

VOLVO

Volvo Environmental Report 2000



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Volvo is one of the world's biggest producers of commercial transport equipment. Its product range consists of trucks, buses, construction equipment, marine and industrial power systems, and aircraft engine components.



5 Volvo and the world about it

Volvo's long-term competitiveness will be determined by its success in identifying and meeting the needs and demands of its customers, shareholders and employees, as well as the community at large. This section contains a general review of the ways in which Volvo is working to achieve corporate citizenship, together with a brief description of current development trends in the transport and environmental fields.



8 Environmental organisation and goals

Read more about the Volvo Group's environmental programmes, its organisation, training initiatives, implementation of environmental management programmes and new environmental goals.



10 Product development and products

Much of Volvo's product development work is environment-related, either directly or indirectly. The result is a range of products boasting ever-lower emissions and lower fuel consumption.



16 Environmental impact of operations

In November 2000, the Volvo Group Executive Committee decided to introduce a new, global environmental standard in its production plants. This will result in better control, lower emissions and more efficient use of resources.



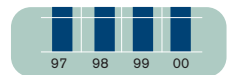
18 Global basis for local activities

Although Volvo's environmental programmes around the world are based on its environmental policy and strategies, each country also undertakes a series of local projects. Reports from India, Brazil and Mexico illustrate the wealth of initiative possessed by the Group.



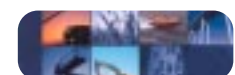
20 Environmental data for products and operations

How many grammes of particles does a truck emit per kilowatt-hour? What are the emission limits for construction equipment in the USA? Did the energy consumption of Volvo plants increase or decrease during the year 2000? The answers to these and many other questions are illustrated in table and chart form.



22 Environmental information from Volvo; persons to contact

How to find out more about Volvo's environmental programmes.



In January 2001, the UN's Intergovernmental Panel on Climate Change (IPCC) published a new report indicating that global warming is progressing more quickly than previously feared. This highlights the urgent need for new international agreements on means of controlling emissions of carbon dioxide and other greenhouse gases. In this context, the transport sector is an area of prime interest. Since carbon dioxide emissions are related directly to vehicle fuel consumption, customer demands for more fuel-efficient vehicles are contributing to steady improvement in this respect. Trends in IT have also created new conditions for developing considerably more efficient and, consequently, less polluting transport. At the same time, efforts to develop alternative power trains and renewable fuels must be intensified.

The second major challenge to the transport equipment industry is to reduce emissions of atmospheric pollutants at local and regional level. In February 2000, the EU introduced new emission control legislation for heavy trucks and buses – a long-awaited decision which will have significant, positive benefits. Now that we know what will be demanded over the next ten-year period, we can concentrate our development resources on meeting the new limits in good time before they come into force. The new standards will also enable individual countries to introduce measures to stimulate the demand for vehicles whose environmental performance is ahead of the legislation. In the case of some Volvo products, we have already developed technical solutions which will assure compliance with the limits due to come into force in 2006.

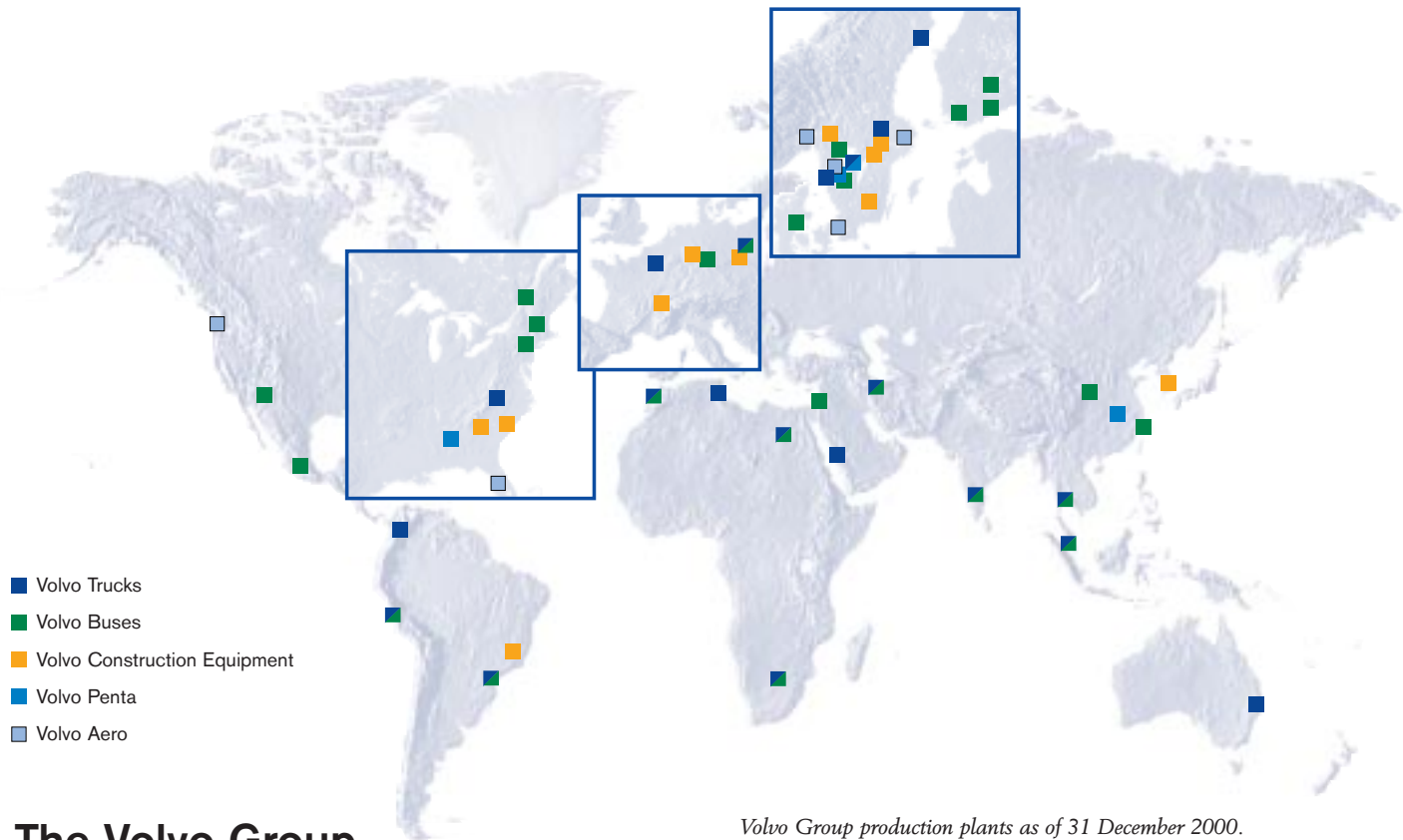
With the acquisition of Renault V.I. and Mack Trucks, Inc., which was completed in January 2001, the Volvo Group has become the world's second biggest producer of heavy trucks, with the large-scale resources required to undertake the aggressive development of new, environmentally compatible products. At the same time, we will be in a position to further improve the efficiency of resource utilisation and reduce the environmental impact of our production plants around the world. The Renault/Mack takeover was preceded by a comprehensive environmental review of the operation and we have now begun to implement the corrective measures identified by it. Our new, global, minimum standard for production facilities, which deals with factors such as emissions to air and water, as well as waste and chemicals management, provides an excellent basis for this task.

This year's environmental report contains a detailed review of Volvo's environmental programmes in all parts of the company. It also details the results of our product development activities and the environmental impact of our operations. In addition, it provides an overview of important external factors and trends which influence us and our actions.



Leif Johansson
President of AB Volvo and CEO





- Volvo Trucks
- Volvo Buses
- Volvo Construction Equipment
- Volvo Penta
- Volvo Aero

The Volvo Group

Volvo is one of the world's biggest manufacturers of commercial transport equipment. The Group produces trucks, buses, construction equipment, marine and industrial power systems, and aircraft engine components.

In 2000, the Volvo Group consisted of the Trucks, Buses, Construction Equipment, Marine and Industrial Power Systems, Aero and Financial Services business areas. Renault V.I. and Mack Trucks, Inc. have been part of the Volvo Group since 1 January 2001 and are not included in this year's report.

In addition to vehicles, engines and components, the operations of the Volvo Group include sales financing, insurance and service. Volvo also participates in the development of goods and passenger transport systems through its subsidiary, Volvo Mobility Systems.

Volvo was founded in 1927. As of 31 December 2000, it had approximately 54,000 employees, production facilities in 27 countries, and a worldwide market organisation. In 2000, the Group's sales totalled SEK130 billion.

Trucks. Volvo Trucks is the world's third biggest producer of heavy trucks, with a world market share of approximately 10% and sales in about a hundred countries. Western Europe, North America and South America account for the bulk of the company's sales. Long-term market development is also under way in eastern Europe, as well as in China, India and Mexico.

Volvo Group production plants as of 31 December 2000.

Buses. Volvo Buses is the second biggest builder of heavy buses in the world, with sales in about 60 countries. The company's main markets are in North America, Europe, South America and southeast Asia. Tourist coaches for the North American market are built by Prévost Car Inc., and city and intercity buses by Nova BUS. Both companies are subsidiaries of Volvo.

Construction Equipment. With production facilities on four continents, Volvo Construction Equipment is one of the world's leading manufacturers in its sector. Its products are sold in over 100 countries, with North America and Europe as its principal market areas.

Marine and Industrial Power Systems. Volvo Penta is a leading producer of complete power systems for marine and industrial applications. Europe and North America are the company's principal markets. Marine engines account for approximately 70% of sales and industrial engines for the remaining 30%.

Aero. Volvo Aero is a global player in the aviation industry. In addition to the development and manufacture of aero engine components, aircraft engine service, maintenance and leasing, together with sales of engine and aircraft parts, account for a growing proportion of turnover.

The Volvo Group shares the Volvo brand with Volvo Car Corporation, which has been part of the Ford Motor Company since 1999.

Key figures, 2000

Sales	SEK 130,070 million
Operating income excl. items affecting comparability	SEK 6,154 million
Net profit	SEK 4,709 million
Income per share excl. items affecting comparability and gains on sales of shares	SEK 11:20
Capital expenditure	SEK 5,419 million
Research and development costs	SEK 4,876 million
No. of employees at year end	approx. 54,300



Volvo and the world about it

Volvo's long-term competitiveness will be determined by its success in identifying and meeting the needs and demands – present and future – of its customers, shareholders and employees, as well as politicians and other major groups. To conduct its operations successfully, a company must constantly earn the confidence of the world about it.

Volvo's reputation is founded largely on its history of corporate citizenship, combined with its consistent, long-term dedication to the development and marketing of products of high quality, advanced safety and low environmental impact.

Volvo's core values – Quality, Safety and Environment. Volvo's vision is to be ranked as a world leader in the commercial transport sector. The basis for positive development is provided by the company's continued commitment to its three core values of Quality, Safety and Environment. In its mission statement, Volvo affirms: "We use our expertise to create transport-related hard and soft products of superior quality, safety and environmental care for demanding customers in selected segments."

New knowledge. Volvo must source new knowledge and ideas, and must attract well-educated, motivated people who share its values – especially in the environmental area – if it is to play a leading role in its sector.

Volvo is an active partner in a series of different trade associations, industrial organisations and international fora. The company itself operates two second-level schools and has developed close links with a number of universities and institutes of technology, such as Columbia University and Massachusetts Institute of Technology in the USA, and Chalmers University of Technology in Sweden. The Volvo Environment Prize has been awarded annually since 1989, while the Volvo Ocean Adventure is a new educational initiative designed to stimulate the interest of the younger generation in environmental issues (see page 7).

'The Volvo Way'. Volvo's global, corporate culture is based not only on common values, but on the dedication of its employees, respect for the individual and teamwork. This is described in Volvo's personnel development plan entitled 'The Volvo Way', which reaches all of the company's

employees throughout the world. In this, Volvo seeks to engage in a constructive dialogue with local personnel representatives and trade unions, to achieve mutually agreed solutions which are beneficial to company and employees alike. Issues relating to the working environment, health and safety are dealt with locally on the basis of the guidelines applicable in each business area. Quality and environmental programmes are conducted in accordance with ISO 9000 and ISO 14000 respectively. By the end of the year 2000, approximately 95% of Volvo employees were working in plants and units with ISO 9000 certification. Relations with local authorities and residents in the neighbourhood of production facilities are obviously also very important. As a major employer in many locations, Volvo plays a significant role in the local community by offering employment opportunities and developing collaboration with suppliers, and by participating in educational, infrastructural and transport system projects. Work to reduce the environmental impact of the company's production plants and units around the world is also ongoing (see pages 16-17).

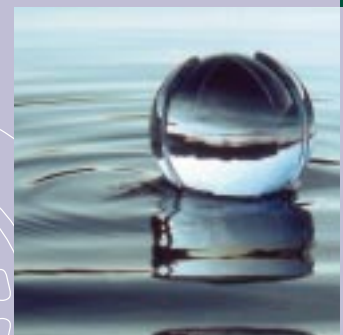


The core values of Quality, Safety and Environment form the basis of the products and systems supplied by Volvo, and of the company's involvement in the community.

Volvo Environment Prize

The Volvo Environment Prize for 2000 was awarded to Prof. Jose Goldemberg (Brazil), Prof. Thomas B. Johansson (Sweden), Prof. Amula K. N. Reddy (India) and Dr. Robert H. Williams (USA), whose joint efforts have helped to create a global, holistic view of energy issues and strategies, indicating new opportunities of meeting the world's long-term energy needs.

The Volvo Environment Prize for 2000 is the eleventh since the award was instituted to promote research in the environmental field. Worth SEK1.5 million, the prize was presented at a ceremony in Gothenburg in October 2000. Further information is available at www.environment-prize.com on the Internet.





The need for more efficient transport systems is growing in many cities around the world.

Positive and negative effects of transport. The products made by Volvo fulfil an important public function. The efficient transport of goods and people, together with a smoothly working infrastructure, is a basic prerequisite to societal development and prosperity. Since the historical relationship between transport and economic growth remains very strong, the need for transport will also continue to grow in future, especially in the developing nations. At the same time, the increasing volume of transport presents a growing threat to health and the environment, especially in major conurbations, in which congestion, noise and atmospheric pollution have caused a deterioration in the living environment. Current OECD figures indicate that the social costs attributable to the transport sector account for about 8% of GNP in Europe. The explosive population growth which may be expected in the world's major cities during the next 10 to 20 years further reinforces the need for new solutions.

Global warming. The combustion of fossil fuels and emissions of carbon dioxide also contribute to global warming. The transport sector presently accounts for about 20% of the carbon dioxide generated by human activity and the percentage is expected to increase.



Switzerland and Austria are among the countries which have introduced new legislation to reduce the environmental impact of heavy road transport.

Reduced air pollution in EU countries. Work carried out to date to reduce the environmental impact of transport has yielded significant results. Emission control legislation in the USA, Japan and EU has been tightened considerably during the last decade, providing an impetus to the development of cleaner vehicle and fuels. Calculations produced as part of the Auto Oil 2* programme indicate that emissions of nitrogen oxides from road transport in the EU fell by 33% between 1990 and 2000, despite an increase of 22% in transport volumes during the same period.

Harmonisation and diversification. Greater harmonisation of legislation and test methods is now taking place at an overall level, making it easier for industry to concentrate its resources on the development of environmentally compatible technology. In the OECD countries, emissions of nitrogen oxides, particulates, hydrocarbons and carbon monoxide will be lowered further over the next ten years as new emission limits become effective. National and local authorities in several countries are already enforcing more far-reaching environmental measures than those required by the relevant legislation, while tax incentives for buyers of specially designed 'green' vehicles are becoming increasingly common. This means that it will become financially advantageous for owners to buy cleaner vehicles, which is an essential prerequisite if the demand for these is to gather pace. For example, Switzerland, Austria and Germany are among the countries which have introduced, or are planning to introduce, taxes and charges of various types on heavy road transport vehicles. In Britain, transport companies purchasing environmentally compatible vehicles now benefit from significant tax concessions, a measure which is coupled with some of the highest fuel taxes in the world. In addition, since more and more buyers of transport services are demanding that the vehicles used to transport their goods comply with environmental standards, transport companies, in turn, are expressing greater interest in models with a low environmental impact.

Cleaner fuels essential. Cooperation between all of the parties involved is required to reduce the environmental impact of transport. In this context, the wider availability of cleaner fuels is an essential condition. A high-quality fuel not only reduces the atmospheric pollution caused by its combustion; it also permits the use of efficient exhaust gas treatment using today's technology. The availability of low-sulphur fuel is still limited to a small number of countries, although the demand is growing. In a document entitled 'WorldWide Fuel Charter' published in April 2000, automakers from the entire world called for wider international availability of petrol and diesel oil with a maximum sulphur content of 5-10 ppm (parts per million) to meet future emission limits. Despite many worthwhile initiatives, emissions of atmospheric pollutants at global level may well continue to rise as vehicles rapidly

Columbia University

Since 1988, Volvo has been involved in a joint programme with Columbia University in Arizona, USA, to support studies in the environmental sciences at the university. Under the Volvo Environmental Scholars Program, Volvo awards ten scholarships annually entitling the recipients to one term of free tuition. The company has

also developed a three-week course in environmental science, focusing on consumption, technology and environmental impact. Further information is available at www.volvo.com/environment/columbia/index.htm on the Internet.



become more numerous and are driven increasingly longer distances. The carbon dioxide emission problem is one which is even more difficult to resolve. Although ever-more fuel-efficient engines and vehicles are being developed, the resulting environmental gains may well be limited by the expected increase in traffic.

Rapid improvement at reasonable cost. The search for new, long-term, sustainable solutions must be intensified to meet the demand for efficient transport. However, the full potential of today's technology must also be used to achieve rapid improvement at reasonable cost, which is essential if an impact is to be made at global level. Nitrogen oxide emissions from new diesel trucks and buses will be cut by two-thirds between now and 2010 with the introduction of refined engine technologies, improved grades of fuel and efficient exhaust gas treatment, reducing these emissions to less than those from today's natural gas-powered vehicles. Volvo is already marketing an exhaust gas system for both new and existing diesel buses, which is relatively uncomplicated in technical terms and will enable emission values to be lowered to within the statutory limits specified in EU 2006 (Euro 4). Volvo's offer to owners of older trucks to upgrade their engines from Euro 1 to Euro 2 is another example of a measure likely to yield positive environmental benefits within a short time. This offers a 15% reduction in nitrogen oxide emissions and almost a 50% reduction in the particulate content of the exhaust gases.

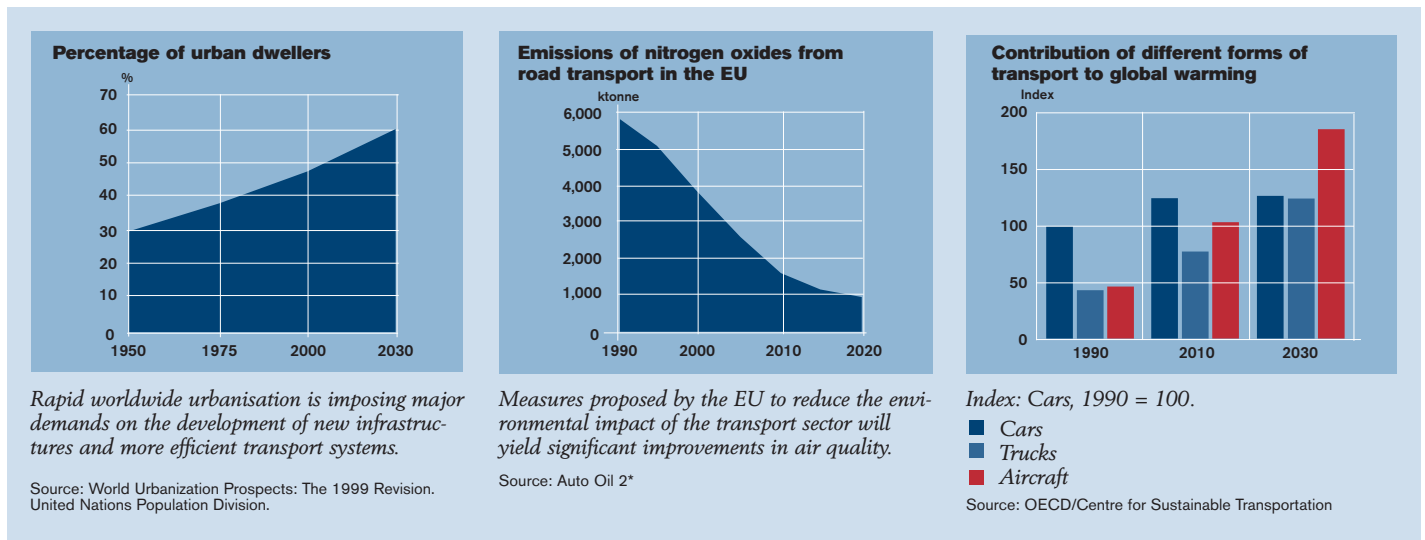
Renewable fuels. The adoption of renewable, non-fossil fuels will be required to reduce net emissions of carbon dioxide. This is another area in which modern technology can be utilised to develop competitive solutions. For example, the diesel engine is ideal for burning fuels

such as dimethyl ether (DME), which can be manufactured from biomass in an energy-efficient process and can be burned at high efficiency with low emissions. Volvo has already developed a DME test vehicle and, in January 2001, founded the International DME Association in partnership with fuel producers and technology suppliers. In the automotive industry, major resources are also being devoted to the development of fuel cells as a motive power source, although it is likely to be some time before this technology becomes commercially viable, at least in heavy vehicles. In the aviation industry, studies are under way to examine the feasibility of using synthetic fuels as renewable energy resources.

More efficient transport systems. The problems of congestion, noise and atmospheric pollution in the world's conurbations will not be solved by improved engines and fuels alone. This will also require streamlining of the entire transport apparatus, including comprehensive renewal of the infrastructure, logistics systems and vehicles, and will involve many different players. The cities in most need of new solutions are usually those with the most limited economic resources.

Volvo's aim is to contribute actively to the development of efficient, safe, environmentally compatible and economically competitive transport systems for goods and passenger traffic. This will be achieved both by supporting research in the area, and by contributing in terms of supplying vehicles, system proposals and transport telematics. Thanks to its excellent network of contacts, Volvo can also help to establish the conditions for infrastructural funding and development.

** Auto Oil 2 is a joint project between the European Commission, the EU member states, and the automotive industry, oil companies and consumer organisations in the EU.*



Volvo Ocean Adventure

The Volvo Ocean Adventure – a new, web-based, global environmental and educational programme for young people – was launched in November 2000. Its purposes are to highlight important environmental issues and to encourage young people to undertake practical projects which can help to improve their own immediate environment. Apart from providing information, the programme offers a means of communicating with other young people, as well as playing games and carrying out experiments. The project is co-sponsored by the Volvo Group and Volvo Car Corporation, together with a number of scientific institutions from a total of nine countries. Further information is available at www.VolvoOceanAdventure.org on the Internet.

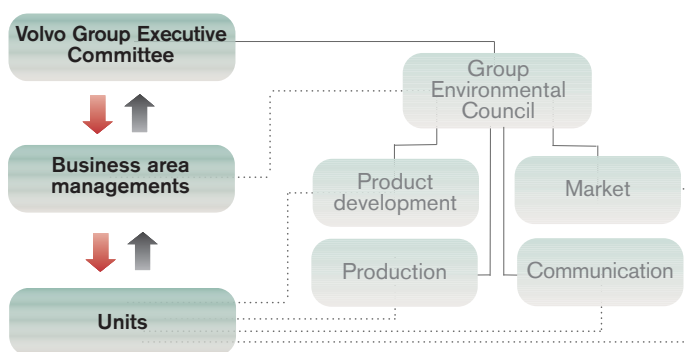


Environmental organisation

Environmental issues are an integral part of Volvo's strategies, and environmental programmes are conducted mainly within the line organisation. Overall environmental strategy decisions in the different business areas are taken by the respective company managements.

Each business area has its own environmental manager, supported by a network of environmental staffs, local environmental coordinators and specialists of various kinds. The organisation also includes a Group-wide function and environmental specialists from Volvo Technological Development. The Volvo Group Executive Committee is responsible for environmental policy, Group-wide strategies and environmental goals, and for monitoring the environmental activities of the business areas. Proposals relating to visions and strategies are developed by the Group Environmental Council, whose membership is drawn primarily from the business areas. Council chairman Lars Anell is also a member of the Executive Committee. The Environmental Council is supported by working groups composed of environmental specialists in the product development, production and market/communication areas. A minimum standard governing activities such as emissions and waste management in Volvo production plants was adopted during the year, while a project to develop EPIs (Environmental Performance Indicators), which also enable the environmental performance of product families to be measured and compared, has been initiated.

Volvo's environmental organisation



Environmental training. In parallel with the completion of 'Dialogue on the environment' – Volvo's comprehensive, basic environmental training programme – the company is also focusing increasingly on the need to meet the demands of various groups for specialist knowhow. For example, Volvo Trucks, Volvo CE and Volvo Penta have trained their design engineers in environmentally compatible product development. Volvo Trucks has also initiated a series of lectures on topics such as fuel cells, particulates, European air quality in the future and exhaust gas treatment technology. Locally adapted environmental training is obligatory when implementing an environmental management system.

Environmental management. The implementation of environmental management systems is ongoing in all parts of the Volvo value chain. By 31 December 2000, 37 Volvo plants and units had received ISO 14001 certification and/or EMAS registration. Volvo carries out continuous environmental auditing of its operations throughout the value chain to ensure that its goals and strategies are followed up.

Environmental management systems in Volvo value chain, 31 December 2000

	VTC	VBC	VCE	VP	VAC
Product development	●	○	●	●	○
Suppliers	●	○	●	●	○
Purchasing	●	●	●	●	●
Production	●	●	●	●	●
Market	●	○	●	●	○

- Environmental management system implemented
- Some units certified
- Work commenced
- Work to be commenced

- VTC = Trucks
- VBC = Buses
- VCE = Construction Equipment
- VP = Marine and Industrial Power Systems
- VAC = Aero

Volvo Group Vision

To be valued as the world's leading provider of commercial transport solutions

Volvo Group Mission

By creating value for our customers we create value for our shareholders. We use our expertise to create transport-related hard and soft products of superior quality, safety and environmental care for demanding customers in selected segments. We work with energy, passion, and respect for the individual.

Environmental policy

Environmental care is a Volvo core value. Volvo is to be ranked as a leader in terms of Environmental care among the world's top producers of automotive and transport products, equipment and systems. Volvo's environmental programmes shall be characterised by a holistic view, continuous improvement, technical development and resource efficiency. Volvo shall, by these means, gain competitive advantage and contribute to a sustainable development.

Environmental goals

Under Volvo's strategy for the period ending in 2003, the Group shall achieve a position of leadership in terms of its three core values of Quality, Safety and Environment. Based on this strategy, a number of overall, Group-wide environmental goals applicable until 2003 was formulated in May 2000. These cover five areas – products, production, market, working methodology and communication – which are essential to the holistic aspect of Volvo's environmental programmes. Each business area analyses the goals and adapts the formulation to suit its own activities. The results and current position are reported to the annual strategy follow-up meetings held between the company and Group managements. Since the individual business area goals described in the 1999 environmental report are covered by the new overall goals, they are not dealt with specifically on this occasion.

Each section below opens with a general statement of the overall goal. This is followed by an explanation of the background and the quantifiable goals which will be monitored by business area, beginning in spring 2001.

Products

“Every new product must have a lower environmental impact than the one it replaces”

Comparable data are required to enable the environmental impact of different products to be compared. Thus, an environmental product declaration (EPD), which describes the environmental effects of the product throughout its life cycle, is both an essential tool and the first step towards achieving the overall goal. A common EPD model is under development within the Volvo Group and will be introduced successively. Each business area shall identify the key products to be accompanied by an EPD.

Goals to be monitored:

- EPDs shall be developed for key products.
- EPD data shall be used to monitor product improvements.

Production

“We shall lead the field in terms of low environmental impact and high resource efficiency wherever in the world we operate”

Since the Volvo Group has production units of various sizes all over the world, the conditions for implementing environmental protection measures vary, both for economic and infrastructural reasons. In 2000, a specification of requirements was developed and adopted to define a 'minimum acceptable level of performance' to be achieved in this area. The minimum level for each plant is defined as the stricter of the body of requirements contained in local legislation and in the specification.

The specification is used when auditing existing plants and as a basis for action plans when purchasing new facilities.

Goals to be monitored:

- Each production unit shall comply with the minimum level specified in the production requirements.
- Each production unit shall implement active improvement measures based on the actual situation.

Market

“Environmental issues shall comprise an essential part of our market and sales contacts”

The local market organisations and dealers are responsible for direct contact with the end customer. Group-wide environmental requirements to be formulated in 2001 will specify the minimum level of environmental activities to be undertaken by dealers. Pending this, the aims are formulated in a general manner:

- Dealers shall undertake customer-oriented environmental activities.
- Products and services of a specific 'environmental' design shall be available.

Working methodology

“Environmental management systems shall be used in a consistent manner throughout the organisation”

Volvo has long experience of environmental management systems as a means of guiding activities at local level towards common goals. Suppliers and dealers are also covered by the Group's environmental policy.

Goals to be monitored

- All business areas shall have their environmental management systems certified in accordance with ISO 14001 no later than 31 December 2001.
- Environmental requirements for suppliers shall be met no later than 2003.
- Environmental requirements for dealers shall be drafted no later than 2001.

Communication

“The environment is an important element of our communication”

This goal requires that environmental issues form a part of Volvo's general communication and that the results of its environmental programmes are made clear.

Holistic view

The environmental impact of our products and processes shall be minimised by:

- taking account of the complete product life cycle;
- seeking to ensure that a similar degree of environmental concern is exercised by our working partners;
- taking a leading position regarding environmental standards, wherever in the world we operate.

Continuous improvement

Our environmental activities shall be integrated in all of our operations and shall be improved continuously by:

- formulating, communicating and monitoring clearly-defined goals;
- involving all employees.

Technical development

Our customers' demands for environmental care and transport efficiency shall be met, and expectations exceeded by:

- an active and future-oriented research and development process;
- working to develop intelligent transport solutions with low environmental impact.

Resource efficiency

Taking account of the complete life cycle, the design of our products and processes shall be such that:

- the consumption of energy and raw materials is minimised;

- the production of waste and residual products is minimised, and waste management is facilitated.

Volvo's environmental programmes and their results shall be communicated in an open and factual manner. Each company head is responsible for implementing action programmes based on this policy.

Authorised as of 16th September 1997.



Product development and products

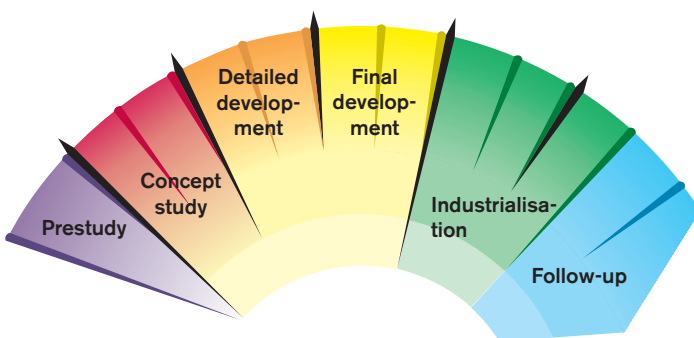
Much of Volvo's product development work is environment-related, either directly or indirectly, due primarily to the high-priority attached to the reduction of fuel consumption and exhaust emission levels. This has resulted in a progressive reduction in the environmental impact of Volvo products.

Since approximately 90% of the environmental impact of a Volvo product is generated during its useful life, environmental issues play an important role in the product development process. In January 2000, several more environmental requirements were added to the 'quality gates' (or evaluation points) used in the process. For example, the use of E-FMEA (Environmental Failure Mode and Effect Analysis) as a systematic method of analysing the environmental demands and hazards associated with new products, and of monitoring the chemicals used in products and manufacturing processes, is now a requirement. This method involves a detailed review of all of the demands imposed on the product and enables effective preventive measures to be implemented at an early stage of product development. The analytical results also provide an excellent basis for deciding on the necessity or otherwise of more thorough elucidation, for example by means of detailed checklists or life-cycle assessment (LCA). During the year, Volvo Trucks performed comprehensive life-cycle assessment on its European FH and FM truck models.

Environmental guide to product development. In spring 2001, Volvo Trucks published a product development guide containing advice and instructions on methods of reducing environmental impact at the design stage. The guide is available both in print and on the Volvo Trucks intranet, where it can be updated continuously.

Suppliers and contractors involved in environmental activities. Since the life-cycle environmental impact of a Volvo product is influenced significantly by players outside Volvo's own organisation, the company is involved in extensive environmental cooperation with its suppliers and contractors. Among other aspects, the global, Group-wide environmental requirements imposed by Volvo on its suppliers extends to the implementation of environmental management systems, the reporting of environmental data and the restricted use of chemical substances. Continuous evaluation of the fulfilment of these requirements by suppliers, using its own 'Supplier Evaluation Model and Purchasing Quality Procedures', is part of Volvo's normal, overall assessment practice. In addition to Volvo's Group-wide requirements, each business area can apply its own criteria.

Products. The description of a number of Volvo's current products and product-related projects on pages 11 to 15 reflects the results of the work carried out to reduce environmental impact during a product's useful life. Although measures designed to minimise emissions of atmospheric pollutants and greenhouse gases are the subject of particular attention, other relevant improvements are also included. Interest among customers in environmentally compatible products varies from business area to business area. At present, the level is highest in the bus market.



The number of environmental requirements in Volvo's product development process was increased in January 2000.

Volvo Group Environmental Award

Volvo's internal environment prize, the Volvo Group Environmental Award, was presented for the first time in June 2000. The recipients were Sture Lindblom of Volvo Construction Equipment (Volvo Wheel Loaders) in Eskilstuna and Stig-Erik Johannesson of Transmission Development at Volvo Trucks. Sture Lindblom was responsible for the development of a load-sensing hydraulic system for wheel loaders, which contributes to significantly lower fuel

consumption. Stig-Erik Johannesson developed a new model for reducing the total environmental impact of products by systematically analysing materials and product specifications, and by selecting the alternative with the lowest environmental impact in each individual case. The purpose of the award is to recognise and reward Volvo projects which have contributed to significant and quantifiable environment-related improvements.



Trucks

In April 2000, Volvo Trucks introduced a new truck – the Volvo FL – designed for local and regional transport applications. The model is equipped as standard with a Euro 3 engine, which complies with the emission control limits due to come into force in the EU in autumn 2001*. For customers anxious to reduce emissions even further, the Volvo FL is available with a Volvo exhaust filter or, alternatively, in a natural gas or biogas (CNG) version.

Volvo exhaust filter. The Volvo exhaust filter reduces emissions of carbon monoxide, hydrocarbons and particulates by 80 to 90%. The nitrogen oxide levels remain unchanged, although the proportion of nitrogen dioxide is increased somewhat. The filter is available both as an option or as a retrofit. Low-sulphur diesel fuel (< 50 ppm) is required to ensure correct operation of the filter. About 80 filters were sold during the year and sales since the unit was introduced in April 1999 total about 150. The Volvo exhaust filter is available for the Volvo FL and Volvo FM trucks.



Launched in April 2000, the Volvo FL is available in both diesel and natural gas versions.

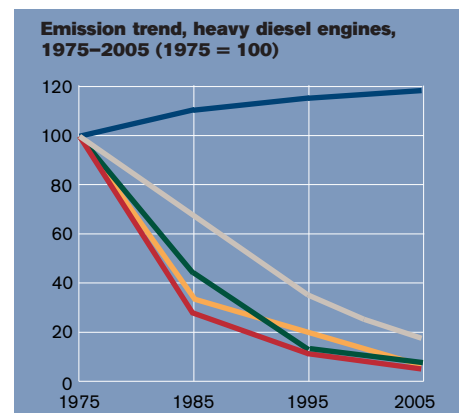
New natural gas and biogas truck. The Volvo FL has been available since September 2000 in a variant designed to run on natural gas and biogas. Intended mainly for applications in sensitive urban environments, the truck is equipped with a new engine (G6B) whose electronic control module detects the fuel being used and adapts the engine automatically to run on that particular grade. Although operation on natural gas and biogas affords low noise and pollutant emission levels, the load capacity is lower than for the equivalent diesel truck. The first ten trucks in the new series were built in autumn 2000 and series production commenced in February 2001.

Expanded Euro 3 engine range. The Volvo D12, D7 and D6 truck engines have been available since April 2000 in variants complying with Euro 3. The focus is now on the achievement of the even lower Euro 4 emission limits in good time before the legislation comes into force in 2006.

Upgrading of earlier engines reduces emissions. As of June 2000, owners of Volvo trucks powered by an earlier 12-litre engine (the Euro 1 D12A) have had the option of upgrading their engines to comply with Euro 2 limits. Apart from lower levels of emissions of atmospheric pollutants, upgrading allows customers to drive in the 'green zones' which have been established in some cities.

Dynafleet 2.0. Dynafleet 2.0, the latest generation of Volvo's transport information system, is now available for all models in the Volvo truck range. The system enables existing transport capacity utilisation to be improved by up to 10%. In practice, this means that more cargo can be transported using fewer trucks, the number of empty or semi-empty runs reduced, and fuel consumption and pollutant emissions lowered. The system also provides information on the quantity of fuel used by a truck under different operating conditions, making it easier for the driver to drive in a fuel-efficient manner. Higher fuel prices are among the factors which have increased market interest in Dynafleet. Almost 5,000 Dynafleet 2.0 systems were sold between the start of production in August 1999 and December 2000.

Electric hybrid project evaluated. The field trials of two Volvo electric hybrid trucks (equipped with a diesel engine and batteries), which have been under way in Gothenburg since 1998, were evaluated in spring 2000. Evaluation has shown that drivers are generally satisfied with the vehicles, especially with their low emissions and low noise level, although the technology is not yet commercially viable due to operational faults, expensive components and a low payload to total weight ratio. Nevertheless, the experience gained from the field trials will be utilised in future Volvo projects.



■ Efficiency
 ■ Carbon monoxide (CO)
 ■ Particulates (PM)
 ■ Hydrocarbons (HC)
 ■ Nitrogen oxides (NOx)

* Statutory emission limits for heavy trucks and buses are tabulated on page 20.



Buses

In September 2000, Volvo Buses launched the Volvo B12M and Volvo 8500, the first models to be based on the company's new TX product platform for intercity buses and tourist coaches. Both models are powered by Volvo's latest 12-litre diesel engine, which complies with Euro 3* and affords a reduction in both fuel consumption and emissions compared with earlier, comparable products. Volvo's 7-litre engine achieved Euro 3 compliance at an earlier date.

Volvo exhaust filter for all engine families. Volvo is the first manufacturer to offer a factory-fitted exhaust filter for all of its engine families (the product is described on page 11 under 'Trucks'). The oxidising catalytic converter, which reduces emissions of hydrocarbons and carbon monoxide by about 60%, offers an alternative to customers without access to low-sulphur fuel. In all, 780 buses were equipped with converters and about 200 with Volvo exhaust filters in 2000. In addition, 125 filters and 250 converters were retrofitted.

New exhaust gas treatment meets Euro 4. In autumn 2000, Volvo Buses introduced an exhaust gas treatment technology which reduces emissions to levels below the statutory limits specified in EU 2006 (Euro 4). Known as Volvo Emission Control, this consists of a Volvo exhaust filter combined with exhaust gas recirculation (EGR), and reduces emissions of hydrocarbons, carbon monoxide and particulates by 80-90%. The content of nitrogen oxides in the gases is also lowered by about 50%.

Volvo Emission Control is available both as a factory-fitted option on new buses and as a retrofit on existing vehicles with 10-litre engines.

EPDs for Volvo B12M and Volvo 8500. Work on the production of EPDs for the Volvo B12M and Volvo 8500 commenced in autumn 2000. The purpose is to provide interested customers with a simple means of obtaining an overview of the environmental impact of the models.

Dynafleet for buses. Since September 2000, several of Volvo's bus models have been equipped with Dynafleet – the most complete transport information system available on the market. Experience gained by Volvo Trucks indicates that the system enables every vehicle



The Volvo 8500 is the first bus to be based on Volvo's new TX product platform.

to be used more efficiently and unnecessary driving eliminated, reducing both fuel consumption and exhaust emission levels.

Increased demand for natural gas buses. In 2000, Volvo Buses sold 188 natural gas/biogas buses, the highest total ever in a single year. Overall, however, this type of bus accounts for only 2% or so of production. Approximately 600 gas-powered buses have been delivered since 1995.

New bus with second-generation fuel cells. Since 1998, Volvo Buses and a number of partners have been testing fuel cell technology in a bus manufactured by Volvo's subsidiary, Nova BUS, in the USA, and a further vehicle commenced field trials in March 2000. The fuel cells in the new bus are based on the latest technology, known as pro-

* Statutory emission limits for heavy trucks and buses are tabulated on page 20.

Transport systems for major cities

Rapid worldwide urbanisation is creating a demand for the development of new and more efficient goods and passenger transport systems. Volvo is conducting a number of projects in collaboration with the authorities in different cities, including Gothenburg and Shanghai, with the aim of developing cleaner, more efficient and safer transport. A high proportion of this activity is carried out by the Volvo Mobility Systems business unit, which was established in 1999. From 2000 on, the Volvo Research Foundation and

Volvo Educational Foundation will also be focusing closely on support for research projects relating to transport in major cities, to which they will contribute SEK30–40 million annually. In March 2000, the two foundations held a conference on the theme of 'Future Urban Transport' in Gothenburg, where about 130 politicians, urban planners and researchers from all over the world gathered to discuss future solutions to traffic problems in major cities.

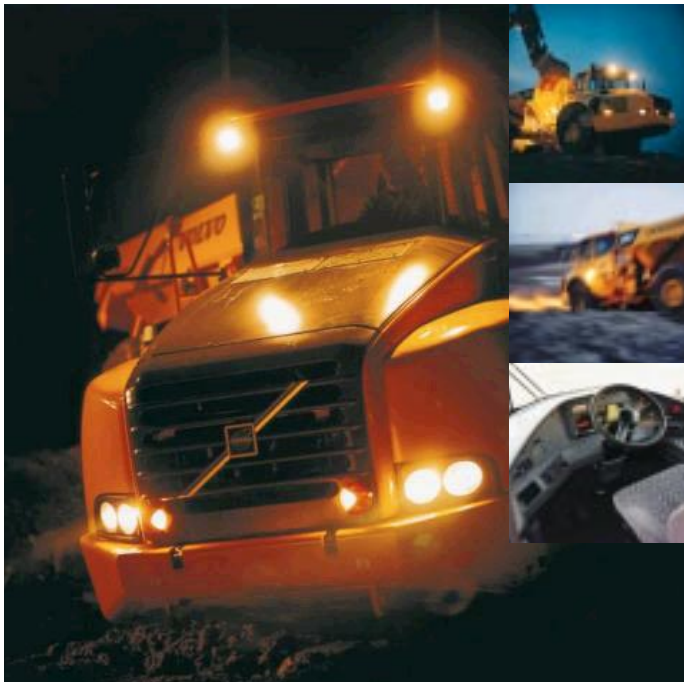


ton membrane exchange. The primary fuel, methanol, is converted to hydrogen by an on-board reformer. The fuel cells, in turn, convert the hydrogen into electricity, which is used to drive the bus by powering an electric motor. Compared with the direct use of hydrogen, the use of methanol as the primary fuel makes it considerably easier to establish a fuel distribution network.

Gas turbine project concluded. Since autumn 1999, Volvo Buses has been conducting field trials in Gothenburg of two gas-turbine, electric hybrid buses powered by ethanol. The results have been both positive and negative. The emission figures, in particular, have been extremely low; for example, the nitrogen oxide emissions are just one-

twentieth of those from a conventional diesel bus. On the other hand, the fuel consumption is approximately 50% higher than that of a conventional bus. Passengers and drivers alike have expressed their particular appreciation of the model's smooth gearchanging and extremely low noise level. Funded in part by the Swedish Transport and Communications Research Board (KFB), the project has yielded valuable experience of electric and hybrid operation, which will be utilised in future development projects.

Construction equipment



Particulate emissions from Volvo's new haulers are approximately 60% lower than from previous models.

In autumn 2000, Volvo CE introduced two new haulers – the A35D and A40D – both adapted to comply with the new emission limits (EPA:2) which came into force in the USA on 1 January 2001. This means that emissions of nitrogen oxides and particulates from the new haulers are about 35% and 60% respectively lower than from previous models. Furthermore, the external noise level has been reduced by 3 dB(A), while the consumption of engine oil, transmission fluid and

filters has been halved, thanks to greatly extended replacement intervals. To minimise the risk of spillage during oil changes, the oil filter has been relocated and a hose is used to drain used oil directly into a container.

Wheel loaders with lower environmental impact. The environmental impact of Volvo CE's latest generation of heavy wheel loaders, which was introduced in 2000, is considerably lower compared with previous models. For example, the fuel consumption of the Volvo L70D (expressed in litres per tonne of material loaded) is about 10% lower, thanks to the model's load-sensing hydraulic system. The external noise level has been reduced by 2 dB(A) to comply with the limits likely to be introduced in 2006. The oil change interval has been doubled to 500 operating hours, halving the consumption of engine oil and filters. The fuel system is equipped with a non-return valve to prevent the leakage of diesel fuel should the machine overturn.

EPD for wheel loaders. Volvo CE published its first wheel loader EPD in 1999. This provides information on environmental performance, materials content etc. The company's approach to environmental issues is described in the brochure entitled Focus on the environment.

Volvo CE published its first wheel loader EPD in 1999.

Marine and industrial power systems



Volvo Penta application engineers ensure that engines are installed so as to minimise noise and vibrations.

Renewal of the Volvo Penta engine range continued during 2000. This included the introduction of a new 12-litre unit (D12). Compared with earlier engines in the same class, the fuel consumption of the Volvo D12 is 5–10% lower, while the emission levels are 25% below the statutory limits. Introduced in December 2000, the industrial variant of the Volvo D12 complies equally with Euro 2, Step II, Tier II and EPA.

The TD640V and TWD740V are another two, new industrial diesel engines for mobile or stationary applications. Emissions from both of these units are 10–15% lower than the applicable limits.

Since January 2000, all Volvo Penta marine diesels rated above 130 kW have complied with the new nitrogen oxide emission limits specified during the year by the International Maritime Organisation (IMO).

RailPac sales increase. The demand for RailPac, Volvo Penta's diesel-powered rail propulsion system, increased during the year, with sales reaching approximately 100 units. Since the diesel engine used

in the system complies with Euro 2, its emissions are substantially lower than the levels specified in the draft standard now before the EU.

New services afford lower environmental impact. In summer 2000, Volvo Penta initiated a project aimed at the development of new services (soft products), which will help customers to reduce the life-time environmental impact of the company's hard products. The services currently offered by Volvo Penta include service programmes and service technician training, which contribute to the optimisation of fuel consumption and emissions, as well as the correct handling of residual products, such as waste oil and filters. Volvo Penta also supplies the services of application engineers to undertake the 'Certified installation' of engines on boats and vessels in a manner ensuring that noise and vibrations are minimised.

New environmental requirements for dealers. Volvo Penta imposed clearer environmental requirements on its dealers in Sweden with effect from spring 2001. Every dealer must now conclude an agreement with a waste management company to dispose of oils, batteries and other environmentally hazardous waste in an environmentally safe manner. The company also plans to apply similar requirements to dealers in the rest of Europe.

Volvo Penta helps boatbuilder to reduce emissions. Larsen, one of Volvo Penta's biggest boatbuilding customers in the USA, called on the company's engineers for assistance when it decided to introduce a new, environmentally compatible and cost-effective production process. Thanks to the new, automated process, emissions from hull production have been cut by over 80%.

Award for environmental ferry. The Villum Claussen, the new, high-speed catamaran ferry, which operates between the Danish island of Bornholm and Sweden, has received the prestigious Western Australian Industry and Export Design Award. Among other factors, the judges cited the fact that the vessel sets a new environmental standard. Built at the Austral shipyard in Australia, and powered by gas turbines and four Volvo Penta TAMD163A gensets, the vessel meets the world's strictest standards for high-speed ferries.

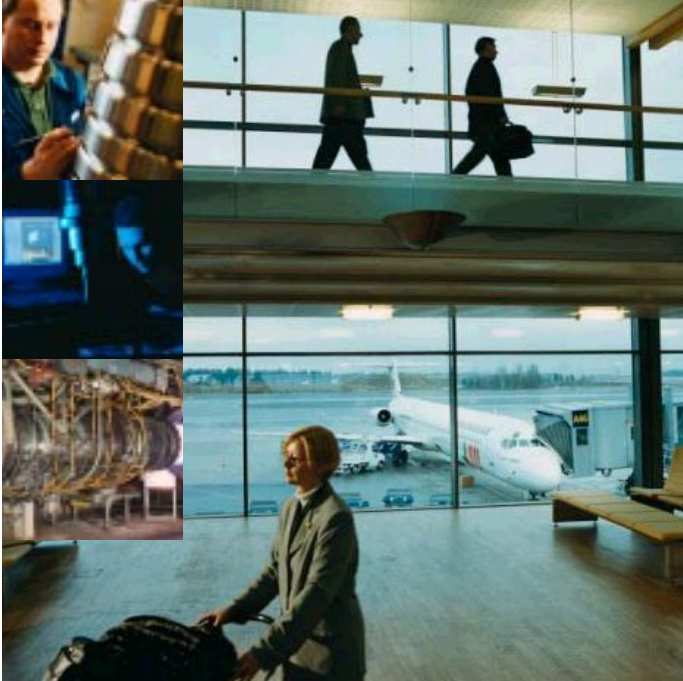
Recycling of products

The uniformly high metal content of Volvo products means that a very high proportion of the materials can be recycled. Dismantling manuals or instructions have been published for most of the products to facilitate environmentally correct dismantling, sorting and recycling.

A significant proportion of all used components is reconditioned and reused. In 2000, Volvo reconditioned truck, bus and construction equipment parts to a total value of approximately SEK2 billion.



Aero



Volvo Aero is participating in a new European project to develop the efficient, environmentally compatible aircraft engines of the future.

In 2000, a major new project was undertaken by interests in the European aviation industry. The aim is to coordinate and further develop leading-edge technologies from national and European aviation research programmes, with a view to developing the next generation of efficient and environmentally compatible aircraft engines. Volvo Aero is a participant in this venture, together with a number of other companies, research institutes and universities from a total of nine countries, focusing on the Antle and Clean engine concepts. Other companies involved in the venture include Rolls Royce, MTU, Snecma, Fiat and ITP. In the case of the most advanced of the engine concepts under study (Clean), the aim is to reduce emissions of nitrogen oxides and carbon dioxide by 80% and 20% respectively, while operating costs are to be reduced by one-third, mainly through lower fuel consumption. Known as EEFAE (Efficient and Environmentally Friendly Aero Engine), the project is part-funded by the EU and will run until 2004. It is intended that the technological advances generated by the project will be ready for adoption in commercially built engines from 2008 on.

Soundproof test cells. Two new engine test cells were commissioned by Volvo Aero in Trollhättan during the year. Both of these are designed to extremely high standards of environmental performance. The soundproofing is probably the most effective in the world. The cells are also equipped with a new technology which minimises the temporary local nuisance previously caused by emissions, mainly of water vapour.

Ongoing gas turbine development. Volvo's development and production of gas turbines for stationary and marine applications continued during the year 2000. Gas turbines have low noise and exhaust emission levels, especially when running on natural gas. Volvo Aero manufactures gas turbines in power ratings up to 5 MW.

The T100 – a 'microturbine' with a rating of 100 kW and a further development of the gas turbine used by Volvo in its experimental vehicles and hybrid buses – was introduced during the year. Development and production of the unit were carried out by Turbec AB, a company owned equally by Volvo Aero and ABB. Equipped with Volvo Aero's patented low-emission combustor, the unit produces a maximum of 15 ppm of nitrogen oxides at 15% oxygen, with natural gas as fuel.

Gas turbine maintenance and aftermarket. During the year, Volvo Aero assumed worldwide responsibility for the maintenance and service of the Dresser Rand 990 4.4 MW gas turbine, of which about 90 units are in service around the world. The company will also market a low-emission combustion upgrade for these units.

Environmental disposal of used computers

Volvo IT has concluded an agreement with computer supplier VM-data for the environmental disposal of used computer equipment from Volvo IT customers in the Gothenburg area. Under the terms of the agreement, VM-data collects all of the equipment, sorts it into items which can be sold or leased on the second-hand market or, alternatively, scrapped. In the latter case, the equipment is disposed of in an environmentally compatible and supervised manner by the Stena Metall recycling company. Depending on the age of the equipment, 20 to 70% of the material content can be recycled. Since Volvo IT customers in the region buy about 5,000 computers annually, the number of used machines is roughly the same. Volvo IT is now planning to sign similar agreements with suppliers in the rest of Sweden and, in the longer term, throughout the world.

Packaging

In 1999, Volvo introduced packaging specification guidelines in which major account is taken of environmental impact and recyclability.





Environmental impact of operations

At the end of the year 2000, the Volvo Group had 45 majority-owned production plants around the world. The environmental impact of these facilities and the environmental programmes conducted by them vary depending on the nature of the operation concerned, the size of the plant, local conditions and the length of time the plant in question has belonged to the Volvo Group.

In 2000, Group management decided to introduce a new, global environmental standard for production plants as a means of ensuring that environmental activities, especially in newly-acquired, but also in existing plants, achieve a minimum acceptable level of performance in accordance with Volvo's environmental policy and strategies. The standard focuses on a number of key areas, such as chemicals usage, energy and water consumption, emissions to air and water, waste and noise, and also specifies minimum requirements governing the organisation of environmental activities. The basic principle is that plant operations must, as a minimum, comply at all times with the stricter of the codes contained in local regulations or the Volvo Group's environmental standard. Most of the production plants have already implemented much more ambitious environmental programmes. Figures for the Group's total production-related environmental impact are presented on page 21. Detailed figures for each plant are available at www.volvo.com on the Internet.

Chemicals usage. To restrict the use of chemicals, the Volvo Group has, since 1996, maintained a 'black list' of prohibited chemicals and a 'grey list' of products whose use must be limited. A 'white list' of alternative products with a lower environmental impact was also adopted in 1997. To facilitate the choice of chemicals, Volvo maintains a database (MOTIV) containing detailed information on over 6,000 chemical products. In 2000, MOTIV was introduced in a new, user-friendly, web-based version, which is available globally on the Volvo intranet.

Minimum requirements, chemicals

- To survey the chemicals used in production
- To implement the requirements of the black list (Volvo Std. 1009.1)
- To work actively to replace the chemicals on the grey list (Volvo Std. 1009.11)

Energy consumption and carbon dioxide emissions. Most of the energy used in Volvo plants is consumed by heating and production processes. Efficient energy utilisation means both reducing costs and lowering emissions of atmospheric pollutants, especially of carbon dioxide, but also of other substances. In 2000, the Volvo Group's energy consumption totalled 1,656 GWh, a reduction of 159 GWh compared with the previous year. Emissions of carbon dioxide were reduced from approximately 184,000 tonnes to approximately 171,000 tonnes.

Minimum requirements, energy and CO₂

- To survey all major energy-consuming processes
- To implement efficiencies in energy utilisation on a continuous basis

Emissions of sulphur dioxide and nitrogen oxides. Emissions to atmosphere from Volvo plants can be attributed largely to energy production. In addition to carbon dioxide, these emissions contain substances such as sulphur dioxide and nitrogen oxides. The emissions can be reduced significantly by using low-sulphur fuels and/or installing purification equipment. Emissions of sulphur dioxide were cut from 77 tonnes in 1999 to approximately 59 tonnes in 2000, while nitrogen oxides were reduced from 478 to 463 tonnes.

Minimum requirements, sulphur and NO_x

- The sulphur content of the fuel must not exceed: Oil 1%, natural gas 0%, coal 1%, biomass 0.05%
 - Nitrogen oxide emissions must not exceed: Oil 150 ml/MJ, natural gas 70 ml/MJ, biomass 100 ml/MJ, TO 100 mg/m³
- TO = Thermal oxidiser (combustion chamber)

Emissions of solvents (VOCs). The continuous emission of solvents from painting and surface treatment processes is a high-priority issue and is subject to statutory control in most countries. In 2000, solvent emissions totalled 1,422 tonnes, representing an increase of 90 tonnes over the previous year.

Minimum requirements, (VOCs)

- To prepare a plan for handling solvents
- To work continuously to reduce solvent emissions

Emissions to water. All of Volvo's majority-owned plants have either installed their own treatment facilities or discharge their effluents to external treatment plants. More and more plants are also installing closed process water systems. The new standard specifies maximum permissible values for emissions of various metals, as well as treatment requirements for organic impurities. During the year, water consumption was reduced from 4,680,000 m³ to 4,314,000 m³.

Minimum requirements, water

- Concentrations of metal impurities in water discharged from Volvo production plants must not exceed the following values (mg/l): Cadmium 0.1, mercury 0.05, chromium (total) 0.5, chromium (hexavalent) 0.1, lead 0.1, nickel 0.5, silver 0.1, tin 2, copper 0.5, free cyanide 0.2, halogens (F, Cl, Br, I) 0.1
- Process water with an organic content must be treated chemically or by an equivalent method. The feasibility of introducing further treatment should be examined.

Waste. Waste is usually classified as hazardous and non-hazardous, although the definitions vary from country to country. The quantity of hazardous waste totalled 17,170 tonnes, an increase of 10% compared with the previous year. The increase is due to changes in national definitions of what constitutes hazardous waste.

Minimum requirements, waste

- To sort and quantify all waste at source
- To implement measures to:
 - reduce the quantity of waste
 - to increase reuse, material recycling and energy recovery
 - to reduce the quantity of waste consigned to landfill

Noise. Noise levels from most Volvo plants are either extremely low or non-existent. The target is to ensure that the external noise level measured at the nearest residential property does not exceed 60 dB(A).

Organisation. An effective local organisation is needed to ensure that work in the plant proceeds as laid down in the Group's environmental standard. As of 31 December 2000, thirty-seven units were certified under ISO 14001.

Minimum requirements, organisation

- To define environmental goals and measures
- To implement an environmental management system
- To assess the environmental impact of new projects and to examine ways of reducing such impact
- To apply the Group's environmental requirements to suppliers and contractors

Environmental audits. Twenty-three environmental audits were carried out during the year. This completes the auditing of all majority-owned plants which comprised part of the Volvo Group as of 31 December 2000. Environmental audits carried out since 1989 have resulted in cleanup measures to a total value of SEK50 million, including SEK4 million in 2000. Risk evaluation of a plant's operation is carried out under the direction of the Group's environmental auditor as part of an environmental audit. A detailed environmental review of operations was carried out prior to the acquisition of Renault V.I. and Mack Trucks, Inc. Volvo holds environment-related insurance against damage to the immediate environment caused by accidental pollutant discharges. Applicable throughout the world, with the exception of North America, these policies cover Volvo against personal injuries and third-party property damage for which the company may be held liable.

Operating licences. At 31 December 2000, Volvo production plants worldwide numbered 45, including 16 in Sweden. All of these facilities hold the necessary operating licences, three of which fall due for renewal in 2001. The Swedish licence conditions govern emissions to air, water and soil, as well as waste production and noise pollution. Conducted by its various business areas, the Group's operations comprise the production and assembly of trucks, buses, construction equipment, marine & industrial power systems and aerospace products.

Volvo's transport operations

Transport movements to and from the Volvo Group's production plants and dealer outlets around the world generate a higher level of atmospheric emissions than the operations of the facilities themselves. Together with efficiency and cost, therefore, environmental impact is a major selection criterion in the purchase of transport services.

Environmental calculation program. The environmental calculation program developed by Volvo Logistics (formerly Volvo Transport) in 1999 was used for the first time in 2000. Including factors for calculating emissions, as well as environment-related information from different transport companies, the program makes it easier to compare the environmental impact of different transport options. Information on safety procedures and the handling of hazardous goods is also included. The information is updated annually by carrying out a survey among the transport companies employed by Volvo Logistics.

Continuous improvement. Volvo Logistics assesses the environmental activities of carriers on a continuous basis, with the aim of stimulating ongoing environmental improvement. Every new supplier's agreement includes an environmental clause under which the carrier undertakes to operate in compliance with ISO 9000 and ISO 14001, and with Volvo's black and grey lists. At the end of 2000, approximately 20% of Volvo Logistics suppliers were certified in accordance with ISO 14001.

Volvo Logistics Environment Prize. Volvo Logistics awards an environment prize annually to one of its haulage suppliers. The 2000 prize was awarded to the Silja Line for its environmental certification, and for the use of low-sulphur fuel and exhaust gas treatment facilities on its vessels.



Global basis for local activities

Although Volvo's environmental programmes are founded on the same basis everywhere in the world, each country also undertakes a series of individual initiatives based on local and national conditions. The following examples from India, Brazil and Mexico illustrate the various ways in which Volvo is involved in communal and environmental issues, in parallel with the everyday task of reducing the environmental impact of its operations and products.

“Our concept enables the same transport work to be carried out with 80% fewer emissions and half the fuel consumption.”

Brigadier Wadhawan, Training Manager, Volvo India.



Volvo has been producing trucks and trailers for the huge Indian market at Hosakote, outside Bangalore, since 1998. Water is a scarce resource in this area and conservation of the limited supplies is vital – a fact which strongly influenced the design of Volvo's production plant.

“Minimising water consumption is one of our highest priorities. This applies equally to water for industrial process and sanitation,” says John Condos, Vice President, Industry. “For example, closed processes enable us to recirculate almost 80% of the water used in the paint shop.”

After treatment, water from the plant's toilets, showers, canteens and restaurants is used to irrigate almost four hectares of land. To minimise the consumption of groundwater and reduce soil erosion, rainwater is also collected in a system of dams and culverts.

“The authorities appreciate our efforts and are recommending other companies to install similar systems.”

At present, the plant is surrounded by eucalyptus plantations which require a great deal of watering.

“For this reason, we have begun to replace these with other species which are much more suited to the local climate,” adds John Condos. “Extending the green areas around the plant was also the focal point of our celebrations for World Environment Day on 5 June 2000.”

Environmental training for new employees. Volvo India as a whole received its ISO 14001 certification in February 2001 and awareness of environmental issues among its personnel is high. Environmental information forms a natural part of the induction programme for new employees, while environmental issues are included as naturally as safety in the week-long driver training programme which the company offers its customers.

“Reducing the environmental impact of our rapidly growing traffic is absolutely essential,” believes Training Manager Brigadier Wadhawan. “In this area, the potential for improvement offered by cleaner engines and fuels, together with drivers with better training and more efficient engines, is enormous. Multi-axle truck and trailer rigs can be used to move as much cargo as four or five of the trucks normally used in India. Considering that Volvo trucks are also more fuel-efficient and less polluting, you get an excellent idea of the degree of improvement which is possible. Our concept enables the same transport work to be carried out with 80% fewer emissions and half the fuel consumption.”



“The children who have seen it will never forget!”

Érico Merenda from São Paulo is one of almost 6,000 people who have seen – and been moved – by Volvo’s theatre roadshow, which is aimed at curbing Brazil’s illegal trade in wild animals.



“The aim of our latest project – Caravana Ecológica – is to curb the illegal trade in wild animals,” explains Antonio Carlos Morassutti, director of corporate affairs at Volvo do Brasil. In this context, truck drivers are an important, although often innocent, link in the chain in which animals are removed from their natural habitats. “We undertake various activities, such as a theatre roadshow designed mainly for truck drivers, but also for children and young people, to increase public awareness of the problems and make the trade more difficult.”

Drivers also comprise one of the most important target groups of the traffic safety campaign which Volvo has been conducting since 1987. This includes the use of seminars, training and information campaigns to successively raise national awareness of traffic and safety issues – an approach which is now something of a standard in Brazil. Volvo and its employees have also established a foundation which provides street children with an opportunity of living in a secure environment in foster homes, and promises them a better future through health care and education.

ISO 14001. Volvo do Brasil is one of the biggest producers of heavy trucks and buses in South America. The company has been certified under ISO 14001 since November 2000, while continuous environ-

mental improvements are being implemented in its production plant in Curitiba.

“We are working continuously to cut our emissions to air and water, and to reduce our quantities of industrial waste,” comments Antonio Carlos Morassutti. “We are already recovering a considerable proportion of our solvents and new painting technologies currently under study should enable us to achieve further emission reductions of a significant order.”

What of the environmental standards of the products? Current environmental legislation applicable to heavy vehicles in Brazil is the equivalent of Euro 2 and discussions regarding the introduction of Euro 3 – the standard which will apply in the EU from October 2001 on – are under way at present.

“Our vehicles naturally comply with the current legislation,” says Antonio Carlos Morassutti. “Furthermore, they have a low fuel consumption. Customers who wish to operate their vehicles more efficiently can avail of services such as Volvo’s Dynafleet transport information system and our comprehensive driver training programme. We will expand our training activities in 2001, with the focus on safety, economy and the environment.”

“Volvo offers the standards of quality, safety and environmental care that we need to be competitive in the passenger transport business in Mexico.”

Rafael Herrera, President of IAMSA, which placed an order for 900 Volvo buses in 1999.



Volvo took over the Mexican busbuilder, MASA, in 1998. A year later, it signed the biggest single contract in the company’s history when the IAMSA consortium, consisting of two of Mexico’s leading intercity bus operators, Grupo Tuloca and Flecha Amarilla, placed a single order for 900 Volvo 7550s for their intercity services.

“The Volvo buses are ideal for renewing our intercity fleet because of their competitive advantages over other makes”, commented Rafael Herrera, president of the consortium, when the contract was signed. “Volvo Bus de México was chosen following a series of visits to producers of chassis and complete buses in various countries. Our decision to buy 900 Volvo 7550s was based largely on the support and backup provided by Volvo, which offers the standards of quality, safety and environmental care that we need to be competitive in the passenger transport business in Mexico.”

Over 90% travel by bus. The buses in question are well-equipped, long-distance models featuring European design and engineering. Buses carry over 90% of all intercity passenger traffic in Mexico and the national fleet is of a uniformly high standard, resulting in fierce competition between busbuilders.

“Volvo is a leader in the field, especially from an environmental perspective”, comments Oswaldo Tuacek, President of VolvoMASA. “For example, we are now using engines complying with US00, the new US emission control standard (which is equivalent to Euro 3). This means

that the new buses will also be approved for service in the centre of Mexico City, where particularly stringent emission control limits have been imposed to alleviate the capital’s acute pollution problems.”

The authorities in Mexico City have also displayed an interest in Volvo’s natural gas-powered city buses as a means of improving the quality of the city’s air.

As in Oswaldo’s homeland, Brazil, Volvo Bus de México provides training programmes which teach drivers to drive in an environmentally-aware and fuel-efficient manner. An incentive programme has also been introduced to encourage economic driving behaviour.

USD25 million. Major environmental improvements have also been implemented in the plant itself.

“We have invested approximately USD25 million to date,” says Oswaldo Tuacek. “Among other things, the money has been used to build a new, modern paint shop equipped with the same environmentally compatible technology as in Europe. To obtain a total picture of our environmental impact, we have also introduced a new system permitting more precise measurement and documentation. Our major investment in plant facilities has also resulted in a significant improvement in the working environment, accompanied by a major increase in the workforce. Personnel numbers grew by 35% during the first half of 2000 and about 2,300 people are employed here at present, making Volvo one of the most important employers in the region.”



Environmental data for products and operations

Emissions and statutory limits

Emission values and limits for heavy trucks and buses, g/kWh

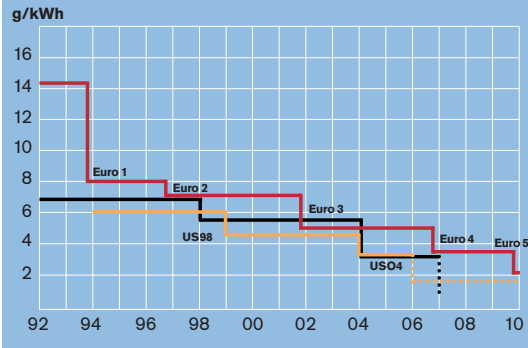
	CO	NO _x	HC	PM
1996 Euro 2	4.0	7.0	1.1	0.15
2001 Euro 3	2.1	5.0	0.66	0.10
Diesel engine ¹	0.6	4.5	0.2	0.06
Diesel engine with Volvo exhaust filter ¹	<0.1	4.5	<0.05	<0.02
Natural gas engine with catalytic converter ²	<1.0	2.0	<1.0 ³	<0.02

¹ Typical Volvo 7-litre engine (Euro 3) running on Swedish Environmental Class 1 diesel fuel (max. sulphur content 10 ppm)

² As per ECE R49 test cycle. Emission values may vary somewhat depending on gas quality.

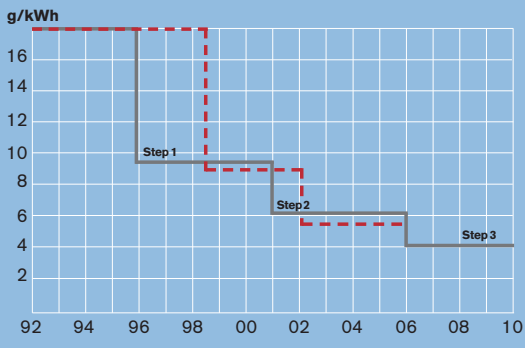
³ Mainly methane

Statutory limits on nitrogen oxide emissions from heavy trucks and buses



- EU
- USA
- USA, not finalised
- Japan
- Japan, not finalised

Nitrogen oxide emission limits for construction equipment (225-450 kW)



- USA
- - - EU

Legislation controlling emissions from construction equipment will be tightened in both the USA and EU in the early years of the 21st century.

Emission values and limits for marine and mobile diesel engines, g/kWh

	CO	NO _x + HC	PM
Modern marine diesel engine	0.5	7.5	0.3
EU/USA 2004*	3.5	7.2	0.2

	CO	NO _x	HC	PM
Modern mobile diesel engine	0.6	6.3	0.25	0.08
EU/USA 2002	3.5	6.0	1.0	0.2

* Proposal

Emission limits for stationary gas turbines

	NO _x
Diesel operation	< 42 ppm*
Natural gas operation	25 ppm**

Both values applicable at 15% oxygen

* Federal USA

** Benchmark value. Volvo Aero has commenced the marketing of gas turbines complying with the specified limits.

Alternative fuels and propulsion systems tested by Volvo

	VTC	VBC	VCE	VP	VAC
Natural gas	4*	4*	1	1	4
Biogas	4*	4*	1	1	2
LPG	1	3**	0	0	0
Ethanol	3	3**	2	2	3
Methanol	2	2	2	2	0
RME	2	2	2	2	0
DME	2****	2****	0	0	0
Hydrogen/fuel cell	2***	2****	0	0	0
Hybrids	3	3	1	1	3*****

4 = Commercial production 3 = Field testing

2 = Laboratory-tested 1 = Feasibility study

0 = No activity

* In certain markets, depending on gas quality

** Local modification, no factory-fitted option

*** Synergies through laboratory testing by Volvo Technological Development

**** Internal concept vehicle developed

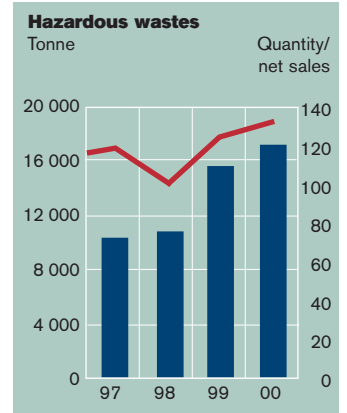
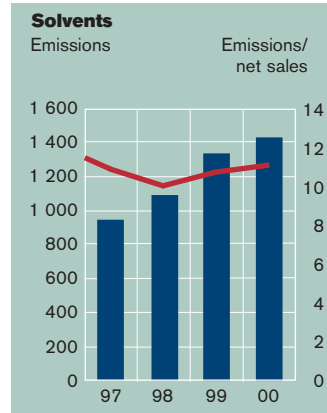
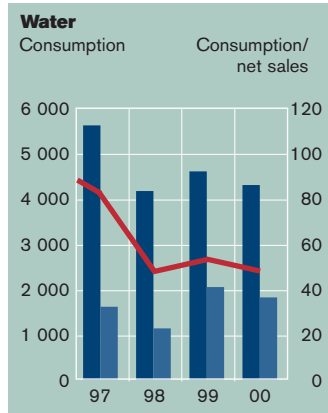
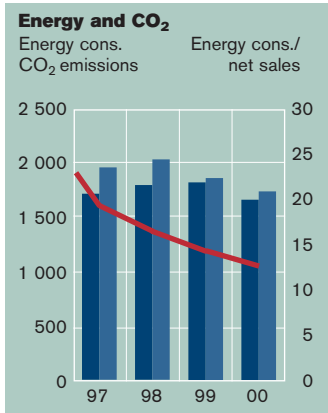
***** Tests by Turbec AB (50% Volvo-owned)

VTC: Volvo Trucks VBC: Volvo Buses VCE: Volvo Construction Equipment VP: Volvo Penta

VAC: Volvo Aero



Environmental data for Volvo production plants



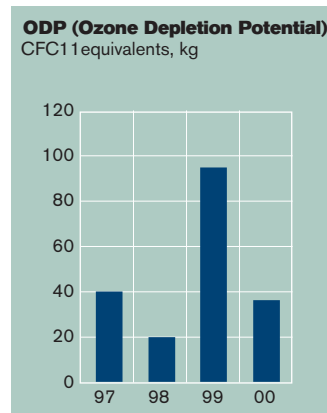
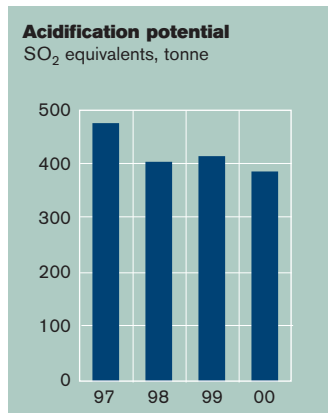
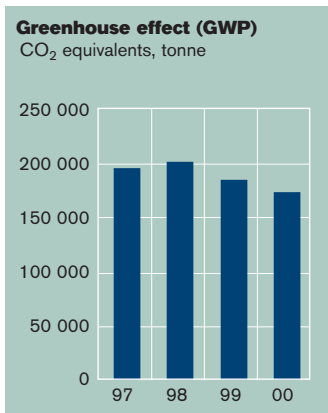
■ Energy consumption (GWh)
■ CO₂ emissions (tonne x 100)
■ Energy consumption/net sales (MWh/MSEK)

■ Cooling water (m³ x 1000)
■ Process water (m³ x 1000)
■ Consumption/net sales (m³/MSEK)

■ Emissions (tonne)
■ Emissions/net sales (kg/MSEK)

■ Hazardous wastes (tonne)
■ Quantity/net sales (kg/MSEK)

The charts indicate total figures (as at 31 December 2000) for all of Volvo's majority-owned production plants worldwide. Figures for 1997 and 1998 do not include Volvo Cars, which was part of the Volvo Group at that time.



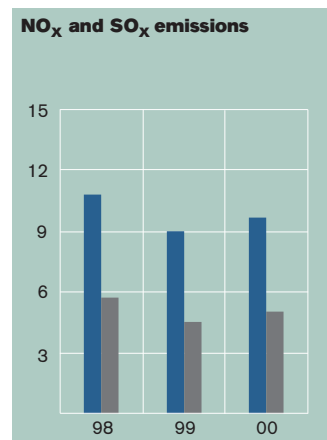
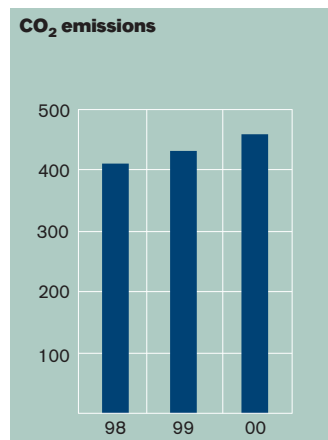
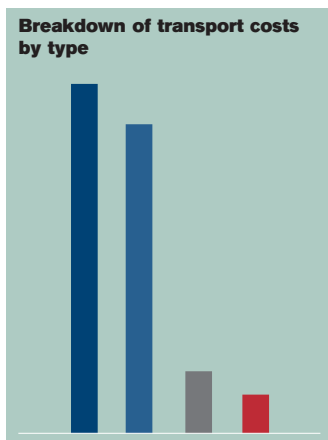
The chart shows the combined contribution to the greenhouse effect of CO₂, CFC compounds and halons, expressed in tonnes of CO₂ equivalents with the aid of GWP factors (GWP 100). CO₂ has a factor of 1, CFCs (CFC 12) a factor of 8,500, HCFCs (HCFC 22) a factor of 1,700 and halons (halon 1301) a factor of 5,600. CO₂ emissions are based on the quantity of fossil fuels (oil and gas) used in Volvo's own plants. GWP= Global Warming Potential

Combined contribution to acidification of SO₂ and NO_x, expressed in tonnes of SO₂ equivalents with the aid of acidification potential factors. SO₂ has a factor of 1 and NO_x (NO₂) a factor of 0.7.

Contribution of CFCs and halons to ozone depletion, expressed in tonnes of CFC11 equivalents with the aid of ODP factors. CFCs (CFC 12) have a factor of 0.82, HCFCs (HCFC 22) a factor of 0.04 and halons (halon 1301) a factor of 12. ODP= Ozone Depletion Potential

The above charts refer to the environmental impact of production activities. Reference for equivalence factors: Wenzel, H., Hauschild, M. and Alting, L. Figures for 1997 and 1998 do not include Volvo Cars, which was part of the Volvo Group at that time. Maintenance of catering refrigeration equipment in Brazilian production plants necessitated additional CFC usage of 60 and 10 kg in 1999 and 2000 respectively.

Environmental data for transport purchased by Volvo Logistics



■ Road 46%
■ Water 41%
■ Air 8%
■ Rail 5%

■ CO₂ (tonne x 1000)

■ NO_x (tonne x 1000)
■ SO_x (tonne x 1000)

Figures include transport operations carried out for Volvo Cars.

Emissions from transport purchased by Volvo Logistics increased somewhat between 1999 and 2000. This is attributable mainly to higher turnover. A further reason for the increase is that the 2000 figures include actual emissions from shipping vessels, which have proved to be higher than the theoretically calculated values used earlier.



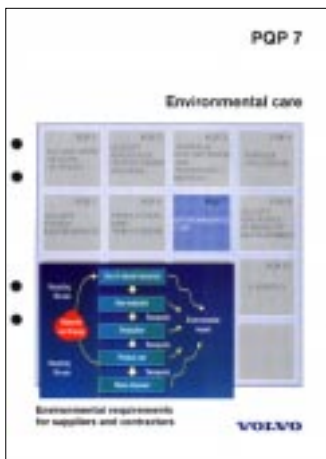
Environmental information from Volvo

Published annually since 1991 as a complement to the annual report, the Volvo environmental report deals with the Group's global automotive and transport equipment operations. Its main purpose is to inform public bodies, customers, employees and other interested parties of Volvo's environmental activities. Environment-related financial information is included in the Volvo Group's annual report. The print version of Volvo Environmental Report 2000 is published in English, Swedish and French. The report is also published in German, Spanish and Portuguese at www.volvo.com on the Internet, together with detailed environmental data from Volvo's majority-owned production plants. This site also includes a list of Volvo's other environmental publications,

together with a glossary. The same content is published on Violin, the Volvo internal communications network (or intranet). Volvo's EMAS-registered plants publish their own annual environmental reports. Working environment issues are not dealt with in the Volvo environmental report; further information on these is available from the respective business areas. For information regarding Group-wide environmental programmes, please contact Environmental and Public Affairs, AB Volvo by telephone at +46-31-59 11 31, by fax at +46-31-59 10 44 or by e-mail at environment@volvo.com. Alternatively, you may contact any of the persons listed on the following page.



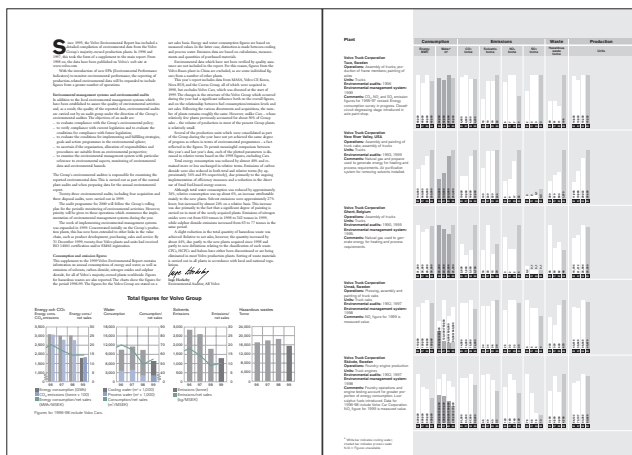
Further environmental information is available at www.volvo.com on the Internet. Click on 'The Volvo Group' and select 'Quality, Safety, Environment'.



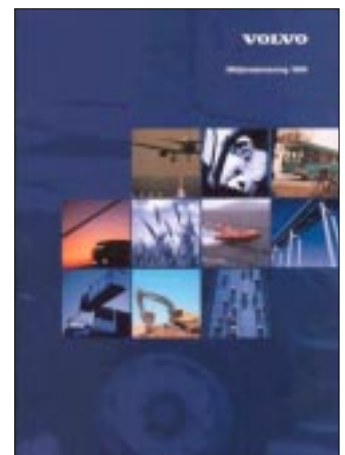
Environmental requirements for suppliers and contractors

Black list

Grey list



Environmental data from Volvo Group production plants



Volvo Environmental Report 1999

Further environmental information, including a detailed review of the environmental impact of Volvo's majority-owned production plants, environmental requirements for suppliers, Volvo's black and grey lists, and previous environmental reports, is available at www.volvo.com on the Internet.

Persons to contact

A new business area, Volvo Global Trucks, with responsibility for the Group's combined truck operations, was formed following Volvo's acquisition of Renault V.I. and Mack Trucks, Inc. in January 2001. Environmental affairs for the new business area are handled by the Environmental and Public Affairs department at the Volvo Group headquarters.

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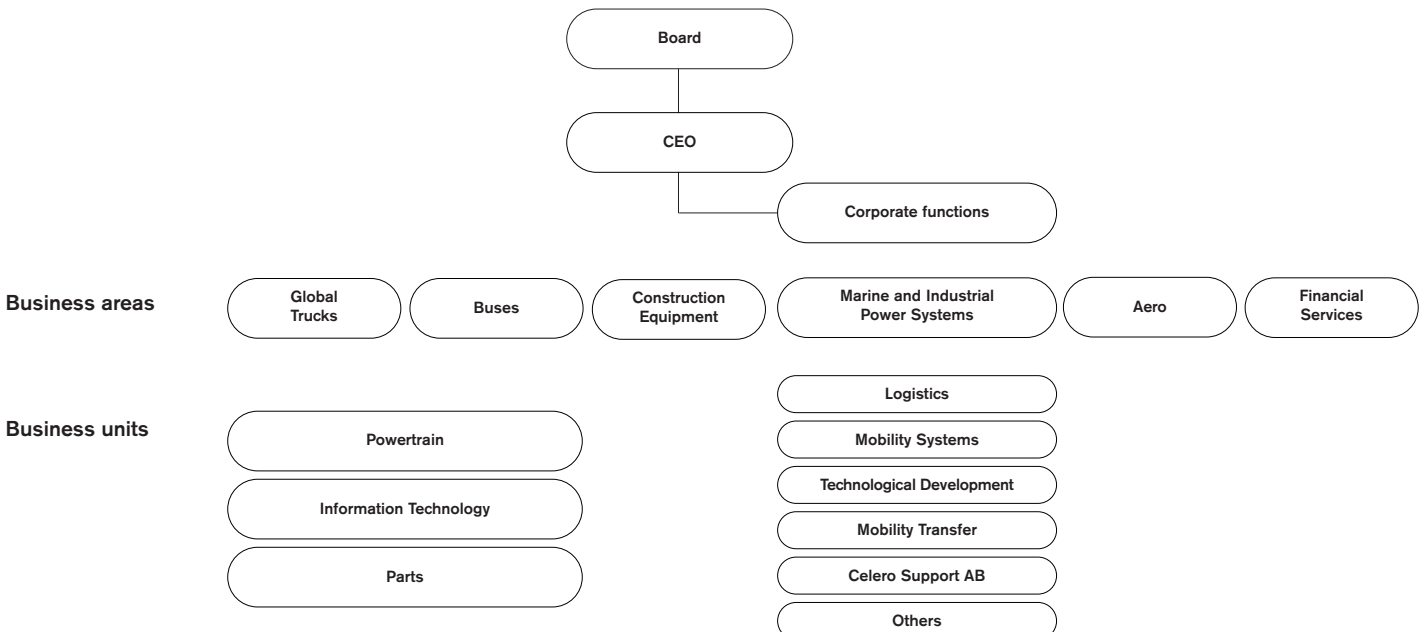
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Volvo Group organisation as of January 2001





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