Environmental Report 1998

The SAS Consortium

SAS Danmark A/S • SAS Norge ASA • SAS Sverige AB

Contents

SAS's environmental report is also available on the Internet (*www.sas.se*).

Additional environmental information is found both on the Internet and in information units which are directed to a variety of different target groups (see p. 1).

The next environmental report is expected to be published in March 2000.

Airline industry-related words, expressions and abbreviations are explained at the end of this report (environmetally related only on the Internet).

Environmental information for different target groups

Now it's easier to find what you're looking for

This is the fourth year that SAS has reported on development of the company's environmental impact, environmental activities and their effects on the financial results. However, this is the first year that all data is not presented in this particular publication.

The reason for this is that the scope of our environmental activities has increased dramatically since we began working systematically according to our new environmental strategy in 1995. To prevent the environmental report from becoming unwieldy, this year we have condensed it somewhat and directed it specifically to readers with a special interest in the environment. For example we have limited quantitative environmental data mainly to the information in SAS's various environmental indexes – the others can be found on SAS's web site. In exchange, we have supplemented it with additional information units where we can better adapt our information to the specific needs of different reader categories.

How to find "your" information unit

All significant data on SAS's environmental work is still reported – but now it is separated into more units:

- **Environmental Report** Starting this year, the environmental report is directed more to readers with a special interest in the environment, such as the environmental managers of corporate customers, financial analysts with an interest in the environment and political decision-makers with responsibility for transports and the environment, environmental journalists and key staff within SAS.
- **Financial Annual Report** The environmental information in SAS's financial annual report is directed to players in the financial market, such as shareholders and analysts. There, it is presented from an economic standpoint in order to provide a concise summary of the overall financial consequences of SAS's environmental impact and activities. For a more detailed account, these readers should also see the separate environmental report.
- **The Internet** SAS's web site (*www.sas.se*) presents the environmental report in full, together with supplementary data and in-depth environmental information for those with a special interest. This information channel will be further developed in 1999.
- **Other information material** We will produce different information units to meet the specific information needs of various target groups. One example is the condensed popular environmental report which is distributed to our passengers and all SAS employees. Another example is the booklet directed to SAS's suppliers.

See p. 48 for information about how to order them.

How to find your way in the environmental report

The information in the environmental report is structured so that you can concentrate on certain sections depending on your primary area of interest and then proceed when you need supplementary or more detailed information:

- **General summary** "The SAS Group in Brief" on pp. 2–3, SAS's environmental index on pp. 18, 22, 28 and 32, and the summary of the most significant key statistics for environment and economy on pp. 19–20 are intended to provide a very general overview of development of SAS's environmental impact and economy in relation to production.
- **Full report** If you want an in-depth look at SAS's environmental strategies and activities, you will find the most essential details in the President's comments, the Board of Directors' environmental report and the first section of the environmental data on pp. 6–20.
- **Environment and economy** If you seek information on the financial consequences of SAS's environmental impact and efforts to exploit the commercial potential of environmental aspects, you will find a helpful overview on pp. 19–20. Other significant information can be found in the Board of Directors' Environmental Report on pp. 10–25.
- **Environmental work in practice** Insight into how SAS's environmental ambitions and strategies can be applied in day-to-day work is found on pp. 38–39, as well as in the review of SAS's environmental management system on pp. 40–46.
- **Facts and figures** Those interested taking in a closer look at the quantitative data on which the environmental indexes are based will find information on pp. 22–35.
- **Words, expressions and abbreviations** Airline industry-related definitions are listed on p. 47 (environmentally related definitions are found in the environmental section of SAS's web site).

Niels Eirik Nertun
Director Environmental Dept.

The SAS Group in Brief

Operations

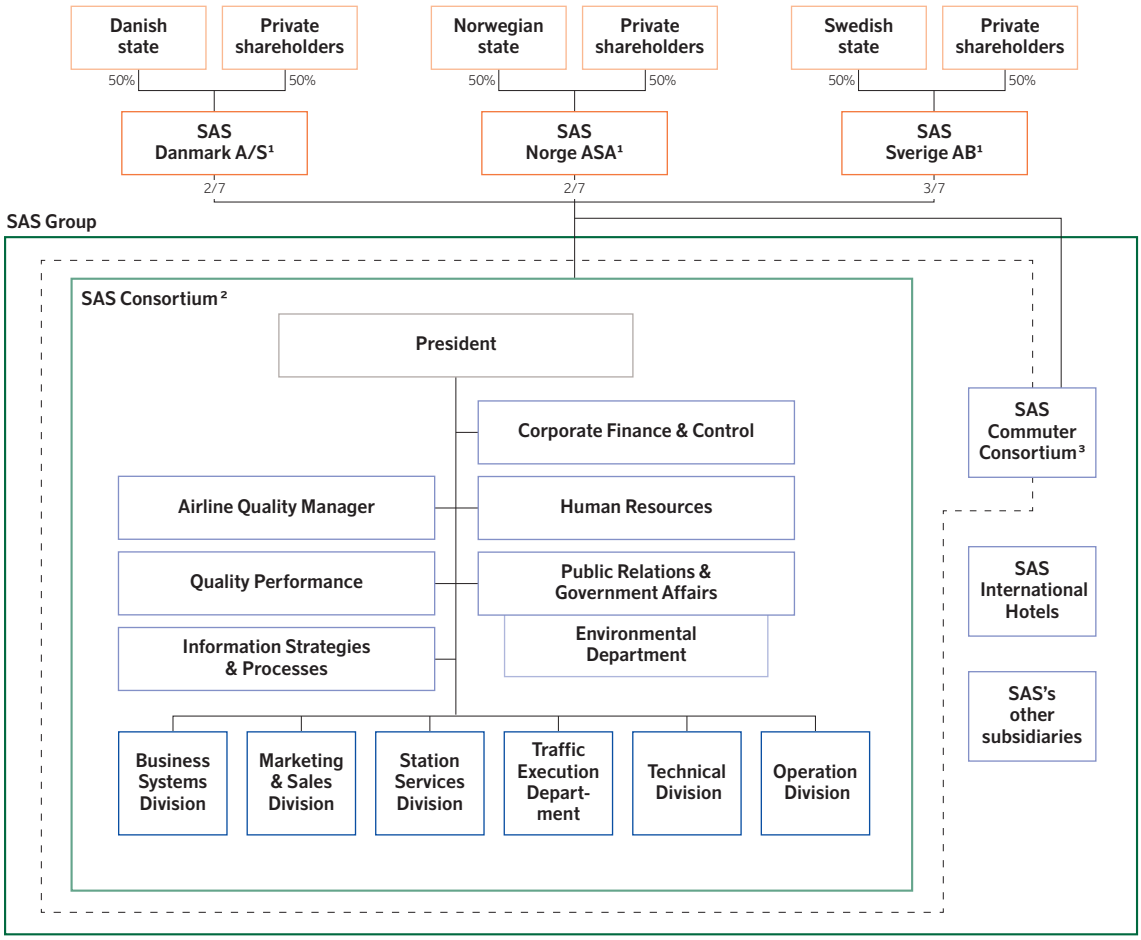
Areas of operation

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

Scope of operations

During 1998 SAS carried 21,699,000 (20,797,000) paying passengers ("revenue passengers") to 101 destinations in Scandinavia and the rest of the world, and SAS Cargo transported 279,924 (278,369) tonnes of cargo. The SAS Group's aggregate turnover in 1998 was 40,946 (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 parent companies SAS Danmark A/S, SAS Norge ASA and SAS Sverige 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 1998 includes the SAS Consortium, SAS Commuter's aircraft fleet 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 close to 24,000 people, of whom approx. 8,700 work in Denmark, 5,700 in Norway and 8,200 in Sweden.

[1] Figures for the average number of employees in 1998 include SAS Commuter (see also p. 2).

SAS Consortium

Production and traffic[1]

	available tonne kilometers (ATK)								
1998	**[Mtonnekm]**	**Change [%]**	**Share [%]**	**RTK [Mtonnekm]**	**ASK x10³**	**RPK**	**Change [%]**	**Cabin factor 1998**	**(1997)**
Intercontinental	1,584	6.2	34	1,186	9,679	7,536	0.5	77.9	(79.4)
Europe + Intra-Scandinavian	1,803	0.6	39	894	15,623	9,357	3.1	59.9	(58.5)
Denmark	87	–12.9	2	46	693	429	–9.0	61.9	(58.2)
Norway	317	1.3	7	180	3,054	1,913	4.4	62.6	(60.9)
Sweden	327	5.1	7	183	3,197	2,034	11.8	63.6	(60.2)
Total[3]	**4,647**	**3.7**	**100**	**2,760**	**32,357**	**21,269**	**2.7**	**65.7**	**(64.9)**

[1] Incl. SAS Commuter (see also p. 2).
[2] The figure includes paying passengers over a certain payment limit ("revenue passengers"). The total number of passengers is approximately 9% higher. Including all passengers, SAS's cabin factor for 1998 was 71.7%.
[3] The total figures include more than the above traffic areas.

Key financial statistics [1]

	1992	1993	1994	1995	1996	1997	**1998**
Operating revenue [MSEK]	24,560	29,723	32,365	33,819	33,480	36,769	**38,211**
Income before taxes [MSEK]	–883	–865	428	2,592	1,746	2,067	**2,588**
Investments [MSEK]	2,731	702	1,256	1,289	4,132	2,938	**5,554**
Return on capital employed [%]	10	5	7	15	10	11	**12**
Number of employees	21,890	21,352	20,888	20,384	21,348	22,524	**23,992**
Environmentally related taxes and charges in relation to turnover [%]	– [2]	– [2]	0.6	1.4	1.8	1.4	**2.3**
Turnover in relation to CO_2 emissions [SEK/tonne]	– [2]	– [2]	130	730	460	510	**620**

[1] Incl. SAS Commuter (see also p. 2).
[2] Data not available.

Key environmental statistics

		1994	1995	1996	1997	**1998**
Environmental index[1]		100	98	100	104	**105**
Proportion of Chapter III aircraft [%]		67	71	81	88	**89**
Fuel efficiency [kg/RPK]		5.8	5.8	6.1	6.2	**6.2**
Cabin factor [%][2]		65.5	65.0	63.6	64.9	**65.7**
Emissions of carbon dioxide (CO_2)	[1,000 tonnes]	3,397	3,528	3,815	4,021	**4,167**
	[g/RTK]	1,540	1,559	1,540	1,517	**1,510**
Emissions of nitrogen oxides (NO_x)	[1,000 tonnes]	– [3]	13.4	14.4	14.8	**15.3**
	[g/RTK]	– [3]	6.0	5.8	5.6	**5.6**
Packaging in cabin operations [g/passenger]		– [3]	60	59	58	**53**
Newspapers in cabin operations [g/passenger]		– [3]	222	239	210	**225**
Collected [tonnes]		– [3]	– [3]	1,038	1,573 [4]	**1,351**
Proportion collected [%]		– [3]	– [3]	22	36	**28**
Energy efficiency of installations managed [kWh/m²]		– [3]	458	452	409	**354**
Environmentally related taxes and charges [MSEK]		approx. 200	approx. 480	approx. 600	approx. 532	approx. **872**

[1] A higher index indicates better ecoefficiency.
[2] The figure includes paying passengers over a certain payment limit ("revenue passengers"). The total number of passengers is approximately 9% higher. Including all passengers, SAS's cabin factor for 1998 was 71.7%.
[3] Data not available.
[4] Adjusted compared with the 1997 environmental report with regard to definitive data.

SAS's environmental work in words

Air transport and sustainable development

In today's society, demand for air travel is growing at an ever-increasing rate. Because of this powerful growth, the major environmental advances achieved by the airline industry over the past few decades are still not sufficient to bring about an overall reduction in environmental impact. This places rigorous demands on all players in the industry to accomplish further improvements. SAS's President Jan Stenberg reviews the company's strategy for finding a place within the framework of society's striving for environmentally sustainable development.

Environmental report reviewed

For the second consecutive year, the environmental report has been reviewed by SAS's external auditors. Based on their review, the auditors conclude that the environmental report provides a true and fair view of the company's operations.

New aircraft improve ecoefficiency

In late 1998 the phase-in of SAS's new medium-haul Boeing 737-600/700/800s commenced. SAS's version is equipped with special combusters for lower nitrogen oxide emissions. In 1999 the continued phase-in is expected to reduce both fuel consumption and emissions in relation to the distance flown.

"We are prepared to pay for the share of environmental impact that is caused by SAS, according to the Polluter Pays Principle, provided that competing transport types (road, rail and sea) also bear their costs in line with the same principle."

Strong growth demands major environmental improvements

SAS's President Jan Stenberg comments on the environmental year

1998 was a year of awesome natural catastrophes, floods and severe droughts, fires and hurricanes. It was also the warmest year on record since systematic weather observations began in the 1800s, and probably the warmest in 600 years.

No responsible scientist would confidently assert that these phenomena are caused exclusively by human emissions. And likewise, no one today can categorically dismiss that risk. Even if controversy still exists among scientists, SAS shares the view that the airline industry, with its unavoidable combustion of fossil fuels, contributes to the greenhouse effect. This insight compels us to take action. Being a good corporate citizen means doing what we can to minimize the risk for climate changes by conducting effective environmental work at SAS.

But this is not our only motive. In my opinion responsible environmental undertakings and good financial results are in no way incompatible. Since SAS's environmental strategy (p. 41) was established by the executive management in 1995, and supplemented this year with an eco-political vision, we have seen countless examples of how environmental investments have both reduced costs and boosted earnings.

Global issues require an overall view

Because the climate debate is global, international cooperation is essential in finding solutions to these problems. In 1992 world leaders at the UN environmental and development conference in Rio de Janeiro signed the climate agreement which was ratified in 1994. In 1997, the UN countries convened in Kyoto and agreed on binding, differentiated measures to limit emissions of greenhouse gases. In November 1998, 180 nations gathered in Buenos Aires to follow up the Kyoto conference. Although it would be misleading to imply that the conference was a big success, the participants eventually reached consensus on an official document which among other things opens opportunities for trading in emission quotas.

This arduous process illustrates both the complexity of the problem and the necessity of solving it in global transnational collaboration. Air traffic is an explicit example of a global activity that cannot be regulated as an isolated phenomenon in each individual country.

The airline business is an industry undergoing powerful growth. At the same time, in the foreseeable future we have no choice but to continue using fossil fuels and thereby contribute to the greenhouse effect. Forecasts indicate that by the year 2050 aircraft exhaust will account for 8% of human CO_2 emissions into the atmosphere, compared with 3% today. Our challenge lies in showing that we are doing everything in our power, within commercially viable limits, to minimize our environmental impact at every stage. An industry experiencing growth of this magnitude is dependent on the acceptance of society. While this growth in itself shows that society places a high value on the advantages of air transportation, there is no escaping the fact of its environmental impact.

In this age of globalization, a world without air travel is inconceivable. Rapid transports are crucial in a borderless world with accelerating growth. Our conviction is that air transports fare well in a comparsion with other types of transport, if the environmental impact is weighed against the benefit these operations represent. This is confirmed in an evaluation by the Norwegian environmental foundation Bellona: All types of transport have the same level of energy consumption and land use in relation to the actual transport work performed, if infrastructure, the risk of accidents and land use are weighed in.

If the passengers are to be able to make rational transport decisions based on assessed benefit versus environmental impact, a more unbiased system of environmental charges is required in which all means of transport bear their own costs in full. We are prepared to pay for the environmental impact SAS generates in line with the Polluter Pays Principle, provided that competing means of transport also bear their respective environmental costs according to the same principle.

Air transport is the only industry whose role in the greenhouse effect and environmental impact in general is covered in the report to be presented by the UN agency IPCC (Intergovernmental Panel on Climate Change) in March 1999. The airline industry both supports and has contributed to the study. SAS believes that this will be one of the most influential documents in the ongoing debate on air transport and its environmental effects, and that it could have consequences for the formulation of the future regulatory framework.

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

Environmental adaptation of the aircraft fleet

Air transport's contribution to the greenhouse effect is linked to combustion of fossil fuels. The key to reduced CO_2 emissions lies in modernization of the aircraft fleet and a transition to more efficient engines. I am therefore proud to report that on October 25, 1998, we introduced the first of our ordered Boeing 737-600s into scheduled traffic. At the end of the year eight aircraft were in traffic in the European network. SAS has ordered a total of 55 Boeing 737s, of which 12 are model 700 and/or 800, with an option for an additional 40. These will replace the Fokker F-28 and McDonnell Douglas DC-9 aircraft.

The purchase of new aircraft represents a substantial investment in the environment. The new aircraft have engines featuring double annular combusters, which burn fuel more ecoefficiently. This innovation reduces nitrogen oxide emissions by 40% compared with the DC-9s which are being replaced. SAS is the first company to order this engine type for all new aircraft in Boeing's 737 series (600, 700 and 800) – an environmental investment of over MSEK 250.

Thanks to SAS's order, the manufacturer CFM has been able to further refine and commercialize engines with double annual combusters. This is setting a new standard in the airline industry which will serve as an example for other companies. To further underline these advances, the engines have been adorned with SAS's new environmental logo.

The new aircraft will also reduce noise levels. Our ears perceive the noise level as half that of the DC-9s and F-28s which are now being phased out.

In 1999 the F-28 fleet will be phased out entirely, after which SAS will attain its goal of having only Chapter III aircraft in traffic. We will then have fulfilled the EU requirements which will go into effect on April 1, 2002 well in advance.

During the year SAS Commuter also decided on major investments of environmental significance. The company will purchase 17 turboprop aircraft of the Bombardier de Havilland Q400-Dash 8 type with good environmental characteristics, an order worth 2,500 MSEK .

The longhaul fleet renewal on which we will make a decision in 1999 will be governed by the same high environmental ambitions.

Continuous improvement

For the past four years, SAS has conducted intensive efforts to coordinate the Group's quality work around joint goals, how to do what we have decided to do, based on business analyses. The environment has become an increasingly prominent part of this work. It carries a lot of weight under "Impact on society", one of the components of the system (EFQM) SAS uses to evaluate its management efforts towards continuous improvement.

Operations should be conducted with a holistic approach, which means that we must steer our environmental work with the same dedication as our other business activities. Environmental work is, and will continue to be, an integral part of normal operational control.

SAS aims to have environmental management systems that can be certified according to ISO 14001. SAS Cargo has gone in advance and decided in 1999 to begin pursuing ISO 9000 certification worldwide and ISO 14001 in Scandinavia.

On pages 40–46 we describe more about SAS's work with environmental management systems.

The new SAS

In the changes SAS is now implementing, we will better exploit the inherent strengths of being a Scandinavian airline. There is a fundamental Scandinavian spirit that has become the cornerstone of our transformation program SAS 2000+, in which the environment plays a natural role. With the strong environmental interest that exists in Denmark, Norway and Sweden, you could say that even that aspect of our profile is Scandinavian.

Air traffic accounts for the overwhelming bulk of SAS's total environmental impact, while cabin operations account for only a small portion. Nonetheless, what we do there is important. In direct interaction with passengers, we show what we want and what we stand for. There, we are working primarily to reduce resource consumption and waste volumes, and to improve handling of these.

Through some 500 environmental projects since 1996, completed or in progress, we are collaborating with our suppliers to advance our position. Environmental work is a criteria in selecting suppliers, who must meet the requirements specified in SAS's general purchasing conditions.

SAS aims to be one of the world's leading airlines in this area. Our cooperation in the industry indicates that we are well on our way towards fulfilling this goal.

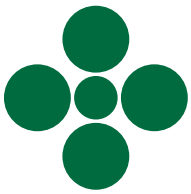
Many of the changes in connection with SAS 2000+ are very discrete. Others are more obvious, for example that the aircraft are clothed in new colors. What is not apparent is that the lacquers we are using contain less solvents than conventional types. This is yet another example of voluntary environmental undertakings on SAS's part. See more about this on pages 38–39.

Many people have wondered what the overall cost for SAS Project 2000+ has amounted to. The answer is that the total additional cost for the new design, promotion process and new products is 80–90 MSEK. Painting an aircraft in new colors is no more expensive than painting it white with the same type of paint, if it's going to be painted anyway. If we didn't take the opportunity to make changes when motivated for normal maintenance reasons, the bill would have been ten times as high.

As a result of SAS's new corporate identity, some 15,000 employees will change uniform. The garments which are replaced will be donated to Lithuania and reused, as proposed by our cooperation partner Save the Children.

Goal-oriented environmental work

Two of our goals in cabin operations are by the end of 2001 to reduce water and energy consumption by 20% and waste volumes by 30% per served meal compared with 1997. The outcome in 1998 indicates that these goals are well within reach, even though it has proven more difficult to reduce consumption of energy. One explanation could be that when we cut down on use of disposable articles we



SAS Environmental Program

SAS's new graphic program includes an environmental logo. The green circles represent mankind surrounded by the four elements (water, earth, wind and fire). The environmental logo will be used to mark special environmentally adapted products, such as the DAC engines in SAS's new Boeing 737-600s.

increase the need for washing and cleaning, which consumes energy. However, we are convinced that improved technology will make it possible for us to achieve this goal on time.

SAS's third area of activity, ground operations, covers such widely diverse fields as workshop operations, the vehicle fleet, station operations, office work and property management. Here we prioritize more efficient energy consumption, waste management and use of chemicals.

The property department continued its efforts to reduce energy consumption. The goal of decreasing electricity and heating consumption per sq. m. by 10% before the year 2001 compared with 1997 was achieved already during 1998. However, because of the move to Oslo's new Gardermoen airport, the figures are deceptive. SAS will therefore wait a year before the figures are considered sustainable in the long term.

The move to Gardermoen was the single most important event in ground operations during 1998 also from an environmental standpoint. SAS itself has built facilities for a total of 1,299 MSEK, of which around 25 MSEK refers to purely environmental investments. From the very start, the airport operator Oslo Lufthavn has placed stringent demands on environmental management and use of the best availble technology. SAS has met these requirements.

At Arlanda airport, SAS has now completed the investments of 12 MSEK for treatment of the process water from the hangars and workshops which was required by the authorities as a condition for the concession.

The new cargo terminal in Copenhagen which was inaugurated on December 7, an investment of 675 MSEK, represents a gain primarily for the work environment, but the terminal also contains many solutions that benefit the external environment.

Star Alliance

Star Alliance is the world's largest airline alliance. It was formed in 1997 by SAS, Lufthansa, Air Canada, United Airlines, Varig and Thai Airways International. In 1999 three additional airlines will join, All Nippon Airways, Air New Zealand and Ansett Australia. This is a federation of independent airlines which have entered a commercial alliance to increase customer benefit. One secondary effect of the alliance is greater scope for cooperation in other areas, such as the environment.

The airlines have differing circumstances and cultures, but all share a commitment to fulfilling their environmental responsibilities through continuous improvements. There is no doubt that this extensive alliance of airlines in close cooperation represents a significant opportunity to urge the industry's environmental work forward.

Social accountability

Being at the leading edge of the environmental area is a commercial and ethical necessity. But it is equally important that SAS, as a good corporate citizen, assumes responsibility in other areas of society. During 1998 we have conducted a pilot study to draw up a policy for ethics and other social issues. This work, which is backed by SAS's management, will continue in 1999.

Environmental information, both within the company and to the market, is a critical control instrument in our environmental work. Among other things, it motivates us to invest in this report. That all three of our earlier environmental reports have won awards in the three Scandinavian countries is proof that this investment is sound. Future innovations are, as earlier, dependent on the readers' comments – see page 48 for an overview of different ways to contact us. For an evaluation of the environmental report's quality in terms of accurate selection and correct reporting of environmental data, as of last year it is examined by an external auditor.

In light of the justifiable attention the threat to the global climate has sparked, it is unavoidable that the airline industry is being closely scrutinized. We welcome an objective analysis and debate, based on fact. The critics should find that we take environmental issues very seriously and are working according to the strategy of continuous improvement, as in other aspects of the company's development. Opinion polls show that our environmental image is not as flattering as we believe our environmental data motivates, although we have seen a positive trend since we introduced our annual environmental report in 1995. This spurs us on to further efforts.

Mankind hold the answers to the problems that mankind has created. Effective environmental measures that contribute to sustainable development also make good business sense.

Jan Stenberg
President and Chief Executive Officer

Auditors' Report

To readers of SAS's environmental report for the 1998 financial year:

We have examined the contents of SAS's environmental report for the 1998 financial year.

The environmental report has been presented to SAS's Board of Directors in March 1999. 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 examine the environmental data and reporting of the environmental work.

The audit was conducted during the period January – March 1999 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", December 1998 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.
- 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 1998 financial year.
- A review of the supplementary data on SAS's Internet site *(www.sas.se)* which is referred to on pages 22, 27 and 31 of the environmental report.

Based on the above reviews, we believe that the data and 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 parts of the Company's operations covered here.

Stockholm, March 19, 1999
Deloitte & Touche AB

Svante Forsberg
Authorized Public Accountant

Board of Directors' Environmental Report

New aircraft create potential for higher ecoefficiency

Flight Operations

In 1998 SAS's total production increased by 3.7% to 4,647 (4,483) MRTK. In relation to production in MRTK of 2,760 (2,651), fuel consumption and emissions decreased somewhat in 1998. The major investments in new, more fuel-efficient aircraft will not have full impact on the statistics until next year. Expressed in absolute figures, fuel consumption and emissions rose due to a traffic increase which more than offset the relative improvements.

Fuel consumption and emissions

SAS's total fuel consumption rose by 3.7% to 1,674,692 (1,615,683) m³ of fuel. In relation to the number of passengers transported and distances flown, SAS's fuel efficiency was unchanged at 6.2 kg/100 RPK, corresponding to 7.8 l/100 RPK – despite an improved cabin factor of 65.7 (64.9)%. In relation to the number of tonnes transported and distances flown, i.e. including cargo traffic, fuel efficiency was unchanged at 4.8 kg/100 RTK, corresponding to 6.1 l/100 RTK. SAS Cargo improved its fuel-efficiency per RTK by 5.1% and increased its production (cargo and mail) by 0.6%.

SAS's fuel consumption and distance flown in 1998 correspond to emissions of 4,167 (4,021) ktonnes of carbon dioxide, 15.32 (14.84) ktonnes of nitrogen oxides and 2.14 (2.07) ktonnes of hydrocarbons. The phase-in of new aircraft which was started in autumn 1998 will not visibly lower emissions until the 1999 statistics are compiled, at which time lower relative emissions levels are anticipated for nitrogen oxides and carbon dioxide.

The proportion of Chapter II aircraft in the SAS fleet fell during the year from 12% to 11%. At year-end 1998, the SAS fleet included 18 aircraft that did not meet ICAO noise criteria for Chapter III – 16 Fokker F-28s and two leased DC-9-41s. In the winter program for 1999/2000 SAS will phase out the remaining Chapter II aircraft and will have thus fulfilled the EU traffic requirements well ahead of the deadline on April 1, 2002.

Aircraft fleet development

The total number of aircraft in the SAS fleet at year-end 1998 amounted to 185 aircraft, owned and leased. SAS itself operated 179 aircraft. Ten aircraft were phased in during the year – eight Boeing 737-600s and two Saab 2000s. Five aircraft were phased out.

The average age of the aircraft operated by SAS in 1998 was 11 years and 4 months, while the average age of the aircraft owned by SAS is 9 years and 1 month. The new aircraft which are being purchased are expected to decrease the average age in SAS's owned and leased fleet to 7 years and 8 months during 1999.

The first eight Being 737-600s were delivered during the autumn, starting in September, and were introduced in traffic on October 25. The order, which amounted to 42 aircraft at the end of 1997, was increased during the first half of 1998 by an additional 13 to a total of 55 aircraft. The order represents a total investment of MSEK 12,000. The aircraft will be used primarily to replace Fokker F-28s and McDonnell Douglas DC-9-41s. Aside from those on order, SAS has an option for a further 40 aircraft. The Boeing 737-600 consumes 20% less fuel and subsequently also produces 20% lower carbon dioxide emissions than the DC-9. The engines in SAS's Boeing 737-600s are equipped with double annular combusters which reduce nitrogen oxide emissions in relation to engines lacking this technology. This gives the aircraft a favorable position in the charge system in countries with nitrogen oxide-based environmental charges, primarily Sweden and Switzerland. SAS is the first airline to invest in these engines in Boeing 737s. The cost for improved combusters amounts to approximately 5 MSEK per aircraft.

SAS Commuter increased its order for Bombardier de Havilland Q400-Dash 8s, a turbo prop aircraft which seats 72–76 passengers, by two aircraft during the year. The 17 aircraft now on firm order, an investment of 2,500 MSEK, will be delivered starting in September 1999. Deliveries will be completed in the second half of 2000. In addition, SAS has an option for a further 18 aircraft and so-called purchase rights, for which the commercial terms and conditions have been established but not the delivery date, for an additional 18. The Q400-Dash 8 is the fastest propeller aircraft after the Saab 2000, and therefore offers high productivity. Fuel consumption is 0.036 kg/ASK, or 0.045 l/ASK, and the noise contour (85 db(A) on takeoff) is 0.5 km², which are low values compared with similar aircraft. Furthermore, like the Saab 2000, the Q400-Dash 8 is equipped with active dampening of noise and vibrations in the cabin.

A decision on possible modernization of SAS's longhaul fleet is expected to be made in 1999. The choice of longhaul aircraft will also follow SAS's policy of utilizing the best available environmental technology within commercially viable limits.

Cabin operations

In 1998 SAS continued to initiate environmental projects together with the more than 100 suppliers who have signed SAS's environmental agreement, so far around 500 projects. 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. 30.

SAS has also advanced its collaboration with suppliers through the annual environmental seminar, which was held for the first time in February 1998 and will be repeated in spring 1999. This is where SAS presents its environmental award to encourage successful environmental work.

SAS's goal for cabin operations by the end of 2001 is to reduce energy and water consumption per meal served by 20% and waste volumes per meal served by 30% compared with 1997. The waste goal for 1998 was a decrease of 4% and the outcome was a reduction of 2.7%. The subgoal for water consumption was a 3% decrease, and the outcome was 4.9%. However, energy consumption increased somewhat, by 4.2%, partly due to a changeover to a higher proportion of non-disposable articles which are washed. SAS believes that the long-term goals by the end of 2001 are still within reach, with regard to energy consumption through technical advances in both manufacturing and washing methods.

In 1998 SAS entered an agreement with LSG Lufthansa Services as a new catering supplier in Scandinavia starting in August 2000. As with other suppliers, this agreement requires LSG to follow SAS's environmental program and to employ an environmental policy of its own.

Ground operations

The total waste volume in ground operations rose by 8.8% to 4,791 tonnes. A few explanations are that production is rising and more waste is being collected, and the cleanup in connection with the move to Oslo's new Gardermoen airport generated a certain amount of waste at the old Fornebu airport. Pre-sorting of paper and cardboard has increased steadily. In 1998 the collected volume amounted to 998 (784) tonnes, an increase of 27%.

In 1998 the ongoing efficiency program reduced SAS's energy consumption in ground operations to 354 (409) kWh/m², a decrease of 13.4%. The ground operations' goal was thus achieved already in 1998: To reduce energy consumption per m² for electricity and heating in the premises where SAS conducts operations by 10% by the end of 2001. However, because the underlying data is uncertain due to the move to Oslo's new Gardermoen airport, SAS prefers to wait for the 1999 statistics before we can be certain that this is a long-term trend.

SAS's water consumption in ground operations during 1998 was 238,871 (200,928) m³, an increase of 18.9%. Consumption increased above all in Oslo, where SAS's electroplating workshop in Oslo had problems with recirculation of cooling water from the electroplating process to the water reservoir.

SAS utilized a total of 2,427 (2,531) ground vehicles within, as well as to and from, the airport areas in the traffic network. Consumption of diesel for these vehicles rose to 3,548 (3,264) m³, while consumption of gasoline fell to 2,125 (2,467) m³. The increased consumption of diesel is explained primarily by the 40% increase in bus traffic in Oslo during the period July 1–October 7, when SAS had traffic to both Fornebu and Gardermoen until the latter was inaugurated.

The ten buses ordered by SAS for traffic to Gardermoen were delivered in June. The buses, which are of the highest environmental standard, run on "green" diesel and are equipped with CRT filters which clean both exhaust fumes and particles, representing an environmental investment of 1 MSEK. In total, SAS owns 19 buses in Norway with an average age of eleven months.

During the year some 2,677 kg of gas were used in a number of ground vehicles in Norway. In ongoing trials to replace diesel in ground vehicles at Arlanda airport, 42 (47) m³ of biofuel were consumed, primarily rapeseed oil.

In 1998 several large-scale construction projects were completed, mainly at Oslo's new Gardermoen airport, which is located on a sensitive terminal moraine containing an important aquifer. SAS has built premises covering over 90,000 m², an investment totaling 1,299 MSEK, of which around 25 MSEK refers to purely environmental investments. From the very start, the airport operator Oslo Lufthavn AS has placed rigorous requirements on environmental control and use of the best available technology, which SAS has made an effort to live up to. In preparation for construction, SAS drew up a health, environment and safety manual and appointed its own full-time environmental coordinator. During the three-year construction phase, no significant incidents involving environmentally detrimental emissions were noted on SAS's part. An audit team carried out an environmental audit in January, at which time no deviations from the applicable requirements were noted for SAS.

In May 1998 a vacuum evaporation plant was installed in the electroplating workshops at Fornebu, enabling zero emissions into the water. In 1999 the electroplating workshops will move into a new building at SAS's technical base at Gardermoen and will install the same plant there. This technique is already being used for treatment of the process water at Gardermoen's technical base. By employing technical solutions that eliminate emissions, the related permits are no longer required and STF (the Norwegian supervisory authority) has subsequently revoked those previous granted to SAS for this purpose.

The new cargo terminal in Copenhagen which was inaugurated on December 7, an investment of approximately 675 MSEK, represents considerable gains above all for the work environment. But the terminal also offers improvements for the external environment, particularly by gathering production in a single location and thereby reducing the need for transports. New lightweight containers are also helping to conserve energy.

At Arlanda, SAS has now completed the investment of 12 MSEK for treatment of process water from the hangars and workshops which was required by the authorities as a condition for the concession.

The quality of data from the main airports in Copenhagen, Oslo and Stockholm has been further enhanced through continuous improvements in collection routines. However, comparisons for some parameters are more difficult this year due to the move to Gardermoen, doubling of certain operations and unreliable data in certain cases.

The environmentally related projects in ground operations that are most significant for SAS's environmental impact are presented on pp. 19–20.

What happened in 1998?

Priority areas	Progress in 1998	Economic consequences for SAS
Development of an aircraft fleet with less environmental impact, through replacement and modification of older aircraft.	SAS's noise impact decreased through the ongoing phase-out of Chapter II aircraft. The phase-in of the new Boeing 737s was started, which will lead to better fuel efficiency and lower relative emissions in SAS's aircraft fleet starting in 1999.	• The charges for use of Chapter II aircraft fell by approx. 11 MSEK. • Each percentage point of improved fuel efficiency reduces fuel costs by around 25 MSEK. • The new Boeing 737s are expected to be placed in a low NOx charge class when they are introduced in Sweden.
Lower consumption of resources, reduced emissions and waste volumes and improved waste management in cabin operations.	The large-scale collaboration with SAS's suppliers has progressed with a current total of 500 environmental subprojects since 1996.	• Collection of aluminum cans on Norwegian domestic flights reduced charges by around 8 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, 28%, resulted in a cost reduction of around 0.5 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. Ongoing conversion from oil to biofuel-based heat production. The new technical base at Gardermoen has a completely closed system for the process water, and the electroplating workshop at Fornebu has installed a system for vacuum evaporation that eliminates all emissions from its process water.	• The 13.4% decrease in energy consumption in 1998 limited the increased costs for heating due to double premises during the transitional period in connection with the move to Gardermoen. • 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.	Far-reaching integration of environmental aspects in the large-scale construction projects, particularly at Copenhagen airport and Oslo's new Gardermoen airport. New technology with zero emissions at the electroplating workshops at Gardermoen and Fornebu. The new water treatment plant at Arlanda ensures fulfillment of the concession requirements.	• Environmental investments at Gardermoen airport of approx. 25 MSEK are expected to provide cost reductions of several MSEK per year. • Environmental investments at SAS Cargo in Copenhagen of 20–25 MSEK are expected to reduce costs.
Intensified internal environmental information.	Continued development of environmental aspects in the staff magazine Inside and internal training programs. A decision was made to publish collective information about SAS's environmental work on the Internet.	
Involvement in developing the environmental requirements imposed on commercial airline operations through participation in central industry, national and international forums.	SAS participated in work on the regulatory framework for the airline industry through the Star Alliance, and in forums such as the IATA, ICAO, AEA and N-ALM.	• For SAS, the total volume of environmentally related taxes and charges included as part of the regulatory framework for the airline industry will probably amount to nearly 1,000 MSEK per year during 2000–2001.
Enhancement of SAS's environmental image so that it corresponds to the actual environmental data.	Emphasis on environmental consideration as an important aspect of SAS's new corporate identity in the launch of SAS 2000+. Participation in environmental expos, seminars, debates and conferences. Lectures at universities and colleges. Participation in the media debate. Ongoing collaboration with Save the Children and the independent Norwegian environmental fund Bellona. Continued cooperation with Coca-Cola in the joint environmental fund.	• SAS's environmental image shows steady improvement from a relatively low level. • 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 in accordance with external requirements.	The environmental report was published on the Internet in an extended version and was supplemented with a booklet directed to specific target groups.	• Quality-assured environmental data is a prerequisite for taking part in a discussion on the airline industry's regulatory framework (see above). • An environmental policy and environmental report are prerequisites in the majority of major customer agreements and for EMAS registration and ISO 14001 certification. • SAS's environmental image (see above) is dependent on high quality market communication about the environment.

Infringements, incidents, disputes

Infringements

In 1998, SAS complied with all applicable concession stipulations in ongoing operations.

Incidents

In connection with the conversion of heating in the Danish head office, Hedegårdvej, from oil to district heating, a hydrostatic test of the facility caused a rupture in an underground outdoor water pipe, after which substantial amounts of water leaked out.

On April 21, 1998, an overfill of around 3,300 liters of fuel oil occurred at the technical base at Fornebu. SAS's oil supplier has taken responsibility and corrective measures for the incident, to SAS's knowledge in compliance with all applicable requirements.

On October 22 a water leak occurred due to a rupture in a municipal water main in the technical base of Gardermoen. Around 500 m³ was collected in the water treatment plant and was mixed with contaminated water from washing of aircraft, among other things. The entire volume of water was treated by an approved subcontract as hazardous waste. The event is being handled as an insurance matter.

In October an involuntary foam discharge from the fire extinguisher system took place in Hangar 1 at Arlanda. This was triggered by a technical malfunction in a valve. The area was cleaned up and all valves of this type were inspected.

On November 5, 1998, a full-scale fire drill in the light maintenance hangar at Gardermoen developed into an incident. At the insurance company's request, the fire was allowed to reach such dimensions that an actual fire was at hand. In connection with the incident, large quantities of foam drained into the sewage system. SAS has reported the incident to the municipal water treatment plant.

In November 1998, it was established that a number of involuntary glycol emissions, estimated at 250 liters, had taken place at SAS's old operations building at Gardermoen. The incident was reported to the Norwegian pollution authority via Oslo Lufthavn and appropriate measures were taken.

Disputes

The Danish Civil Aviation Authority's 1997 complaint against SAS for suspected infringement of local regulations on use of jet engines for braking during landing on 15 occasions is under legal investigation. The case may come up in spring 1999.

The EU has ordered the Swedish government to comply with EU Community law and revoke the 1997 ban on landing with Chapter II aircraft at the new airport in Karlstad by March 1999. SAS reported the ban to the EC, since the restriction was implemented before the EU ban goes into effect on April 1, 2002.

SAS is in dispute with the previous owner regarding a necessary cleanup of land at Copenhagen airport, where SAS has built a new component workshop. This dispute involves costs of 16 MSEK and is expected to be legally resolved during 1999.

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

Altered environmental regulations

In 1998 the EU presented a "white paper" dealing with matters such as responsibility for environmental damage. The report contains the proposals anticipated by SAS regarding the polluter pays principle. If several polluters are responsible they have joint and several responsibility, though with the possibility for those who can prove they have only contributed to part of the damage to bear responsibility only for that part. However, since legislation in the Scandinavian countries already incorporates earlier requirements of this type, the white paper will not lead to any change for SAS. SAS advocates this principle and sees it as a prerequisite for long-term competitively neutral regulations.

At the climate conference in Kyoto, Japan in 1997 and follow-up in Buenos Aires in 1998, a global agreement was signed for differentiated reduction of greenhouse gas emissions. The conference kept international air and sea traffic outside the quotas due to the difficulty of linking emissions to a specific country.

The UN's Intergovernmental Panel on Climate Change, IPCC, will present its report on air traffic and climate effects in April 1999. On its own initiative the airline industry will be the first sector to undergo special examination. The document will carry substantial weight in the debate on air transport and the environment, and can be influential in formulating the future framework of environmental regulations.

On January 1, 1998, Denmark introduced a passenger charge which amounted to 215 MSEK for SAS during the year.

On April 1, 1998, the previous passenger charge in Norway was replaced with a seat charge. Norway also imposed a carbon dioxide tax on aviation fuel as of January 1, 1999. The charge was initially intended to apply also to international flights, but this stipulation was revoked in late January.

Oslo Lufthavn was the first international airport to implement differentiated regulations for Chapter III aircraft. For example, MD-80s may not take off or land at night between 12 and 6 a.m., while Boeing 737-400-800s may do so. The general rule for Chapter II aircraft at Gardermoen is that they may be used in traffic only between 8 a.m. and 4 p.m.

On January 1, 1998, new emissions-related landing charges went into effect in Sweden. The system covers emissions of nitrogen oxides and hydrocarbons, but not carbon dioxide. These charges replace the so-called emissions tax which had been in effect in Sweden since the late 80s, but which was abolished in January 1997 after Sweden's admission to the EU as contrary to EU regulations. SAS paid nitrogen oxide charges of 49 MSEK in 1998.

Noise charges in Sweden are based on a discount for Chapter III aircraft and an addition to the ordinary landing charge for Chapter II aircraft. On January 1, 1998, this increase was raised from 55 to 65%. At the same time, the ordinary landing charge was lowered to 12% in connection with introduction of the above emissions charge. The net

effect of the increased noise charge is therefore limited. At year-end 1998 this increase was raised further, to 75%.

See also section on future development, pp. 19–20.

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 risk of contamination.

Other environmental issues

At Olso's new Gardermoen airport, Oslo Lufthavn AS has the required permits from the Norwegian pollution authority (SFT) for use of chemicals for deicing of aircraft and runways (glycol and acetate). The airport is located in the periphery of a large aquifer, and one precondition for locating the airport there was that the aquifer was protected from contamination. In order to prevent leakage into the ground water, Oslo Lufthavn erected a facility with microbial decomposition of chemicals. In early 1999 it was established that acetate and glycol had reached the ground water. Both SFT and the environmental foundation Bellona have reported Oslo Lufthavn to the police and district attorney. Oslo Lufthavn is working to rectify this urgent situation and is planning long-term measures. SAS sees this situation as critical.

Oslo's former airport Fornebu was closed on October 8, 1998. No future use for the land has yet been decided. Contamination from the previous usage has been catalogued. The land owners Statsbygg and the Municipality of Oslo will begin cleanup measures in 1999.

Environment and economy

The general trend is towards rising environmental charges and taxes and stricter 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 fundamental attitude is that all types of transport should bear their share of the costs for infrastructure and environmental impact based on the polluter pays principle.

SAS total environmental charges and taxes amounted to 872 (532) MSEK in 1998, an increase of 64% (see p. 19). This is attributable to the new environmentally related passenger charge in Denmark of MSEK 215, the new emissions charge in Sweden of MSEK 49 and the increase in environmentally related seat charges in Norway of MSEK 126. As of January 1, Norway's carbon dioxide and sulfur charge of SEK 0.30 plus VAT per liter is also added.

For an account of the additional increases in charges and taxes which will be imposed on 1999, as well as other ongoing efforts to change the regulatory framework of the airline industry with possible economic consequences for SAS, see pp. 19–20.

COWI Consult in Denmark is working with several reports on the airline industry's regulatory framework, social benefit and environmental impact on behalf of SAS. This work is being carried out in collaboration with Transportøkonomisk Institutt in Norway and Inregia in Sweden. The report is expected to be completed in 1999.

TQM and environmental management

Environmental activities at SAS form a natural part of the overall work on Total Quality Management – TQM (see also p. 40).

In 1998 SAS conducted a pilot project towards the goal of developing a certifiable environmental management system. An additional project for environmental management and training is being planned, with sights set on a certifiable system by 2001. The evaluation carried out by SAS Cargo in Copenhagen resulted in the company's decision to go ahead of the Group in obtaining ISO 9000 certification globally and ISO 14001 in Scandinavia. This work is being initiated in 1999.

In 1998 SAS's central environmental department was reinforced with the new position of Environmental Advisor, with special responsibility for developing the environmental management system.

For a more in-depth description of SAS's environmental management system, see pp. 40–46.

Internal information

In 1998 the environmental report, together with articles in the staff magazine Inside, served as the most important internal information channel about SAS's environmental work. In order to make this information easier to read, as of this year the environmental report is also published in a popular version and the collective environmental data is available via the Internet and SAS's internal computer network.

For an account of the continuous internal training activities, see p. 43.

Profile/image

A survey in November 1998 confirmed recent years' trend towards steady improvement in SAS's environmental image among customers in all the Scandinavian countries.

SAS has used various means to enhance the market's perception of the company's environmental work, through participation in exhibitions, seminars, debates and open conferences in both Scandinavia and Europe. SAS sponsored an environmental seminar in New York which was arranged by the Swedish-American Chamber of Commerce.

The environmental image is a key component of the new corporate identity developed within the SAS 2000+ project. In order to emphasize this a special environmental logo has been created, which among other things adorns the engines of the new Boeing 737s. (See p. 8).

SAS's environmental activities have been covered in the Scandinavian and international press. SAS has communicated information about air transport and the environment

in educational forums and lectures. SAS's environmental director has taken part in the debate on conditions in the airline industry, for example through a lengthy article in the Norwegian newspaper Aftenposten.

The environmental properties of the Boeing 737-600/700/800s were highlighted in an advertising campaign in the Norwegian national press during autumn 1998.

As in previous years, SAS's environmental report was widely distributed internationally. In Sweden it was ranked as the year's best by Företagsekonomiska Institutet and the weekly business magazine Affärsvärlden. In a similar evaluation in Norway it was given honorable mention and received the year's highest score in Deloitte & Touche's Swedish ranking.

For an account of SAS's sponsorship commitments, see p. 46.

Collaborations

During the year SAS collaborated with the members of the Star Alliance and other partner airlines, was actively involved in various international forums and conducted dialogues with national authorities, suppliers and other stakeholders.

Since spring 1998, SAS is represented on the board of the Inflight Catering Association (IFCA) and chair's the AEA's work group for waste management and environmental conditions in cabin operations.

In connection with construction of Oslo's new Gardermoen airport, SAS has contributed staff and information to the project being conducted by the airport operator Oslo Lufthavn together with local residents.

For a detailed description of SAS's collaborations, see pp. 44–46.

Health and safety

Development of a safe and sound work environment is carried out within the framework of SAS's business strategies and 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 1998, a number of significant changes were made in organization of SAS's health, environmental and safety activities. The three national departments were merged into a joint-Scandinavian unit coordinated by a HES manager. The goal was to ensure effective advice with a dual focus on environmental improvements and development of operations. In Denmark this development is supported by legal requirements on quality approval of the HES organization. SAS in Norway and Sweden are also scheduled to undergo a similar process. The content of the quality approval is largely equivalent to ISO 9000 requirements.

One of SAS's operative goals is for all managers to inspect the work and external environments 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.

For a complete account of SAS's work in the area of health, work environment and safety, as well as information about accidents, injuries and sickness absence, see p. 40 of the financial annual report.

Scope of the Environmental Report

Like last year, the 1998 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 activities. SAS Commuter's other environmental impact has not been included in the description of the SAS Consortium's environmental management system, since it has independent legal responsibility and conducts its own environmental work as a separate consortium in the SAS Group. Both SAS Commuter and SAS International Hotels provide an account of their environmental impact and activities in their annual 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 to conduct and document its environmental work in accordance with SAS's environmental strategy.

The data for flight operations may deviate somewhat from the corresponding statistics in the annual report, since the environmental report provides an account of SAS's total operations, while the annual report only covers SAS's scheduled flight operations.

As of 1997, the environmental report includes data from Scandinavian line stations.

SAS judges the reported data to be of a high quality, with the reservation that the move from Fornebu to Gardermoen makes certain data in 1998 unavoidably difficult to compare with previous years.

In certain cases external data has been included – from other companies, regional averages, etc. – in order to make a comparison. 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 data with reasonable relevance for SAS's environmental impact. As of 1997 the environmental report is examined by an external auditor.

All quantitative data provided in this Board of Directors' Environmental Report is also reported in the form of overall charts and tables in the environmental data on pp. 18–35 and on SAS's web site *(www.sas.se)*. The Internet site also provides supplementary environmental information.

SAS's environmental report is published in Danish, Norwegian, Swedish and English. The Swedish version is officially considered to be the original.

SAS's Board of Directors has reviewed the following environmental report in March 1998.

SAS's environmental work in numbers

Increase in fuel consumption and emissions in relation to production curbed

SAS's fuel consumption per passenger kilometer stabilized at the 1997 level and decreased per tonne kilometer. Because of this, flight operations' emissions in relation to production were largely unchanged compared with the preceding year.

Cabin operations' environmental goals within reach

In 1998 waste volumes and water consumption in cabin operations were reduced according to plan. However, energy consumption rose due to the changeover to non-disposable porcelain which requires washing. SAS nonetheless assesses that all of these goals can be reached by the end of 2001.

Environmental goals in ground operations already met

In 1998, energy consumption per m^2 for electricity and heating in the premises where SAS conducts operations was reduced by more than the target level for 2001. However, because of the uncertainty in the figures due to the move to Oslo's new Gardermoen airport, SAS prefers to wait another year before the goal can be considered sustainably fulfilled.

Continued increase in SAS's environmental charges and taxes

SAS's total environmental charges and taxes rose by 340 MSEK to 872 MSEK in 1998. The increase is attributable to a new environmentally related passenger charge in Denmark, a higher environmentally related seat charge in Norway and a new environmental charge in Sweden.

"The phase-out of older Chapter II aircraft continued. The goal is to have an aircraft fleet consisting exclusively of low-noise Chapter III aircraft by the end of 1999."

1998 Environmental Data

Complete key statistics for 1998

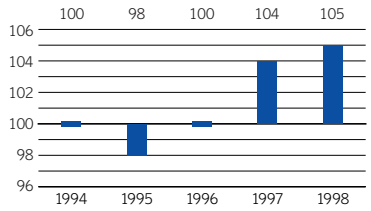
This data includes all input factors pertaining to Scandinavian operations. The only factor we have no viable possibility of weighing in is the waste unloaded from the aircraft at stations outside Scandinavia, for which reason it has not been included in these statistics. Based on the share of passengers on these routes, this presumably corresponds to around one third of the total volume.

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 m², etc.) in order to provide opportunities for others to compare themselves with us.

Total SAS

Environmental index

[1994=100]
The higher the index figure, the better the resource utilization and the smaller 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 for 1998 in brackets):

$$\frac{\text{Number of tonne kilometers (2,760,000,000) + no. of baggage items (23,868,900) + kg of cargo and mail (279,924,000) + dm² managed floor area (54,503,800)}}{\text{Liters of aviation fuel (1,674,691,520) + liters of fuel for ground vehicles in Copenhagen (1,435,278) + kWh energy for SAS buildings (192,849,600)}}$$

The 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 1998 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 assigning 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.

SAS's development: The base year used is 1994, with an index of 100. The improvement in 1998 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. 13% per m².

Environmentally related earnings and cost reductions [1]

[MSEK]	1996	1997	**1998**
Decrease in landing charges due to phase-out of Chapter II aircraft	–[5]	appr. 25	appr. 11
Decrease in costs due to reduction in waste volumes, improved pre-sorting and increased recycling [4]	14–19	15	8

Environmentally related charges and taxes[2]

[MSEK]	1996	1997	**1998**
Passenger charges (Denmark)	–	–	215
Seat and passenger charges (Norway)[6]	469	475	601
Of which:			
Seat charges	145	139	[6]
Passenger charges, international	221	250	[6]
Passenger charges, domestic	103	86	[6]
Environmental charge on emissions (Swedish domestic)[7]	116	–[7]	49[7]
Noise charges [8]	15	6,5	7

Environmentally related investments and costs [3]

[MSEK]	1996	1997	**1998**
Boeing 737-600 [9]	–	–	40
Extra cost for use of remaining Chapter II aircraft	–[5]	50	39
Investments and costs in construction and ground operations – environmentally related share	5	25[10]	72[11]
Management of waste and hazardous waste, operation of treatment plants, oil separators, etc. – environmentally related share	10–20	17	19[12]
Environmental report, environmental profiling, environmental sponsorship	3	3	3

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

[2] Costs for environmentally related charges and taxes associated with operations – both extra costs for charges and taxes debited to operations because the environmentally best available process or equipment has not 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 are related to measures to prevent, reduce or repair environmental damage arising from operations.

[4] The full agreed charge reduction was made in 1995–98 despite the fact that SAS did not meet the Norwegian authorities' requirement of a 90% return rate for aluminum. In 1999 this requirement was lowered to 85%.

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

[6] On April 1, 1998 the passenger change in Norway was replaced with a differentiated seat charge which amounts to 386 MSEK on international routes and 215 MSEK on domestic routes.

[7] Sweden imposed a new emissions charge with effect from January 1, 1998. This replaced the environmental tax on domestic traffic which was abolished on January 1, 1997, when the European Commission declared it inadmissible. In 1997 the Swedish authorities levied no emissions tax on flight traffic. Since the then Swedish legislation was found to be contrary to EU Community law, which Sweden's representative has also acknowledged, SAS has filed a legal claim for repayment of the charges paid in 1995 and 1996. This matter has not yet been resolved. When the new emissions charge was introduced, the landing charges were lowered by 12%. Consequently, there was no increased cost for SAS.

[8] The gradual decrease is attributable to the ongoing phase-out of Chapter II aircraft.

[9] In 1998, eight of SAS's ordered Boeing 737-600s were delivered. The environmentally related extra costs for their DAC engines amount to approximately 5 MSEK per aircraft.

[10] Refers only to Oslo's new Gardermoen airport and environmentally related investments in ground operations.

[11] Includes half of the environmentally related investments in SAS's own construction projects at Gardermoen and other environmental investments in ground operations.

[12] The increase is explained by higher volumes of sorted waste/hazardous waste and higher taxes and charges.

Future development: The general trend in the airline industry is towards higher environmental charges and taxes. In 1998 this tax level increased for SAS by 64% to 872 (532) MSEK.

In SAS's Scandinavian home market, the environmentally related taxes and charges remain at the same level in 1999 as in 1998. However, one new factor is the CO_2 charge imposed by Norway on January 1, 1999. It initially applied to both international and domestic flights, which is contrary to ICAO guidelines and Norwegian civil aviation agreements with other countries. The charge was quickly revised to apply only to domestic traffic. It is a combined sulfur and CO_2 charge of 0.30 SEK+VAT per liter of aviation fuel. There is some uncertainty about what the elimination of CO_2 fuel tax on international routes will mean. The government's expressed opinion is that the state treasury must be compensated for the loss of around 80 MSEK through increases in other taxes/charges on flight traffic. The differentiated Norwegian seat charge is currently under review by EFTA's supervisory agency ESA, since it is not permissible to impose different charges on domestic and international traffic.

In Sweden, the 3% discount on the noise charge for Chapter III aircraft is expected to be eliminated in the near future, by 2002, and Chapter II charges are being raised from 65% to 75% in 1999.

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 give rise to extra costs for all major airlines in the range of several hundred million SEK, unless the entire system of taxes and charges is redistributed in conjunction with this. The ECAC is drawing up a proposal for noise classification of Chapter III aircraft. This classification is intended for use at airports that apply noise charges. This could have consequences for SAS's MD-80 fleet. Other environmental charges and regulations could impair flexibility in utilization of SAS's fleet and increase costs in the traffic system, and could also adversely affect the resale values in parts of the fleet.

The ICAO is working on altered certification requirements and guidelines for taxes and charges. Stricter requirements are expected. There is some uncertainty as to whether this will have any significance for SAS.

The AEA is formulating binding environmental goals which could eventually be incorporated into negotiatory agreements with the authorities. SAS supports this work, which is in line with the goal of working under conditions that apply to all players and do not distort

competition in the long term. In light of the current development of SAS's aircraft fleet, these goals should be within the limits of what we have already achieved.

Trading in emissions quotas is undergoing rapid international development. SAS is following this process and believes a system of this type could have consequences for the airline industry. This could be in line with SAS's support of the polluter pays principle, depending on how the system is structured.

The introduction of special rules for night flights at Gardermoen which differentiate between various Chapter III aircraft types is contrary to ICAO principles. SAS believes that this may have a prejudicial effect for other airports in SAS's traffic system.

At its meeting in March 1999, the EU Council of Ministers is expected to make a decision to stop EU registration of hushkitted aircraft after April 1, 1999, and to impose a ban on traffic after April 1, 2002. For SAS this will have no immediate consequences since the previously hushkitted DC-9s have been sold and leased back. All aircraft which are affected by the decision will be phased out before this deadline. The ban on operation of hushkitted aircraft is contrary to ICAO guidelines and indicates that the EU is not awaiting widespread international consensus in this matter.

The EU directive on more stringent requirements for nitrogen oxide emissions from new engines is not expected to have any significance for SAS's planned aircraft fleet.

Circumstances after the opening of Oslo's new Gardermoen airport indicate that limitations on the opportunities for deicing of both aircraft (glycol) and runways (acetate) can be expected. This could lead to diminished capacity and restrictions on use of the runway system. Future modifications to prevent leakage into the ground water are anticipated.

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

SAS's market advantages: The introduction of nitrogen oxide based charges, such as in Sweden and Switzerland, place SAS's new Boeing 737-600/700/800 DACs in favorable charge classes. In general, this type of emission-based charge system is expected to increase.

If the EU's proposed ban on operation and registration of hushkitted Chapter III aircraft (see above under Future development) is adopted, there will be no operative or economic consequences for SAS. SAS sold all of its hushkitted McDonnell Douglas DC-9s in 1998 via leaseback agreements. SAS's fleet planning assumes that these will be phased out by 2002.

Both ECAC and national/local noise charges and restrictions may have consequences for Chapter III aircraft, SAS's modernization program ensures that much of the fleet will be adapted for future requirements.

SAS's studies and decision on the possible modernization of the longhaul fleet are based on the principle of utilizing the best available environmental technology within commercially viable limits. This will create good operative and economic conditions, adapted to future demands.

SAS has entered a long-term agreement with one of the world's largest and leading airline catering companies, LSG Lufthansa Services. The agreement gives SAS competitive terms and entails the establishment of new environmentally adapted flight kitchen facilities at the most important airports in Scandinavia.

Emissions and resource consumption

Grey bars refer to improvements, red bars to deterioration.

Key statistics	Change 1997-98 [%][1]	1997	**1998**		For comments, see page:
Fuel consumption	+3.7	1,616 [3]	**1,675**	[1 000 m³]	26[4]
Carbon dioxide	+3.7	4,021	**4,167**	[1 000 tonnes]	24
Nitrogen oxides	+3.3	14.8	**15.3**	[1 000 tonnes]	24
Hydrocarbons	+3.3	2.1	**2.1**	[1 000 tonnes]	24
Water vapor	+3.7	1,580	**1,638**	[1 000 tonnes]	25
Glycol consumption	+7.9	3,211	**3,466**	[m³]	33
SO_2, NO_x, CO_2 from heating plants	–5.4	3,180	**3,008**	[tonnes]	–[4]
Diesel, ground vehicles	+8.7	3,264	**3,548**	[m³]	34
Gasoline, ground vehicles	–13.9	2,467	**2,125**	[m³]	34
Emissions of heavy metals (cadmium, chromium)	–59.0	6.9 [3]	**2.8**	[kg]	–[4]
Packaging in cabin operations	–4.2	1,204	**1,154**	[tonnes]	29[4]
Newspapers in cabin operations	+11.7	4,362	**4,874**	[tonnes]	29
Collected newspapers	–14.1	1,573	**1,351**	[tonnes]	29
Waste paper/cardboard	+27.3	784	**998**	[tonnes]	–[4]
Garbage	+5.4	3,140	**3,308**	[tonnes]	–[4]
Hazardous waste [2]	+8.8	446	**485**	[tonnes]	32[4]
Water consumption, buildings	+18.9	201	**239**	[1 000 m³]	37
Energy consumption, buildings	–0.7	194	**193**	[GWh]	33
Relative energy consumption	–13.4	409	**354**	[kWh/m²]	34[4]
Comparative figure: RTK	+4.1	2,651	**2,760**	[x10⁶ tonne km]	

[1] The percentual change is calculated based on figures which are not rounded off.
[2] Aggregate of the many fractions included and adjusted to comparable values.
[3] Adjusted compared with the 1997 environmental report with regard to definitive data.
[4] Data also presented on SAS's web site (www.sas.se).

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. 22, 27 and 31.

In	Operations & production	Out	See page
Flights			
• Fuel • Engine oil	Number of ATK (available tonne kilometers) 1998: 4,646,963,000 Number of RPK (revenue passenger kilometers) 1998: 21,268,560,000	• Carbon dioxide (CO_2) • Nitrogen oxides (NO_x) • Hydrocarbons (HC)/VOC • Water vapor • Oil aerosols • Jettisoned fuel • Noise	24–25 24–25 24–25 25 –[3] –[3] 23[3]
Cabin			
• Food • Beverages • Packaging • Disposables • Semi-disposable articles • Goods for sale • Newspapers • Chlorinated water • Germicides	Number of passengers in 1998: 21,699,000 Number of meals served in 1998: 13,589,000[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	28[3] 29[3] – – 28, 29[3] 29[3] –[3]
Ground			
• Glycol ○ Urea/acetate • Water • Halons • Freon • Maintenance materials (components, etc., chemicals) • Energy (oil, LPG, electricity, biofuel, gas) • Office supplies	Managed installations in 1998: 697,675 m²	○ Glycol ○ Urea/acetate • Waste • Hazardous waste Waste water: • Drainage ○ Treatment • Halons • Freon • Sulfur dioxide (SO_2) • Carbon dioxide (CO_2) • Hydrocarbons (HC)/VOCs • Nitrogen oxides (NO_x) • Soot/particles • Noise	33 – –[3] 32[3] 32 –[3] –[3] –[3] –[3] – –[3] – –[3]
Ground vehicles			
• Fuel (diesel, gasoline, biofuel, gas) • Oil • Electricity	Number of ground vehicles in 1998: 2,472	• Carbon dioxide (CO_2) • Nitrogen oxides (NO_x) • Hydrocarbons (HC)/VOC • Hazardous waste • Noise	– – – 32[3] –

• SAS's responsibility.
○ Airport operator's responsibility.
[1] Refers to within and from Scandinavia.
[2] Refers to Copenhagen, Oslo and Stockholm.
[3] Adjusted compared with 1997 with regard to definitive data.
[4] Data also provided on SAS's Internet site (www.sas.se).

Flight operations

Flight operations are where the absolute bulk of SAS's environmental impact arises. For example, flight operations alone account for more than 90% 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 4.1% to 2,760 (2,651) MRTK.

The changes compared with the 1997 environmental report are that the following data has been moved to SAS's Internet site *(www.sas.se)* in order to make this report less unwieldy: Noise index, Noise restrictions in SAS's traffic system, Turbine oil (new for this year), Fuel efficiency per business area, Fuel consumption and production, Comparison between different transport types, Average age in the aircraft fleet and Fuel jettisoning.

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.

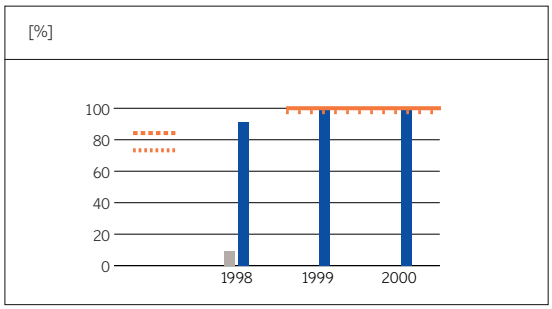
IN	SAS transports	Operation/use	OUT	Activity	Final treatment/ environmental aspect	Significant environmental impact
Aviation fuel Supplier: – Oil company	– [1]	Flight – Combustion in engine	**Carbon dioxide** **Water vapor** **Hydrocarbons** **Nitrogen oxides**	–	Emissions into air	Greenhouse effect Greenhouse effect Greenhouse effect, low level ozone Greenhouse effect, acidification, ground level ozone, thinning 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**	–	Emissions into air	Greenhouse effect
			Oil aerosols	–	Emissions into air	Greenhouse effect
–	–	Takeoff and landing	**Noise**	–	–	Disruption

[1] *No transports under SAS's 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.

SAS's phase-in of Chapter III aircraft



[Number]	1998	1999	2000
Chapter II aircraft	18	–	–
Chapter III aircraft	167	179	185

SAS's goal: 100% Chapter III aircraft by December 31, 1999

Reference levels:
ICAO's goal, EU requirement: 100% Chapter III aircraft by April 1, 2002

Proportion of Chapter III aircraft in 1997:
AEA 83%
IATA 74%

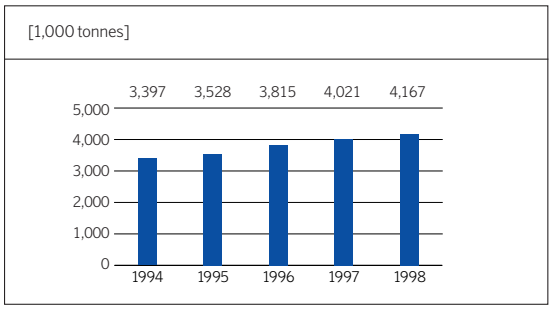
Background: Noise levels in the airline industry are controlled by means of the ICAO's certification requirements, supplemented by local traffic restrictions – in SAS's traffic networks for many airports, especially in Europe. As of April 1, 2002 only aircraft with the current certification, Chapter 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. However, a further tightening up of the rules is under discussion (see p. 19).

Development of SAS's aircraft fleet

Aircraft type	Fuel consumption	Max. values under ICAO's certification requirements [g/kN]			Noise contour	Aircraft used in SAS's operations	Planned development			
Longhaul and cargo	[l/ASK]	Nitrogen oxides	Hydrocarbons	Carbon monoxide	[km²/85 dB(A)][1]	in 1998	1999	2000	2001	2002
Boeing 747-200BC	0.103[5]	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**	**13**	**13**
Short and mediumhaul										
Boeing 737-300-QC[4]	0.045	40.3	4.7	72.9	–[2]	**2**				
Boeing 737-600	0.045	32.4	14.6	117.5	1.2	**8**				
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	–[2]	**22**				
Douglas DC-9-81	0.047	73.4	15.2	41.1	4.7	**9**				
Douglas MD-81	0.045	73.4	15.2	41.1	4.7	**19**				
Douglas MD-82	0.047	73.4	15.2	41.1	5.2	**28**				
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						**136**	**135**	**139**	**139**	**140**
Commuter										
de Havilland Q400-Dash 8	–[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	**6**				
Total						**28**	**30**	**33**	**37**	**39**
Total fleet						**179**	**178**	**185**	**189**	**192**

[1] Manufacturer's specification. Relates to takeoff.
[2] Data from manufacturer not available.
[3] Not subject to certification.
[4] On daytime lease from Falcon Air.
[5] Refers to ATK.

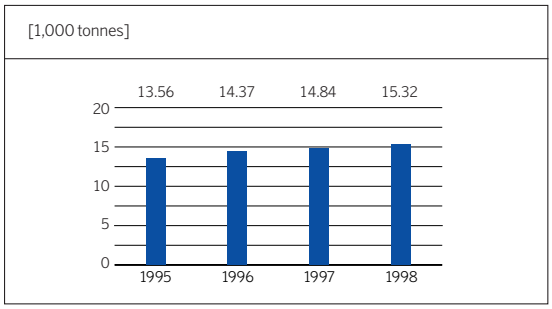
Carbon dioxide (CO_2)



	1994	1995	1996	1997	**1998**
g/RPK	180	183	192	194	**196**
g/RTK	1,540	1,559	1,540	1,517	**1,510**

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 undergoing reformulation following the climate conference in Kyoto in 1997 and Buenos Aires in late 1998. **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 minor 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 1998, 126 g/ASK and 897 g/ATK can also be used. (See p. 25 for a comparison between SAS and other airlines.)

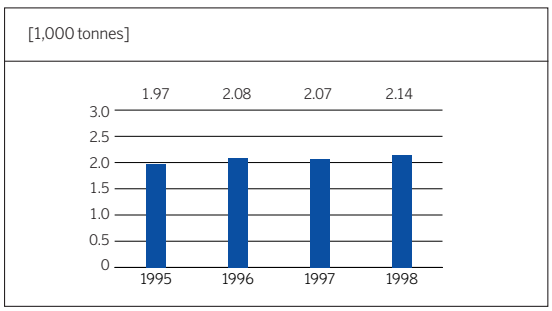
Nitrogen oxides (NOx)



	1995	1996	1997	**1998**
g/RTK	6.0	5.8	5.6	**5.6**

Background: The aircraft engines' nitrogen oxide emissions are restricted through the ICAO's certification requirements, which are expected to become more stringent by the year 2000, and are calculated based on distance flown. **SAS's development:** SAS's nitrogen oxide emissions are calculated based on the distance flown with a coefficient of 0.0595 kg/km. This factor is specific for SAS with regard to the composition and operational pattern of the aircraft fleet. • The higher emissions in 1998 are explained by SAS's increase of more than 3% in the distance flown. However, due to development of the aircraft fleet towards engines with lower nitrogen oxide emissions, emissions have increased at a lower rate than total distance flown – in 1998 GCD 258 (249) Mkm. In 1998, SAS began phasing in aircraft featuring engines with double annular combusters, which reduce emissions by 40% compared with older aircraft. The effects of these will not be visible to any significant extent until the environmental report for 1999 is published. At that time, a new coefficient will be used for SAS's aircraft fleet. • As an additional comparative figure for 1998, 3.3 g/ATK (see p. 25 for a comparison between SAS and other airlines).

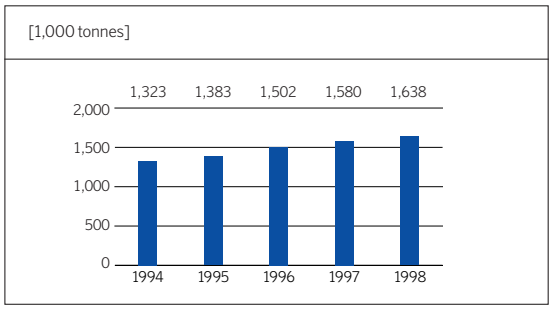
Hydrocarbons (HCs)



	1995	1996	1997	**1998**
g/RTK	0.87	0.84	0.78	**0.77**

Background: The data refers to hydrocarbons (HCs), excluding other VOCs, on the same scale as in the ICAO's certification. The aircraft engines' hydrocarbon emissions are restricted through the ICAO's certification requirements, and are estimated on the basis of distance flown. **SAS's development:** Flight operations' hydrocarbon emissions are calculated based on the distance flown, using a coefficient of 8.3 g/km. This factor is specific for SAS with regard to the composition and operational pattern of the aircraft fleet. • SAS's increase in 1998 is due to an increase in the total distance flown – in 1998 GDC 258 (249) Mkm. However, in relative terms hydrocarbon emissions have continued to decrease. 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 1998, 0.46 g/ATK can also be used (see p. 25 for a comparison between SAS and other airlines).

Water vapor (H_2O)



	1994	1995	1996	1997	**1998**
g/RTK	606	614	606	596	**594**

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. The airline industry's emissions of water vapor are believed to contribute to the greenhouse effect. **SAS's development:** The increase in recent years is explained by a rise in fuel consumption in connection with higher production. • As an additional comparative figure for 1998, 352 g/ATK can also be used. (see below for a comparison between SAS and other airlines).

Emissions in relation to production
Comparison with other airlines

[g] **Fuel consumption**	*British Airways*	*Lufthansa*[1]	*KLM*	*Swissair*	*Finnair*	***SAS***
Per ATK	227	–[2]	227	390	–[2]	**285**
Per RPK	–[2]	41	–[2]	–[2]	44	**62**
Per RTK	326	–[2]	291	381	377	**479**
Carbon dioxide						
Per ATK	790	–[2]	679	792	–[2]	**897**
Per RPK	–[2]	125	–[2]	–[2]	137	**196**
Per RTK	1,039	–[2]	918	1,146	1,180	**1,510**
Nitrogen oxides						
Per ATK	3.15	–[2]	2.45	3.3	–[2]	**3.3**
Per RPK	–[2]	0.58	–[2]	–[2]	0.58	**0.72**
Per RTK	4.58	–[2]	3.35	5,0	5,0	**5.6**
Hydrocarbons						
Per ATK	0.18	–[2]	–[2]	0.19	–[2]	**0.46**
Per RPK	–[2]	0.02	–[2]	–[2]	0.05	**0.10**
Per RTK	0.27	–[2]	–[2]	0.27	0.42	**0.77**
Water vapor						
Per ATK	281	–[2]	281	315	–[2]	**352**
Per RPK	–[2]	64	–[2]	–[2]	54	**77**
Per RTK	408	–[2]	360	456	467	**594**

[1] Refers only to Lufthansa Passenger Airline.
[2] Not reported.

Background: The comparative figures come from the airlines' most recent available environmental reports – for British Airways, Lufthansa, KLM and Finnair from 1997/98, for Swissair from 1995. Consequently, SAS can not vouch for the quality of this data with the same degree of certainty as its own data. We also know that their data may be compiled based on different calculation methods and documentation. • Many of the differences between these airlines key statistics are explained by the varying ages and compositions of the aircraft fleets, as well as the operational patterns and aircraft configurations.

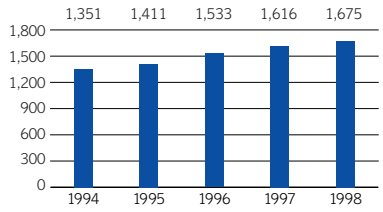
Energy consumption

More data at www.sas.se

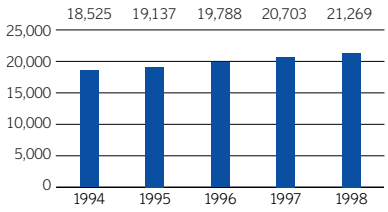
Fuel efficiency

SAS's development: Since total fuel consumption increased no more than production, relative fuel efficiency was unchanged compared with the preceding year.

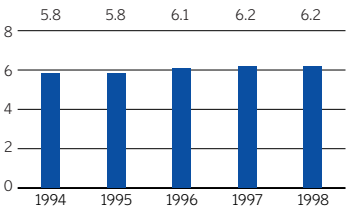
Fuel consumption · SAS total
[1,000 m³]



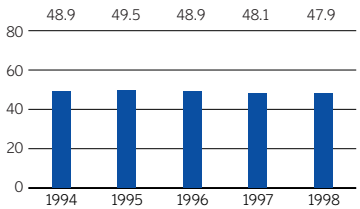
RPK · SAS total
[x10⁶]



Fuel consumption/100 RPK · SAS total
[kg/100 RTK]

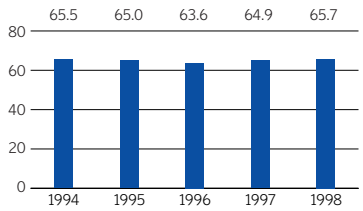


Fuel consumption/100 RTK[1] · SAS total
[kg/100 RTK]



[1] RTK for 1998 was 2,760 x10⁶ tonne km.

Cabin factor · SAS total[1]
[%]



[1] The figure includes paying passengers over a certain payment limit ("revenue passengers"). The total number of passengers is approx. 9% higher. Including all passengers, SAS's cabin factor for 1998 is 71.7%.

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 meet not only safety and commercial requirements, but also environmental requirements. After completing the purchase of SAS's latest mediumhaul aircraft (MD-90) and the next short and mediumhaul aircraft (Boeing 737-600), both of which have environmental data that are among the best in the industry, and a new commuter aircraft (de Havilland Q400-Dash 8), preliminary studies were carried out in 1998 in preparation for the possible purchase of the next generation of longhaul aircraft. Also here, SAS will adhere to the principle of choosing the best available environmental technology within commercially viable limits. A decision is expected to be made during 1999).

Quieter aircraft

In 1998 SAS, together with the engine suppliers to the MD-80 fleet, continued to work 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. SAS's next generation of Boeing 737s are considered to be among the quietest in their class. SAS will also place rigorous noise requirements on any new longhaul aircraft.

Other information

More data at www.sas.se

Cabin operations

Although cabin operations on the whole are 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 consists 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 the number of meals served on board, which was decreased through the introduction of meal service in a gate buffet by 1.1% to 13, 589 (13,735) million on flights within and from Scandinavia.

The changes compared with the preceding year's environmental report are that catering waste is reported as sorted and unsorted, and that the following data has been moved to SAS's Internet site *(www.sas.se)* in order to make this report less unwieldy: Germicides, Chlorine, Insecticides, Catering waste total, Packaging total, Water total catering and Electricity, gas and heating total catering.

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.

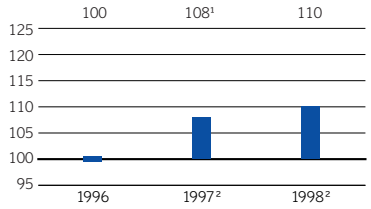
IN	SAS transports	Operation/use	OUT	Activity	Final treatment/ environmental aspect	Significant environmental impact
Food, (incl. packaging) Supplier: – Catering companies	–[3]	Consumption	**organic waste/ (leftover food)** **Packaging:** – Paper – Plastic – Aluminum	Pre-sorting (partly) Transports	Incineration/ 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, un-opened beverages** – Glass – Plastic – Cardboard – Aluminum	Pre-sorting (partly) Transports	Incineration/ energy extraction Deposition Reuse Recycling	Greenhouse effect, acidification, low level ozone, use of land overfertilization,
Disposables Misc. suppliers	–[3]	Cabin service	**Waste** – Plastic – Paper – Cotton – Aluminum	Pre-sorting Transports	Incineration/ energy extraction Deposition	Greenhouse effect, acidification, low level ozone, use of land, overfertilization
Semi-disposable Supplier: – Plastic and textile producers – Tableware manuf. – Packaging suppliers	–[3]	Cabin service	**Used semi-disposable articles** – Porcelain – Melamine plastic – Glass – Stainless steel – Cotton	Washing/ laundering	Reuse	Water consumption, energy 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 Incineration/ 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 suppliers	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 utilization and the smaller the relative environmental impact.



¹ Adjusted compared with the 1997 environmental report with regard to definitive data.
² Line stations included as of 1997.

The environmental productivity index for cabin operations expresses resource consumption in relation to production, thereby indicating the operations' ecoefficiency. The formula used is (with 1998 data):

$$\frac{\text{12,380,000 meals produced}^5 + \text{21,699,000 passengers}^3}{\begin{array}{c}(\text{1,154,000 kg packaging}^3 - \text{21,420 kg collected aluminum}) \\ + (\text{4,874,000 kg loaded magazines/newspapers}^3 - \text{1,351,000 kg} \\ \text{collected magazines/newspapers}^4) + (\text{5,709,000 kg catering waste}^5 \\ - \text{1,495,000 kg recycled}) + (\text{5,537,000 kg cleaning waste}^4 \\ - \text{502,000 kg recycled}) + \text{149,686 m}^3 \text{ of water consumption in} \\ \text{catering}^5 + \text{31,924 x10 MWh of energy consumption in catering}\end{array}}$$

By giving a higher weighting to production and a lower weighting to aluminum recovery and resource consumption than other gauges 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.

³ Throughout the traffic network.
⁴ Scandinavia only.
⁵ Copenhagen, Oslo and Stockholm only.

SAS's development: The positive trend is explained by a certain improvement in resource consumption and recycling in relation to production.

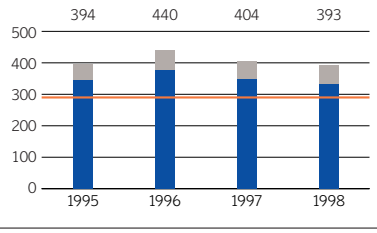
Emissions into the water
Emissions into the air *More data at www.sas.se*

Waste

More data at www.sas.se

Catering ¹

Total ¹ per meal served ²
[g/meal]

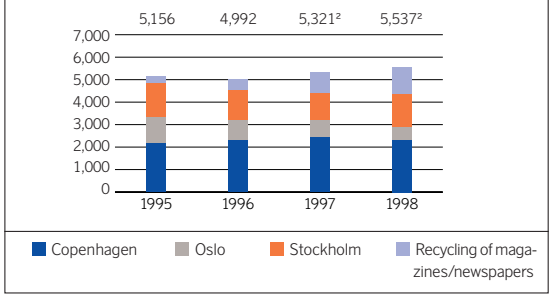


¹ Excluding magazines/newspapers.
² The meals SAS's receives from its suppliers in Copenhagen, Oslo and Stockholm.
³ New grounds for calculation were used in 1997, which means that the figures for the different years are not directly comparable.

SAS's development: Despite an increase in production, waste volumes from catering decreased somewhat to 5,995 tonnes, or by 3.2%. The reduction per meal was 2.8%. The improvement per meal in 1998 can be explained by new service concepts and improvements at the suppliers, among other things. Starting with this year's environmental report, waste is specified as sorted or unsorted.

Aircraft cleaning [1]

Total cabin operations
[tonnes]

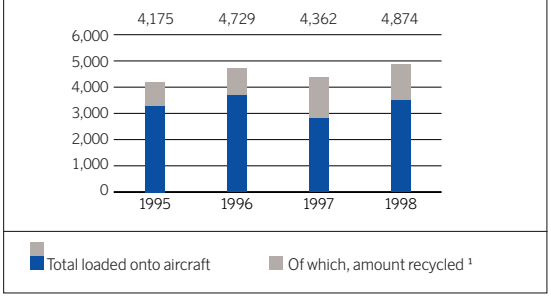


[1] *Refers to waste collected by SAS or SAS's suppliers when cleaning the aircraft.*
[2] *As of 1997, the statistics include data from the Scandinavian line stations. The figures are therefore not directly comparable with earlier years.*

SAS's development: The total volume of waste is rising, although the proportion of sorted waste is also increasing. Unsorted waste decreased by 10% during the period 1995–1998. In Copenhagen, magazine/newspaper collection was started in 1998.

Magazines/newspapers

Total cabin operations
[tonnes]

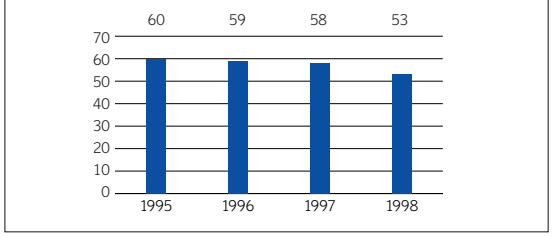


[1] *1997 including a certain proportion of other types of paper.*

SAS's development: In total, an average of 225 (210) g of magazines/newspapers per passenger were loaded on board SAS flights in 1998. The recycling rate was 28 (36)%. The decrease is most likely explained by the fact that the volumes reported in 1997 included other types of paper. During 1999 the newspaper recycling system in Scandinavia will be reevaluated.

Packaging

Per passenger
[g]



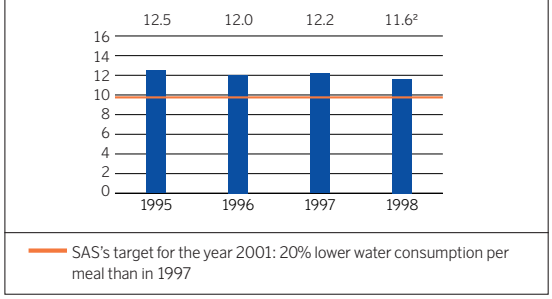
SAS's development: Of the total amount of packaging loaded onto SAS flights, 1,154 tonnes are recycled, or 1.9% (2.5%). Collection of aluminum packaging on domestic routes for recycling is carried out in Norway (statutory) and in Sweden (aluminum beverage packaging is prohibited in Denmark). In 1998, 12.5 tonnes of aluminum were collected in Norway, and 8.9 tonnes in Sweden. In Norway this represents a collection rate of 60% (87%) for aluminum, which means that SAS did not reach the target of 90% which is contracted with the authorities. In Sweden this meant that the collection rate for aluminum decreased to 43% (55%). The Swedish public's recycling rate for aluminum beverage containers, 92%, can be used as a reference level. SAS will study the routines for collection of cans in order to find the reasons for the lower recycling rate in 1998.

Consumption of raw materials

More data at www.sas.se

Water

Per meal served [1]
[l]



[1] *The meals SAS receives from its suppliers in Copenhagen, Oslo and Stockholm; in 1997 and 1998 also including Gothenburg and Malmö.*
[2] *In October 1998 catering operations in Oslo moved into new premises at Gardermoen. The Oslo figure for 1998 therefore only covers the period January 1–September 30, and the total figure is thus not directly comparable with earlier years.*

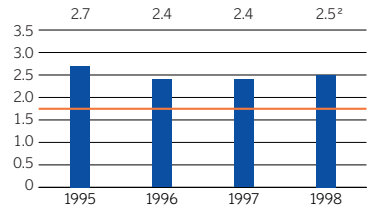
SAS's development: Total water consumption in catering operations has decreased in relation to the number of meals served. The improvement is a result of the ongoing focus on water consumption.

Energy consumption

More data at www.sas.se

Electricity, gas and heating

Per meal served[1]
[kWh]



SAS's target for the year 2001: 20% lower energy consumption than in 1997.

[1] *The meals SAS receives from its suppliers in Copenhagen, Oslo and Stockholm – in 1997 and 1998 also including Gothenburg and Malmö.*

[2] *In October 1998, catering operations in Oslo moved into the new premises at Gardermoen. Consequently, Oslo's figures for 1998 cover only the period January-September. The total figure for 1998 is therefore not directly comparable with 1997.*

SAS's development: Total energy consumption, 34,097 MWh, has increased in catering operations. The increase took place in Oslo and Stockholm. The reason is hard to pinpoint, but SAS's choice of meal types is influential. One contributing factor could be the transition to reusable material on certain routes, which will be fully implemented during 1999 when cabin service is developed according to SAS 2000+. Several ongoing environmental projects are aimed at reducing energy consumption despite increased washing for reuse. The goal of reducing consumption by 20% before the end of 2001 compared with 1997 is unchanged.

Projects

Environmental projects – Overview

Environmental projects in collaboration between SAS and suppliers

	Energy	*Water*	*Waste*	*Air*	*Noise*
Food	4	6	7	3	–
Beverages	5	5	5	5	–
Packaging	5	7	8	9	–
Transports	8	7	7	9	5
Equipment	8	8	7	7	7
Materials	30	6	8	25	–
Magazines	21	9	23	22	–
Chemicals	7	7	21	20	–

In 1998 a total of 112 (84) environmental projects were conducted in collaboration between SAS and suppliers. (Many projects are included in several of the above cells, since they have an impact on several environmental areas.)

Environmental projects at suppliers due to agreement with SAS

	Energy	*Water*	*Waste*	*Air*	*Noise*
Reported	96	67	112	55	49

In 1998 a total of 379 (223) environmentally related projects had been reported by SAS's suppliers as a result of their agreements with SAS.

Pre-sorting

In 1996 meal service in the form of gate buffets was tested and in 1997–98 the concept was extended to several routes. One of the goals was to reduce waste volumes. In 1998 a pre-sorting trial was started on SAS routes. The experiences so far have been positive and this activity will be further evolved.

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 1998 the trial was extended to the routes between Copenhagen, Oslo and Stockholm and a modified waste collection cart was introduced and was given a positive evaluation by the cabin crew. However, returned aluminum cans decreased somewhat – on Norwegian domestic routes from 87% to 60%, and on Swedish domestic routes from 55% to 43%. The move to Gardermoen is one reason – a review of concepts and routines is being carried out during 1999 to improve the collection rate.

Environmentally adapted cabin service (SAS 2000+)

In preparation for the introduction of the extensive process of chrage SAS 2000+ to the customers in spring 1999, SAS continued to develop a range of environmentally adapted products in 1998. On longhaul routes and in Europe, excluding Scandinavia, disposable materials even in economy class were replaced with glasses, plates and cutlery that is washed and reused, which reduces raw material consumption and waste volumes. Porcelain has been replaced by lighter materials and new plastic glasses are being developed with a lower plastic content, reducing both raw material and fuel consumption/emissions. New, lighter packaging is providing similar effects. All of the new products are marked with their content of critical raw material e.g. aluminum for accurate recycling. In purchasing of new uniforms, textiles bearing the Ökotex label have been chosen as a guarantee that they are free from harmful chemical residues.

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 4.2% production increase to 21.7 (20.8) million passengers, and expansion of the aircraft fleet with seven aircraft since 1997.

The change compared with the preceding year's environmental report is that the following data has been moved to SAS's Internet site *(www.sas.se)* in order to make this report less unwieldy: Engine tests, Infringements and incidents, Heat production (SO_2, NOx, CO_2), CFCs and Halons, Heavy metals (Cd, Cr), Oil and oil emulsions, Hazardous waste (specification), Paper and cardboard, Garbage, Solvents, Gas, Land vehicles, and Installations managed.

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.

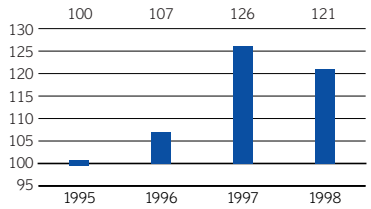
IN	SAS transports	Operation/use	OUT	Activity	Final treatment/ environmental aspect	Significant environmental impact
Glycol From supplier	From storage to aircraft	Deicing of aircraft	**Spillage**	Collection Transport Leakage	Reuse	Overfertilization
Urea/acetate From supplier	–[1]	Deicing of takeoff and 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, greenhouse effect
Maintenance materials **• components, etc.** **• Chemicals** Misc. suppliers	From storage to place of use	Maintenance of aircraft, machinery, vehicles, equipment, buildings and land	**Hazardous waste**	Pre-sorting (predominant) Transports	Recycling Reuse Destruction Incineration 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 Incineration Destruction Deposition	Greenhouse effect,, contamination of soil and water

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

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

Environmental index

[1995=100] · The higher the index figure, the better the resource utilization and the smaller 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 (1998 data in brackets):

$$\frac{\text{Number of takeoffs and landings (340,940) + passengers x10}^3\text{ (21,699) + tonnes of cargo and mail (279,924)}}{\text{MWh of energy for electricity and heating (192,850) + m}^3\text{ water (238,871) + kg of hazardous waste (485,030) + m}^3\text{ of fuel for ground vehicles (5,673)}}$$

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.

SAS's development: The lower figure for 1998 is attributable to higher volumes of hazardous waste, due to increased production and a higher degree of sorting, and by increased water consumption at Fornebu. The increase at Fornebu is attributable to problems with recirculation of cooling water from the electroplating process to the water reservoir. • Earlier years' indexes have been adjusted with regard to definitive data.

Noise
Emissions into the air
Emissions into the water *More data at www.sas.se*

Waste

More data at www.sas.se

Hazardous waste

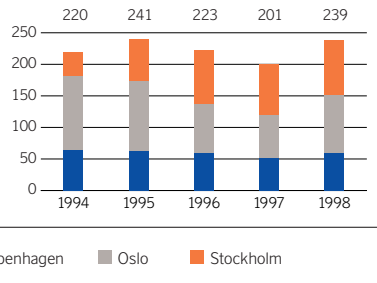
[tonnes]	1995	1996	1997	**1998**
	523.6	513.9	445.9	**485**

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. **SAS's development:** In total, SAS delivered 485 tonnes of hazardous waste in 1998, which corresponds to an increase of 8.8% from 1997.

Consumption of raw materials

Water

[1,000 m³]

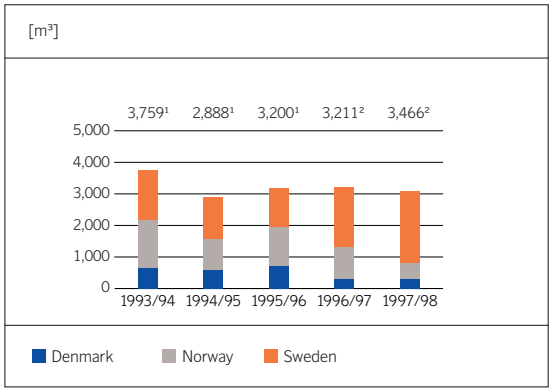


SAS's development: Water consumption has increased at all of the main airports and particularly in Oslo (Fornebu). This was due to problems with recirculation of cooling water from the electroplating process to the water reservoir.

Consumption of chemicals

More data at www.sas.se

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.

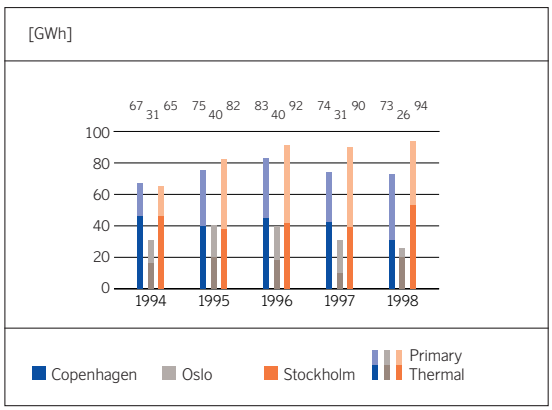
² As of 1996/97, domestic line stations are reported in all Scandinavian countries.

Background: Glycol is sprayed on the 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. Glycol consumption at Gerdermoen has therefore not been included in this year's environmental report. 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 1997/98 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. (See p. 14 for information about problems with use of glycol at Gardermoen.)

Energy consumption

More data at www.sas.se

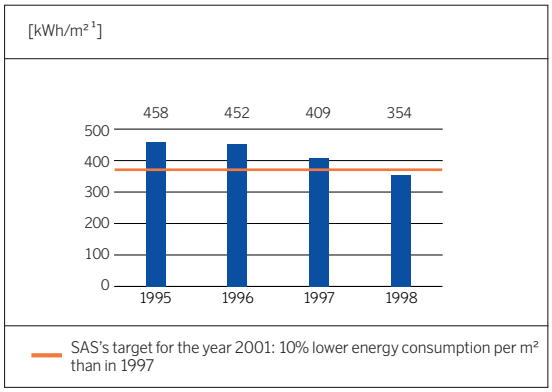
Electricity and heating



[GWh]	1994	1995	1996	1997	**1998**
Total	163	197	215	194	**193**

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% environmentally modified oil and 50% electricity at Fornebu. At Gardermoen SAS has chosen not to install its own heating plant, but to instead supply the buildings with district heating, primarily chip-based with oil additives. In Stockholm biofuel-fired district heating is used as of 1997 (previously LPG). Through deregulation of the electricity market (in Norway since 1983 and in Sweden as of 1996), SAS is able to freely choose its electricity supplier. Starting in 1998 SAS Sverige and SAS Norge have entered an agreement with Norwegian Tromskraft for delivery of electric power. **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 some 80% of its energy from a geothermal plant, which produced 8,959 MWh in 1998. • The move to Gardermoen leads to uncertainty in 1998 data. The statistics for 1999 can be expected to provide a more accurate picture. An ongoing focus on energy efficiency reduced relative energy consumption in 1998.

Relative energy use

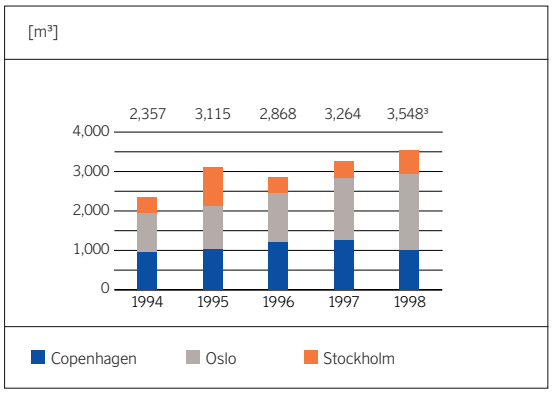


[number]	1995	1996	1997	**1998**
Electricity and heating [MWh]	197	215	194	**193**
Area used [1 000 m²]¹	431	475	475	**545**
Energy efficiency [kWh/m²]	458	452	409	**354**

¹ Total area with registered resource consumption.

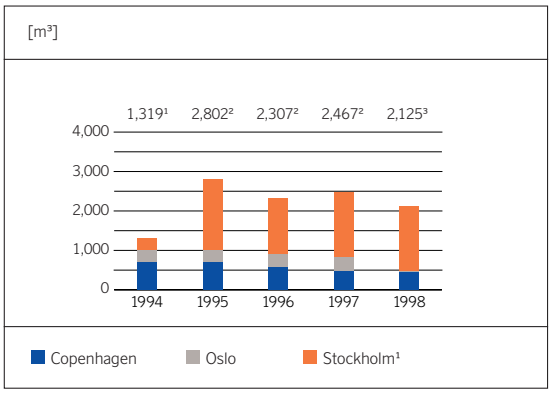
Background: In order to indicate SAS's ecoefficiency, registered resource consumption is compared with the total SAS-owned floor area where resource consumption takes place. In 1998 SAS moved into several new buildings — the cargo terminal in Copenhagen and three new buildings at Gardermoen. The approx. 90,000m² at Gardermoen will be included in the relative data in the 1999 environmental report. **SAS's development:** SAS's target for the year 2001, to reduce energy use relative to the total area with registered resource consumption by 10% compared with 1997, was achieved already after one year with a reduction of 13%. However, due to the move to Gardermoen in autumn 1998 the underlying data is uncertain. We will therefore wait a year to ensure that this trend is sustainable in the long term before we consider this goal fulfilled and set a new one. Furthermore, the move to Gardermoen means that comparisons between 1998 and earlier years are difficult to make. • An additional comparative figure for use in 1998 is SAS's energy consumption in ground operations excluding catering of 8.9 (9.3) kWh per passenger.

Diesel



Background: SAS strives to use only diesel of the best environmental quality in each country. **SAS's development:** SAS's higher consumption in 1998 is explained primarily by a 40% increase in production in Oslo, where both Fornebu and Gardermoen were trafficked during the period July 1–October 7 prior to the official opening of the latter airport. In Copenhagen SAS discontinued its airport shuttle traffic in 1998. • In Stockholm, SAS is conducting a pilot project for replacement of diesel with biofuel, and in 1998 42 m³ of biofuel were used in Stockholm. • In addition to the volumes reported here, SAS's catamarans between Malmö and Copenhagen airport used 2,001 (2,148) m³ of diesel in 1998. The decrease is explained by lower production in 1998.

Gasoline



¹ 1994 from ground operations at Arlanda airport only. As of 1995, gasoline used for SAS's company cars is also included.
² The volumes for 1994 and 1995–97 are not directly comparable – see Note 1.
³ As of 1998, all values are reported including the line stations. This means that consumption for Copenhagen and Stockholm are not comparable with the preceding year's, in contrast with Oslo where the figure previously included the line stations.

Background: SAS strives to use only unleaded gasoline, which has already been achieved in the majority of locations.

Projects

New airport (Oslo)

In construction of SAS's facilities for operation, technical maintenance and cargo (a total of 90,000 m²) at Oslo's new Gardermoen airport which was inaugurated in October 1998, the facilities were 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. 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 the applicable laws and regulations. SAS's investment amounts to a total of 1,299 MSEK, of which approx. 25 MSEK is related to the environment.

New cargo terminal (Copenhagen)

On December 7, 1998, SAS's new cargo terminal was inaugurated at Copenhagen airport. The terminal offers major improvements in the work environment, such as considerably better insulation, but also in the external environment. 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. Since SAS's entire production will be gathered in one place, the need for transports will also decrease. SAS's total investment amounts to 675 MSEK, of which 20–30 MSEK is related to the environment.

Computer-controlled energy consumption (Copenhagen)

In 1998 the property department at Copenhagen airport carried out an adjustment of energy consumption for heating in the Danish head office with the help of the central control system for heating and ventilation. Over a period of 12 months a reduction of approx. 25% was noted. Thanks to this success, a decision was made to begin a comprehensive analysis of all SAS-owned buildings on March 1, 1999.

Towing of aircraft (Copenhagen)

In 1997 SAS began trials to replace the aircraft's navigation lights with mobile lamps on the towing vehicles to avoid having to start the aircraft's auxiliary power units (APU) during towing, thereby reducing fuel consumption, exhaust emissions, noise and costs (approx. 1 MSEK per year). In 1998 the trials were extended pending permanent authorization from the Danish Civil Aviation Authority.

Reduction/treatment of waste water (Stockholm)

In 1998 SAS completed construction of new facilities for washing of aircraft and vehicles at Arlanda in Stockholm, which will open on April 1, 1999. The investment amounted to 8 MSEK, of which half is environmentally related. The goal is to meet the authorities' concession requirements for emissions of heavy metals and mineral oil and to replace, from a work environment standpoint, an outmoded process. The ambition is to recirculate the process water by 80%.

New painting methods

In 1998 SAS began implementing new painting methods with the goal of achieving a 20% reduction in total emissions from lacquer-related solvents by the year 2000. The objective is for both aircraft and vehicles to always use lacquers of the high solid type, which contain 30% less solvents than traditional types.

Conversion to district heating

In Copenhagen all new buildings are heated with district heating or natural gas. In addition, SAS's office building converted to district heating during 1998. In 1999 Computer Blocks 3 and 4 will also begin conversion, which is scheduled for completion in 2000.

At Gardermoen in Oslo, SAS has chosen not to build its own heating plant, but will instead supply the buildings with district heating, primarily based on chips with an oil additive.

Treatment of process water

At Gardermoen airport in Oslo SAS has built a treatment plant with zero emissions. The facility employs a technique in which the process water is evaporated after which the half-dried fraction, which contains heavy metals, etc., is treated as hazardous waste and the water is returned to the process. The same closed system for treatment of process water has been installed at SAS's electroplating workshop at Fornebu.

At Arlanda in Stockholm, SAS is building a waste water treatment plant for the hangars and workshops in order to ensure that the concession requirements are met without recirculation of the process water. The plant is expected to be in operation starting on April 1, 1999, and represents an investment of 12 MSEK, all of which is environmentally related.

Pre-sorting

In Copenhagen, pre-sorting activities were intensified during 1998. A container yard was set up in a temporary location to enable correct sorting of waste into eleven fractions.

At Gardermoen in Oslo, a joint system for waste management has been set up, and includes all actors in the airport area. This ensures cost-effective and environmentally adapted pre-sorting. In addition , the waste subcontractor Ragn-Sells has built a facility for reloading and further sorting.

Scandinavian database for technical products

In 1999 SAS completed the project which was initiated in 1997 to ensure registration of chemicals within SAS is carried out in the best possible manner from an environmental standpoint. A joint database for SAS in Denmark, Norway and Sweden covering all chemical products used in the three Scandinavian countries will be completed in the fourth quarter of 1999. Through harmonization of the range and yearly updating of the environmental and health data for the various product the risk of incidents is reduced. This also decreases the costs for purchasing, storage, training, official documentation, management of hazardous waste, etc.

Environmental adaptation of deicing routines

In 1998 SAS continued its trials of applying viscous deicing fluid to the aircraft in Copenhagen while they are parked at night. The goal is to reduce consumption of deicing fluid by 75% for the aircraft which are treated. In connection with the move to Oslo's new Gardermoen airport, the suppliers were required to provide environmental documentation on biological testing of the deicing fluid.

Environmental approval of SAS facilities (Copenhagen)

In late 1998 SAS commenced a process of identification and environmental inspection of the facilities and activities under SAS's responsibility which are to be approved by the authorities in mid-1999. The approval requirement pertains primarily to hangars, aircraft washing and similar. In connection with the project, an environmental coordinator has been appointed for each major production area within the technical department. A control group has been formed with the respective managers as members. This work has been organized to as far as possible incorporate the preparatory identification and documentation data required for ISO 14001 certification.

SAS' environmental work in practice

Environmental adaptations a natural part of product development

In autumn 1998 SAS launched its most extensive process of change in close to twenty years. Based on a particular Scandinavian spirit, SAS has developed services and products with customer benefit in focus. This also incorporates the environmental aspects.

Continuous improvements the guiding principle in SAS's environmental management system

An overall approach, continuous improvements, supplier collaborations, industry-wide cooperation and certifiable systems are the cornerstones of SAS's environmental management. We provide an account of SAS's visions, goals, strategies and organization for environmental work.

"Every manager with decision-making authority and budget responsibility is obligated to include an environmental impact assessment as part of the decision data."

The environment in product development

A natural part of the new SAS

In the second half of 1998, SAS 2000+, the most extensive process of change in close to twenty years, was introduced. One key point of departure has been the common features that characterize the Scandinavian nations, our unique kinship based on history and language, nature and seasons, culture and lifestyle. We feel that there is a particular Scandinavian spirit of informality and individuality that also permeates our relationship with the environment. These qualities should be reflected in our service and products.

In 1998 the purchasing departments in Denmark, Norway and Sweden purchased a large volume of articles reflecting the new corporate identity, from one million pieces of stainless steel cutlery to 60,000 pairs of pants and new aircraft colors. Throughout this purchasing process, the buyers have placed environmental demands on the products, for example that the lacquer should be of the high solid type, which contains less solvents. The objective has been for SAS 2000+ to raise resource-consciousness and reduce environmental impact throughout SAS. On longhaul routes and in Europe, with the exception of Scandinavia, disposable materials in economy class have been replaced with glasses, porcelain and cutlery that are washed and reused.

The goal has been, as far as possible, to change over to the new design in connection with normal maintenance. However, one unavoidable consequence of buying new materials is that a great deal of equipment is phased out. To remedy this, the ambition is for everything to have a "life after SAS". Reuse is always the first alternative.

Reuse first and foremost

The uniforms are one example. When 15,000 uniformed employees change wardrobe a lot of fabric gets left over. Possible uses for this are under discussion between SAS and its cooperation partner Save the Children. The uniforms will be donated to a school for seamstresses in Druskininkaj, Lithuania, some one hundred kilometers southwest of the capital city Vilnius. There, they will be refashioned into various garments which are needed in the country. Similar solutions are planned for other phased-out articles such as pillows and blankets.

The foremost objective is to find further use for the products, since this enables the most efficient conservation of resources. Recycling is chosen for paper, cardboard and aluminum, where well established channels for material recovery already exist and hygienic considerations make reuse inappropriate.

The introduction of new porcelain in the cabins will not involve a dramatic change in materials, which will continue to be dominated by stainless steel, glass and plastic, although there has been a shift from polystyrene to more environmentally friendly polypropylene. All of the new products launched within SAS 2000+ are marked for recycling to facilitate sorting into the right fractions. This makes it easy to separate waste that should not be incinerated or sent to a landfill. In total, SAS

Dialogue and collaboration

One sure sign that Christmas is approaching at SAS Products & Services at the head office is the deluge of faxes and e-mail from suppliers. Aside from a few holiday greetings, the bulk consist of the companies' yearly reports on their progress in the environmental program that is a precondition of every procurement.

Over 100 suppliers have signed an agreement with SAS Products & Services in which they undertake to have a well documented environmental policy, a high level of environmental awareness and responsibility for ensuring that the applicable legislation is followed. Each SAS supplier must actively strive for environmental improvements and must have an action and follow-up plan to enhance their products or services in areas that affect resource consumption and environmental impact. Key suppliers also pledge to follow SAS's environmental program. Before choosing a supplier the production facilities are carefully examined. For example, how do they handle their waste?

500 environmental projects

As a result, since 1996 Products & Services has initiated some 500 environmental projects in collaboration with its suppliers. These have spanned a wide spectrum, from food and beverages to equipment, packaging and transports.

Some projects may seem trivial. That the 75-centiliter wine bottles on longhaul routes have no cork casings is something most people wouldn't notice. But these often contain metal alloys, and the aggregate amount is considerable. SAS has therefore requested that its suppliers remove them. (So far, the small bottles tend to leak without casings).

SAS's requirements also strongly influenced the newspaper companies who supply SAS's flights to improve their environmental efforts.

SAS does not require its suppliers to have EMAS registration or ISO certification, only to work in line with these criteria. Continuous improvement and reliable collaboration with suppliers is the point, not to ensure that they are flawless from the start or to pressure them for rapid results. That could provide short-term gains, but in the long term SAS, the supplier and the environment benefit more if the investments are economically sustainable.

Reducing waste volumes is a strategic priority. By the end of 2001, the volume excluding magazines and newspapers will be reduced by 30%

serves around 13.6 million meals a year on flights to and from Scandinavia alone.

Throughout the process, the focus has also been on resource conservation. Porcelain is being replaced with lighter materials, providing lower fuel consumption. Plastic cups that formerly contained 16 grams of plastic now contain 9 grams. In millions of meals, that means a reduction of many tonnes.

See box for more examples of how SAS is environmentally adapting cabin operations.

Less solvents in aircraft lacquer

The aircraft fleet is being clothed in new colors. At SAS's request, the aircraft are being repainted with a type of lacquer that contains less solvents than conventional types, so-called high solid. Paint lacquers normally contain between 50 and 60% solvents, while high solid contains only 30–40%. For SAS's MD-80s this means 50 kg less solvents per aircraft.

Repainting is taking place somewhat later than planned due to market decline in the second half of 1998. SAS has chosen to prioritize the improvements that generate benefits for the customers according to the intentions for SAS 2000+. In 1999 some 55 aircraft will be decorated with the new design, and the remainder of the fleet will be repainted in the year 2000.

The new look is not limited to the aircraft's' exterior, the cabins are also being given a facelift with new colors and textiles. This work has been entrusted to Lufthansa Technik, largely because of the company's meticulous environmental management and documentation. Lufthansa Technik's facilities are registered according to EMAS.

SAS's prerequisite has been that all material which can be recycled should be recycled. All textiles from the aircraft seats are used as cleaning rags at an institution for the psychologically handicapped in Alsterdorfer, Germany. The carpeting is also reused after being separated from its plastic undercoating. Lufthansa has requested, and received, specifications for the composition of the various materials in order to take care of them appropriately. Similarly, a steel mill and an aluminum mill in Hamburg make use of these two metals.

Summing up the cost of the SAS 2000+ project is no easy task. As far as possible, renovation work is coordinated with normal maintenance. SAS's assesses the extra cost for new design, promotion and new products at MSEK 80–90.

Above all, the SAS 2000+ project is a process of change designed to motivate all employees and reinforce SAS's values and standpoints, based on a holistic environmental and social perspective. In the short-term, our environmental requirements have sometimes led to measures that are costlier than conventional solutions. At the same time, is it obvious that high environmental ambitions and good finances go hand in hand in the long term. Careful utilization of resources is not just a Scandinavian phenomenon, it also makes good business sense.

from the 1997 level. The subgoal for 1998 was a 4% decrease per meal served, while only 2.7% was achieved.

There is an ongoing debate on the value of recycling certain products. SAS is well aware of this. Seen from a life cycle perspective, disposable articles may be preferable to porcelain that requires washing. We are open to any future reassessments when new data is available.

No one is claiming that discarded newspapers are among the gravest environmental threats. But it is SAS's environmental strategy to recycle everything that can be recycled, so we collect them when possible. We also ask the passengers to help us to do this because we feel there is value in involving the customers in our environmental work.

Maintaining uniform standards worldwide can be difficult, since the conditions vary so widely from country to country. In Scandinavia, where 60% of our operations are located, waste reduction is the right choice. In tropical third-world countries, water conservation might be more important and there is little reason to opt for porcelain that requires washing instead of disposables.

Cabin operations also strive to continuously reduce water and energy consumption – before the end of 2001 by 20% per served meal compared with 1997. The subgoal for 1998 was a 3% decrease, which was achieved for water but not energy, partly due to the shift from disposable to reusable articles. The long-term goal is nonetheless within reach, through technical development of both manufacturing and washing methods.

Industry cooperation

SAS's environmental work in cabin operations has attracted widespread interest in the industry. In spring 1998 SAS's environmental coordinator from Products & Services was appointed to the board of the Inflight Catering Association (IFCA), an organization of more than 250 airlines together with catering companies and airline industry suppliers.

SAS's representative was asked to draw up a proposed environmental program for the IFCA. When it was presented in London in December 1998, it was adopted unanimously. SAS's tenet that efficient resource conservation is also good for business was shared by the board.

Prior to the meeting, SAS calculated the industry's consumption of natural resources and made a comparison with different cities. Every year, cabin operations in the world's airlines produce as much waste as the city of Rome, more than one million tonnes. Their water consumption is equal to the city of Brighton's, around ten million m^3. Energy consumption is on par with Kiel's, close to two million MWh. The combined annual cost for waste, water and energy is approx. 640 million dollars.

Both the environment and the economy would gain by reducing that bill.

Environmental work in practice

SAS's management system for continuous environmental improvements

One cornerstone of SAS's operational control is for the management systems to be fully integrated. In our experience, companies that conduct environmental or other improvement processes as isolated phenomena run a major risk of failure. Every SAS manager with decision-making authority and budget responsibility is obligated to include an environmental impact assessment as part of decision data. This is expressed in SAS's environmental strategy.

In 1998 SAS conducted a pilot project to adapt the company's environmental management system to ISO 14001. Plans have been drawn up to outline how the project should proceed to give significant operations in SAS a certifiable system by the year 2001. Parts of the company are ahead of schedule. SAS Cargo has decided to begin working towards certification according to ISO 9000 worldwide and also ISO 14001 in Scandinavia by the end of 1999.

Since 1995, evaluation of SAS's overall operational control follows the model recommended by the European Foundation for Quality Management (EFQM). EFQM evaluation is divided into nine central areas for business development, where environmental work is found under the heading of "Social impact and environmental consideration", but also under the others according to SAS's overall standpoint – that to be effective, environmental work must be an integral part of the entire operations.

One central tool for implementing this this model for continuous improvements is regular self assessments which underline in which areas the responsible management groups in SAS have a gap to close between where they stand and where they should stand according to established goals, today and tomorrow. The assessments are directed by Group Staff Quality Performance, with a staff of six at the head office in Stockholm. In 1998, 60 such assessments were carried out. By identifying the gaps between goals and results, the assessments help to alert managers and their units to possible shortcomings in their operational control and to reinforce their strongpoints.

Improvement measures are targeted and followed up within the respective EFQM areas *[fig. 3]* and goals are broken down to the local level (e.g. division and department). The main objective is to strengthen commercial operations and customer satisfaction, in which the environment plays an important role.

National systems

- With effect from 1999, SAS in Denmark is required by law to apply a system of environmental accounts which illustrate environmental risks, resource consumption and preventive measures ("green accounts"). Since 1992, SAS in Denmark has applied the system voluntarily, and has since 1995 submitted "green accounts" to the Danish authorities. In addition, in 1999 SAS's activities which could potentially pollute the environment to a significant extent will be subject to concessionary review.
- 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, for example regarding emissions for which permits are required. This practice has been extended to include full environmental audits within the framework of the internal control system.
- In Sweden, the environmental authorities apply a system of permits and reporting requirements in order to create a regional regulatory framework for individual companies with operations which are subject to supervision. These are required 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 supervised by local or central authorities.

In each of the three Scandinavian countries, the authorities have different systems for control of health, environmental and safety issues. With regard to the work environment, Denmark has its workplace assessment and Norway and Sweden have systems for internal control. In 1996 SAS initiated a project to develop standards and tools for use throughout the Group and included both the work and external environments. In 1998 this work led to the establishment of joint-Group reporting systems and a joint training program for managers in SAS.

Environmental management

SAS's Management Team establishes the vision, goals and strategies for the company's environmental work, among other things in the form of overall present situation and goal descriptions in SAS's work with Total Quality Management (TQM). These are then broken down into detailed objectives in each business area of SAS. These goals, in turn, lead to a large number of environmental projects which are followed up yearly in connection with evaluations in the TQM process: Were the goals fulfilled? How does this affect SAS's financial results? (The major environmental projects in 1998 are reported on pp. 26, 30 and 35.)

The yearly preparation of the environmental report also contributes strongly to SAS's management of environmental work. The process of choosing and publishing relevant data creates a powerful incentive for continuous improvement. The time series in the key statistics highlight trends in various areas.

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 regulatory framework of overall business planning and quality assurance.

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

SAS's goal is to be counted among the leaders in the airline industry. Our ambitions for the environment program and the quality we strive for in our environmental performance are defined in the *environmental goals*.

The *environmental strategy* defines the overall focus of the environmental work and states that this strategy is to be pursued at all levels in the company and that environmental aspects should be a part of all decision data throughout the line organization. SAS's will seek solutions that yield the best possible environmental benefits for every krona invested.

In 1998 SAS added its eco-political vision to the regulatory framework outlined in the environmental vision, goals and strategy *[fig. 1]*.

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.4]*. The Management Team's efforts are crucial for SAS's ability to maintain high quality in its environmental work.

The *Environmental Director* leads the activities of the environmental department – a staff function which coordinates the company's environmental work. He ensures that the environmental strategy is implemented throughout the company and that the environmental work is integrated into operations. 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. The participants act as environmental coordinators within their respective divisions, and their day-to-day work creates a two-way communication that spreads environmental issues throughout the organization. They are responsible for reporting of environmental data from their division, among other things to the environmental report.

[Fig. 1] **SAS's Eco-political Vision**

All four transport types (road, rail, sea and air transport) should pay for investments in, and operation of, their infrastructures, other social costs (e.g. accidents) and environmental impact according to the *Polluter Pays Principle,* after which they should compete in a uniform and competitively neutral transport system.

[Fig. 2] **Environmental Vision, Goals and Strategy**

SAS's Environmental Vision

- SAS will develop 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 have 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 shall develop into one of the airline industry's leading companies in the environmental sphere.
- Environmental work shall 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 environmental report.
- SAS shall promote understanding among external stakeholders of the role and environmental impact of air transportation.

Originally adopted by the SAS Management Team in June 1995 and thereafter revised annually according to plan. The Board of SAS has reviewed the environmental strategy and eco-political vision most recently at a Board meeting in December 1998.

In 1998 the central environmental department was reinforced through the addition of an *Environmental Advisor* to expand resources and devote special attention to development of systems for environmental management. In addition, with effect from January 1999 the central sales and marketing department has set up a position which is mainly dedicated to *environmental communication.*

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 in each country, assuring a link between the external environment and the work environment.

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

[Fig. 3] SAS's TQM work – the environmental area

(Social impact and) environmental consideration[1]

Goals 1998	Achieved	Goals 1999 (revised)	Goals 2000 (new)
• SAS works with and reports on the environment and resources in a systematic manner. • SAS introduces the Boeing 737-600 DAC in traffic. • SAS works continuously with environmental adaptation in future planning of the aircraft fleet. • SAS is perceived as a resource and environment-conscious company and one of the leaders in airline industry. • SAS begins development of an environmental management system aimed at obtaining EMAS registration and ISO 14001 certification. • Environmental aspects are integrated in the largest and most critical supplier agreements. • SAS moves into the new Gardermoen airport in Norway and into a new cargo terminal at the Copenhagen airport, which have both been built to meet high environmental standards. • Environmental training and information are conducted systematically, and SAS integrates environmental training with the company's other training activities. • SAS further develops work on the regulatory framework for the airline industry. • Environmental aspects are part of the market profile, and SAS works to integrate them in parts of market communication. • SAS enhances its environmental profile and follows it up with environmental image surveys.	✔ ✔ ✔ [2] ✔ ✔ ✔ [3] ✔ ✔ ✔	• SAS develops its environmental management system towards ISO 14001 and evaluates the possibilities for seeking environmental certification of prioritized areas of operation. • SAS further develops its communication about resource consumption, environmental impact and examination of environmental data. • Environmental adaptation of SAS's aircraft fleet continues with phase-in of Boeing 737-600/700/800s and de Havilland Q400-Dash 8s. SAS thus has 100% Chapter III aircraft. • SAS decides whether or not to replace the aircraft in the long-haul fleet. • SAS continues to work on the regulatory framework for the airline industry. • SAS conducts active efforts to improve its own environmental image. • SAS further develops the environmental training that is integrated with the Group's other training activities. • In the airline industry, SAS is perceived as one of the industry's leading companies in the environmental area. • SAS collaborates with its partners to increase environmental benchmarking. • SAS develops environmental aspects as a natural element of market communication.	• SAS seeks environmental certification for prioritized parts of operations. • SAS directs its communication about resource consumption and environmental impact to various target groups with the help of several media and channels. • Environmental adaptation of SAS's aircraft fleet with Boeing 737-600/700/800s and de Havilland Q400-Dash 8s is completed. • SAS further develops its examination of environmental data in the pursuit of more conclusive verification and validation. • SAS continues to work on the regulatory framework for the airline industry. • SAS achieves a significant improvement in its environmental image compared with 1997, and is perceived as one of the industry's leading airlines also by the general public. • SAS conducts planned and systematic market communication on the environmental aspects of its operations. • SAS further develops the environmental training that is integrated with the Group's other management training. • Environmental training is integrated with training of SAS's employees in the form of separate computer-based course. • SAS collaborates with its partners to increase environmental benchmarking.

[1] Due to lack of space, the half of the strategic area that deals with social impact has been omitted.
[2] The goal has only been partly fulfilled, with better results among professionals in the airline industry and environmental area than among the general public. The goal has been moved forward to 1998–2000.
[3] The goal has only been partly fulfilled – the environment has been integrated with other training, but still without a systematic framework for environmental training and information. The goal has been moved forward to 1999–2000.

In 1998 the established goals were fulfilled in all areas except the environmental image and environmental training (see Notes 2 and 3 above).

efforts are in line with SAS's environmental 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 cleanup 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.

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 cargo or passengers has occurred. RCG is responsible for ensuring SAS's preparedness in the event of a nuclear power incident that could affect air traffic. 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 and radioactivity.

Environmental permits

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

- The Scandinavian certification for conducting civil aviation operations incorporates environmental approval.
- All operative flight activities are subject to official permits, which also regulate environmental conditions.
- To the extent that subcontractors are used, it is these who are responsible for compliance within the regulatory framework of various permits (veterinary and hygiene regulations, etc.).
- In addition to the national laws and regulations in ground operations, SAS has in certain cases sought and obtained permits for emissions into water and air, etc. SAS has systems for routines for fulfillment and annual reporting to the authorities.

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

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 that flight crews are exposed to since the level of cosmic radiation in the upper stratosphere is twice that at ground level. The authorities carried out measurement and calculation of radiation doses on certain routes in cooperation with SAS. Because the planned joint-Scandinavian regulations were not finished in 1998, they could not be implemented in SAS's own safety regulations. SAS maintains continuous contact with the relevant authorities so that this can be carried out as soon as possible.

Internal information and expertise development

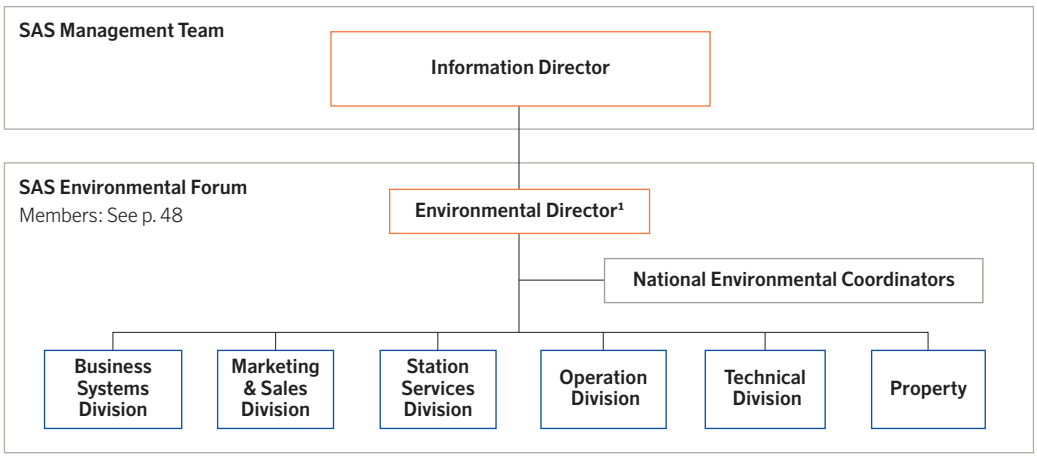
Information and training at all levels in the organization promotes employee awareness of SAS's environmental philosophy. This ensures that environmental consideration is actually taken in day-to-day work.

SAS has chosen not to carry out standardized environmental training for all employees, but instead integrates flexible environmental modules in the expertise development programs primarily for managers and key staff.

The most important 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 was introduced in 1998 for parts of the operative management and SAS's suppliers.
- In Copenhagen, an environmental module has been part of basic training for some 50 managers per year since 1995. Since 1986–87 there is also a special ongoing

[Fig. 4] **SAS's Environmental Organization**



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

training program for all employees who handle chemicals.
- In 1997 SAS initiated development of a training program for all new managers, which will also incorporate the environment and will be attended by an estimated 200 persons every year.

For SAS's employees the environmental report is intended to be the most important source of information on environmental conditions and activities, in addition to articles on this topic in the staff magazine Inside.

Information and initiatives from the organization are generated via the TQM process, in the national Health, Environment and Safety units and suggestion routines and safety committees where the trade unions are represented.

Cooperation

Partners

Star Alliance, the world's largest airline alliance, was formed in 1997 by SAS, Lufthansa, Air Canada, United Airlines, Varig and Thai Airways International. In 1999 they will be joined by another three companies: All Nippon Airways, Air New Zealand and Ansett Australia.

The partners have agreed on common objectives for future environmental efforts based on a philosophy of continuous improvement. Like other forms of cooperation, joint environmental work is conducted within the Alliance's special partner forum, where the partners can explore the possibilities for reaching consensus on uniform key ratios and measurement routines for benchmarking of environmental performance, as well as standards for resource consumption, emissions and pre-sorting.

SAS also participates in a mutual exchange of experience in the environmental area with the other partner companies, where SAS in many cases has an ownership stake.

Suppliers

Environmental consideration is an integral part of the demands SAS places on all of its suppliers. SAS's purchasing manual stipulates that all subcontractors must fulfill SAS's environmental requirements in both negotiation of new agreements and renegotiation of existing ones. In general, SAS requires that suppliers have an environmental policy and an action plan for environmental work, can document environmental data for the goods and services SAS purchases and that their own suppliers can fulfill the same

Bellona on the transport industry

In the summer of 1998 the environmental foundation Bellona launched its environmental collaboration project with the commercial sector, called B7. As the name implies, the environmental work is divided into seven target areas:

- Environmental rights (incl. environment and health)
- International environmental conservation (global environment, Russia)
- Environmental management (biodiversity, marine environment, forestry, agriculture)
- Environment and economy (environmental capital, regulatory framework)
- Environmental technology (production, waste)
- Energy (cleaner fossil fuels, renewable resources)
- Environmental data (monitoring, publication)

In this project the foundation is collaborating with SAS and 16 other representatives from the private and public sectors. The objective is to reach consensus on effective long-term predictable environmental requirements for the commercial sector, to promote new technology and to work for continuous environmental improvements. With this ambition, B7 analyzes which national and international regulations are necessary to encourage this process instead of impeding it.

Competitively neutral regulatory framework

The foundation is solution-oriented and pro-technology, and works according to the belief that the commercial sector must be given incentives to make sound environmental choices. In this regard, market mechanisms could bring about better solutions and advances.

Bellona's goal for the transport program is to find an efficient and clean system for the transport of goods and people that consumes as little energy and resources as possible and uses the smallest possible land area.

Bellona advocates neutral conditions for all players. This enables transport users to make accurate choices with regard to costs and environmental impact. The various transport types should therefore be governed by the same regulatory framework and prices for land use, noise and energy consumption.

It should also be possible to assess the socioeconomic benefit/impact of the transport alternatives in terms of traffic safety, ease of use and esthetics. The cost levels for all types of fossil fuels should be equal (aviation fuel, diesel, bunker fuel, etc.), and electrical power for rail traffic should be sold at the market price. Hidden subsidies prevent accurate, open choices and so far have narrowed the scope for sound environmental choices and critical environmental improvements.

Today's environmental problems

The environmental impact caused by the transport sector is highly complex, with a wide spectrum of effects – both on mankind and the economy. The global transport sector is undergoing strong expansion. Transports make a significant contribution to the globalization and development of cross-cultural understanding that is the foremost trend of our age. Transport also have major economic importance. Transport costs per passenger or tonne kilometer are low due to government subsidies, cheap energy and fierce competition.

The most urgent environmental problems caused by the transport industry are emissions of carbon dioxide and other pollutants, noise and use of land. From an environmental standpoint, the various transport types are surprisingly simi-

criteria. The final agreement includes a table of environmental requirements which incorporate aspects such as supplier accountability for handling of packaging materials. In cabin operations the purchasing policy also stipulates that the suppliers, within the framework of cooperation with SAS, must initiate at least one new environmental project in their operations and report on this to SAS every year.

The environmental clauses in SAS's supplier agreements often stimulate a higher level of ambition in the suppliers' own environmental efforts, in which SAS gladly takes part and increases its own knowledge and experience. For instance, cabin operations hold an annual conference with suppliers in order to promote consensus on environmental objectives. SAS's environmental award for activities in the environmental area is also presented there. Read more about cooperation with suppliers in cabin operations on pp. 38–39.

The greatest environmental effects are achieved in connection with orders for new aircraft, where SAS always strives for lower relative fuel consumption, which automatically leads to lower emissions. SAS relative demands that new aircraft perform at least as well or better than those they replace, and applies of policy of utilizing the best available technology within commercially viable limits.

Other stakeholders

The potential for success in environmental activities is enhanced by a constructive dialogue with various other stakeholders, aside from the company's own partners and suppliers. SAS maintains a continuous dialogue of this type:

- The associated companies' environmental activities are influenced via directives issued to SAS's representatives on their respective boards.
- In the Scandinavian countries, SAS conducts a systematic dialogue with influential environmental organizations.
- As of 1998, SAS collaborates with Save the Children in Denmark, Norway and Sweden, and with the Norwegian environmental foundation Bellona. Bellona's objectives for the cooperation with SAS and 16 other commercial and public sector representatives is to formulate stringent but predictable long-term environmental requirements for the commercial sector, to promote new environmental technology and to encourage continuous

lar in terms of energy consumption. With regard to emissions of other pollutants and land use, the differences are considerably wider. Consequently, capacity utilization and avoidance of serious conflicts over land use are more important factors in choosing a transport solution than the other environmental attributes of the transport types.

Future opportunities

It has been shown that air traffic has its strongpoints and deserves a better reputation from an environmental perspective. In any case, the foundation has decided to use the collaboration period to become well acquainted with the transport industry, particularly SAS, from the inside. Bellona is working to abolish environmental charges, since the goal is to eliminate all future environmental impact. The environmentally related and environmentally based seat charges paid by the airlines today go straight into government coffers together with function-based charges – without contributing to any environmental improvements!

Many flight paths intersect the stratosphere, where emissions of nitrogen oxides have a stronger impact on the greenhouse effect than corresponding emissions at ground level. The foundation sees an exciting development of alternative fuels throughout the transport industry – particularly hydrogen, which with the help of upcoming fuel cell technology will produce emissions consisting solely of water vapor.

Since 1998 SAS collaborates with the environmental foundation Bellona. The foundation works via offices in Oslo, Murmansk, St. Petersburg, Brussels and Washington to identify problems and to initiate and evaluate international cooperation in environmental, resource and energy issues in order to reach practical solutions.

This unaffiliated environmental foundation was formed in Oslo on June 16, 1986 by Frederic Hauge, who currently heads operations, and Rune Haaland. In the span of ten years turnover swelled to 20 MSEK, of which around ten percent comes from 3,000 sustaining members. 60% of the funding comes from private and public organizations via support advertisements in the foundation's publication Bellona Magasin. Other funding comes from private donations, subscriptions and grants for various projects from companies and the foreign department.

Bellona Magasin provides a channel for communication with the organization's stakeholders. The magazine is published in 6–8 issues per year with a circulation of close to 9,000.

Bellona describes itself as pragmatic, result and solution-oriented and scientifically based. The foundation has some twenty employees, some of whom are specialists in their fields and others who are generalists with long experience of environmental work and non-profit organizations. Furthermore, when needed Bellona works with a range of experts in areas such as nuclear physics, biology, energy, chemistry, economics, legal affairs, anthropology, etc.

An evaluation in connection with the ten-year anniversary in 1996 led to the conclusion that short-term solutions are no longer of interest. On the other hand, a long-term regulatory framework for the industry could bring about a near elimination of environmentally harmful emissions within ten years as new technology becomes available. Bellona strongly advocates the utilization of new technology with reduced environmental impact.

environmental improvements. (See also box below.)
- Each SAS station maintains an ongoing dialogue with the respective airport operators and local authorities.
- SAS participates in specially tailored communication programs for affected stakeholder groups in connection with special projects, such as construction of Oslo's new Gardermoen airport and the cargo terminal at Copenhagen airport.
- Passengers are actively involved in environmental efforts by returning used newspapers for recycling and reuse.
- 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.
- SAS carries out regular market surveys and customer interviews, for example in connection with the large-scale process of change SAS 2000+.

Industry organizations

SAS participates in the activities of the following national industry organizations:
- **Flyselskapenes Landsforening** The Norwegian airline sector organization. SAS is represented in the governing bodies as well as numerous environmental work groups.
- **Föreningen Svensk Flyg** The Swedish airline sector organization. SAS is represented in the association's various committees.
- **Dansk Industri** SAS is active in the aviation section 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 operators, 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. 13).

With regard to international cooperation, SAS is active in the central agencies:
- **ICAO** Since the late 1980s, SAS has participated both as a member and as the IATA's representative in the ICAO's expert group CAEP, which is responsible for developing and establishing rules and recommending measures to reduce the environmental impact of air transport.
- **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.
- **IFCA** Since spring 1998 SAS is a represented on the Board of the Inflight Catering Association, where it has drawn up a proposed environmental program that has won the IFCA's support.
- **AEA** SAS chairs the committee for waste management and environmental conditions in cabin operations and is a member of several other work groups for environmental issues.
- **N-ALM** Coordination between the Nordic countries increases the potential to promote joint environmental standpoints in international forums, such as the ICAO and the EU.

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

Environmental profile and sponsorship

Today, a carefully considered and well developed environmental dimension in a corporate brand name strengthens its commercial potential and opens new opportunities for business development. Furthermore, we feel that air transport has a less favorable environmental image in society than the underlying data motivates, which influences development of the regulatory framework for air transportation and could distort competition in favor of other transport types.

Strategic target groups for SAS's environmental communication include customers, suppliers, the general public, mass media 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 mass media and authorities. SAS also distributes its own environmental information in the form of the environmental report, advertisements, booklets, etc., and via contributions to the inflight magazine Scanorama. Lectures at universities, colleges and conferences are other channels for communicating SAS's environmental work.

Together with Coca-Cola, SAS manages a newly established foundation which administers a fund for a better aquatic environment in the Nordic-Baltic region – The SAS/Coca-Cola Environmental Foundation. Starting in February 1999, this foundation will award five grants each year.

Together with several large Swedish companies, in 1998 SAS sponsored and participated in an environmental seminar in New York which was arranged by the Swedish-American Chamber of Commerce.

The company is also the head sponsor for the environmental award established by the crown princes of Denmark and Spain, the Princes Award, which is presented once a year in Copenhagen.

For several years SAS has been one of the head sponsors of the campaign to clean up Swedish roads and highways and has supported the work of the Worldwide Fund for Nature.

In 1998 SAS continued to fund publication of "The Environmental Book", a teaching aid that is distributed free of charge to elementary schools in Sweden, and as of 1998 also in Norway. SAS also supported environmental training for school children in the city of Sigtuna by producing the "Nature and Environment" folder.

During the year articles about SAS's environmental work were featured in several environmental publications and in the Scandinavian and European general-interest and business press, such as the Aftenposten in Norway and Dagens Industri in Sweden.

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

Words, expressions and abbreviations

Only airline industry-related – environmentally related terms are defined on SAS's Internet site.

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

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

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 dioxides (CO_2) The airline industry's carbon dioxide emissions are being reduced through a transition to more fuel-efficient aircraft, which is also desirable for reasons of economy since low fuel consumption automatically leads to lower costs.

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

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

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

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

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

FNL Flight Noise Level. (See also *Noise, EPNdB*.)

Depletion of the ozone layer 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.

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 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 spreads in the vicinity of the airport.

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

IATA International Civil Aviation Association, the UN 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.

IFCA Inflight Catering Association, organization in which over 250 airlines collaborate with catering companies and other suppliers to the airline industry's cabin operations.

Insecticides Chemicals which are used to combat insects.

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

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

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

Nitrogen oxides (NOx) 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. In recent years, human use of gases like Freon and Halons have caused rapid depletion of the ozone layer, particulary over the Antarctic. 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 stricter. New engines with double annular combusters (DACs), for example, reduce emissions by up to 40% compared with the previous generation of engines. In 1998 SAS began the phase-in of new Boeing 737-600s with DAC engines in its aircraft feet.

Noise Within the EU, aircraft types with high noise levels, so-called Chapter II aircraft (see definition) will be banned as of April 1, 2002. SAS will have phased out these aircraft by year-end 1999. (See also *EPNdB, FNL*).

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.

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

Recipient Recipient of emissions. Commonly used with reference to bodies of water, lakes and oceans. The environmental effects of the emissions are linked to the sensitivity of the recipient.

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

SEK International currency designation for Swedish kronor.

Star Alliance Commercial collaboration, initially between the airlines Air Canada, Lufthansa, SAS, Thai Airways, United Airlines and Varig; but starting in 1999 also All Nippon Airways, Air New Zealand and Ansett Australia.

Sulfur dioxide (SO_2) 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, both by switching to oils with a lower sulfur content in its oil-fired heating plants and by replacing oil-firing with other forms of heating systems and energy carriers where it is cost-effective to do so.

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 organization strives to exceed the customers' expectations by improving its competitiveness through the efforts of the employees. See also p. 40.

Volatile organic compounds (VOCs) 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. 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
Fax: +47 67 59 83 70
e-mail: niels_eirik.nertun@sas.se

Kristin Haaland
Environmental Advisor
Telephone: +47 67 59 66 79
Fax: +47 67 59 83 70
e-mail: kristin.haaland@sas.se

Jens Stokholm
Martin Porsgaard Nielsen[1]
Environmental Coordinators, Denmark
Telephone: +45 32 32 41 36
Fax: +45 32 32 52 91
e-mail: martin.porsgaard@sas.se

Reidar Pettersson
Environmental Coordinator, Sweden
Telephone: +46 8 797 47 12
Fax: +46 8 797 36 90
e-mail: reidar.pettersson@sas.se

Berit Wifladt[2]
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

Susanne Ganning[3]
Corporate Communications

[1] Martin Porsgaard Nielsen is also responsible for preparing the environmental statements for SAS Denmark.
[2] Maria Tandberg, Health, Environmental and Safety, has participated as a substitute.

[3] Linda Fredheim-Björk is Marketing & Sales' representative in the Environmental Forum. In 1998 Susanne Ganning acted as her substitute.

Contact SAS

We would like to know what you think of our environmental work and this environmental report.

Send your comments by letter or fax, or via our Internet site. There you can also order this or last year's environmental report or this year's financial annual report, as well as other material from SAS's environmental program.

For comments:
Fax: +47 64 81 83 70
Internet: http://www.sas.se
Mail: SAS, OSLPE, NO-0800 Oslo

To order:
Telephone: +47 64 81 80 25
E-mail: niels_eirik.nertun@sas.se
Fax, Internet, mail: See at left

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The SAS Group
SE-195 87 Stockholm
Telephone +46 8 797 00 00
http://www.sas.se

SAS Danmark A/S
DK-2300 Copenhagen S
Telephone +45 32 32 45 45

SAS Norge ASA
NO-0080 Oslo
Telephone +47 64 81 63 98

SAS Sverige AB
SE-195 87 Stockholm
Telephone +46 8 797 12 93

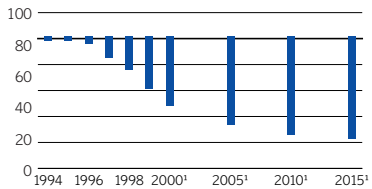
Flight operations

Noise, emissions into the air

Noise index

Only on the Internet

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



¹ Forecast.

Background: The calculation formula used is:

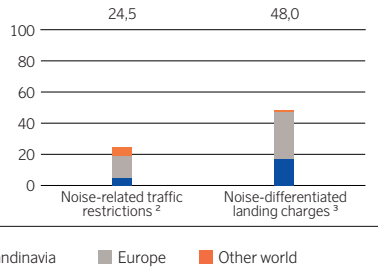
$$\frac{\text{The noise contour for each respective aircraft type [85 dB in takeoff] in km}^2 \text{ x total number of each aircraft type in the SAS aircraft fleet x the number of takeoffs per day for each respective aircraft type}}{\text{Total number of aircraft in the SAS aircraft fleet x the number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

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-90s and Boeing 737s, which more than compensate for SAS's expanding aircraft fleet and higher production.

Noise restrictions in SAS's traffic network

Only on the Internet

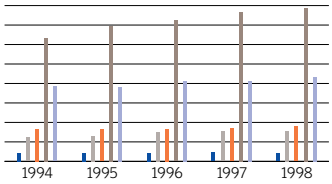
Percentage of airports with noise restrictions [%] ¹



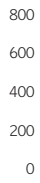
¹ 1996 estimate.
² Ban on operating at certain times of day.
³ Higher for Chapter II than for Chapter III, and/or higher at certain times of day.

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 continued in 1998. 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 utilization of the aircraft fleet.

Background: Turbine oil is used to lubricate bearings in the engine. But since it has a limited useful life, small volumes are continuously drained directly into the air or burned in the turbine, depending on which bearing the oil is drained from. These diffuse emissions are assumed to have a minor impact on the environment.



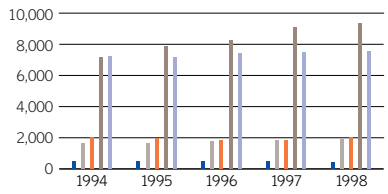
Fuel consumption · By business area
[1 000 m³]



[1000 m³]	1994	1995	1996	1997	**1998 [2]**
Denmark	42.8	43.4	43.1	44.9	**40.2**
Norway	122.9	129.0	149.7	153.5	**155.4**
Sweden	165.4	164.1	166.9	168.4	**179.1**
Europe[1]	632.1	694.3	723.4	768.5	**785.8**
Intercont.	385.0	380.6	412.9	413.0	**432,4**

[1] Including intra-Scandinavian traffic.
[2] The total number of passengers is approx. 9% higher than the number of "revenue passengers" (paying passengers over a certain limit). This means that the actual fuel consumption per passenger kilometer is lower than the above figure.

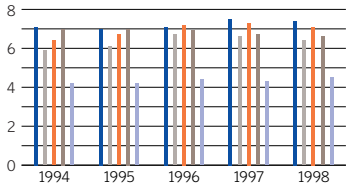
RPK · By business area
[x10⁶]



[x10⁶]	1994	1995	1996	1997	**1998 [2]**
Denmark	475	493	479	471	**429**
Norway	1,648	1,660	1,763	1,832	**1,913**
Sweden	2,052	1,938	1,839	1,819	**2,034**
Europe[1]	7,137	7,857	8,266	9,079	**9,357**
Intercont.	7,213	7,189	7,442	7,502	**7,536**

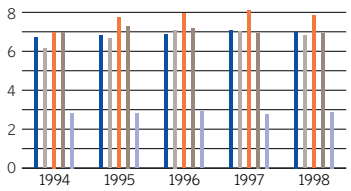
[1] Including intra-Scandinavian traffic.
[2] The total number of passengers is approx. 9% higher than the number of "revenue passengers" (paying passengers over a certain limit). This means that the actual fuel consumption per passenger kilometer is lower than the above figure.

Bränsleförbrukning/RPK · Per affärsområde
[kg/100 RPK]



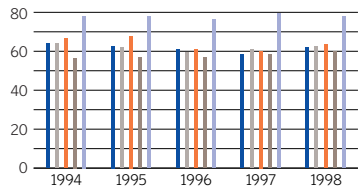
[kg/100 RPK]	1994	1995	1996	1997	**1998**
Danmark	7.1	7.0	7.1	7.5	**7.4**
Norge	5.9	6.1	6.7	6.6	**6.4**
Sverige	6.4	6.7	7.2	7.3	**7.0**
Europa	7.0	7.0	6.9	6.7	**6.6**
Interkont.	4.2	4.2	4.4	4.3	**4.5**

Fuel consumption/RTK · By business area
[kg/100 RPK]



[kg/100 RTK]	1994	1995	1996	1997	**1998**
Denmark	67.1	68.2	68.7	70.5	**68.9**
Norway	61.4	66.5	70.9	70.2	**68.4**
Sweden	69.9	77.4	79.3	81.0	**77.1**
Europe	69.8	73.0	71.5	69.4	**69.4**
Intercont.	28.3	28.0	29.2	27.8	**28.8**

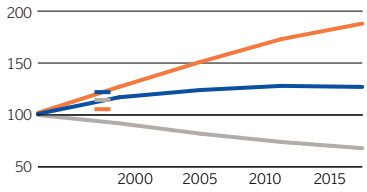
Cabin factor · By business area[1]
[%]



[%]	1994	1995	1996	1997	**1998**
Denmark	63.9	62.7	60.9	58.2	**61.9**
Norway	63.8	62.1	59.2	60.9	**62.6**
Sweden	66.4	67.9	61.1	60.2	**63.6**
Europe	56.6	56.7	56.9	58.5	**59.9**
Intercont.	78.1	77.8	76.5	79.4	**77.9**

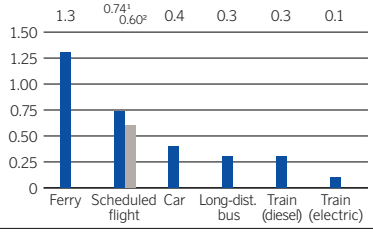
[1] The figure includes paying passengers over a certain payment limit "revenue passengers". The total number of passengers is approx. 9% higher. Including all passengers, SAS's cabin factor for 1998 is 71.7%.

Fuel consumption and production · Forecast 1997
[index 1994=100] Short and mediumhaul flights



- Forecast fuel consumption total
- Forecast fuel consumption per ASK
- Production [ASK]
- Actual fuel consumption 1998
- Actual fuel consumption per ASK 1998
- ASK 1998

Comparison of various types of transportation
[kWh/passenger kilometer 1997]



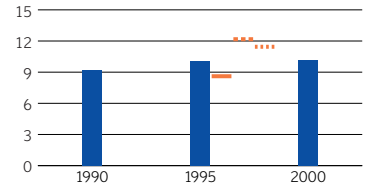
[1] SAS total.
[2] SAS's new short and mediumhaul McDonnell Douglas MD-90-30s in SAS's version and with SAS's cabin factor.

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

Other information

Average age of the aircraft fleet

Total [year'month"]



[year'month"]	1990	1995	2000[1]
Total	**9' 2"**	**10' 1"**	**6' 10"**

- SAS 1998: 11'4" [2]
- AEA 1996: 8' 8"
- IATA 1997: 12' 1"

Fuel jettisoning

Only on the Internet

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 during 1998. When this environmental report was approved, the emergency system had been utilized on one occasion in 1999 which will be accounted for in the environmental report for 1999.

[1] Planned development.
[2] The average age of the aircraft SAS owns is nine years and one month.

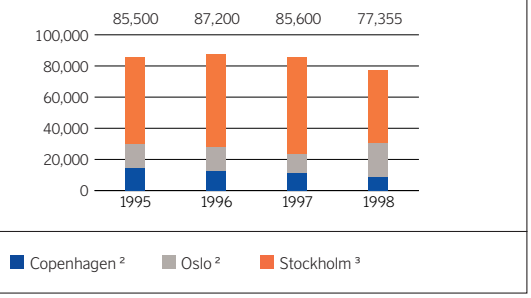
Cabin operations

Emissions into water

Germicides [1]

Only on the Internet

Consumption
[kg]



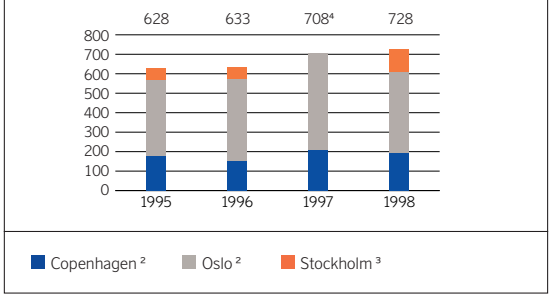
[1] Handled by SAS in Copenhagen and Oslo (quadrivalent ammonia compound) and by the Swedish Civil Aviation Administration in Stockholm (sodium hydroximethane sulfonate).
[2] SAS's own consumption and SAS deliveries to other airlines.
[3] The volume SAS purchases from the Swedish Civil Aviation Administration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

Only on the Internet

Consumption
[l]



[1] Chlorine compounds (sodium hypochlorite in a concentration of 10–15% active chlorine is diluted to maximum 3 mg/l in the prepared solution).
[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.

Background: Although the water on board the aircraft is classified as drinkable, it is mainly 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.

Emissions into the air

Insecticides

Only on the Internet

[kg]	**1998**
	36

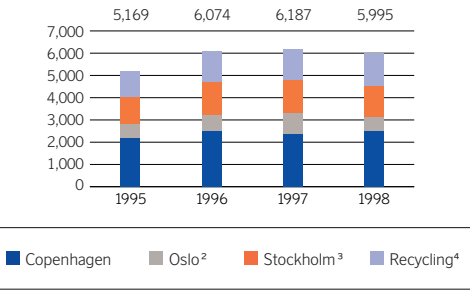
Background: SAS uses the insecticide Permethrin on board aircraft on flights to Delhi at the request of the Indian authorities, which also issue instructions. Permethrin is a target specific insecticide which is approved by the WHO for this usage. The active agent is related to the naturally occurring pyrethrin I and II found in daisies. This substance is easily decomposable in nature and has no proven tendency towards bioaccumulation. SAS has not received any reports on discomfort or side effects due to use of this insecticide.

Waste

Catering [1]

Only on the Internet

Total cabin operations
[tonnes]



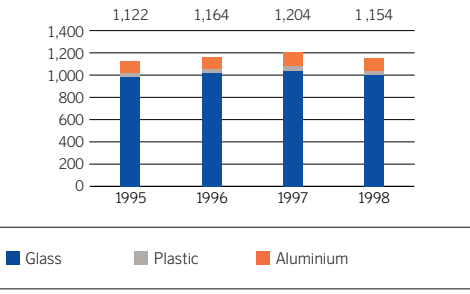
SAS's development: The waste volumes from catering decreased more than the number of meals served. At the same time, the number of passengers increased. The recycling rate, including newspapers, rose slightly to 25%.

[1] Refers to waste collected by SAS's catering suppliers, estimated on the basis of data on SAS's share in their 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] 1998 and 1997 including the airports in Gothenburg and Malmö.
[4] Including newspapers.

Packaging

Only on the Internet

Total cabin operations
[tonnes]



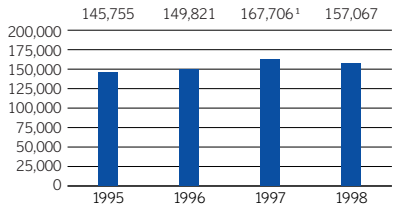
SAS's development: Of the total amount of packaging loaded onto SAS flights, 1,154 tonnes, 1.9% (25%) are recycled. Collection of aluminum packaging on domestic routes for recycling is carried out in Norway (statutory) and in Sweden (aluminum beverage packaging is prohibited in Denmark). In 1998, 12.5 tonnes of aluminum were collected in Norway, and 8.9 tonnes in Sweden. In Norway this represents a collection rate of 60% (87%) for aluminum, which means that SAS did not reach the target of 90% which is contracted with the authorities. In Sweden this meant that the collection rate for aluminum decreased to 43% (55%). The Swedish public's recycling rate for aluminum beverage containers, 92%, can be used as a reference level. SAS will study the routines for point-of-sale collection in order to find the reasons for the lower recycling rate in 1998.

Consumption of raw materials

Water

Only on the Internet

Total catering
[m³]



SAS's development: Total water consumption in catering operations, 157,067 m³, has decreased both in total and per meal served despite a higher proportion of semi-disposable materials which are washed for reuse.

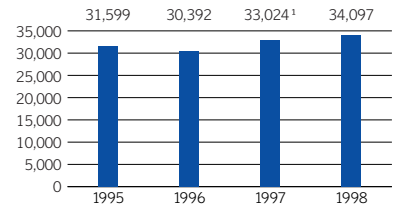
1 Adjusted compared with the 1997 environmental report with regard to definitive data.

Energy consumption

Electricity, gas and heating

Only on the Internet

Total catering
[MWh]



SAS's development: Total energy consumption, 34,097 MWh, has increased in catering operations. The increase took place in Oslo and Stockholm. The reason is hard to pinpoint, but SAS's choice of meal types is influential. One contributing factor could be the transition to semi-disposable material in certain routes, which will be fully implemented during 1999 when cabin service is developed according to SAS 2000+. Several ongoing environmental projects are aimed at reducing energy consumption despite an increased need for washing for reuse. The goal of reducing consumption by 20% before the end of 2001 compared with 1997 is unchanged.

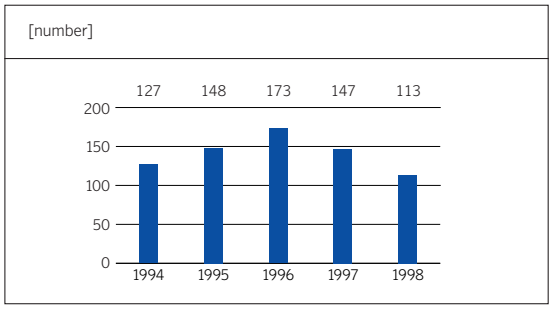
1 Adjusted compared with the 1997 environmental report due to the fact that Gothenburg and Malmö are now included.

Ground operations

Noice

Engine tests [1]

Only on the Internet



[1] *Tests after engine replacement only.*

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. The tests reported are only those carried out in conjunction with engine replacement. All the engine tests are carried out in special, noise-protected locations. 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. The very low figure for 1998 is related to the move to Gardermoen, which led to a decrease in heavy maintenance, and therefore also engine tests. Some maintenance is also carried out by a sub-supplier in Dublin.

Emissions into soil

Infringements and incidents

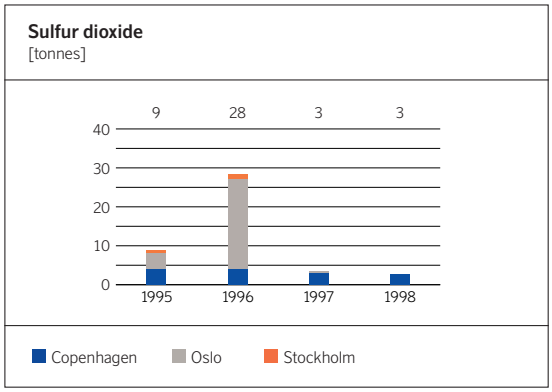
Only on the Internet

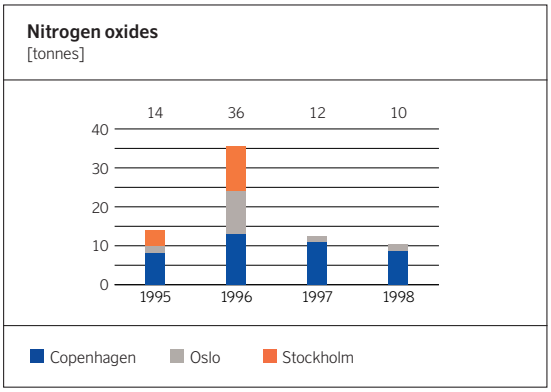
Infringements and incidents in SAS's operations are described in the Board of Directors' Environmental Report on p. 13.

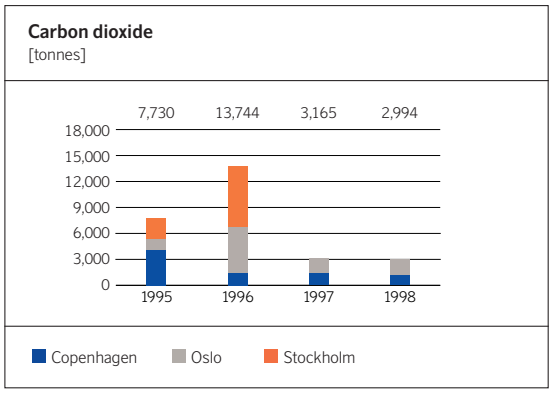
Emissions into air

Heating production

Only on the Internet





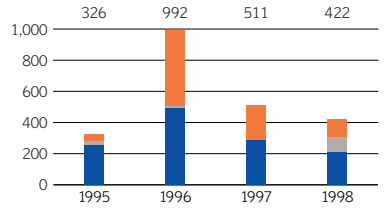


SAS' development: Since 1996 SAS has increased the proportion of district heating in Copenhagen, which has resulted in a massive reduction in carbon dioxide emissions. • The maximum emissions in Oslo (oil-firing) are regulated by concessions. After an increase in emissions in Oslo during 1996, caused 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 uses biofuel-fired district heating from the day it opened in autumn 1998. • SAS's head office in Stockholm is supplied by a geothermal heating installation which contributed 8,959 MWh in 1998 (80% 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.

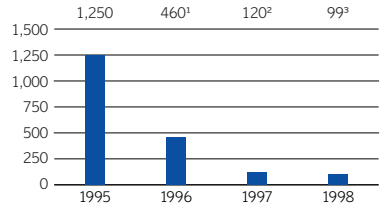
CFC, Halons

Only on the Internet

Consumption of Freon
[kg]



Consumption of Halons
[kg]



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

Installed volume 1998 [kg]	*Freon R12, R22, R404A*	*Freon R134, R502*	*Halon 1301, 1211*
Copenhagen	2 432	182	15[1]
Oslo	435	–	40
Stockholm	1 829	121	–
Total	**4 696**	**303**	**55**

[1] Incorrectly attributed to Oslo in the 1997 environmental report.

[1] Includes 126 kg from other airlines.
[2] Includes 93 kg from other airlines.
[3] Includes 63.65 kg from other airlines.

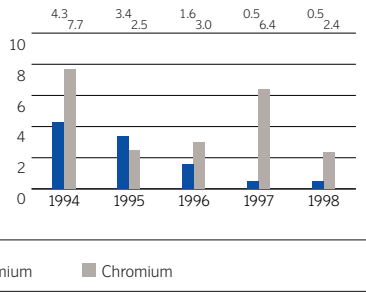
Background: The airlines' use of Halons for emergency procedures such as extinguishing of fires on board aircraft and in engines are subject to a exception from the Montreal Protocol's general ban on use of Halons. **SAS's development:** In 1998 no Halons were used in SAS's aircraft. • In Copenhagen SAS has a Halon recovery facility that serves SAS as well as 15 other airlines. The facility recovered 504 kg in 1998. SAS's stores of Halons amounted to approx. 4,400 kg at year-end.

Emissions into water

Heavy metals

Only on the Internet

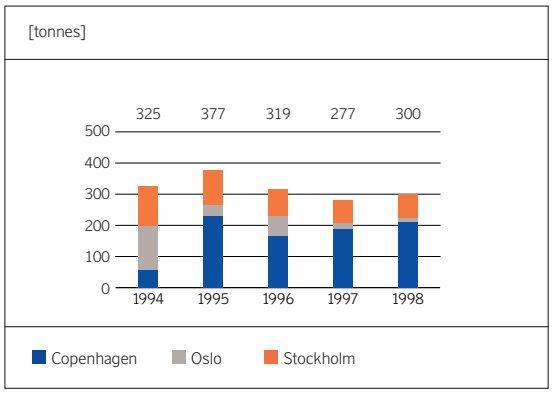
[kg]



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:** SAS's technical base at the new Gardermoen airport in Oslo has a process water treatment facility which provides zero emissions into the recipient. The water from the processes is evaporated and reused, after which the half-dried fraction is handled as hazardous waste. The same technology is used in the new installation at SAS's electroplating workshop at Fornebu, as well as the facility into which the workshop will move in spring 1999. The new wastewater treatment plant to be opened by SAS at Arlanda airport in spring 1999 will also provide a significant improvement. These measures will further reduce SAS's emissions of heavy metals.

Oil, oil emulsions

Only on the Internet



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 approved subcontractors.

Waste

Hazardous waste

Only on the Internet

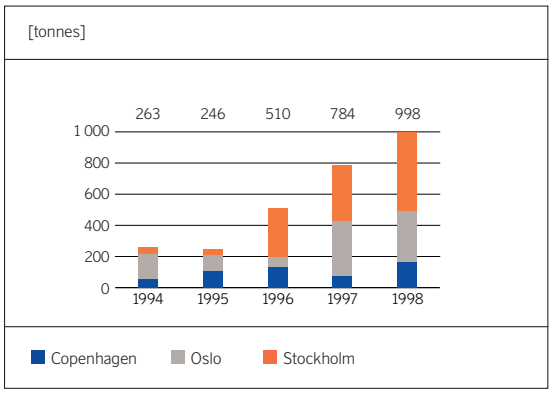
[tonnes]	1996	1997	**1998**
Oil/oil sludge	319.3	277.0	**299.5**
Waste oil	73.1	65.9	**44.7**
Waste containing oil	23.3	19.4	**8.2**
Solvents without halogens	15.8	7.1	**21.4**
Solvents with halogens	2.7	2.8	**11.7**
Paint, lacquers, other organic solvents	25.3	19.5	**15.4**
Alodin solvent (contains heavy metals)	3.8	1.7	**–**
Acids	5.4	0.1	**2.2**
Alkalis	2.0	2.8	**1.7**
Waste containing heavy metals (sludge)	0.9	0.8	**3.3**
Waste from brake maintenance [2]	3.7	7.7	**11.5**
Waste containing cyanide	3.8	6.5	**0.3**
Waste containing asbestos [2]	1.0	–	**–**
Waste containing mercury	0.001	0.196	**0.007**
Freons, Halons	0.025	0.511	**0.423**
Isocyanates	0.8	0.3	**0.4**
Photochemicals	0.2	0.9	**0.7**
Batteries	7.8	6.7	**16.5**
Electronic waste	25.0	15.8	**42.5**
Radioactive waste	–[1]	0,009	**–**
Unspecified hazardous waste	–[1]	10.2	**4.6**
	513.9	**445.9**	**480.4[3]**

[1] Data not available.
[2] Refers to the wheel and brake workshop in Copenhagen.
[3] Not including the 468 m³ of water which leaked out into the technical base at Gardermoen on October 22, 1998 after a pipe ruptured. The entire volume of water was handled as hazardous waste. As a result of the incident, water from the main pipe was mixed with process water from aircraft washing. The incident did not lead to any emissions.

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:** The increase in waste oil, waste containing oil, solvents with halogens, acids and waste containing heavy metals and cyanide are non-periodic and can be explained by yearly fluctuations. The increase in batteries and electronic waste (e.g. fluorescent tubes containing mercury) is attributable to better collection routines and stricter requirements from the authorities. In general, the overall increase can be explained by higher production, non-periodic fluctuations and somewhat better routines for sorting.

Paper, cardboard

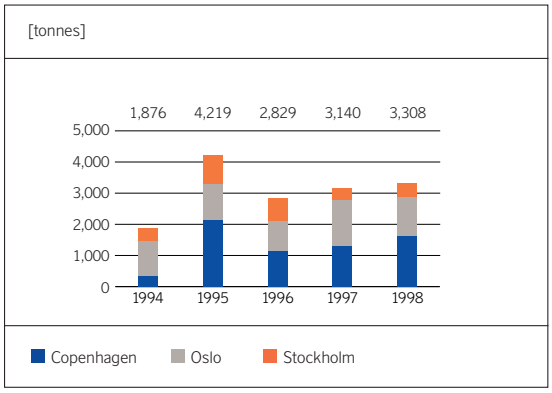
Only on the Internet



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 and higher production.

Garbage

Only on the Internet

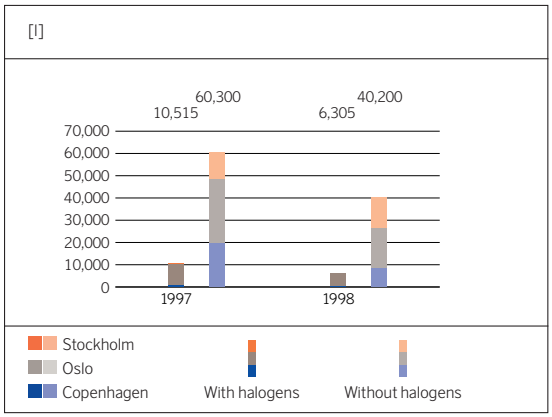


Background: All garbage is delivered to an approved subcontractor for sorting and partial recycling. **SAS's development:** The major decrease in 1996 was attributable to the measures taken at that time to reduce waste volumes. The increase from 1997 onwards is explained by the fact that waste from additional areas within SAS was included for the first time, and by the inclusion of 75 tonnes of iron and 97 tonnes of lumber from Copenhagen and Oslo. The move to Gardermoen has also led to extra volumes of waste from the cleanup at Fornebu.

Consumption of chemicals

Solvents

Only on the Internet



Background: The absolute bulk of solvents containing halogens comprise trichloroethylene and 1.1.1 trichlorethane for degreasing and cleaning in Oslo. • Chloroethylene is used in Denmark and Sweden. • The bulk of solvents without halogens consist of cleaning agents, paints and thinners. **SAS's development:** The decrease is mainly due to reduced aircraft painting in Oslo. The decrease in halogenated solvents is attributable to non-period use.

Energy consumption

Gas

Only on the Internet

In 1998, a total of 2,677 kg of gas was used for a number of ground vehicles in Norway.

Ground vehicles

Only on the Internet

[number]	1995	1996	1997	1998
Denmark	750	800	825	753
Norway	607	622	976[1]	995
Sweden	256	299	730[1]	724
Total	**1,613**	**1,721**	**2,531**	**2,472**

[1] 1As 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 vehicles has taken place.

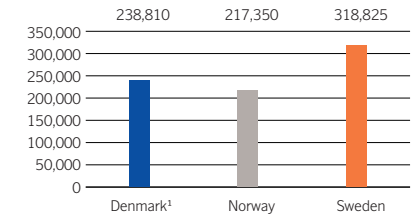
Background: SAS uses ground vehicles for a number of purposes: aircraft towing, baggage transportation and loading, ordinary passenger transportation, airport shuttle services (under own management in Oslo with ten new buses of the highest European environmental standard) and so on. Around 2/3 of vehicles 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

Only on the Internet

Area utilized
[m²]



[1] Parts of the managed area in Copenhagen were used for only part of 1998 (the new cargo terminal which was inaugurated on 7 December).

[m²]	*Total area utilized* **1998**	*Total area with registered resource consumption* **1998**
Denmark	238,810	227,446
Norway	217,350	93,701
Sweden	318,825	223,891
Total	**774,985**	**545,038**

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 several environmental data should be compared with the total floor area where registered resource consumption takes place. In 1998 SAS moved into several new buildings – the cargo terminal in Copenhagen and three buildings at Gardermoen. The area utilized at Gardermoen will be included in the relative calculations in the environmental report for 1999.

Terms and abbreviations

Utvidgad jämfört med den tryckta miljöredovisningen

Acetate Acetic acid (CH_3COOHX) Used by airport operators in deicing of runways, as a less environmentally harmful alternative to urea (see also this term). 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, since their ability to break down organic material is impaired.

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

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

ASK Available Seat Kilometers, the available number of passengers seats multiplied by the distance flown (see also *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 *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 also a key component of the ecocycle – it is released in the air exhaled by animals and absorbed in the photosynthesis process in plants – and 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 of aircraft types ICAO's (see definition) requirements regarding noise and emissions of carbon monoxide, nitrogen oxides and hydrocarbons (see definitions and *Chapter II, III*).

CFC Chloroflourocarbons, 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 business 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, FBN*).

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. 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 in line with the earth's estimated carrying capacity.

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

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

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

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

FNL Flight Noise Level. (See also *Noise, dB, EPNdB*.)

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

Freon See *CFC*.

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.

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

Greenhouse effect A layer of gases in the atmosphere (see definition), including water vapor and carbon dioxide (see definition), which retains the heat radiated by the

earth's surface and prevents it from escaping into space. Consequently, the earth's average temperature is kept higher than it would otherwise be. Other gases that contribute to the greenhouse effect are CFC (see definition), methane and nitrous oxide.

The majority of researchers now believe that human activities exacerbate the greenhouse effect so that atmospheric warming is taking place. Combustion of fossil fuels (see definition) releases carbon dioxide which has been bound in the earth's crust. Although carbon dioxide is formed in all combustion, burning of biofuels (see definition) does not contribute to the greenhouse effect, since the vegetable matter which is burned emits the same amount of carbon dioxide as its has bound during its lifetime and the net increase is zero. The use of coal, oil and natural gas, however, leads to a net increase. Consequently, SAS's conversion from oil-fired to biofuel-fired district heating at Arlanda has made it possible to reduce net emissions of carbon dioxide to zero.

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

HCs Hydrocarbons (see *Volatile organic compounds*).

Heavy metals Certain high density metals, e.g. cadmium and mercury, which can cause severe and acute toxic damage.

Hydrocarbons (HCs) See *Volatile organic compounds*

IATA International Civil Aviation 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 binding norms for commercial aviation.

ICC International Chamber of Commerce.

IFCA Inflight Catering Association, organization in which the world's over 250 airlines collaborate with catering companies and other suppliers to the airline industry's cabin operations.

Insecticides Chemicals which are used to combat insects.

IPCC Intergovernmental Panel on Climate Change, an expert panel appointed by the UN's environmental program UNEP and the World Meteorological Organization (WMO) to assess the consequences of a changed climate on earth.

ISO 14001 The International Standardization Organization's standard for environmental management and auditing (see also *Environmental Management systems*).

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 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).

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

Nitrogen oxides (NOx) A collective name for various compounds of oxygen and nitrogen. These are formed in all combustion in aircraft engines since 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 limited is exceeded nitrogen contributes to acidification (see definition) of soil. Throughout the troposphere (see definition), nitrogen oxides react with VOCs (see definition) and sunlight, forming "oxidants", 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 stricter. New engines with double annular combusters (DACs), for example, reduce emissions by up to 40% compared with the previous generation of engines. In 1998 SAS began the phase-in of new Boeing 737-600s with DAC engines in its aircraft fleet.

NOx Nitrogen oxides (see definition).

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, FNL*).

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.

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

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 resulting deoxygenation 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.

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.

Recipient Recipient of emissions. Com-

monly used with reference to bodies of water, lakes and oceans. The environmental effects of the emissions are linked to the sensitivity of the recipient.

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

SEK International currency designation for Swedish kronor.

SO_2 Sulfur Dioxid (See definition).

Star Alliance Commercial alliance, initially between the airlines Air Canada, Lufthansa, SAS, Thai Airways, United Airlines and Varig; but starting in 1999 also All Nippon Airways, Air New Zealand and Ansett Australia.

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 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-firing 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 organization strives to exceed the customers' expectations by improving its competitiveness through the efforts of the employees.

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 synthetic 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.*)

VOCs Volatile organic compounds (see definition).

Volatile organic compounds (VOCs) A collective name for a number of different compounds, including most hydrocarbons (HCs). 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, VOCs 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.

Environmental Management System

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

In its original form, EMAS has been focused on the industrial sector, where experience of applying environmental management and auditing is longest. However, pilot studies are underway 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).

According to the modified EMAS ordinance, with effect from August 1, 1998, companies and organizations can voluntarily register their facilities in the system. The organization is then required e.g. to adopt an environmental policy for its entire operations, and for the facility in question:

- 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 examine 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 Standardization Organization.

The general management principles on which ISO 14000 is based are the same as in the ISO 9000 quality standard. In 1996 the first environmental standards were adopted – ISO 14001 and 14004, which form the basis for an internationally accepted environmental management system. These have been followed by standards and proposed standards for Environmental audits (ISO 140010–12), Environmental marking (ISO 140020–24), Environmental performance (ISO 14031), Life Cycle Assessment (ISO 14040–43) and Environmental terminology (ISO 14050). 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 and, within Sweden, activities in the public sector, agriculture and forestry, construction and civil engineering, retail trade, property management, transportation and services; 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, an organization must ensure that suppliers to the facility/operation which is to be registered apply environmental standards corresponding to the organization's own. These requirements are less clearly expressed in ISO 14001.