authorities carried out an audit of health, environmental and safety conditions in SAS's facilities without finding any deviations from applicable laws and regulations. SAS's investment amounts to a total of 1,500 MSEK, of which 25 MSEK is related to the environment.

New cargo terminal (Copenhagen)

In early 1997 construction of SAS's new cargo terminal was started at Copenhagen Airport. The goal is to minimize environmental impact both during construction and in future operations. An energy efficiency program will reduce SAS's costs for lighting, processing energy, ventilation, heating, etc., by at least 20% compared with the old terminal. The new terminal will open for operation at the end of 1998.

Towing of aircraft (Copenhagen)

In 1996 SAS applied for authorization to begin trials to replace the aircraft's navigation lights with mobile lamps on the towing vehicles in Copenhagen to avoid having to start the aircraft's auxiliary power units (APU) during towing, thereby reducing fuel consumption, exhaust emissions and noise as well as costs (approx. 1 MSEK per year). In 1997 the authorities granted SAS a dispensation for these trials, which after an initial phase with positive results was extended to additional vehicles.

Laundering/dishwashing routines (Copenhagen)

In 1996 a project was initiated to environmentally adapt all laundering and dishwashing routines and thereby restrict the use of laundry and dishwashing products with an adverse impact on the environment, such as chlorine. The project was continued in 1998.

Hazardous waste at SAS's workshops (Copenhagen)

In 1996 a project was initiated to reduce the wheel and brake workshop's solvent use, oil discharge, water consumption and waste volumes through the introduction new rinsing methods using soap-based products, as well as planning & design of a wastewater treatment plant enabling effluents to be purified and possibly reused. The project is scheduled for completion in 1998, comprising a total investment of more than 0.5 MSEK, an annual cost savings of over 0.4 MSEK and a reduction in waste fluids of 200 tonnes per year.

Conversion to district heating (Copenhagen)

During the year conversion of SAS's office building in Copenhagen Airport to district heating was started and is expected to be completed in 1998. Together with conversion of hangar 5 during 1996, this will reduce SAS's emissions of carbon dioxide, sulfur dioxide and nitrogen oxides from its own heating plants by 90%.

Reduction/treatment of waste water (Stockholm)

In 1996 planning & design of new facilities for washing of aircraft and vehicles at Arlanda Airport was initiated in order to meet the authorities' concession requirements for emissions of heavy metals and mineral oil. A new vehicle wash with recirculating process water will be opened by November 1, 1998, and a new treatment plant for the process water will be in operation by April 1, 1999.

New painting methods (Stockholm)

A decision was made to implement new painting methods at SAS during 1998–99, with the goal of achieving a 20% reduction in total emissions from paint-related solvents by the year 2000. In 1997 a pilot study was therefore carried out at Arlanda Airport using so-called High Solid Paint with a 30% lower solvent content than traditional paints.

Biofuels for ground vehicles (Stockholm)

In February a pilot study was initiated at Arlanda Airport to replace diesel with RME (a biofuel derived from rapeseed oil) in the ground vehicles. The environmental advantages are that rapeseed oil fuel is 100% renewable, decomposes naturally in only one month and does not lead to any net increase in greenhouse gases in the atmosphere. The initial evaluations after three months were positive and the overall experience over the year was favorable, with only minor technical incidents and some negative perceptions of the work environment. A total of 47 m^3 liters of biofuel were consumed in 1997, which resulted in a corresponding reduction in diesel consumption. The target for 1998 is to extend the trials to include as many ground vehicles as possible throughout Arlanda.

Conversion to district heating (Stockholm)

In 1997 SAS at Arlanda Airport converted to heating from a biofuel-fired district heating plant, whereby carbon dioxide emissions there were eliminated entirely and emissions of sulfur dioxide and nitrogen oxides were reduced by 90%.

Recycling of magazines/newspapers

During 1997 a pilot study was initiated for collection and partial recycling of discarded magazines/newspapers from Swedish and Norwegian domestic flights. A total of 1,437 tonnes of magazines and newspapers were thus collected during the year, corresponding to 33% percent of the total volume loaded on board. In 1998 this collection routine will also be introduced on Danish domestic flights.

Pre-sorting

A preliminary study was initiated for pre-sorting of waste in Copenhagen, Oslo and Stockholm in order to ensure handling in accordance with laws and municipal regulations, and to achieve lower costs and a higher recycling rate in waste management. A new system is planned for implementation starting in 1998.

Harmonization of ground vehicles and equipment

In 1997 a project was started for harmonization and environmental adaptation of SAS's purchasing routines for ground vehicles and equipment in preparation for the impending modernization of the vehicle and equipment fleet, a project costing approx. 100 MSEK.

Scandinavian database for technical products

During the year a project was initiated for the creation of a joint database for SAS in Denmark, Norway and Sweden covering all chemical products used in the three countries' technical departments. Through harmonization of the range and a reduction in the number of products, cost reductions can be achieved in purchasing, storage, training, documentation for the authorities, management of hazardous waste, etc.

Environmental adaptation of deicing routines

In 1997, SAS in Copenhagen initiated trials to rinse the aircraft with viscous deicing fluid while they are parked at night. For the aircraft treated this reduces consumption of deicing fluid by 75%, and since the treatment is already completed when morning traffic is started, departure punctuality is also improved. In 1997 SAS obtained a permit from the authorities to use this method. The goal is to implement the method in other cities as well during 1998. In cooperation with the Norwegian Civil Aviation Administration, an evaluation of environmentally adapted deicing chemicals was also initiated, with a special focus on operation at Oslo's new Gardermoen Airport, which will be completed in October 1998.


DAGLIGEN
DAILY
06.00-22.30
LÖRDAGAR
SATURDAYS
06.00-20.00

Are environmental charges good for the environment?

The airline industry has reduced its environmental impact successively over a 30-year period, and radically in the past decade. This has been accomplished entirely without general environmental taxes. All the same, the introduction of such taxes is under discussion and tax schemes disguised as environmental charges have already been imposed at most European airports. Despite the fact that no environmental gains can be attributed to these measures, the authorities continue to use them. We would like to present SAS's position on the pros and cons of various environmental management systems and why we recommend international regulations instead of ineffective taxes which sometimes even lead to negative environmental effects.

The transport sector is of central importance for a well functioning society. But all transports affect the environmental in the form of resource consumption, emissions and noise. Consequently, for a long time society has been seeking solutions to minimize this impact. Companies have utilized market economic mechanisms, with the incentive that reduced environmental impact, particularly fuel consumption, leads to better business results. Politicians have two main instruments at their disposal:

- Environmental regulations through rules and bans – global and local.
- Environmental taxes which inhibit demand and/or reward a changeover to more environmentally-adapted technology.

Environmental charges should not be counted among these instruments since the term "charge" normally refers to something other than a tax, namely the price paid for a specific service – in this case direct financing of clearly defined environmental measures, not environmental control taxes.

Environmental regulations

The aviation industry is accustomed to regulations, since they have always been a natural feature of flight safety. The very high safety level in modern air transport is a result of the agreements made within the UN agency ICAO, the binding elements of which are followed by virtually all countries which conduct civil aviation.

Noise problems in the first generation of jet aircraft in the 1960s were the first environmental issue to gain attention in the airline industry. The natural reaction was to let the ICAO regulate the aircraft's noise levels, and regulations on engine emissions were later added. It is thanks to these international agreements that the first generation of jets (non-certified aircraft) could be phased out as early as the mid-80s and the second generation of jets (Chapter II aircraft) will be phased out by the year 2002. Negotiations are currently underway within the ICAO and the EU to also impose stricter standards on the next generate of aircraft engines with regard to emissions.

Long-term effects

The significant feature of these regulations is that they recognize that the aircraft can only undergo technological modifications to a limited extent under their useful lives. The critical improvements must therefore be made from generation to generation, through technological development of aerodynamics, weight reduction and more efficient engines. Consequently, environmental regulations must be long-term and stable over time so that the airlines can plan their operations according to them. The key to success is to motivate aircraft and engine manufacturers to develop new designs and versions.

In light of the substantial capital tied up in aircraft and the major operational transition necessary for an airline to change over to a new type of aircraft in terms of training, maintenance and stocking of spare parts, the natural service life of new aircraft must be taken into account in order for replacement to be economically feasible. Especially for a large airline like SAS, which owns virtually all of its nearly 180 aircraft – with a replacement value of close to 40,000 MSEK! – an entire fleet cannot be renewed in under 15 years.

The decision for an international phase-out of Chapter II aircraft by the year 2002 was made in 1987. SAS has therefore had ample time to plan replacement of the Chapter II fleet, which at the time of the decision consisted of 78 aircraft (including the former domestic carrier Linjeflyg's Fokker F-28s) and which will be completed more than two years before the ban goes into effect.

ENVIRONMENTAL TAXES

Today politicians are increasingly using tax instruments, not only to finance government operations but also to steer people and businesses in a more socially beneficial direction. Tobacco and liquor taxes were previously the clearest examples of this, and in the 1990s the environment has become another such area.

There is a relatively wide consensus among politicians, the business sector and researchers that environmental taxes are a good control instrument. But they must be used differently depending on what is to be controlled. For instance, transports offer significantly greater social benefits than liquor and tobacco do. They are one of the foundations for a

functioning society, contributing to a country's social prosperity and promoting the forging of good relations between nations. It is therefore less attractive to use general consumption-inhibiting taxes to restrict utilization of transports. Instead, an environmental control tax should stimulate development of technologies which lead to a lower level of environmental impact for the same transport benefit.

Environmental gains without environmental taxes

The ICAO has issued a recommendation that the member states do not impose a general tax on airline operations. This decision has been confirmed a number of times, most recently in 1994 (Doc 8632-C/968). Due to the ICAO's recommendation most countries have refrained from setting a general tax on international air transport, but unfortunately there are exceptions. The most notable in Europe are the taxes that the U.K., Denmark and Norway impose on airline passengers.

However, the ICAO has no influence on domestic air traffic. Sweden was therefore able to apply a domestic environmental tax from 1989 to 1995 without directly violating the ICAO's principles. This tax was abolished after Sweden became a member of the EU, since EU rules prohibit taxes of this kind.

Despite the rarity of general environmental taxes, the airline industry has carried out extensive environmental improvements ever since the 50s, when jet aircraft were introduced *[fig.1]*. And if environmental taxes were not the impetus for this positive development, then what was the critical factor?

The answer is the previously mentioned internationally harmonized regulation and phase-out of older aircraft, and – perhaps most importantly – the airline industry's economic incentives to reduce energy consumption. Energy costs account for a much bigger share of overall costs for an airline than for other types of transportation or most other operations – between 10 and 30 percent. This in itself is a sufficiently strong motive for technological development, likewise for using the smallest and most fuel-efficient aircraft possible on routes with low capacity utilization. Since reduced energy consumption automatically leads to lower emissions, this incentive is directly linked to environmental effects.

ENVIRONMENTALLY RELATED LANDING CHARGES

Parallel to the major international regulations within the ICAO, a new type of charge has gradually emerged – environmentally related landing charges. This means a charge which is related to the aircraft's environmental characteristics, normally noise performance, and which is paid for the use of runways and landing aids. Since this type of environmentally related charge essentially lacks an overall international standardization, several different charge systems have emerged, primarily in Europe, without harmonization.

The airlines are accustomed to paying charges – in the sense of payment in direct exchange for services rendered and for the use of a society's infrastructure. That is what distinguishes charges from taxes, which are generally paid to a society without being linked to a specific service in return. In some cases, the environmentally-based charges have been linked to action programs for reducing noise pollution, such as noise insulation of properties surrounding an airport. For the most part, however, these charges are not linked to specific environmental measures, such as the systems in Sweden and Norway.

The ICAO clearly states in its recommendations (Doc 9082/5) how charges should be imposed at airports. With regard to environmental charges, these may be charged only if an airport has both actual environmental problems and direct costs for eliminating them. The airlines accept this. The airlines also gladly participate in the EU debate on the so-called internalization principle – that a society's indirect costs related to environmental impact, such as for development of infrastructure and operation of businesses, should be made visible and should to a greater extent be paid by whoever gives rise to them. However, the introduction of such a system in the transport industry requires a just comparison of the benefits, energy consumption and environmental impact of various types of transportation. (After pressure from the AEA, the EU decided to initiate a study of this type in 1997.)

But the ICAO is equally clear in its statement that airport charges may not be used as a general control instrument for environmental improvements. This should be seen in light of the ICAO's rejection of a general tax on airline operations.

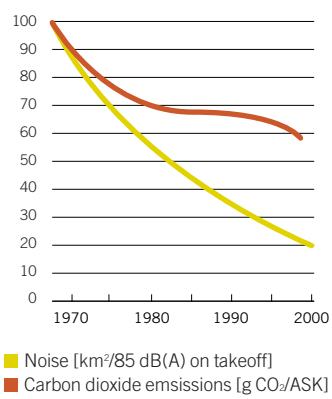
Accordingly, the airlines support the principle that environmental charges be imposed when the airports are carrying out environmental action programs that cost money. It is then reasonable that whoever contributes to the problems also pays more to the program (known as the "Polluter Pays Principle").

However, one prerequisite is that the classification of aircraft is objective and correct, and actually measures the factors giving rise to the negative impact. The ICAO has only one classification system, structured as limits for overall global certification of aircraft and aircraft engines. There is no internationally accepted, more sophisticated environmental measurement system which also makes it possible to classifying aircraft and aircraft engines in an operating environment within the certification intervals.

As a result, an array of different aircraft classification models have arisen in Europe. Some countries use the ICAO divi-

***[FIG 1]* ENVIRONMENTAL IMPROVEMENTS IN AIR TRANSPORT**

[index DC-9-21 (1968) = 100]



In addition to achieving dramatic reductions in noise and carbon dioxide emissions, with the help of new technology air transport has reduced its emissions of nitrogen oxides, and today emissions of hydrocarbons and soot are essentially negligible.

sion into Chapter II and Chapter III aircraft (e.g. Sweden and Norway). Some apply the ICAO's certification data but have created their own class divisions (such as Belgium). And a few airports have implemented their own noise measurement systems and based classification on these (e.g. Zurich). One consequence is that the noise-related portion of the basic landing charge varies significantly, from 10 to 250 percent.

A few countries, including Denmark and Finland, have refrained from implementing noise-related charge systems.

The drawbacks of environmentally related charge systems

There are a few critical reasons why environmentally related charges are not effective in terms of creating a better environment (aside from the charges which finance actual environmental programs):

- Environmentally related charges are often introduced and adjusted with very short notice, and do not give the airlines opportunity to adapt their aircraft fleets in pace with the changes.
- The lack of internationally harmonized regulations undermines any control effects.
- Environmentally related charges do not have potential for stability, since the airports which apply them include them in the revenue required to conduct operations. As the airlines phase out older aircraft and modernize their fleets, this revenue decreases. In order to maintain the level of revenue, they must then raise the charges even for the aircraft with the best environmental data. Since the phase-out of Chapter II aircraft is progressing rapidly, the Swedish Civil Aviation Authority has now been forced to make this adjustment and has raised landing charges for Chapter III aircraft by five percentage points. This weakens the very incentive which the lower charges were intended to create.
- ICAO certification, on which most noise-related landing charge systems are based, does not recognize the fact that an aircraft's environmental performance differs between test runs and actual flights. For example, environmental data for the McDonnell Douglas MD-80 in SAS's aircraft fleet varies considerably depending on whether it is an MD-83 version flown with a maximum takeoff weight (e.g. for a long-haul charter flight) or an MD-87 version flown with a significantly lower takeoff weight (e.g. for a normal scheduled flight within Europe).
- Environmentally related charges mean that an airport's pricing no longer reflects the costs generated by different flights. This hinders the dialogue between airline and airport on product quality vs. charges.
- Due to the lack of international harmonization, there is a major risk that airports which impose environmental charges may simply cause environmental problems to be "exported" to another airport.
- An airline which is slow to phase out its aircraft runs the risk of being financially weakened by charges, which also impairs its ability to replace the fleet. In this scenario the effect of the charges is diametrically opposed to their alleged purpose, as would general traffic taxes if they were imposed on commercial flights.

Emissions-related charge systems

The environmental systems dealt with above incorporate noise as a charge-bearer. Two countries, Switzerland and Sweden, have also decided to introduce a new system in which the landing charge is based on aircraft emissions.

All objections to noise-related charges also apply to emissions-related charges, in addition to:

- The measurements used by the ICAO to certify aircraft engines with regard to emissions are intended only to ensure that ground level emissions do not exceed a specific limit. Consequently, the certification values do not reflect emissions in an operating environment and are therefore not an appropriate basis for an environmental charge system.
- An aircraft's actual emissions are affected by factors such as its weight and aerodynamics, since lower fuel consumption also produces lower emissions. But the existing certification systems refer only to the engines as isolated sources, and no system for certifying entire aircraft exists.
- Since every individual aircraft/engine combination has a unique emission performance and emission data can be altered through engine modifications, an emission-related charge system is administratively complex in proportion to the environmental effects achieved.
- The greatest environmental impact caused by aircraft is emissions with global environmental effects, which means that the relation to local landing charges is of little relevance.

A method which is considerably easier to administrate and more directly linked to actual environmental control effects would be a charge on fuel consumption, which with modern engine technology is directly proportional to carbon dioxide emissions regardless of the aircraft and engine model. This naturally assumes that it is accepted and applied internationally so that it becomes competitively neutral, and that the charge is used to tackle the environmental problems on which it is based.

LOCAL REGULATION OF FLIGHT OPERATIONS

There has always been a need to introduce unique local regulations at different airports, especially if there are business/residential developments in the local area. These often focus on regulation of first choice of runways or runway direction, regulated approach and climb-out routes, time restrictions in traffic (such as bans on operating at certain times of day, e.g. at night, for Chapter II aircraft or in general), handling of runway deicing fluids, glycol and waste, etc.

These regulations are normally designed not to disrupt the airport's normal operations. Problems arise when these regulations go so far that they conflict with international agreements. One such case emerged in Sweden during 1997 when the National Franchise Board for Environmental Protection prohibited flights with Chapter II aircraft to and from the new airport in Karlstad. This conflicts with the ICAO agreement stating that all Chapter II aircraft are to be phased out by the year 2002. This entails an obligation for the airlines, but also a right to operate these aircraft until the year 2002! Another example was in late 1997 when the Norwegian Depart-

ment of Communications proposed a night ban on certain Chapter III aircraft at Oslo's new Gardermoen Airport, which conflicts with the 1990 ICAO agreement not to impose different operational restrictions on various Chapter III aircraft.

SAS'S POSITION ON REGULATIONS VS. ENVIRONMENTAL TAXES AND ENVIRONMENTALLY BASED CHARGES

In recent years the airline industry has clearly demonstrated that it is not only prepared to take responsibility for the environment with the help of international regulations, but also that this is commercially motivated. Neither environmental taxes nor environmentally related charges can be proven to be effective and accelerate environmentally favorable development. On the contrary, they raise the price of air transport and inhibit demand for air travel, which then lessens the industry's overall benefit to society. Furthermore, the airlines are economically weakened and their financial capacity to invest in new, environmentally-adapted technology is impaired.

SAS is highly critical of the new type of travel tax introduced in Denmark and Norway, partly motivated by environmental arguments from political interests. Such taxes only serve to weaken the Scandinavian economies in relation to competing countries. SAS, for which the bulk of production is based in Denmark, Norway and Sweden, is particularly vulnerable in comparison with airlines in countries lacking similar charges. The mobility of the Scandinavian people is also affected, which counteracts political decisions to strive for decentralized living and a borderless labor market.

SAS instead advocates competitively neutral environmental control by introducing increasingly stringent ICAO standards in pace with technological development of the aircraft and supports all measures by the Scandinavian governments to encourage the ICAO in this work.

On several occasions it has been discussed within the ICAO whether environmentally-based charges are an effective control instrument for a better environment. So far, no one has been able to prove that any existing environmental charge system for air transport in the world has led to a better environment than would otherwise have been achieved. Instead, all studies indicate that the increased fuel efficiency in response to higher energy costs and the ICAO's global program for the phase-out of older aircraft are the driving forces behind the strong trend towards aircraft with lower environmental impact.

These forces work only in a long-term perspective, with successive yearly improvements. Political interests have often claimed that international harmonization takes too long to carry out. Since politicians must be quick to take action particularly at the national or local level, for example by setting examples, they have been lured into hasty political decisions on environmental charge systems. Environmentally-based landing charge systems have been a convenient solution, since they superficially appear to be an effective control instrument. But no environmental improvement through these measures has yet to been seen.

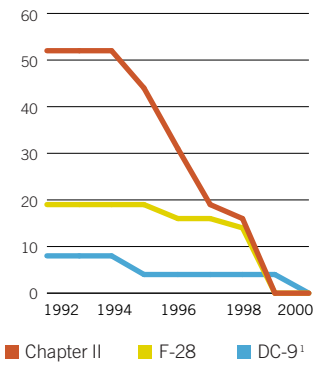
During 1995–1997, SAS ordered 65 new aircraft of the best available environmental class for approx. 11,500 MSEK, with an option to purchase another 43. Most of these have been equipped with a new combuster design – an additional investment of 150–200 MSEK which means that when delivered, the aircraft will already meet the future's stricter environmental standards for nitrogen oxide emissions. Furthermore, noise levels in SAS's older DC-9-41s have been reduced through a program costing around 400 MSEK. *[Fig.2]*

We have thus followed our policy of utilizing the best available technology, and see no further measures we could have taken. Consequently, the environmental control effects of government and municipal income sources masked as environmental taxes are probably non-existent.

SAS urges the authorities and researchers in Scandinavia to study the current environmental charge systems for the airline industry and evaluate whether they are valuable in terms of promoting a better environment. If not, we urge them to investigate the most effective way to achieve improved environmental conditions in the industry. We strive for an open and constructive dialogue.

***[FIG. 2]* GENERATION SHIFT SOON COMPLETED**

[Number of aircraft in SAS]



The aircraft in SAS's aircraft fleet with the poorest noise, fuel consumption and emissions data today – the Fokker F-28 and the hushkitted McDonnell Douglas DC-9s – will be completely phased out by the year 2000.

[1] *Hushkitted as of 1995.*

At year-end 1997 *SAS had ordered 42 new Boeing 737-600 aircraft. During delivery of these over the period until 2001, SAS's aircraft fleet will meet the goal of 100% low-noise Chapter III aircraft, well ahead of the ban on older Chapter II aircraft as of April 1, 2002. In this generation of aircraft the perceived noise levels have been halved and cabin noise in the Boeing aircraft is also lower. Furthermore, all modern aircraft are more fuel-efficient than their predecessors and therefore have lower carbon dioxide emissions, and SAS's version of the Boeing 737-600 is equipped with special engines which reduce emissions of nitrogen oxides.*

KURT KÜHNE
HEAD OF FLEET DEVELOPMENT, STOCKHOLM

”BY THE END OF 1999 SAS’S AIRCRAFT FLEET WILL CONSIST EXCLUSIVELY OF CHAPTER III AIRCRAFT.”

Increased fuel efficiency limits carbon dioxide emissions

Over the past 30 years the airline industry has halved its relative emissions of the most significant greenhouse gas, carbon dioxide. But what can the industry do to compensate for the fact that traffic is currently increasing fasterthan the ongoing emissions reductions?

Carbon dioxide accounts for around half of the greenhouse effect caused by human activities. Carbon dioxide emissions from combustion of fossil fuels are always proportional to fuel consumption. Consequently, there are only three ways to reduce the airline industry's carbon dioxide emissions:

- By limiting air traffic. However, this would impair the mobility of the society and thereby also economic development.
- By altering the mixture of fuels used. In the airline industry, commercially feasible alternative fuels are several aircraft generations and decades away.
- By increasing fuel efficiency. This is a general ambition, also because fuel costs represent a large proportion of the total costs for air transport.

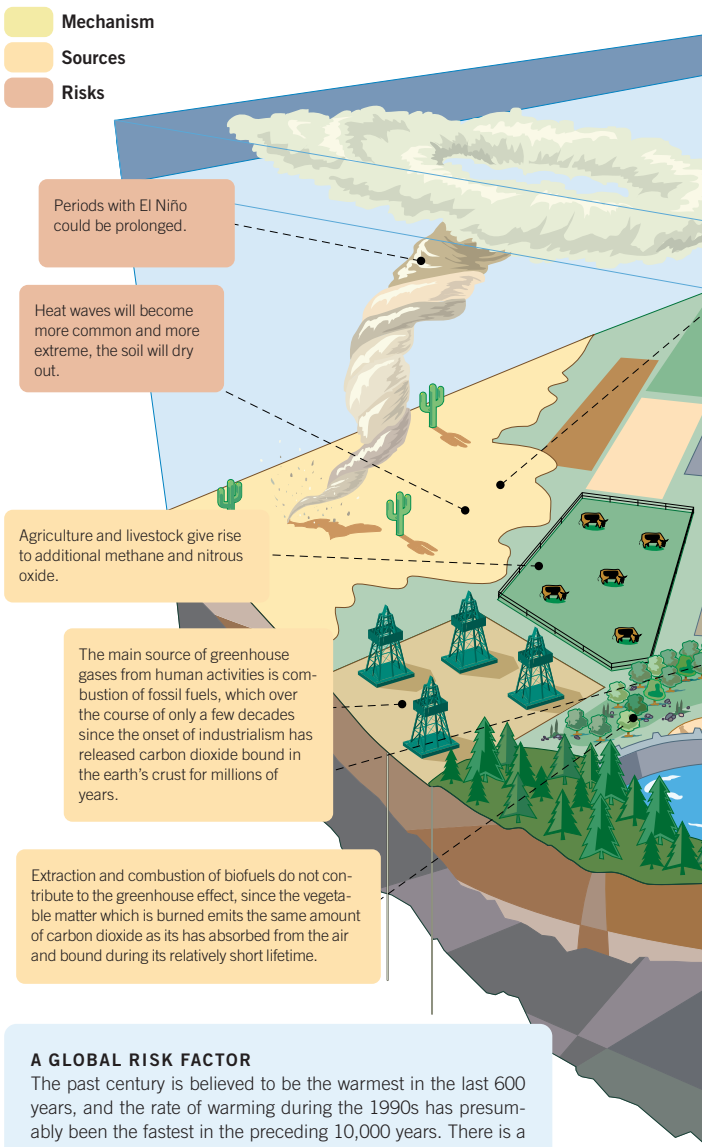
Further improvements in fuel efficiency can be achieved in several ways:

- Continued development of aircraft engines. Today's engines provide more energy per unit of fuel thanks to more efficient combustion and improved aerodynamics.
- Further development of aircraft. Today's aircraft are lighter and have better aerodynamics, and their extended flying range has reduced the number of fuel-consuming intermediate landings.
- Technological development of aircraft maneuverability, such as computer-controlled thrust, enables more fuel-efficient flights.
- The higher the cabin factor, the higher the fuel efficiency. However, the major commercial airlines are already close to the ceiling of around 70% with regard to market conditions.
- Development is underway to improve navigation and traffic control systems in order to shorten flying distances and thereby reduce fuel consumption.
- Projects are in progress at many airports to shorten holding delays, which today cause extra fuel consumption and noise.

In addition, trials are underway to develop alternative aviation fuels, such as hydrogen gas, but scientists are a long way from developing practical and economically feasible methods.

Attempts have also been made to use pure biofuels in aircraft engines, by American NASA among others, but performance has proven to be too unstable. However, SAS is currently discussing the possibility of participating in trials where today's fossil fuels are mixed with e.g. 10% biofuel.

The greenhouse effect:



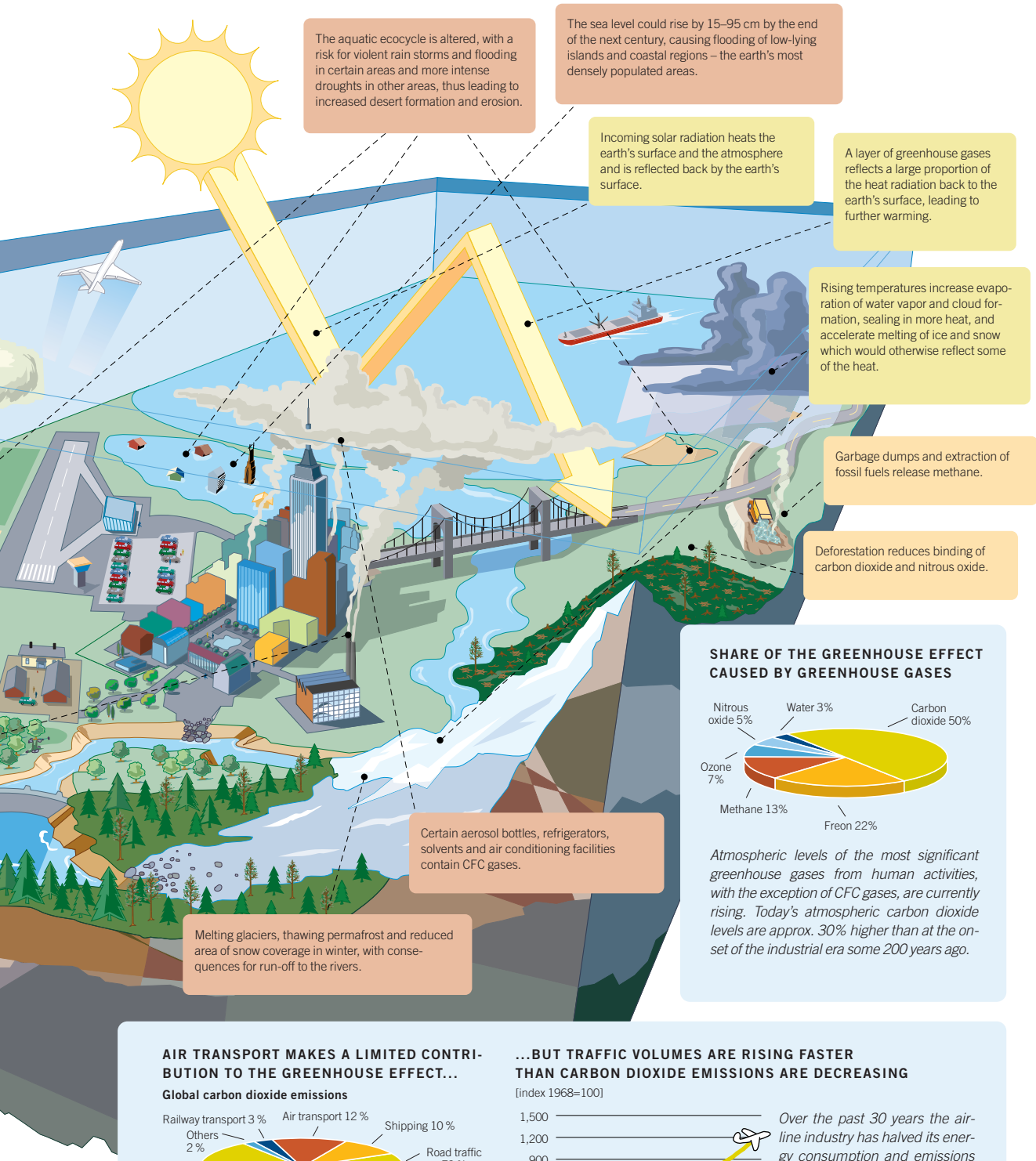
A GLOBAL RISK FACTOR

The past century is believed to be the warmest in the last 600 years, and the rate of warming during the 1990s has presumably been the fastest in the preceding 10,000 years. There is a general consensus among scientists that this warming is caused by human activities, that it will continue if no measures are taken, and that it will affect the living conditions for life on earth.

Carbon dioxide remains in the atmosphere for one hundred years or more, so even if the concentration of greenhouse gases in the atmosphere is stabilized by the year 2001 the temperature would rise before the climate system reaches a balance. However, the urgency of taking immediate measures is countered by the enormous costs for these and the major uncertainty in current scientific models.

When the 1992 UN climate conference in Rio de Janeiro was followed up in Kyoto in December 1997, an agreement was reached to reduce emissions of greenhouse gases through various measures on the part of different continents and groups of countries. The agreement was then submitted to the governments of the affected countries for ratification.

Sources: The UN climate panel IPCC/the Swedish National Environmental Protection Board, 1995/96, et. al.

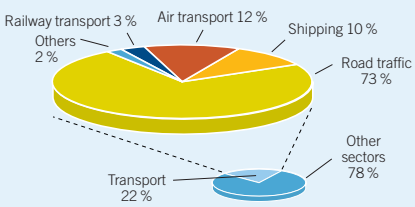


SHARE OF THE GREENHOUSE EFFECT CAUSED BY GREENHOUSE GASES

Atmospheric levels of the most significant greenhouse gases from human activities, with the exception of CFC gases, are currently rising. Today's atmospheric carbon dioxide levels are approx. 30% higher than at the onset of the industrial era some 200 years ago.

AIR TRANSPORT MAKES A LIMITED CONTRIBUTION TO THE GREENHOUSE EFFECT...

Global carbon dioxide emissions



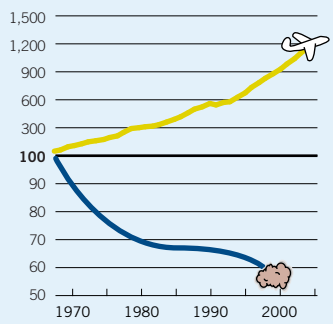
Source: International Energy Agency

Today air transport accounts for 2–3% of global carbon dioxide emissions produced through combustion of fossil fuels. Since carbon dioxide is responsible for about half of the greenhouse effect from human activities, this means that carbon dioxide from air transport accounts for less than 1.5% of the total greenhouse effect caused by man. (To this should be added an approximately equal share caused by emissions of nitrogen oxides.)

Source: Swedish Environmental Protection Board

...BUT TRAFFIC VOLUMES ARE RISING FASTER THAN CARBON DIOXIDE EMISSIONS ARE DECREASING

[index 1968=100]



Fuel consump./CO_2 emissions [l/g per ASK] (Swedish Civil Aviation Admin.).
Volume increase in air transport [passenger kilometers] (ICAO)

Over the past 30 years the airline industry has halved its energy consumption and emissions of carbon dioxide per passenger kilometer. However, commercial air transport volumes are currently increasing faster than the rate of decrease for its carbon dioxide emissions per passenger kilometer, which means that the airline industry's total carbon dioxide emissions are expected to rise twice as fast as the global average.

Source: The Swedish Civil Aviation Administration, ICAO.

»All types of transport (road, rail, sea and air) have equal energy consumption and environmental impact in relation to the actual transport work performed. With a system where each transport type bears its own costs for infrastructure and impact on society, the most economically advantageous transport alternative in each individual case will also be the most efficient and cause the least environmental impact.«

Environmental work in practice

Since 1995 when the Group's new environmental strategy was established, SAS has continuously developed its environmental efforts. This has taken place systematically with the help of an environmental management system based on the method used in SAS's quality assurance work – Total Quality Management (TQM).

The system SAS has chosen for its quality assurance work was developed by the European Foundation for Quality Management (EFQM) *[fig. 1]*. It consists of modules for nine areas of operation central to business development, where environmental impact and measures occur in two dimensions – both as an area in itself and as part of all the other areas, based on the concept that, to be effective, environmental work must be an integrated as a natural part of all operations.

SAS's goal within the framework of the EFQM system is to attain the highest European quality rating in 1998, and in 1997 a new staff function was created for this task. To get an indication of how the Group was performing in relation to its goals, close to 50 self-assessments according EFQM evaluation routines were carried out during the year. The final assessment for social impact and environmental awareness resulted in 32 points of 60 possible, which indicates that there is a margin for further improvement in the environmental area.

Continuous improvement is a key concept in quality assurance work. Goals are set and followed up using descriptions of the present situation and goals in each respective EFQM area *[fig. 2]*. Each of SAS's areas of operation has broken down these descriptions at the local level (e.g. division and department) and conducted operational analyses according to the TQM model as a basis for self-assessment. Certain units have also carried out a so-called gap analysis *[fig. 3]*, where the present situation as determined in the operational analysis is compared with current and future requirements. The resulting specific action programs will ensure sound utilization of resources and correct prioritization, and will give the individual employees practical guidance in their work. To further reinforce the link between strategic goals and operating activities, in 1998 environmental issues will be more strongly emphasized at the middle management level.

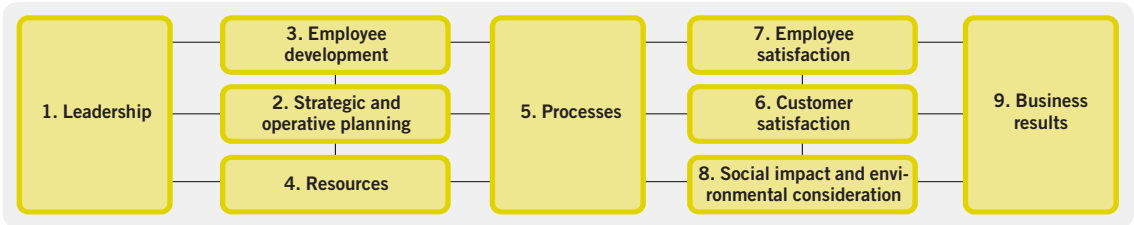
In 1997 a gap analysis was carried out in parts of station operations at Arlanda Airport as part of efforts to adhere to an international standard for environmental management and audits. SAS believes that the revised EMAS will be extended to include the Group's sectors – Transport and Service – in 1998. SAS therefore intends to initiate a project to adapt its environmental management system to ISO 14001 and apply this within the framework of EMAS (both of these standards are described on p. 60). However, since obtaining EMAS/ISO 14001 registration/certification is a time-consuming process, it has been budgeted over two years starting in 1998.

National environmental management systems

In the Scandinavian countries, SAS has been working for several years according to the standards which will be included as parts of EMAS and ISO 14000:

- Since 1992, SAS in Denmark has voluntarily applied a system of environmental accounts which link critical environmental parameters ("green key ratios") to the corresponding financial effects. As of 1996 this is prescribed by law for some major business in Denmark with an environmental impact, and as of 1999 for SAS, when approx. 4,000 operations will be included. Until then we will continue to apply the system on a voluntary basis. SAS in Denmark has also introduced environmental management for purchasing, energy and construction projects.
- Since 1992, the Norwegian authorities have applied a law on internal control entailing a system for documentation and auditing of various health, environmental and safety parameters. At SAS an internal control system has been established for annual audits and reports to the Norwegian authorities regarding, for example, emissions for which permits are required. This practice has been extended to include full environmental audits within the framework of the internal control system. The inspection of health, environmental and

***[FIG. 1]* SAS'S TQM WORK – AN OVERVIEW**



Each area contains goals for the next few years, which are continuously revised. Not only is the environment an area in itself, environmental objectives are also included in the goals for the respective areas.

safety conditions in SAS's facilities at Oslo's new Gardermoen Airport which was conducted in January 1998 did not find any deviations in relation to laws and regulations.

- In Sweden, the environmental authorities apply a system of permits and reporting requirements in order to create regional framework conditions for individual companies. Under this system, businesses subject to supervision are obliged to draw up annual environmental reports. SAS in Sweden has permits for certain emissions and systems for management of chemical waste which are monitored and inspected locally. In 1998 the authorities will audit SAS's internal control system for the work environment at Arlanda and the head office in Frösundavik.

Since 1996 a development project (HMS 2000) has been underway to create joint-Group standards and tools which include both Denmark's workplace assessment (APV – a statutory system with regular reviews of each workplace in relation to the requirements in work environment legislation), Norway's internal control system for the work and external environments and Sweden's internal control system for the work environment. These standards and tools are aimed at both the work environment and the external environment and are to be established as part of TQM, paving the way for a certifiable environmental management system.

***[FIG. 2]* SAS'S TQM WORK – THE ENVIRONMENTAL AREA**

(Social impact and) environmental consideration [1]

Goal 1997	Achieved	Goal 1998 (revised)	Goal 1999 (new)
■ The environmental report describes development in key environmental areas, audit of environmental goals carried out.	✔	■ SAS works with and reports on the environment and resources in a systematic manner.	■ SAS develops its environmental management system and evaluates environmental certification for prioritized areas of operation.
■ SAS's environmental philosophy/ strategy is known xthroughout the company.	✔	■ SAS introduces the Boeing 737-600 DAC in traffic.	■ SAS further develops its communication about consumption of resources, environmental impact and review of environmental data.
■ Guidelines drawn up for environmental profiling and sponsorship.	✔	■ SAS works continuously with environmental adaptation in future fleet development.	■ Environmental adaptation of SAS's aircraft fleet continues with the phase-in of Boeing 737-600s and Dash-8-400s. SAS thus has 100% Chapter III aircraft.
■ Environmental aspects included in the market profile.	[2]	■ SAS is perceived as a resource and environment-conscious company and one of the leaders in airline industry.	■ SAS continues to develop work on the regulatory framework for the airline industry.
■ Environmental training and information is conducted systematically.	[3]	■ SAS begins development of an environmental management system aimed at obtaining EMAS registration and ISO 14001 certification.	■ SAS conducts active efforts to improve its own environmental image.
■ The share of Chapter II aircraft has further decreased in relation to previous years.	✔	■ Environmental aspects are integrated in the largest and most critical supplier agreements.	■ SAS further develops the environmental training integrated with the Group's other training activities.
■ Opinion polls on SAS environmental image carried out.	✔	■ SAS moves into the new Gardermoen Airport in Norway and into a new cargo terminal at the Copenhagen Airport, which are both being built to meet high environmental requirements.	■ SAS is perceived as one of the leading companies in the airline industry.
		■ SAS integrates environmental training with the company's other training activities.	■ SAS works with its partners to increase environmental benchmarking.
		■ SAS further develops work on the regulatory framework for the airline industry.	■ SAS develops environmental aspects as a natural element of market communication.
		■ SAS works to integrate environmental aspects in parts of its market communication.	
		■ SAS enhances its environmental profile and follows up with environmental image polls.	

[1] Due to lack of space, the half of the strategic area which deals with social impact has been omitted.
[2] The goal is has not been fulfilled and has therefore been moved forward to 1998.
[3] The goal has only partly been fulfilled and has therefore been moved forward to 1998.

In 1997 the established goals were fulfilled in all areas except environmental aspects of the market profile and environmental training (see Notes 2 and 3 above).

ENVIRONMENTAL MANAGEMENT

At SAS environmental responsibility and work are integrated into the line organization. SAS's environmental philosophy expresses this as "every manager with decision-making authority and budget responsibility is obligated to include an environmental assessment as part of the decision documentation".

Part of the SAS Management Team's job is to draw up strategies and guidelines for the company's environmental work, among other things in the form of TQM's overall present situation and goal descriptions. These are then broken down into specific objectives in each area of SAS, resulting e.g. in a number of projects which are followed up yearly with regard to goal fulfillment and repercussions on SAS's financial results (the major environmental projects in 1997 are reported on pp. 26, 32 and 41).

The cyclical work on the annual environmental report also has a strong environmental influence. In the process of choosing which environmental information to report, measuring and collecting this data and announcing the results through publication, a powerful incentive is created for continuous improvement deep within the organization.

Environmental vision, goals and strategy

SAS's environmental vision, goals and strategy form a system that is effective in promoting specific environmental efforts within the framework of overall quality assurance *[fig. 4].*

SAS's *environmental vision* links operational and financial goals with environmental considerations and social awareness. These are intimately connected – a well run organization and continuous investments in quality, safety and the environment are essential for a sound financial position.

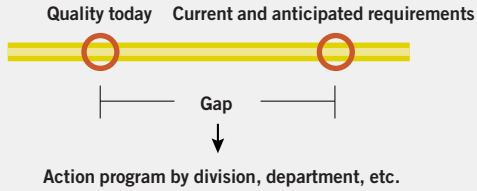
The *environmental goals* define SAS's ambitions for the environmental program and the quality of environmental performance we strive to achieve – to be counted among the leaders in the airline industry. These goals also state that the environmental aspects of all decisions must be integrated with our other operations, on par with SAS's traditional quality goals in the areas of safety, punctuality and service.

The environmental strategy indicates critical areas for action. One basic requirement is that SAS should always seek production methods and techniques characterized by low energy and resource consumption, minimal emissions, small waste volumes and potential for recycling. Whenever feasible, such assessments must be based on a perspective which takes environmental impact throughout the life of the product into consideration.

The fundamental idea behind the environmental strategy is to ensure a good profit trend by seeking environmentally correct and cost-effective solutions. SAS's position is that sound environmental solutions go hand in hand with sound finances, and the key concept in the balance between environmental and financial consideration is cost-effectiveness – SAS chooses the solutions that yield the best possible environment for every krona invested.

Goals which are not fulfilled according to plan are automatically subjected to analysis aimed at revising either formulation of the goal or the timetable.

[FIG. 3] **GAP ANALYSIS**



As the name implies, the gap analysis identifies areas where there is a gap between the company's current status and current/anticipated requirements, so that measures can be introduced to meet the established goals.

[FIG 4.] **ENVIRONMENTAL VISION, GOAL AND STRATEGY**

SAS's Environmental Vision

- SAS will develop profitably in free competition, with optimal utilization of resources and minimum environmental impact, in order to contribute to environmentally sustainable development in society. ("Sustainable development" means that when humanity satisfies its needs today, it does not limit future generations' opportunities to satisfy theirs).

SAS's Environmental Goals

- SAS shall develop one of the airline industry's most ambitious environmental programs.
- SAS shall have an environmental standard equivalent to the leading competitors in the industry.
- SAS's environmental goals and measures shall be coordinated and harmonized with other goals for production, quality and profit.

SAS's Environmental Strategy

- Within the framework of SAS's financial and qualitative goals, all operations shall be conducted in such as way as to cause the least possible environmental impact.
- SAS will develop into one of the airline industry's leading companies in the environmental sphere.
- Environmental work must be conducted at all levels and within all units, thus creating increased environmental awareness throughout the organization.
- Environmental aspects shall be included in all decision data in the line organization.
- SAS shall utilize/introduce methods that minimize the environmental impact of production, characterized by low energy consumption, recycling potential and minimal emissions.
- SAS shall issue an account of its environmental work in a separate annual report.
- SAS shall promote understanding among external stakeholders of the role and environmental impact of air transportation.

"BY THE YEAR 2001 SAS WILL HAVE REDUCED ITS ENERGY CONSUMPTION PER M^2 FOR ELECTRICITY AND HEATING TO THE PREMISES WHERE WE CONDUCT OPERATIONS BY 10% COMPARED WITH 1997"

The environmental strategies and goals are reviewed yearly. In autumn 1997 the SAS Management Team presented its position on these in the booklet "Why, What and How?" which was primarily intended for internal use but was also circulated externally.

SAS has also undertaken to develop its environmental work in accordance with the ICC's 16 principles for environmentally aware leadership, and is represented in the ICC's Swedish section.

Environmental organization

SAS's environmental efforts are led by the SAS *Management Team,* where the Information Director has special responsibility for environmental issues *[fig.5]*. The Management Team's efforts are crucial for SAS's scope to maintain high quality in its environmental work.

The chief task of SAS's *Environmental Director* is to direct the activities of the environmental department – at SAS, a staff function which coordinates the company's environmental work. He ensures that the environmental strategy is implemented and that environmental information and training are carried out. Furthermore, the Environmental Director is responsible for production and publication of SAS's Environmental Report.

The Environmental Director also directs the work of SAS's *Environmental Forum* – a cross-divisional group with advisory and coordinating functions, as well as duties at the policy and strategy level (in certain contexts also operative functions, such as work on the environmental report). The participants act as environmental coordinators within their respective divisions, and their day-to-day work creates two-way communication which spreads environmental issues throughout the organization.

In 1997 a decision was made to expand the central resources for environmental activities by adding a new position in order to evolve work on SAS's environmental management system.

National environmental coordinators in the three Scandinavian countries are responsible for coordinating environmental work at the national level and assisting their respective national organizations with advice in the environmental sphere. They also ensure that the requirements of the national environmental agencies are complied with and reported. The environmental coordinators are organizationally linked to the Health, Environment and Safety Department, thereby ensuring a link between the external environment and the work environment as well as total solutions for the entire health and environmental area. (See p. 14 for a summary of SAS's work on health and the work environment, which is dealt with in more detail on p. 50 in SAS's 1997 annual report.)

In the jointly owned companies where SAS has board representation (e.g. SAS International Hotels), SAS's *board members* are responsible for ensuring that environmental efforts comply with SAS's environmental philosophy and strategy.

In the aviation sector, there are detailed plans for emergency rescue services and crisis management in the event of crashes and other accidents. Prevention and clean-up of contaminating discharges form an important part of these plans, especially in Europe. At the airports where SAS has substantial traffic, primarily in Scandinavia, SAS takes part in incident planning and practice drills.

Environmental permits

The company must comply with the applicable laws and granted permits:

- The Scandinavian certification for conducting civil aviation operations also incorporates environmental approval.
- All operative flight activities (takeoff, landing, overflys, etc.) are subject to official permits, which also regulate environmental conditions.
- In cabin operations, it is often SAS's subcontractors (catering, waste collection, etc.) who are responsible within the framework of various permits (veterinary and hygiene regulations, waste management, etc.).
- All technical bases have a number of permits, e.g. for emissions into water and air.

Compliance is ensured through proactive measures (e.g. regular inspection of underground tanks) and continuous, periodic or random inspections and routine reports to the authorities and other issuers of permits.

INTERNAL INFORMATION AND EXPERTISE DEVELOPMENT

One central objective is use of information and training at all levels in the organization to promote employee awareness of SAS's environmental philosophy, and thereby ensure that environmental consideration is actually taken in day-to-day work.

SAS has chosen not to carry out routine environmental training for all employees, but instead integrates flexible environmental segments in the expertise development pro-

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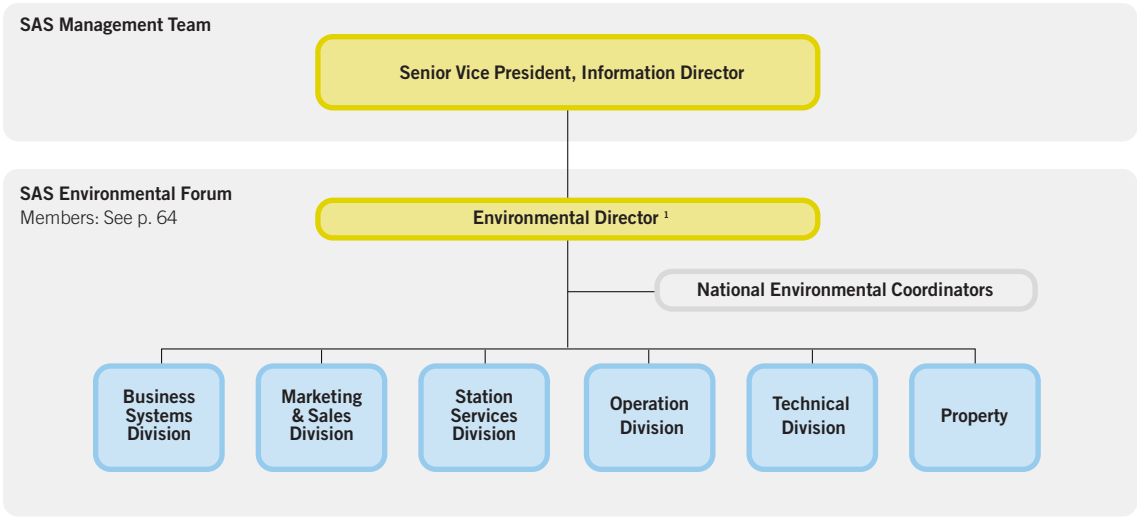
» **In our wide-ranging ground operations** *there is major potential for more efficient resource consumption – fewer and less chemicals in the workshops, reduced water consumption in washing of aircraft, more fuel-efficient ground vehicles and buses, etc. But above all, energy consumption for electricity in and heating of the nearly 500,000 m² of premises where we conduct operations. We are already utilizing innovative alternatives like geothermal heating at the head office in Stockholm and biofuel-fired district heating at Arlanda Airport, and the new environmentally adapted facilities which will open in 1998, particularly in Oslo and Copenhagen, will further reduce consumption of resources.* «

BJØRN NORDBY
OPERATIVE MANAGER, REAL ESTATE DEPARTMENT, OSLO

[FIG. 5] **SAS'S ENVIRONMENTAL ORGANIZATION**



[1] *Also coordinates SAS's representation in international environmental forums.*

grams primarily for managers and key staff, based on the respective employee's needs and work duties. The most important environmental training activities are:

- Regular environmental information and training for management teams at the divisional level, covering a total of some 50 managers.
- Middle managers, approx. 500, and safety representatives are informed about the priorities in environmental work based on the latest environmental report.
- Environmental aspects are included in one of the three modules of the training program for some 200 managers in the international traffic network.
- In cabin operations, an environmental training program is being introduced in 1998 for parts of the operative management and SAS's suppliers.
- In Copenhagen since 1995, an environmental module is part of basic training for some 50 managers per year. Since 1986-87 there is also a special ongoing training program for all employees who handle chemicals.
- In 1997 SAS initiated development of an environmental training program for all new managers, which will be attended by an estimated 100–150 persons in the next few years.

The ambition is for SAS's environmental report to serve as one of the most important sources of information on environmental conditions and efforts for SAS's own employees. Updates on SAS's environmental efforts are also provided in the internal newsletter Inside which reaches all employees, as well as features in the internal video Fokus which is distributed to some 800 SAS managers for further circulation.

Environmental issues are a natural part of the agenda at SAS Management Team meetings, and the Environmental Forum is informed about significant environmental matters which have been dealt with by the Management Team.

In the environmental area, development initiatives from the organization are generated naturally in the TQM process, the national Health, Environment and Safety units and the cooperation with trade unions and safety representatives. Ahead of 1998, SAS's ordinary suggestion routines have been reorganized and assimilated in the TQM process for improved efficiency.

COOPERATION

Partners

In addition to SAS, in 1997 Air Canada, Lufthansa, Thai Airways, United Airlines and Varig were all members of the Star Alliance (where SAS has also developed a bilateral environmental collaboration with Lufthansa). The parties have agreed on an ambition for future environmental efforts based on the philosophy of continuous improvement. Like other forms of cooperation, joint environmental work is conducted within the Alliance's special partner forum, where among other things the scope for reaching consensus on uniform key ratios, measurement routines for benchmarking environmental performance and standards for pre-sorting are studied. Star Alliance also works actively with development of long-term predictable and internationally competetively neutral means for environmental control and development of more effective international traffic control systems with effects on fuel consumption and emissions.

In the other partner companies (where SAS in many cases has an ownership stake) – Air Baltic (Latvia), Air New Zealand, British Midland, Cimber Air (Denmark), Icelandair, Quantas (Australia), Skyways (Sweden), Spanair (Spain), Widerøe (Norway), and with effect from 1998 also Air Botnia (Finland) – we partake in a mutual exchange of experience in the environmental area.

Suppliers

SAS's purchasing philosophy incorporates environmental considerations at the same level as other key elements such as quality, price and delivery conditions. In SAS purchasing manual, which was revised in 1997, it is stipulated e.g. that all subcontractors must fulfill SAS's environmental requirements in both negotiating for new agreements and renegotiating existing ones (see e.g. the report on the year's environmental projects in cabin operations on p. 32). In general, SAS requires that suppliers have an environmental policy and an action plan for environmental work, and can document environmental data for the goods and services SAS purchases, and that their suppliers meet the same requirements. The suppliers should be evaluated based on their ability and ambition to develop environmentally adapted products and services while maintaining the right quality and a competetive price level. In cabin operations the purchasing policy also requires the suppliers, within the framework of cooperation with SAS, to initiate at least one new environmental project in their operations and report this to SAS.

The environmental clauses in SAS's supplier agreements often lead to a higher level of ambition and activity in the suppliers' own environmental efforts, where SAS gladly takes part and develops its own know-how and experience. For instance, in cabin operations an example of a successful environmentally related supplier cooperation will be featured on SAS's Internet site as an inspiration for other suppliers. In addition, cabin operations hold an annual conference with suppliers (where among other things SAS's environmental award for exceptional progress in the environmental area is presented) in order to strengthen agreement on the underlying objectives for environmental cooperation. One consequence is that more suppliers now include similar clauses in their own supplier agreements. The results of the suppliers' environmental efforts are often a source of valuable feedback for SAS.

Some examples of supplier cooperation with a tangible environmental impact are the development of new coffee packaging in collaboration with Nestlé, environmental adaptation of catering operations together with Gate Gourmet which includes drawing up of environmental key ratios per meal, elimination of sleeves on the necks of wine bottles in cooperation with six major wine suppliers and a requirement for environmental labeling of newspapers in cabin operations, such as Expressen and Göteborgs-Posten. All of these measures have resulted in significant reductions in raw material consumption and waste volumes. In several cases, such as environmental labeling of newspapers, SAS's criteria have driven development of stricter industry standards.

The greatest environmental effects are achieved in connection with orders for new aircraft, where SAS strives for lower fuel consumption, which automatically leads to lower emissions. SAS demands that new aircraft perform better than those they replace, and applies of policy of utilizing the best possible technology. Among other things, this meant that in 1996 we were the first airline in Europe to introduce the McDonnell Douglas low-noise MD-90 in service and in 1998 will be first in Europe to fly the Boeing 737-600 with a special engine featuring a double annular combuster (DAC) which minimizes nitrogen oxide emissions. The latter was also fitted with a quieter auxiliary power unit (APU) for providing electricity and air conditioning when the aircraft is on the ground, developed in response to SAS's criteria.

Other stakeholders

Aside from its own partners and subcontractors, SAS is engaged in a continuous dialogue with a number of other stakeholders. For obvious reasons, this includes both large and small factors:

- Passengers are actively involved in environmental efforts by returning used newspapers when exiting the aircraft, for recycling and reuse.
- Each SAS station maintains a continuous dialogue with the respective airport owners and local authorities.
- In connection with special projects, such as construction work at the Copenhagen Airport and Oslo's new Gardermoen Airport, specially tailored communication programs are created for the affected stakeholders.
- Every year, the members of the SAS Environmental Forum make study visits to other companies conducting successful environmental work for a mutual exchange of experience.
- The associated companies' environmental efforts are influenced via directives to SAS's representation on their respective boards.
- In the Scandinavian countries, SAS conducts a systematic dialogue with influential environmental organizations.

Industry organizations

SAS participates in the activities of the following national industry organizations:

- **Flyselskapenes Landsforening** In the Norwegian airline sector organization SAS is represented in the governing bodies as well as numerous environmental work groups.
- **Föreningen Svensk Flyg** In the Swedish airline sector organisation SAS is represented in various committees.
- **Dansk Industri** SAS is active in the aviation section which has been set up within the employers' association Dansk Industri.

National and international authorities, agencies, etc.

In Denmark, Norway and Sweden SAS conducts an ongoing dialogue on environmental issues with the respective environmental and communications departments and aviation authorities, and cooperates closely with airport owners above all at the three main airports in Copenhagen, Oslo and Stockholm.

In addition to these continuous contacts, SAS reports regularly to the appropriate authorities in the event of emissions, accidents, etc. (see the Board of Directors' Environmental Report on p. 10).

With regard to international cooperation, SAS is active in all the central agencies:

- **ICAO** Since the late 1980s, SAS has participated both as a member and as the IATA's representative in the ICAO expert group CAEP, which is responsible for developing and establishing rules and recommending measures to reduce the environmental impact of air transport. The issues discussed in 1997 included a possible increase in stringency of certification standards for nitrogen oxide emissions by a further 16% and a concept for future emission charges.
- **IATA** SAS is part of the IATA work group which is devoted to environmental issues – the Environmental Task Force (ENTAF) – and can therefore contribute its experience from all over Scandinavia to the international environmental effort. The issue of more stringent ICAO standards for nitrogen oxide emissions has also been discussed within the IATA. Furthermore, the IATA led a legal inquiry into proposals for new noise regulations at airports in London and Zurich (the English inguiryl was won in 1997 while the Swiss inguiry will continue in 1998). The IATA's environmental section participated in several conferences and other meetings to present facts about the airline industry's environmental efforts and the IATA's Secretariat joined several individual airlines in formulating an IPCC report on air transport and global warming.
- **AEA** SAS is a member of the AEA's environmental work group which follows the European airline industry's environmental issues, such as the EU directive which prohibits Chapter II aircraft with effect from April 1, 2002, the ongoing efforts to draft a joint-EU carbon dioxide tax and discussions within the EU on not imposing special restrictions on hushkitted Chapter II aircraft. SAS and other leading airlines are active in the AEA's efforts to draw up international waste handling standards, initiated by SAS. Development of rules for protection from cosmic radiation is also being carried out in association with airlines in the AEA.
- **N-ALM** Coordination between the different members gives the Nordic perspective more weight in international forums, such as the ICAO and the EU. In 1997, N-ALM dealt with issues in the Swedish Civil Aviation Authority's work group for noise- and emission-differentiated landing charges.

The cooperation within the Star Alliance, particularly with Lufthansa, gives SAS greater influence in driving environmental issues in both the IATA and the AEA.

In 1997 SAS also participated in the work group for noise and emissions-related charges (BARLA) under the direction of the Swedish Civil Aviation Authority, which studied a new charge system based on emissions of nitrogen oxides which was introduced on January 1, 1998.

SAS is also active in the EU project AEROCERT, which charts how certification data correlates to emissions data from active operation.

ENVIRONMENTAL PROFILING AND SPONSORSHIP

The strategic target groups for SAS's environmental communication are customers, suppliers, the public, massmedia and authorities. SAS's strategy for environmental profiling includes participating in environmental exhibitions, seminars and debates. An active dialogue on environmental issues is conducted with the massmedia and authorities. SAS also distributes its own environmental information in the form of the environmental report, advertisements and brochures, etc., and via contributions to the in-flight magazine Scanorama.

With effect from 1998 SAS is engaged in sponsorship of Save the Children in Denmark, Norway and Sweden, and the Norwegian environmental organization Bellona. Together with Coca-Cola, SAS manages a newly established foundation which administers a fund for a better water environment in the Nordic-Baltic region – The SAS/Coca-Cola Environmental Foundation. For several years SAS has been one of the main sponsors of the campaign to clean up Swedish roads and highways and has supported the work of the Worldwide Fund for Nature.

In 1997 SAS also sponsored publication of a free of charge teaching aid for elementary schools which was previously published in Sweden and has now also been published in Norway. During the year SAS sponsored childrens' activities in the Norwegian environmental conservation organization and provided support through advertisements in various environmental publications.

The impact of these activities on SAS's environmental image is monitored continuously with the help of regular surveys.

»Every manager is obligated to include an environmental impact assessment as part of the basis for decision-making.«

[EXCERPT FROM SAS'S ENVIRONMENTAL MANAGEMENT PHILOSOPHY]


SK 369421
SAS
MOL
BU 182
FBU
SK 497
CHECKED
BAGGAGE

Terms and abbreviations

Acetate Acetic acid (CH_3COOH_x). Used by airport operators in deicing of runways, as a less environmentally harmful alternative to urea (see definition). Contributes to overfertilization.

Acidification A chemical reaction involving a fall in pH in lakes, groundwater and soil due to the effects of nitric acid, which is formed from nitrogen oxides (see definition), and sulfuric acid, which is formed from sulfur dioxide (see definition).

Soil acidification has an indirect impact on vegetation, while acid precipitation on the surface of foliage directly affects plant life. Biodiversity in lakes and waterways decreases. Acidification accelerates leaching of nutrients into the ground, while solubility of heavy metals and aluminum in the soil also increases. This many inhibit root growth and, accordingly, reduce nutrient absorption. Microorganism activity is also affected, so that their ability to break down organic material is impaired.

Acidification also attacks iron structures and objects of limestone and marble, such as statues and facade ornamentation.

AEA Association of European Airlines, cooperative body for European airlines.

APK Available Passenger Kilometers, available capacity for passengers expressed as the number of seats multiplied by the number of kilometers flown (see also *ASK, ATK, RPK, RTK*).

ASK Available Seat Kilometers, the available number of passengers seats multiplied by the distance flown (see also *APK, ATK, RPK, RTK*).

ATK Available Tonne Kilometers, available capacity for passengers and cargo expressed in tonnes (metric tonnes), multiplied by the distance flown (see also *APK, ASK, RPK, RTK*).

Atmosphere The gaseous envelope surrounding the earth (see also *Stratosphere, Troposphere).*

Biofuel Solid or liquid fuel produced from living organisms, primarily plants.

Cabin factor Percentage of available passenger capacity that is utilized during a flight.

CAEP Civil Aviation Environmental Protection, technical committee in the ICAO (see definition) charged with developing and establishing rules and recommending measures to reduce the environmental impact of aviation.

Carbon dioxide (CO_2) Formed in the combustion of all fossil fuels. Carbon dioxide is a key component of the ecocycle – it is released in the air exhaled by animals and absorbed in the photosynthesis process in plants – and is the most significant greenhouse gas.

Carbon monoxide (CO) Toxic and combustible gas formed by incomplete burning of substances containing carbon, e.g. fossil fuels.

Certification ICAO's (see definition) requirements regarding e.g. noise and emissions of carbon monoxide, nitrogen oxides and hydrocarbons (see definitions and *Chapter II, III).*

CFC Chlorofluorcarbons, certain halogenated hydrocarbons, such as the trademark Freon (see also *Depletion of the ozone layer).*

Chapter II, III ICAO's (see definition) noise certification requirements.

CO Carbon monoxide (see definition).

CO_2 Carbon dioxide (see definition).

Concession Official permit to conduct certain operations, often designed to ensure compliance with environmental protection requirements and appropriate utilization of natural resources.

dB Decibel, logarithmic unit of sound measurement. Figures are often weighted to take into account the human psychological perception of sound, e.g. as dB(A). (See also *Noise, EPNdB).*

Depletion of the ozone layer High altitude ozone, in the stratosphere, absorbs shortwave (ultraviolet) solar radiation, thereby protecting life on earth. The ozone layer is very thin; if all the ozone found in the stratosphere were collected at sea level, it would be only some 3–4 mm thick.

In recent years, human use of gases like Freon and halons have caused rapid depletion of the ozone layer, particularly over the Antarctic, since these halogenated hydrocarbons cannot be broken down or extracted from lower layers of air. Instead, they are borne up into the stratosphere, where they are broken down by short-wave sunlight, releasing chlorine atoms that break down ozone far more rapidly than it is formed.

Without the protective ozone layer, proteins and other vital organic molecules could not exist (except underwater, since water also absorbs UV light). A depleted ozone layer also increases the risk of skin cancer, cataracts and impairment of the immune system.

Like other industries, airlines are working to replace ozone-depleting chemicals with less harmful alternatives. This mainly applies to Freon, used in air conditioning equipment, and halons, used for extinguishing fires. SAS has replaced a more hazardous type of Freon with one that has considerably less impact on the ozone, invested in a halon recycling plant in Copenhagen and entirely phased out halons in Stockholm.

ECAC European Civil Aviation Conference, a forum for cooperation between and coordination of European national authorities in issues related to civil aviation.

Ecoefficiency The capacity to deliver reasonably priced products and services that satisfy human needs and enhance quality of life while progressively reducing ecological impact and resource consumption, throughout the life cycle, to a level at least equal to the earth's estimated carrying capacity.

Ecosystem Ecological system, including all life and living environments within a defined area.

El Niño Periodically recurring disruptions in the Pacific Ocean current which cause disturbances in the global climate system, particularly in the coastal regions of South America.

EMAS Eco-Management and Audit Scheme (*see Environmental Management Systems*).

ENTAF Environmental Task Force, working group within the IATA that deals particularly with environmental issues.

EPNdB Equivalent Perceived Noise, a unit commonly used in the aviation context to express the average perceived noise level. (See also *Noise, dB.)*

Fossil fuels Fuels comprising organic carbon and hydrogen compounds in sediment or underground deposits – especially coal, oil and natural gas.

Freon See *CFC.*

Gap analysis See p. 53.

GCD Great Circle Distance, definition of the shortest flight distance between two points, taking the curve of the earth's surface into account.

Germicides Added to the sanitizing liquid in lavatories on board to reduce infection risks.

Glycol A relative of alcohol which is sprayed on aircraft in cold weather to prevent ice formation. Nowadays non-toxic propylene glycol is used. Approximately 80% of the glycol runs off the aircraft when it is applied, and seeps into the ground unless collected. A further 15% is emitted into the air and thus spreads in the vicinity of the airport. Heavy emissions may cause deoxygenation in groundwater and small waterways, since oxygen is required to break down the glycol.

Airports use vacuum trucks and flushing sites with drainage facilities to collect glycol run-off for reuse. SAS is also attempting to minimize consumption through more effective application techniques.

Greenhouse effect See pp. 48–49.

Halons A general designation for halogenated hydrocarbons and, specifically, a brand name for fire extinguishing agents (see also *Depletion of the ozone layer*).

HC Hydrocarbons (see *VOC*)

Heavy metals Certain high density metals, e.g. cadmium and mercury, that once they have entered the food chain are persistent in the long-term and can thus cause severe damage.

Hydrocarbons See *VOC.*

IATA International Air Transport Association, international cooperative body for 256 of the world's airlines.

ICAO International Civil Aviation Organization, the UN's specialist agency for international civil aviation. One of its functions is to develop internationally binding norms for commercial aviation.

ICC International Chamber of Commerce.

ISO 14000 The International Organization for Standardization's standard for environmental management and audits.

k Abbreviation for kilo- (as in kWh), i.e. thousand (1,000).

Life cycle assessment (LCA) Systematic method used to describe and evaluate a product's total environmental impact throughout its entire life cycle.

Low level ozone (O_3) 90% of the atmospheric ozone is found at an altitude higher than 10 km (stratosphere, see definition). At lower altitudes (in the troposphere, see definition), ozone is formed by sunlight acting on hydrocarbons, nitrogen oxides, carbon monoxide, etc. (see *Nitrogen oxides*). Low level ozone is

ENVIRONMENTAL MANAGEMENT SYSTEM

EMAS The EU's Eco-Management and Audit Scheme.

In its original form, EMAS has been, and remains, focused on the industrial sector, where experience of applying environmental management and auditing is longest. However, pilot studies are underway in preparation for the anticipated revision of EMAS in 1998, with extension of the system to include such activities as transportation, services and public administration. (SAS participates in this work together with the Swedish Civil Aviation Administration through the register authority for EMAS in Sweden, the Environmental Control Council).

Under the EMAS ordinance, companies can voluntarily register their facilities in the system. The company is then required e.g. to adopt an environmental policy for its entire operations, and for the facility in question to:

- Carry out an environmental survey and define environmental targets.
- Introduce an environmental program and environmental management system in order to fulfill environmental policy and targets.
- Implement environmental audits.
- Draw up an environmental report.
- Engage an accredited environmental inspector to review and approve the environmental policy, program, management system, survey or audit procedure and environmental report.
- Disseminate the approved environmental report among the public in an appropriate manner.

ISO 14000 Summary designation for international standards in the environmental sector which are administered by the International Organization for Standardization.

The general management principles on which ISO 14000 is based are the same as in the ISO 9000 quality standard. Draft environmental standards exist in several areas, and in 1996 the first of these were adopted – ISO 14001 and 14004, which form the basis for an internationally accepted environmental management system. An approved system of this kind is a prerequisite for EMAS registration of facilities.

Differences between EMAS and ISO 14001 The EMAS ordinance resembles the ISO 14001 standards in many respects, but since they were developed at different points in time and in different forums, there are some important distinctions:

- The EMAS ordinance is currently adapted for industrial facilities in the EEA (the European Economic Area), while the ISO standards are intended for use by all types or organizations worldwide (which means that the activities EMAS is adapted for are also covered by ISO 14001).
- EMAS registration relates to a facility, including its environmental policy, program, management system, survey or audit procedure and environmental report, while ISO 14001 certification covers only the environmental management system.
- EMAS refers primarily to environmental auditing of facilities and their environmental aspects, while ISO 14001 refers to auditing of environmental management systems. However, through an extended procedure the ISO standards can be applied so as to cover the environmental audit requirements in EMAS as well.
- Both EMAS and ISO 14001 stipulate the drawing up and maintenance of an environmental policy that dictates continuous improvements. Unlike the ISO standard, EMAS also requires the environmental policy to be based on the objective that environmental impact may not exceed that achieved with economically feasible utilization of the best available technology.
- EMAS, but not ISO 14001, requires environmental reports for specific facilities to be drawn up and issued to public agencies and the general public.
- According to EMAS, a company must ensure that suppliers to the facility which is to be registered apply environmental standards corresponding to the company's own. These requirements are less clearly expressed in ISO 14001.

formed at the lowest level of the troposphere, i.e. up to 100–200 meters.

Combined with sulfur dioxide and nitrogen oxides, ozone damages plant life. It also occurs over large areas in such concentrations as to be a cause of plant damage in its own right. In some metropolitan areas smog is formed by high ozone concentrations in combination with air-borne particles, which can cause irritation of the eyes and mucous membranes as well as headache and respiratory problems at higher concentrations.

M Million (as in MSEK) or mega- (as in Mtonne, i.e. one megatonne = 1,000,000 tonnes).

Methane (CH_4) Marsh gas. Comprises the key component of natural gas and is formed through decomposition of vegetable matter, e.g. in agriculture and garbage dumps. Contributes to the greenhouse effect (see pp. 48–49).

N-ALM The Nordic Working Group for Environmental Issues in Aviation, composed of civil aviation, environmental and communication authorities, and airlines.

Nitrogen oxides (NO_x) A collective name for various compounds of oxygen and nitrogen. These are formed in all combustion – in aircraft engines because the high temperature and pressure cause the atmospheric nitrogen and oxygen to react with each other, mainly during takeoff and ascent when the engine temperature is at a maximum.

At low altitudes nitrogen oxides are converted into nitric acid (HNO_3), which is deposited in the natural environment. In moderate quantities, nitrogen has a positive effect on growth, but when the limit for what plants can absorb is exceeded nitrogen contributes to acidification (see definition) of soil. Throughout the troposphere (see definition), nitrogen oxides react with VOC (see definition) and sunlight, forming oxidants (see definition), especially ozone (O_3, see definition) which at altitudes up to 100–200 meters is known as low level ozone. In the rest of the troposphere, i.e. above 100–200 meters, ozone works as a highly effective greenhouse gas (see *Greenhouse effect*). At altitudes above 8–10 km (the lower stratosphere, see definition), where aircraft sometimes cruise during long flights, nitrogen oxides remain in the air for years before finally reacting with and breaking down ozone molecules (see *Depletion of the ozone layer*). However, the contribution of air traffic to the "hole" in the ozone layer is assumed to be negligible.

With effect from 1996, the ICAO has introduced more stringent requirements for nitrogen oxide emissions and by around 2000 these are expected to be made even more stringent. New engines with double annular combusters (DACs), for example, reduce emissions by up to 40% compared with the previous generation of engines. SAS has decided to equip a large part of its fleet with DAC engines from 1998.

Nitrous oxide (N_2O) Greenhouse gas (see pp. 48–49), which is formed e.g. in combustion processes and through synthetic fertilization, and is broken down through photochemical processes in the stratosphere into carbon monoxide and nitrogen oxides.

Noise A subjective perception which can be defined as "undesirable sounds". It is often more meaningful to judge individual noise situations, such as how noise from airports, railroads, highways and industries affect the local environment, than to measure general noise levels. Within the EU, aircraft types with high noise levels, so-called Chapter II aircraft (see definition) will be banned from April 1, 2002. SAS will have phased out these aircraft by year-end 1999. (See also *dB, EPNdB*).

NO_x Nitrogen oxides (see definition).

O_3 Ozone (see definition).

Oil aerosols Oil sprayed from the aircraft engines during operation under high pressure. Upon contact with air it forms a fine mist which is then broken down primarily into carbon dioxide.

Overfertilization In most natural ecosystems growth is limited by access to nitrogen, and plant life reacts quickly to changed nitrogen levels – so-called overfertilization. Today the supply of nitrogen to lakes, groundwater and soil in certain parts of southern Sweden has exceeded the limit for what the vegetation can assimilate. From having originally been a local

phenomenon with agriculture causing overfertilization on limited areas of land, this problem has now expanded to the regional scale as increasingly large areas are affected by nitrogen fall-out from the air.

Increased nitrogen levels and rapid growth cause leaves and needles to age faster and fall, trees become more sensitive to frost and resistance to parasites decreases. Algae and other microorganisms begin to appear, e.g. on needles and tree trunks, and nitrogen-seeking vegetation eventually overcomes other plants in the ecosystem, fundamentally altering the biological composition. Nitrogen oxides in water form nitrates, which decrease the quality of drinking water when they seep into the groundwater.

The addition of nitrogen also causes imbalances in waterways, leading to increased production of biological material which consumes a great deal of oxygen during decomposition, and the deoxygenation which may arise then kills fish and shellfish living at the lake bottom. Nitrogen-seeking vegetation proliferates at the expense of other plants, and one well known phenomenon in recent years is the massproliferation of certain marine algae.

Oxidants Group of powerful oxidizing agents, including ozone (see also *Low level ozone*).

Ozone, ozone layer See *Low level ozone* and *Depletion of the ozone layer.*

Passenger kilometers The number of passengers transported multiplied by the distance flown.

Photochemical Of or relating to a process, reaction, etc., caused by absorption of solar radiation.

Photosynthesis The process by which all plants convert light into chemical energy, mainly by fixing carbon in the form of carbon dioxide.

RPK Revenue Passenger Kilometers, utilized (sold) capacity for passengers expressed as the number of seats multiplied by the distance flown (see also *APK, ASK, ATK, RTK*).

RTK Revenue Tonne Kilometers, utilized (sold) passenger and cargo capacity expressed in tonnes (metric tons), multiplied by the distance flown (see also *APK, ASK, ATK, RPK).*

SEK International currency designation for Swedish kronor.

SO_2 Sulfur dioxide (see definition).

Star Alliance Airline industry cooperation between Air Canada, Lufthansa, SAS, Thai Airways, United Airlines and Varig.

Stratosphere Part of the earth's atmosphere (see definition) between 10 and 50 km above the earth's surface.

Sulfur dioxide (SO_2) Formed in combustion of fossil fuels, through oxidation of sulfur in the fuel by atmospheric oxygen. In the atmosphere it is slowly condensed by photochemical oxidation, forming sulfuric acid (H_2SO_4). A small proportion of the sulfur dioxide is further oxidized to form sulfur trioxide (SO_3), which, on emission, immediately absorbs water, in turn forming sulfuric acid.

Sulfuric acid in precipitation contributes to acidification (see definition). Locally, sulfur dioxide may also be present in such high concentrations as to cause direct plant damage. Sulfuric acid is also highly corrosive and attacks iron, limestone and marble, with visibly damaging effects on statues and facades in cities with air pollution.

Aviation fuel contains a minute proportion of sulfur, and, accordingly, causes only minor emissions of this substance. The same applies to the "green" diesel now used in ground vehicles. In the airline industry, as in many others, sulfur dioxide emissions come largely from oil-fired heating. In the past few years, SAS has cut its sulfur emissions by 80%, both by switching to oils with a lower sulfur content in its oil-fired heating plants and by replacing oil-fired with LPG-fired heating, district heating or electricity where it is cost-effective to do so.

Sustainable development For humanity to satisfy its needs today without limiting future generations' opportunities to satisfy theirs.

Tonne kilometers The number of transported tonnes of passengers and cargo multiplied by the distance flown.

TQM Total Quality Management, a management philosophy in which a company or organisation strives to exceed the customers' expectations by improving its competitiveness through the efforts of the employees. See also section beginning on p. 51.

Troposphere Lowest part of the earth's atmosphere (see definition) extending to an altitude of between 10 and 20 km above the earth's surface.

Urea A urine substance synthetically produced from carbon dioxide and ammonia which is used by airport operators for deicing of runways. Contributes to overfertilization. See also *Acetate*.

VOC Volatile Organic Compounds, a collective name for a number of different compounds, including most hydrocarbons (HC). They are emitted during incomplete combustion of fossil fuels – in aviation mainly when the engine is at low speed and the temperature in the combustion chamber is low. This category also includes all types of solvents that evaporate from e.g. detergents and paints.

Together with nitrogen oxides and sunlight, VOC form low level ozone (see definition). Solvents containing chlorine also contribute to depletion of the ozone layer (see definition). Many constituents of solvents also cause direct damage, such as leaf loss in plants and poisoning of fish and mammals.

From April 1, 2002 only aircraft with low VOC emissions will be permitted in the EU. The modern aircraft that SAS is now phasing in will have hydrocarbon emissions more than 90% lower than their predecessors. As in other industries, a changeover to non-solvent chemicals is taking place in aircraft maintenance. Where this is not feasible, SAS is first phasing out all chlorinated substances.

SAS ENVIRONMENTAL FORUM

Niels Eirik Nertun
Environmental Director
Telephone: +47 67 59 78 12
Telefax: +47 67 59 83 70

Jens Stokholm
Environmental Coordinator, Denmark[1]
Telephone: +45 32 32 52 32
Telefax: +45 32 32 52 91

Reidar Pettersson
Environmental Coordinator, Sweden
Telephone: +46 (0)8 797 47 12
Telefax: +46 (0)8 797 36 90

Berit Wifladt
Environmental Coordinator, Norway

Ingolf Jørgensen
Property

Bengt Noreskog
Technical Division,
Traffic Related Maintenance

Linnar Borén
Station Services

Bengt Olov Näs
Fleet Development

Lars Benett
Traffic Planning

Janne Sødring
Cabin Operations

Linda Fredheim-Björk[2]
Marketing & Sales

[1] *Martin Porsgaard Nielsen, Health, Environment and Safety, has participated as a substitute and contributed to this environmental report. He is also responsible for preparing the environmental statements for SAS Denmark.*
[2] *Susanne Ganning, Corporate Communications, has acted as a substitute.*

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SAS DANMARK A/S

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Telephone: +45 32 32 45 45

SAS NORGE ASA

NO-1330 Oslo Airport
Telephone: +47 67 59 63 99

SAS SVERIGE AB

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