MINISTRY OF THE ENVIRONMENT

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Finlands´s Natural Resources and the Environment 1998

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Foreword

The extensive programme approved at the UN Development and Environment Conference held in Rio de Janeiro in 1992 (Agenda 21) endeavours to define broadly the measures required for implementing a policy of sustainable development. It was stated at the follow-up meeting (UNGASS) in New York in summer 1997, however, that practical implementation of the programme should be enhanced considerably in order to bring us closer to a sustainable future. The final communiqué issued by that meeting pointed to changes in production methods and consumption habits as the major challenge for sustainable development in the industrialised countries. The sparing exploitation of natural resources and "qualitative" economic growth are emerging as concrete aims in this respect, alongside restrictions on greenhouse gas emissions.

The EU environmental programme defines ecologically sustainable development as one of the Union's major objectives. This means that economic development should take place within the carrying capacity of the natural environment. As a member of the EU and UN, Finland has committed itself to the objectives of sustainable development, which means combining ecological, social and economic sustainability in all social functions and at all levels of decision-making. The chief aim laid down in the Finnish government's resolution announced in spring 1998 was to strengthen the principles of sustainable development in the various sectors of society and to ensure high-quality environmental protection. This objective is essentially connected with the drawing up of an environmental accounting system within the national and public sector economy and with the process of assessing environmental impacts. This volume 'Natural Resources and the Environment 1998' continues the practise, initiated in 1994, of assessing the state of the nation's natural resources and environment in connection with the draft proposal for the next year's budget.

This review was compiled by a working group appointed by the Ministry of the Environment and chaired by Markku Nurmi, head of department at the Ministry of the Environment, the other members of which were Heikki Sourama and Pekka Pelkonen, consultant civil servants at the Ministry of Finance, Anna Mälkönen, senior inspector at the Ministry of Agriculture and Forestry, Esa Hyvärinen, senior inspector at the Ministry of Trade and Industry, Maria Rautavirta, inspector at the Ministry of Transport and Communications, and Jarmo Muurman, senior inspector, and Pirkko Isoviita, head of forest management, at the Ministry of the Environment. The secretaries to the working group were Jukka Hoffrén of Statistics Finland and Harriet Lonka, geologist, and Kimmo Silvo, limnologist, at the Centre for the Environment. The project was financed by the Ministry of the Environment.

Helsinki, September 1998

for the Ministry of the Environment

Minister of the Environment
Pekka Haavisto

Statistics Finland

Director General
Timo Relander

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1. The national economy and the environment

Development of an international environmental policy

The policy of sustainable development, defined at the Environment and Development Conference held in Rio de Janeiro in summer 1992, acts to a great extent as a point of departure for both international and national environmental policies at the present time. This has been particularly so since the nations confirmed their commitments to the Rio aims at a follow-up meeting, the United Nations General Assembly Special Session (UNGASS) on sustainable development, in summer 1997.

The first legally binding global agreement on reducing greenhouse gas emissions in the face of the threat of climatic change was concluded at the UN Climate Meeting in Kyoto, Japan, in December 1997. This agreement, which covers 160 countries, states that the industrialised countries should reduce their greenhouse gas emissions by an average of 5.2 per cent from the 1990 level in the next 15 years, the requirement for the United States being seven per cent, that for the EU countries eight per cent and that for Japan six per cent. No requirements of this kind were defined for the developing countries, however. It is predicted that the agreement will slow down the progress of the greenhouse effect slightly. The industrialised countries were unwilling to accept greater cuts because of a fear of impaired economic growth and competitiveness, nor were the developing countries prepared to sacrifice their economic development prospects for this purpose.

The meeting also approved the notion of trading in emission quotas, principles for which will be agreed on at Buenos Aires in Autumn 1998. Basically, this will mean that the emission reductions achieved by one country can be purchased by others in order to reach their own reduction targets. According to EU Commission calculations, the reduction of greenhouse gas emissions in its member countries to the level agreed on in Kyoto will cost some FIM 90,000-120,000 million. Estimates of the total economic effects on GDP vary between +1 and -1.5 per cent.

The final communiqué of the United Nations General Assembly Special Session (UNGASS) mentioned changes in production methods and consumption habits in the industrialised countries as the most important step towards attaining sustainable development. The concept of eco-efficiency, which combines environment policy aims with the sparing utilisation of natural resources, is now emerging as the concrete objective in this respect. The aim is to reduce the use of raw-materials so as to minimise detrimental environmental effects in terms of pollution and waste etc. which exceed the finite carrying capacity of the global ecosystem. At present the consumption of raw materials exceeds this carrying capacity in the industrialised countries in particular. It has been proposed that the general objective in the medium term, i.e. over the next 20-30 years, should be to reduce the inputs of natural resources, raw materials and energy per unit of production to one fourth of the present level. This is known as the Factor 4 Objective, while in the long-term, over 30-50 years, a Factor 10 Objective should apply, requiring a reduction to one tenth of the present level. These factors serve well to express the direction and order of magnitude of the changes that are called for, and it should be quite possible in both technical and economic terms for the industrialised

countries to improve material utilisation efficiency in this way.

It is also noted in the UNGASS final communiqué that the questions of how realistic this eco-efficiency aim is and by what means it can be achieved will constitute important topics for future research. Such objectives that require changes in production methods and consumption habits pose a major challenge in many ways, in view of the trend towards globalisation and free trade. The draft MAI investment agreement which is being prepared by the OECD and is aimed at achieving greater freedom in world trade contains many principles which are at variance with those of environmental protection.

The European Union has acted as a leading group in promoting measures conforming to the Agenda 21 policy in international forums, e.g. at the New York and Kyoto meetings. The fifth EU environmental programme, entitled 'Towards sustainable development', similarly quotes ecologically sustainable development as its fundamental aim. It has been estimated that the EU has made progress in reducing some adverse environmental effects, though not to a extent sufficient for securing a sound state of the environment in the member countries or promoting sustainable development as such.

The EU introduced the Northern Dimension as an official objective in 1997, partly in the hope that it would contribute to the standards of environmental protection in the Baltic Countries and Northern Russia in particular. Another instance committed to promoting environmental protection and sustainable development in Northern Europe is the Arctic Council, set up in September 1996 and comprising representatives from the Nordic Countries, Russia, Canada and the United States. This is intended to continue the "Rovaniemi process", launched on Finland's initiative in 1991, which was likewise aimed at improving standards of environmental protection in the north. Another body dedicated to promoting environmental protection and the sustainable use of natural resources in the Nordic Countries and NW Russia is the Barents Euro-Arctic Council, established in 1993.

Instruments of environmental protection

It is laid down in Finnish government policy that the principles of sustainable development should be strengthened in the various sectors of society by the beginning of the new millennium, particularly as regards the management of natural resources and the environment. The programme includes a number of guidelines and policies concerning natural resources, energy, agriculture and transport, for example, all of which are connected with the environment and sustainable development. A Committee on Sustainable Development was set up in Finland after the Rio de Janeiro meeting to act as an instrument for promoting sustainable development, a discussion forum and a body for putting forward new initiatives for consideration by government committees. The term of office of this committee, headed by the prime minister, was extended in spring 1998 to the end of the year 2002, to coincide with the five-year programme of the UN Committee on Sustainable Development.

According to the resolutions of the Rio de Janeiro Environment and Development Conference, all countries should have developed a sustainable development strategy of their own by the year 2002. Finland was in fact one of the first countries to compile such a programme, a government bill to this effect being approved in June 1998. The major objectives laid down in it include the slowing down of climatic changes, alterations in production methods and consumption habits, a reduction in the use

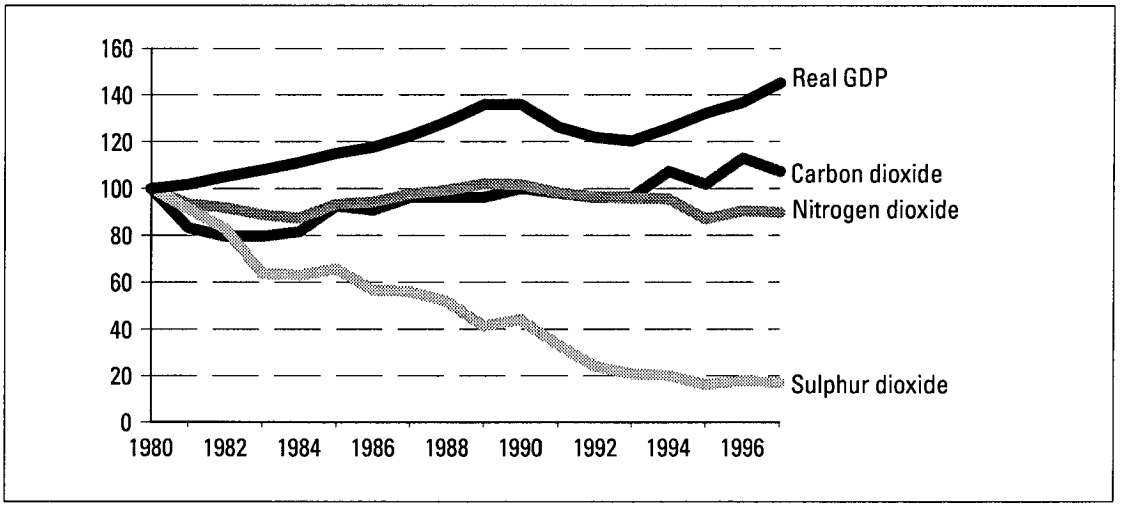
of non-renewable natural resources and the maintaining of biodiversity. The various branches of the administration are due to report to the Committee on Sustainable Development on its implementation by summer 2001.

Governmental control in this field has been developed in the last few years by reforming the Waste Disposal Act (1994), Forest Act (1997), Nature Conservation Act (1997) and Extractable Land Resources Act (1997) to conform to the principles of sustainable development. The Building Act is now being revised to the same effect and an Environmental Protection Act is in preparation. An programme of objectives for the protection of water areas was also completed in March 1998, to cover the period up to the year 2005. This focuses in particular on agricultural emissions, aiming at cutting down phosphorus and nitrogen loading, major sources of eutrophication, by a half from the levels recorded in the early 1990's. The aim of the EU Nitrate Directive is similarly to reduce nitrate nitrogen loading from agriculture, which is apt to cause eutrophication in lakes and rivers. The obligations laid down in this directive were implemented in Finland by means of a decision issued by the Council of State in April 1998. Approved by the Council of State, the National Waste Plan until the year 2005, in accordance with the Waste Act, came into force in August 1998.

In addition to legislative restrictions, various economic instruments of control such as environmental taxes and voluntary instruments such as environmental markings on goods and informal agreements over environmental standards have been introduced during the 1990's. On the other hand, it has been emphasised in industrial circlers in particular in the last few years that Finland should not proceed any more quickly than other countries in introducing environmental taxes, so as to maintain international competitiveness and prevent investment capital from drifting overseas. Direct environmental expenditure in Finland has amounted to some 1.7% of GDP in the last few years.

No extensive shift in the focus of taxation towards conservation of the environment has taken place in any country, mainly due to the vastly wider scope of the taxation base for incomes relative to that for any imaginable form of environmental tax. Besides, high environmental taxes could lead to the relocation of functions in other countries. This empha-

Figure 1. Trends in real GDP and atmospheric emissions in Finland (1980=100)



1. State taxes and payments concerned with the environment (FIM million)

	1993	1994	1995	1996	1997	1998	1999
	R	R	R	R	R	B	BP
Alcoholic beverages surtax (disposable drinks packaging tax)	16	48	88	52	50	50	50
Soft drink surtax	19	16	15	9	9	9	9
Fertilizer tax	516	267	–	–	–	–	–
Pesticide fee	6	6	6	6	6	6	6
Electricity tax	656	56	–	–	–	–	–
Energy taxes, of which	8 404	9 815	11 628	12 714	13 895	15 170	16 300
Carbon dioxide component	*1 005*	*1 140*	*1 488*	*1 375*	..	..	..
Energy component	–	*760*	*791*	*890*	..	..	..
Basic tax	*7 399*	*7 915*	*9 349*	*10 449*	..	..	..
Oil waste tax	21	19	21	20	20	20	20
Motor vehicle tax	1 609	2 054	2 685	3 611	4 210	4 500	5 300
Charter flight tax	111	80	–	–	–	–	–
Water protection tax	2	2	3	3	2	3	3
Oil pollution control fee	34	31	34	29	33	32	32
Vehicle licence tax ("sticker tax")	–	618	1 046	1 110	1 129	1 140	1 120
Vehicle fuel tax ("diesel tax")	885	844	668	929	979	900	1 000
Waste tax	–	–	–	41	127	200	170
Total	**12 279**	**13 856**	**16 194**	**18 524**	**20 460**	**22 030**	**24 010**

R = Final accounts B = Budget BP = Budget proposal – = not in use .. = data missing

sises the need for international cooperation and a broad economic approach when introducing forms of environmental taxation. It is impossible to assess the effects of changes in the focus of taxation upon the nation's economy in general, since these are dependent on a wide range of economic mechanisms.

The most recent environmental tax to be introduced is the waste tax, which is levied on all waste transported to public refuse dumps with the exception of sand, gravel, rock material and biodegradable waste etc. An extension to the scope of the tax is currently under consideration. Among the most recently introduced recycling systems are those for used car tyres, funded by a recycling fee included in the price of the tyre, and a system for thee recovery and re-utilisation of packaging materials. Deposits are already payable on glass bottles and drinks cans.

All taxes and fees which have an obvious regulatory impact on the state of the environment may be regarded as environmental taxes, though not all of these are itemised in the state budget. There is a separate fund for collecting an oil pollution control fee, for example. Many of these taxes and fees have been imposed for reasons other than environmental protection. The environmental taxes and fees with the most marked regulatory effect are the surtaxes levied on alcoholic beverages and soft drinks, the progressive nature of the environmental energy surtaxes, the waste oil disposal fee, the oil pollution control fee and the waste tax. Energy taxes will be discussed in more detail in Chapter 5 and transport taxes in Chapter 6.

Environmental protection in central government

In addition to economic and administrative instruments, a Government can seek to improve the state of the environment through its own environmental protection measures and in particular by pursuing an environment-conscious purchasing policy, as the public sector

is a major purchaser of industrial investment and consumer goods. Public sector purchases in Finland in 1996, for example, amounted to FIM 81,000 million, some 14 per cent of GDP. Environmental aspects can be taken into consideration in public sector purchases when determining the items to bee purchased and when drawing up the technical specifications. In addition, environmental effects and costs can be considered when assessing the overall profitability of alternative quotations, although still complying with the requirements of public accountability, including impartiality and non-discrimination.

The government administration plays an important role in conducting and funding environmental research and development. Environmental research is financed by the Academy of Finland, the Technology Development Centre and ministries acting in the environment, energy and natural resources sectors. In 1995, universities and institutions of higher education funded 56% of their research into natural resources and the environment from their own budget, while 20% of the funding came from the Academy of Finland, 11% from the ministries and 2% from the Technology Development Centre. The total

2. Government expenditure on environmental protection (FIM million)

	1992	1993	1994	1995	1996	1997	1998	1999**)
Environmental administration	391	355	378	430	457	472	480	505
Central government	*108*	*95*	*128*	*127*	*135*	*139*	*144*	*148*
Local government	*283*	*260*	*250*	*303*	*322*	*333*	*335*	*357*
Cooperation with neighbouring areas	86	55	57	57	57	62	64	63
Nordic environmental finance company	8	9	9	8	7	7	7	7
Research and development*)	610	620	675	737	754	860	870	908
Environmental conservation and management [1]	*209*	*202*	*229*	*190*	*202*	*204*	*213*	*210*
Use and management of natural resources [2]	*98*	*89*	*83*	*119*	*128*	*141*	*138*	*139*
Universities	*166*	*166*	*185*	*204*	*227*	*230*	*241*	*240*
Development of environmental technology [3]	*110*	*136*	*149*	*193*	*168*	*255*	*250*	*290*
Other environmental research [4]	*27*	*27*	*29*	*31*	*29*	*29*	*28*	*29*
Grants to non-government environmental organisations	6	6	6	6	6	6	6	5
Environmental protection	92	118	161	85	119	189	175	152
Clean air and waste management	*25*	*38*	*47*	*45*	*41*	*57*	*53*	*47*
Water protection	*24*	*25*	*22*	*8*	*33*	*32*	*14*	*13*
Environmental management and decontamination	*43*	*55*	*83*	*32*	*45*	*106*	*109*	*93*
Nature conservation	235	264	366	312	325	479	550	402
Promotion of energy saving	8	6	10	6	8	9	15	15
Environmental protection in transport*)	..	..	131	139	182	171	220	221
Rail transport	..	..	..	..	79	93	..	..
Manure pit investment support	47	55	84	–	80	65	47	19
Environmental support for agriculture	–	–	–	1 420	1 570	1 631	1 690	1 690
Basic support	–	–	–	*1 330*	*1 367*	*1 372*	*1 390*	*1 390*
Special support	–	–	–	*90*	*139*	*259*	*300*	*300*
Environmental support for forest management	–	–	–	–	10	15	15	15
Total	**1 483**	**1 488**	**1 877**	**3 200**	**3 654**	**4 060**	**4 139**	**4 002**

– = not in use .. = data missing *) = estimate **) = forecast

[1] Environmental Administration and the Academy of Finland [2] Agriculture and Forestry Administration
[3] Technical research [4] Other administrative sectors

expenditure of universities and institutions of higher education on environmental research in 1995 amounted to FIM 308 million, of which their own budget funding accounted for FIM 170 million and outside funding for FIM 138 million. The funding of the Academy of Finland, the ministries and the Technology Research Centre is not included in the figures in Table 2. Apart from their own budget funding, the expenditure of universities and institutions of higher education on research and development also includes funding from private sources, such as foundations, enterprises, etc.

Expenditure on environmental protection is mainly directed at improving the state of the environment and repairing environmental damage and takes the form of investment support for industry and grants to local councils. Nature conservation expenditure is intended for the purchase and management of nature conservation areas. The most significant item of government expenditure on protection of the environment is the environmental support paid to agriculture, the distribution and use of which will be discussed in more detail in Chapter 2.

Environmental protection by local councils

Local councils can do much to promote sustainable development through land use planning, education and the providing of proper operating conditions for enterprises. A total of some 700 persons were engaged in environmental duties, either full-time or part-time, in Finland's 455 local councils or their joint bodies in 1996. Only 172 local councils had not hired environmental experts at all. The Finnish Association of Local Councils adopted in March 1997 an action plan for sustainable development that extended to the year 2005. Local agenda projects for sustainable development are currently in progress in some 245 local councils which represent almost 80% of the country's population.

The local councils launched a campaign in autumn 1997 for reducing greenhouse gases as part of an international project for reducing such emissions in urban areas. The process already covers Finland's largest cities, notably Helsinki, Espoo, Vantaa, Tampere, Lahti, Oulu and Pori, and involves first drawing up a voluntary greenhouse gas balance and emission forecast for the towns for the next 10-20 years on the assumption that the current trend will continue, together with concrete policies for stemming the increase in emissions and eventually reducing them. Special attention will be paid to energy gener-

3. Local authority expenditure on environmental protection (FIM million)

	1993	1994	1995	1996	1997*)
Waste management					
Expenditure					
Investments	51	98	87	71	83
Operating costs	415	409	404	476	562
Water supplies					
Expenditure					
Waste water treatment					
Investments	287	224	203	216	266
Operating costs	849	768	760	668	785
Sewerage					
Investments	557	512	469	523	643
Operating costs	1 038	919	910	780	917
Energy generation					
Expenditure					
Clean air					
Investments	655	169	34	86	70
Operating costs	143	156	158	139	130
Environmental management					
Expenditure					
Investments	16	29	20	38	21
Operating costs	188	188	200	209	251
Total					
Expenditure					
Investments	1 666	1 032	813	934	1 083
Operating costs	2 633	2 440	2 432	2 272	2 645

*) = preliminary data

ation, transport, industrial plants and refuse dumps. The campaign will come to an end in the autumn of the year 2000.

Expenditure by local councils, their joint bodies and local authority companies on environmental protection is set out in Table 3. The bulk of this expenditure is on sewerage and waste water purification. The costs arising from waste management, sewerage and waste water treatment are for the most covered by the fees paid by users, but investments in these projects have to some extent been funded out of the national budget. Expenditure on environmental management is financed out of the local council tax revenues and through government grants.

Environmental health

According to a report published recently by the European Environment Agency (EEA) and the WHO, many environmental problems are clearly reflected in human health. The most difficult problems are those connected with air pollution, water contamination and traffic accidents.

Improved housing conditions, better nutrition, rising standards of hygiene and comprehensive vaccination programmes have contributed to a steady improvement in the health of the Finnish people in the 20th century, although at the same time there has been an obvious increase in the prevalence of asthma and various types of allergies. Thus where about 1% of the adult population reported having asthma in the 1960's, but the figure had risen to approximately 4% by 1995 (according to research by the National Institute of Health). It is not clear what exactly lies behind the increased prevalence of allergic diseases, but risk factors for their development evidently include smoking, poor quality indoor air and exposure to chemicals. It is believed that the risk of contracting asthma is increased by outdoor air pollutants, particularly traffic emissions.

When the Council of State defined guideline values for air quality in 1984, these were exceeded in many places at that time. The values were completely readjusted in the mid-1990's, however, and the figures recorded today are in line with these. Generally speaking, the quality of the outdoor air has improved considerably in cities where industry and energy generation have been the principal sources of pollution. Short-term peaks in nitrogen oxide emissions still occur in areas with busy traffic, although sulphur dioxide concentrations have dropped to as little as half of their 1980 levels in rural areas. Approximately 40% of the population are exposed to air pollution in built-up areas, and this has been estimated to lead to aggravations of asthma in some 30,000 persons a year and to airway infections in 30,000-40,000 children. Exposure to risk factors in the living environment in Finland is still low when compared with the situation in the industrialised areas of Europe.

The worst polluters of indoor air are smoking and traffic exhaust gases permeating from outside. The quality of the air is also essentially dependent on the building methods and materials used and on the ventilation provided. Health problems are caused not only by planning and building faults, but also by humidity and fungal growths arising from incorrect use of the premises. A number of research projects on the quality of indoor air have been supported in Finland in the last few years, the emphasis being on the measuring of organic emissions from building materials, the achieving of reductions in these and the developing of ventilation systems.

2 Natural resources

Reducing the exploitation of natural resources

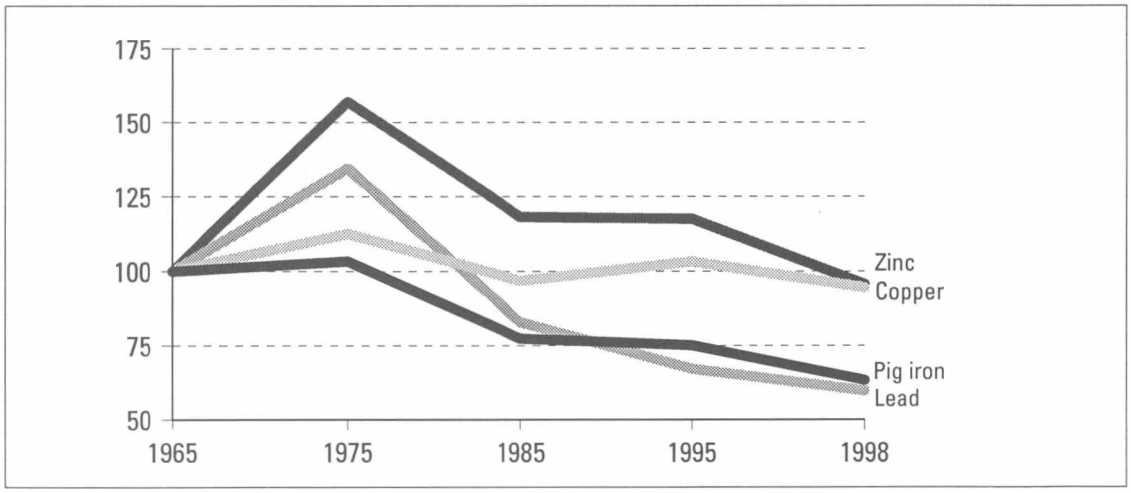
According to present knowledge, the exhausting of natural resources will not threaten continued economic growth, thanks to technological improvements, new discoveries and reassessments of existing resources. In fact rather than declining, the exploitation of natural resources has increased continuously and their prices have in most cases dropped in real terms during the 1980's and 1990's. This has been particularly true of metal and oil prices, although it should be noted that the mounting environmental problems caused by the use of fossil fuels and materials have emerged as a major environmental issue on account of the threat posed to the renewal and bearing capacities of our environment.

The current pricing system has not always able to take into consideration the external costs that arise from inadequate rights of ownership and utilisation, which are important from the point of general well-being, and this has led to inefficient use of these resources. A solution to the problems inherent in the pricing system is now being sought by introducing the concept of eco-efficiency, which combines the sparing use of natural resources and environmental policy objectives with economic efficiency, the essential aim being to derive greater affluence from the use of smaller quantities of natural resources and energy.

4. Sufficiency in the availability of certain metals, according to 1992 data on reserves and consumption (years)

	Sufficiency of known resources	Estimated sufficiency of all resources
Aluminium	207	252
Copper	33	62
Lead	23	47
Mercury	45	83
Potassium	59	137
Tin	41	59
Zinc	20	48
Iron ore	152	233

Figure 2. Trends in the world market prices of certain important metals (1965=100)



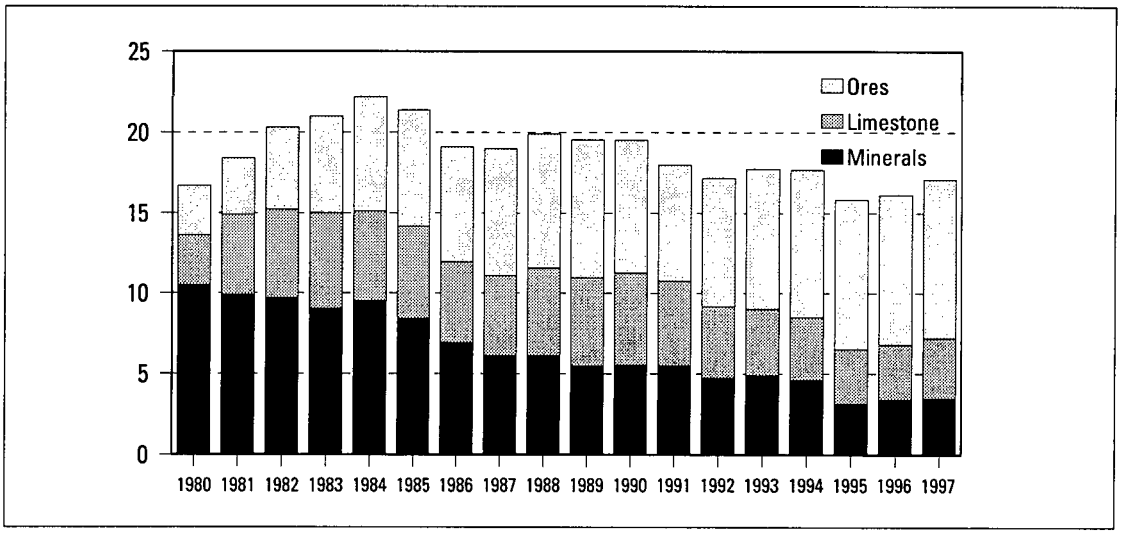
Finnish environmental policy as practised in earlier times did not pay much attention to overall quantitative reductions in the use of natural resources, the emphasis in environmental protection being instead on safeguarding biodiversity, preventing and reducing environmental hazards and ensuring the survival of ecosystems in the face of the exploitation of natural resources. Control over the use of natural resources is exercise by legislative means, e.g. through the Nature Protection and Forest Acts and the Water, Extractable Land Resources and Mining Acts, and also the Refuse Disposal Act as far as the waste arising from the use of natural resources is concerned.

Ores and other extractable resources

In addition to high standards of education, the fairly late industrialisation phase in the economic development of Finland, occurring after the Second World War, was grounded to an essential extent in the country's timber and ore resources. It should be noted, however, that the currently known ore reserves are relatively small relative to the volume of industrial production and in the majority of cases are rapidly becoming exhausted. As Finland has a modern, competitive metallurgical industry, the further processing of metals can be expected to continue for a long period of time, albeit depending on imported raw materials and recycling. Steel, for example, is mainly manufactured from concentrates imported from Sweden and Russia and from scrap iron.

At the same time as ore production in domestic mines have suffered a radical drop during the 1990's, metal imports have expanded greatly. In 1997, for example, production volumes amounted to 3.7 tonnes and imports to almost 5 million tonnes. Iron makes up more than 95% of all imports by quantity. Domestic industrial mineral production amounted to almost 9.9 tonnes in 1997, the most important metals being chromium, zinc, nickel, copper and gold. Limestone production in 1997 was 3.7 million tonnes. The consumption of gravel and other rock materials reached its peak in the late 1980's, followed by fall in the early 1990's as activity in the building sector declined markedly. Thus gravel consumption in 1995 was approximately 60-65 million tonnes, even though existing permits would

Figure 3. Mining of ores and industrial minerals and quarrying of limestone in 1980-97 (millions of tonnes)



have allowed the extraction of more than 200 million cubic metres. The use of natural rock as a substitute for gravel has increased greatly in the last few years, as the gravel resources close to residential centres are becoming exhausted. Where this material accounted for 30% of total consumption in 1993, it reached more than 60% in 1996. The value of production in the rock sector is FIM 800-900 million a year and that of the associated transport services FIM 600-700 million.

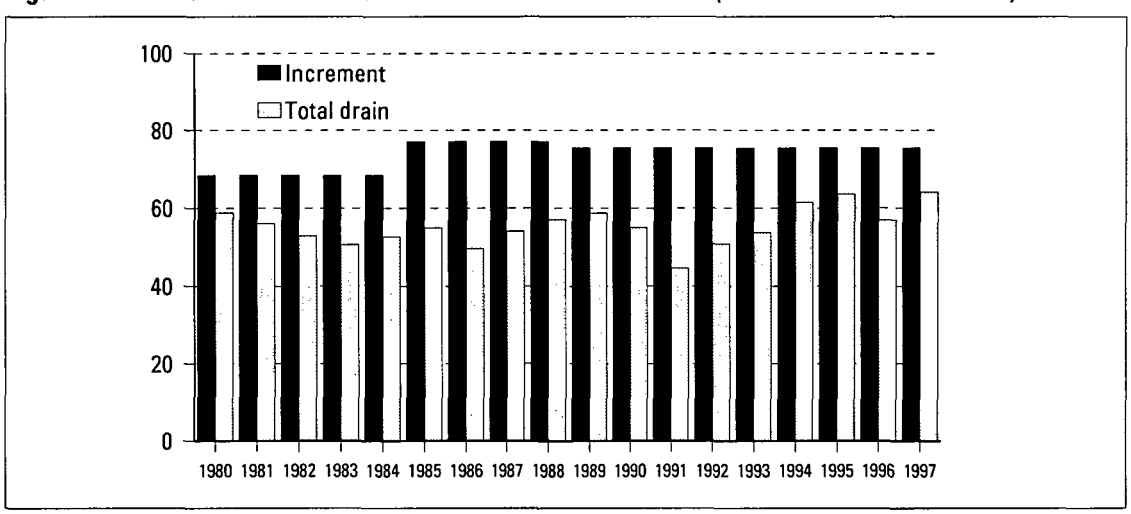
The Extractable Land Resources Act of 1981 was revised in June 1997 in order to conform better to the principles of sustainable development. It applies to the extraction of rock, gravel, sand, clay and soil, with the aim of ensuring the availability of these and safeguarding supplies of the groundwater which occurs in the related landforms without endangering the diversity of nature. Other objectives are the restrained, economically practicable utilisation of soil resources, recycling and promotion of the use of substitute materials. The follow-up obligation incorporated in the Act also greatly enhances the collection of data on the volumes of material extracted and creates the necessary conditions for devising an accounting system.

Timber resources

Economically the most important natural resource that Finland possesses is its forests. The country has over 26 million hectares of forestry land, which constitutes 86% of its total land area. Forest land proper amounts to 20 million hectares, the remainder being low-productivity wasteland. 54% of all the forestry land is owned by private persons, 33% by the state, 8% by companies and 5% by others, but the proportion of actual forest land that is privately owned is somewhat higher, 62%. The total volume of growing stock is some 1900 million cubic metres. The total annual increment, 75 million cubic metres, is well in excess of the total cut. A record figure of 52.1 million cubic metres of timber felled for industrial and other uses was achieved in 1997, the total drain on forest resources, including waste and natural losses, being some 64.1 million cubic metres. A total of nine million cubic metres of timber (solid measure) were imported into Finland in 1997.

The majority of Finland's surface area consists of naturally regenerated forests that are in commercial use. The way in which these forests are managed is crucial from the point

Figure 4. Annual increment and total drain of forest resources (million solid cubic metres)



of view of maintaining biodiversity. The systematic accumulation of timber resources by means of intensive forestry has reduced forest diversity and led to reductions in the area of ancient forests, the proportions of tree species of limited commercial value and the amounts of rotting wood left in the forests. It should be noted, however, that the environmental programme for forestry and the resulting forest management recommendations which take the diversity and nature conservation aspects into consideration have already been accepted quite well as part of current forestry practises.

The purpose of the new Forest Act introduced in 1997 is to promote the economically, ecologically and socially sustainable management and utilisation of forests. It applies to all commercially exploited forests, with the aim of ensuring that these will yield good financial profits without detracting from their natural diversity and variety. Restrictions are placed on the exploitation of certain particularly important habitats in order to preserve forest diversity. Research has indicated that it is possible to preserve the character of valuable environments of this kind entirely or almost entirely in some 90% of cases when undertaking fellings or other forest management procedures.

A proposal for a forest certification system suited to conditions in Finland was completed in spring 1997, with virtually all the forestry organisations and interested parties participating in its formulation, together with environmental and other civic organisations. The system was tried out in 1997, and a further project for its improvement commenced in March 1998. The hope is that it will then be possible to initiate the large-scale certification of forests in Finland. The official body responsible for administering the state forests, the National Board of Forestry, has intensified its consideration of social and environmental aspects by drawing up natural resource plans jointly with major interest groups and the inhabitants of the areas concerned in which the opportunities for forest management and utilisation are reconciled with the expectations aroused by these. Plans for Western Finland, Kainuu and Eastern Lapland were drawn up in 1997. The National Board of Forestry was awarded an ISO 14001 environment certificate in April 1998.

The aim of the statutory regional objective programmes for forestry, drawn up for the first time in 1997-98, is to balance out the objectives set for the various uses to which commercial forests may be put. Compiled jointly with forest owners and various civic and interest groups, they provide an overall impression of the state of forestry in each district administered by a forestry centre, its development needs and opportunities for development in this sector in broader terms. The aim is to bring the combining of economic, social and ecological viewpoints to the fore at a practical level and to apply interactive planning and the proximity principle to the design and implementation of forest policy. The objective programmes also include surveys of forest resources, forest protection and diversity, the effects of forestry on employment and forestry-related business activities.

The Finnish government began work at the beginning of 1998 on preparations for a national forest programme, to extend to the year 2010. The purpose of the programme is to develop forest management, utilisation and protection in such a way that the forests will remain healthy, vital and diverse while at the same time meeting the country's economic and recreational needs in a variety of ways and in a sustainable manner. It is also an indication of Finland's commitment to international objectives regarding the sustainable use and conservation of forests. A proposal for this national programme, drawn up in consultation with all the major interest groups and public organisations, will be completed by the end of 1998.

According to a forest health survey conducted by the European Commission and the ECE, one fourth of the forests in Europe were suffering from crown damage in 1996. A decline in the health of the forests was noted in areas receiving a severe pollution load from Central Europe and around the Mediterranean, but improvements were seen in parts of Eastern Europe where emissions had decreased. The forests of Finland suffer from less needle loss on average than those in other parts of Europe, and it is mainly attributable to ageing of the trees and unfavourable weather and climatic factors. It is only locally, close to built-up areas and beside roads, for example, that air pollution has observable adverse effects. One encouraging feature is that the lichens that are sensitive to sulphur deposition are beginning to return to their former habitats in Central Finland.

Cultivated resources

Some 8% of Finland's land area is in agricultural use, i.e. for cultivated fields and gardens. This means a total of around 2.5 million hectares, of which some 2.15 million were under cultivation in 1996. The mean size of a Finnish farm is 67 hectares, of which 49 hectares consist of forest and 18 of fields. 94,114 of the farms (60%) pursue active production, and their mean area of arable land on these is 23 hectares. Only one third of all farms are run on a full-time basis, however. Agricultural production is mainly based on animal husbandry, so that 80% of all the arable land is devoted to growing grass, silage and fodder crops or used as grazing land. Dairy products and meat account for almost a half of total agricultural production. The country has a total of 1.1 million head of cattle, 1.4 million pigs, 10 million chickens and hens, and 0.2 million sheep. Total agricultural turnover in 1997 was FIM 14,300 million, of which various forms of support accounted for FIM 7,600 million, or 53%.

The most obvious direct adverse environmental effect of agriculture is the runoff of nutrients from fertilizers into lakes, rivers and aquifers. 47% of the total phosphorus load imposed on lakes and rivers and 30% of the nitrogen load can be traced to agriculture, the proportions being over a half in Southern and South-West Finland. These nutrients lead to eutrophication and impaired water quality in general, and also to an elevated groundwater

5. Environmental support for agriculture (FIM million)

	1995	1996	1997	1998	1999
	R	R	R	B	BP
1. Basic support	1 329.7	1 367.0	1 372.0	1 390.0	1 390.0
2. Special support	76.5	158.0	195.0	300.0	300.0
2.1 Organic production	36.5	99.5	123.5	..	..
2.2 Protective zones	1.1	2.8	5.3	..	..
2.3 Treatment of runoff	33.2	41.7	47.2	..	..
2.4 More efficient use of manure	0.9	1.1	1.2	..	..
2.5 Landscape management and biodiversity	2.3	9.4	14.4	..	..
2.6 Diversification of production	0.1	0.1	0.1	..	..
2.7 Native breeds	2.4	3.4	3.5	..	..
3. Training and advisory services	8.7	10.0	7.0	..	..
4. Experimental projects	5.0	8.0	6.0	..	..
5. Other environmental management programmes	–	27.0	51.0	..	..
Total	**1 419.9**	**1 570.0**	**1 631.0**	**1 690.0**	**1 690.0**

R = Final accounts B = Budget BP = Budget proposal – = not in use .. = data missing

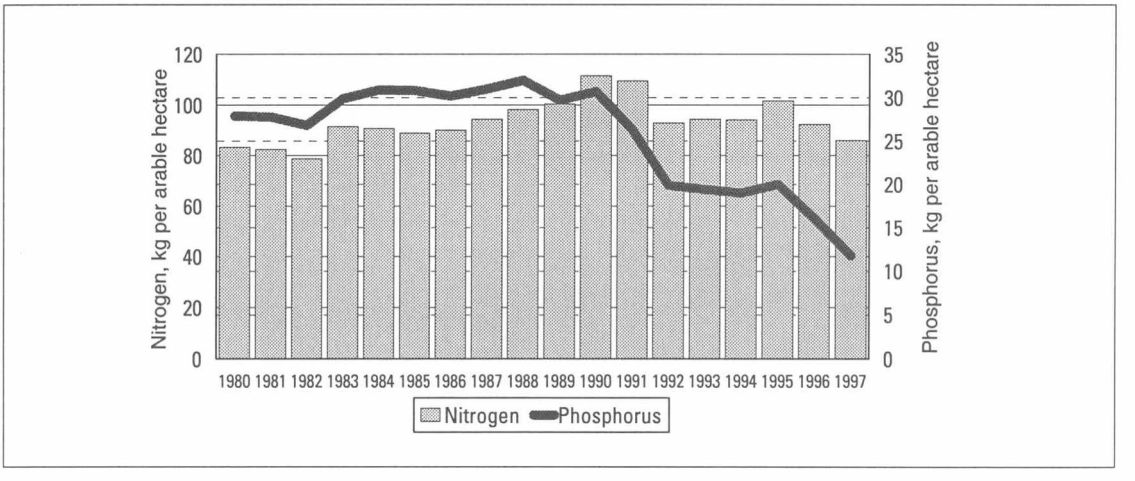
nitrate content in some areas. Under a resolution of the Council of State dated March 1998, the passage of nitrates of agricultural origin into lakes and rivers should be restricted in accordance with the EU Nitrate Directive. The decision contains regulations on the dimensioning of manure storage facilities, manure banks and the maximum nitrogen content of manure and fertilizers when spread on the land. The spreading of manure on frozen or snow-covered ground was forbidden in winter 1995-1996, and silage compression liquid must now be recovered and stored in sealed containers. In addition, recommendations were given for reducing the leaching of nitrates from stores of cattle manure and as a result of its use on fields.

6. Use of fertilizers and pesticides in certain industrialised countries in 1995 (tonnes/km^2)

	Nitrogen	Phosphorus	Pesticides
Netherlands	18.1	2.9	0.54
Belgium	10.6	3.2	0.71
Japan	10.4	12.4	1.26
Germany	10.3	2.3	0.20
Denmark	10.3	1.7	0.18
Great Britain	8.1	2.2	0.20
France	8.0	3.4	0.28
Finland	**7.0**	**2.8**	**0.04**
Ireland	7.6	2.5	0.04
Sweden	6.0	1.4	0.03
Italy	5.7	3.4	0.97
Greece	3.9	1.7	0.10
Portugal	3.5	1.8	0.30
Austria	3.2	1.7	0.10
Spain	2.9	1.6	0.09
United States	2.6	1.0	0.09
New Zealand	1.0	2.7	0.03

When Finland joined the European Union and adopted the environmental support system for agriculture, environmental protection was at once adopted as a criterion for the allocation of agricultural subsidies. The objectives of the Finnish environmental programme for agriculture for the period 1995-1999 are to improve the standards of water protection in farms, to reduce the level of air pollution and to maintain the traditional rural landscape and biodiversity. The programme also aims at eliminating the direct loading imposed by animal husbandry and the production of silage on water bodies. Slightly over FIM 1500 million has been paid out to farmers each year in environmental support, of which the EU covers a half. This compensates farmers for costs and loss of incomes resulting directly from implementation of the programme and guarantees them a living under changing circumstances. In 1997, for example, Finland received an additional FIM 60 million towards the provision of environmental support, which together with the gov-

Figure 5. Use of fertilizers in agriculture



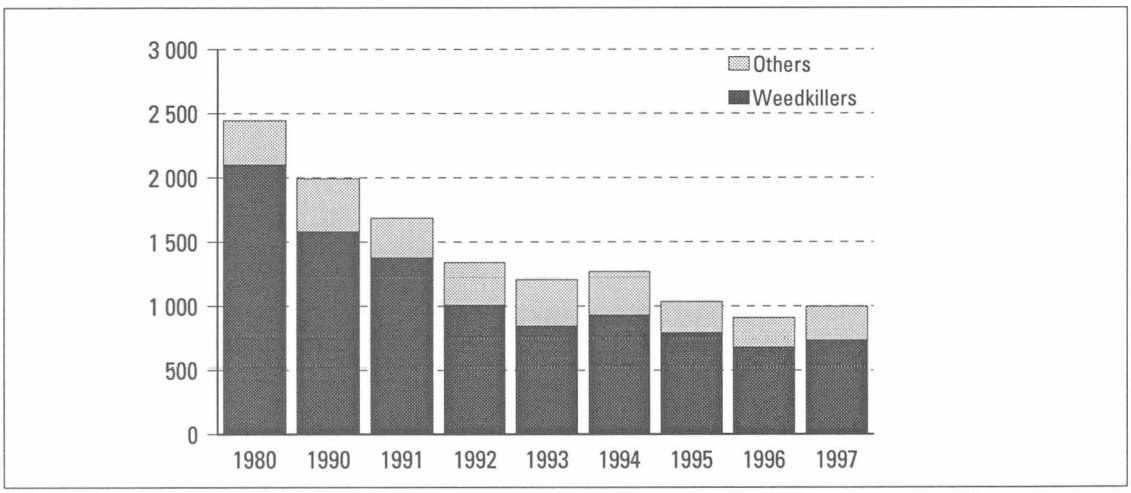
ernment's own contribution increased this support by FIM 120 million.

To qualify for basic environmental support, farmers are required to draw up an environmental management plan for their farms, to adhere to the limits imposed on the use of fertilizers and to establish protective zones and embankments between their arable land and any rivers and lakes, brooks and main ditches. Most of the special forms of environmental support for agriculture are intended for promoting water protection. The measures include the construction of wide protective zones of perennial vegetation around fields adjacent to lakes or rivers or in groundwater areas, the establishment and management of precipitation basins and wetland areas to collect erosion material and nutrients from fields, and support for organic farming. There is also an agreement for the protection of Finland's indigenous livestock species. A total of some 4500 farms with a combined arable area of approximately 106,000 hectares were engaged in organic cultivation or working towards this by the end of 1997.

Another objective of the environmental support programme for agriculture is to preserve biodiversity and the traditional rural landscape. Conventions concerning the management of traditional biotopes are aimed at securing the preservation of habitats created by traditional agriculture and the plant and animal species living in these. Farmers are nevertheless free to decide whether or not they wish to join this programme. Some 85% of active farmers (responsible for a similar 85% of the area under cultivation) are committed to complying with the conditions for basic environmental support. If the programme is implemented in full, it is estimated that the loading imposed by agriculture on lakes and rivers will be reduced by 20-40%.

It has been estimated that the costs to farmers of the environmental management measures required as a qualification for receiving environmental support have been lower than was anticipated. Approximately a half of the basic support, i.e. some FIM 700 million, is devoted annually to compensating for losses in income and other costs connected with environmental management. In practise, however, it is still impossible to assess the effects of environmental support, though it can certainly be said to have altered cultivation practises and the use of fertilizers.

Figure 6. Use of pesticides in agriculture (thousands of kilogrammes of active ingredient)



It is possible to achieve high quality products in a clean environment through the adoption of sophisticated methods. Finnish agricultural products are largely free of contamination, as pesticides are used less extensively than elsewhere in Europe, partly on account of the cold winters. In addition, given our lower levels of air pollution, growing conditions are cleaner. The average exposure of the population in industrialised countries to heavy metals is 2-5 times greater than that recorded in Finland. Products covered by the quality control system, and particularly organic products, will play an important role among agricultural exports in the near future.

Fur farming is extremely important both to the economies of certain regions and as a source of income for the farmers practising it. Exports of furs were worth FIM 1,500 million in 1997, and there are some 2250 fur farms functioning, a half of them in connection with conventional farms. Most of the fur farms are located in Ostrobothnia, making this region responsible for some 85% of the country's total fur production. Finland in fact produced about 60% of the world's fox furs in 1995. Fur farms are major sources of local pollution, with most of the environmental problems resulting from the mixing of meltwater or rainwater with the excrement of the fur animals. Increasing efforts have been made in recent years to reduce damage to lakes, rivers and aquifers from this source.

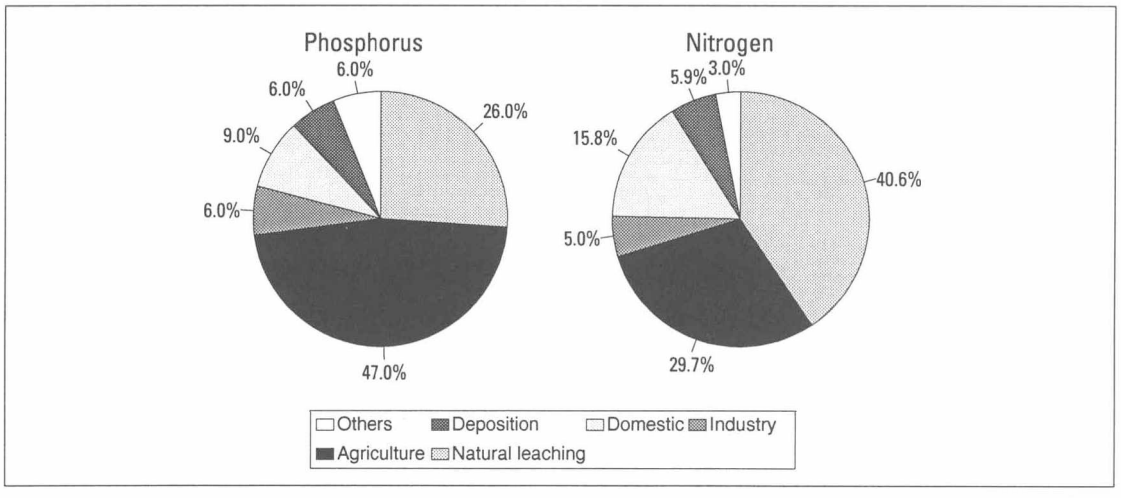
7. Use of water resources in certain European countries (million cubic metres per year)

	Renewable water resources	Water supplies	Utilisation intensity (%)
Belgium	12 500	9 030	72
Spain	117 000	36 900	32
Italy	175 000	56 200	32
Estonia	15 000	3 300	22
Britain	120 000	14 237	12
Greece	58 650	6 945	12
Denmark	13 000	1 200	9
Russia	1 500 000	106 227	7
Finland	**108 000**	**3 001**	**3**
Sweden	168 000	2 932	2
Switzerland	54 000	1 166	2
Norway	39 200	2 025	1

Water resources

Finland has abundant surface water and groundwater resources relative to its population and level of water consumption. Its inland watercourses cover some 10% of the total

Figure 7. Sources of loading in rivers, lakes and aquifers in 1995

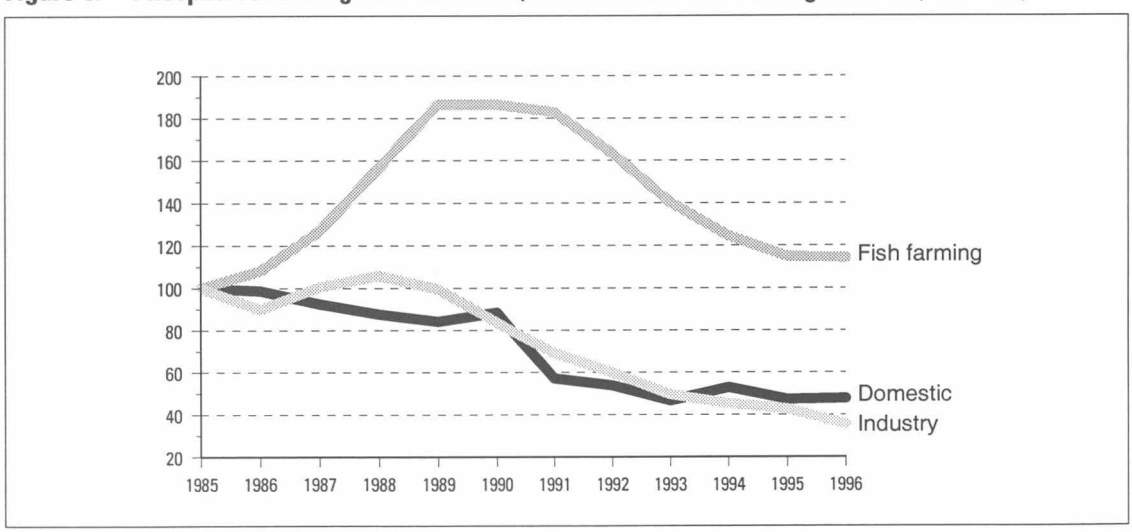


area, i.e. 33,500 km2, and its territorial waters amount to 36,000 km2. The total groundwater yield is estimated to be 10-30 million cubic metres a day, of which some 6 million is suitable for water supplies. Approximately 15% of this latter figure is actually made use of at the present time. Correspondingly, almost 60% of the water used by waterworks in Finland is derived from aquifers or artificial groundwater. The consumption of water distributed through the public water supply continued to decrease in 1995, to reach a figure of 256 litres per consumer outlet per day. Water consumption in industry, domestic supplies and energy production totals some 2500 million cubic metres a year. The more isolated rural areas obtain most of their domestic water from their own wells, although there are frequently problems regarding the continuity of supplies under all conditions. A total of 2-4% of Finland's exploitable water resources are utilised each year.

According to an extensive groundwater classification and survey project completed in 1996, there are 2226 significant groundwater areas in Finland, 1300 areas suitable for use for water supplies and 3615 other classified aquifers. The Finnish aquifers are characteristically small, shallow and usually isolated from one another, features which distinguish them markedly from the extensive groundwater basins found in Central Europe. In addition, they are extremely sensitive to acidification, as the Finnish bedrock is mainly composed of acidic rock types. The soil layers protecting the aquifers are also quite thin, which often increases the risk of contamination.

Groundwater quality varies greatly from one area to another. Depending on the bedrock and soil, an aquifer may occasionally contain hazardous quantities of arsenic, fluoride and radon etc., while the consequences of human activities are reflected in the form of elevated nitrate, chloride, hydrocarbon and heavy metal concentrations. Risk factors for groundwater contamination include agriculture, the use of de-icing salt on roads, the transport and storage of oil products and other toxic substances, industrial emissions, urban development, sand and gravel extraction and the percolation of waste water into the ground. In addition, air pollution has already affected groundwater quality in southern and south-eastern Finland. Implementation of the EU

Figure 8. Phosphorus loading from industrial, domestic and fish farming sources (1985=100)



drinking water directive in Finland has called for stricter water quality requirements. Measures have been taken to improve alkalisation and the removal of iron and manganese at waterworks based on groundwater sources.

Approximately 80% of Finland's lakes are classified as exhibiting good or excellent water quality, some 3% as polluted and approximately 0.3% as polluted and of poor quality. The total surface area of heavily polluted lakes has decreased in recent years, particularly with respect to domestic and industrial loading. At the same time, however, the total area of completely unpolluted, natural water has decreased, on account of diffuse loading.

Waste water loading from industry, housing and fish farming has continued to decline markedly in the last few years. Readily decomposable industrial organic loading decreased by about 80% in 1987-1996, phosphorus loading by more than 60% and nitrogen loading by almost 40%. Loading from domestic sources has also decreased, particularly as regards organic matter and phosphorus, the average purification rates for which are over 93%. Agriculture accounts for 47% of total phosphorus loading and 30% of total nitrogen loading. Diffuse loading is now decreasing over wide areas, thanks to the measures introduced under the environmental support programme for agriculture, for example.

The most obvious environmental problem facing the Gulf of Finland has been its serious eutrophication over the last few decades. A vast, intensive algal bloom was experienced there in the exceptionally warm, sunny summer of 1995, partially consisting of toxic blue-green algae. Although the increase in nitrogen concentrations in the Gulf of Finland came to a halt in the early 1990's, large quantities of phosphorus have accumulated in the bottom mud in the last few decades, and these still affect the quality of the water. Further action will have to be taken in Finland and elsewhere in the Baltic basin in order to arrest this eutrophication process. It should be remembered, of course, that only 10-12% of the nutrient runoff into the Baltic Sea can be attributed to Finnish sources. The greatest loads imposed on the Gulf of Finland, approximately 80% of the total, are from the St. Petersburg area. Finland's own emissions have a major impact on the state of the coastal areas, however, so that it is essential that phosphorus and nitrogen emissions from agriculture and nitrogen emissions of domestic origin should be reduced in south-western Finland in particular. Fish farming also has a considerable local influence on the coastal waters in places.

The purpose of the EU framework directive on water policy is to achieve a reform of the legislation governing surface water and groundwater sources. The main aim is to improve surface water quality to an ecologically good level and to guarantee the sustainable use and high quality of groundwater sources. The actions to be taken, monitoring and administration should essentially be focused on entire catchment areas at a time and should be coordinated within such areas. The state of water areas and the required measures should be defined by reference to the ecological functioning of biocommunities on the one hand and the presence of hazardous substances on the other. The directive will also apply to coastal waters which fall within the member state's territorial waters. The EU Council aims at reaching mutual agreement on the directive during 1998.

3 Nature conservation

Nature conservation aims to maintain biodiversity by setting up conservation areas to preserve unspoilt environments, by protecting endangered species, and by integrating the interests of nature conservation into the demands of land-use planning -- as has been the trend in recent years. The ensuring of sustainable use of the commercial forests is a particularly important aspect of the preservation of biodiversity in Finland, and the country's network of nature conservation areas has been gradually expanded since the late 1970's to include different biotopes and habitats. The oldest of the nature conservation programmes, that providing for the creation of national parks and nature reserves, has for the most part now been implemented.

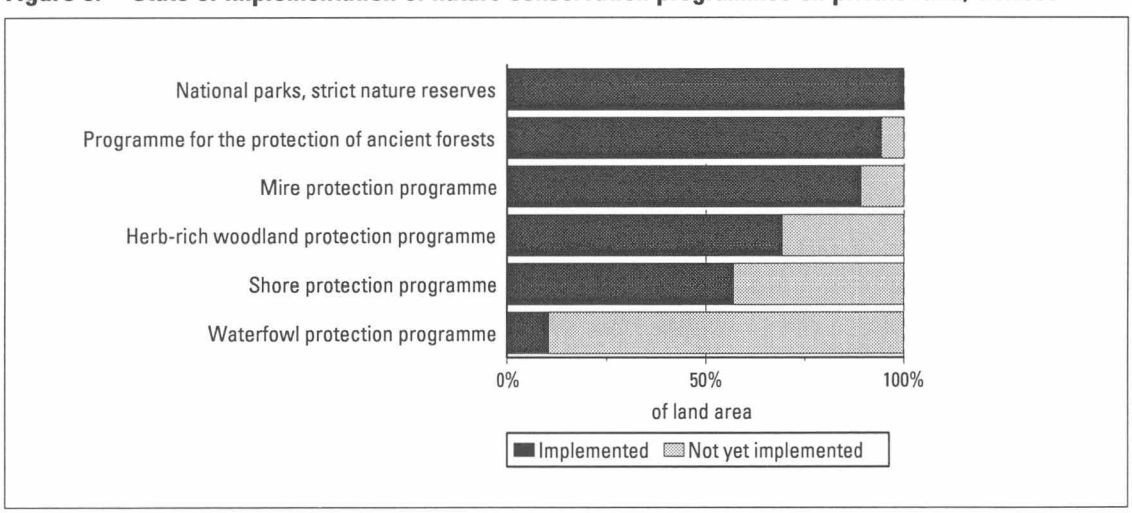
Nature conservation areas covering some 1.36 million hectares and wilderness areas totalling 1.5 million hectares have been established on state-owned land. This means that 10.4% of all the forestry land in Finland is under some protection order. A total of FIM 1410 million was spent on the purchase of conservation areas and compensation for their acquisition over the period 1971-1997, in addition to which, state land to a total value of FIM 430 million was used in exchange deals. Con-

8. Financing of nature conservation areas and programmes, 1994-1998 (FIM million)

	1994 R	1995 R	1996 R	1997 R	1998 B	1999 BP
Purchase of land	161	183	184	321	362	222
Purchase of private land	*85*	*89*	*87*	*111*	*117*	*92*
Land exchanges	*67*	*87*	*80*	*110*	*150*	*70*
Incomes from the sale of land	*9*	*7*	*17*	*100*	*95*	*60*
Management of conservation areas	85	75	69	75	75	82
Compensation payments	20	19	19	43	47	69
Protection of rapids	100	35	45	25	45	10
Life (Natura) programme	–	–	8	15	21	19
Total	**366**	**312**	**325**	**479**	**550**	**402**

– = = not in use R = Final accounts B = Budget
BP = Budget proposal

Figure 9. State of implementation of nature conservation programmes on private land, 1.1.1998



servation programmes applying to privately-owned land have been implemented to the extent of 190,000 hectares, and the government still has plans for the conservation of a further 250,000 hectares and options on certain other areas.

The speed with which areas the conservation programmes are being implemented has been greatly increased, and an overall financial plan has been agreed upon for the nature conservation programme which will guarantee adequate funds for this purpose. The aim is to complete the implementation of the programme by the year 2004, with funding extending to the year 2007, due to the staggering of payments. A total of FIM 3285 million has been set aside for the funding of this programme (including the value of land to be used in exchange).

Although the importance of preserving biodiversity is widely recognised, our knowledge of many habitat types and plants and animal species is still incomplete. The Finnish Centre for the Environment launched a three-year programme in 1997 to examine the current state of the Finnish nature conservation system and to assess its ability to ensure the preservation of different biotopes and endangered species. The project is also assessing the efficacy of nature conservation measures and the degree to which the declared objectives have been attained. In the same year the Ministry of the Environment also launched an extensive study of endangered species.

The thoroughly revised Nature Conservation Act that took effect as from the beginning of 1997 provides a much wider range of tools for use in nature conservation, particularly as regards the preservation of biotopes and species. It also satisfies the demands of the EU wild life and bird life directives, to be implemented by creating a uniform network of protected areas known as Natura 2000. The revised proposal for Finland's Natura 2000 network comprises a total of 4.768 million hectares, of which 3.539 million hectares are land area. The proposal includes 3.715 million hectares of state land and 0.493 million hectares of water areas. The revised proposal covers 317,007 hectares of private land and 736,219 hectares of water areas. Conservation of the Natura areas can be implemented in various ways, depending on the need for protection of each biotope and species separately. The European Commission is about to make its final decision on the network in 1999, and the directive lays down that the Natura network should be completed within six years of this decision being reached.

9. The Natura barometer in the EU countries, 12.5.1998

	Proposal for programme	Number of reserves	Total area (km^2)	Per cent of land area
Denmark	Partly completed	175*)	11 000*)	25.5*)
Greece	Final	230	25 745	19.6
Italy	Final	2 480	46 074	15.3
Spain	Final	588	70 250	14.0
Austria	Partly completed	93	11 130	13.3
Portugal	Final	65	12 150	13.1
Sweden	Final	1 383	35 929	8.0
Ireland	No	207*)	5 530*)	7.9*)
Finland	Partly completed	415	25 599	7.6
Netherlands	Partly completed	27	2 820	6.8
Britain	Final	301	15 681	6.5
Belgium	Final	101	903	3.0
France	Partly completed	543	10 581	1.9
Germany	Partly completed	295	4 968	1.3
Luxembourg	No	0	0	0
Finland	**A proposal of the ministers' working group**	**1 457**	**47 686**	**11.6**

*) = Unofficial, provisional proposal

10. Nature conservation funding plan, 1996-2007 (FIM million)

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Funds allocated	106	149	175	185	185	185	185	185	185	185	185	185
Interests	0	9	12	15	12	10	10	10	10	6	3	3
Value of land exchanged	180	110	120	100	60	60	60	60	60	–	–	–
Incomes from sales of land	50	100	90	40	–	–	–	–	–	–	–	–

– = not applicable

The EU LIFE fund is contributing to the costs of implementing the Natura 2000 network. The fund has a budget of approx. ECU 450 million for 1996-1999, 40% of which will be allocated to nature conservation and about 50% to innovative environmental technology projects. The Commission allocated a total of some FIM 240 million to LIFE projects in 1997, of which Finland's share was FIM 35 million. Funding to be received from the Life Fund in 1998 will remain low because of the delay in the Natura decision.

4 Industry

Control over environmental protection

Finland's competitiveness on global markets and its ranking among the richest countries in the world in terms of standards of living are largely the results of advanced expertise and knowhow. Finland is a land of large industrial enterprises, a higher proportion of the labour force being employed by these than in European countries on average. The proportion of GDP accounted for by the industrial sector has increased to 31.2% in the 1990's, accompanied by drops in the contributions of the service sector, construction and agriculture. The metallurgical industry generated 39% of all industrial production in 1997, the pulp, paper and timber industries 18% and chemicals 10%, their corresponding proportions of the value of Finnish exports in the same year being just under 51%, over 30% and slightly less than 10%.

Much has been done to intensify environmental protection in the industrial sector in Finland, the current focus amongst industrial enterprises being on the introduction of environmental management systems. A combined directive on the prevention and control of emissions was approved by the EU in 1996 and will take effect in the member countries by the end of October 1999. This underlines the responsibility of companies for using the best technology available in their processes and other functions. This requirement has already been included in the Finnish legislation on water and air pollution control, waste disposal and the protection of sea areas, and a new environmental protection act is in preparation which will contain the main body of the country's anti-pollution legislation. This will create greater uniformity in the laws concerned with the environment and bring changes in administrative practises and the division of labour between the various authorities. It will mean that environmental permits will still be issued by local councils and regional environmental permit centres, but also by special permit boards to be established in the future. The existence of a uniform body of legislation will render conservation more effective and speed up and simplify the processing of permit applications and complaints. The new law will annul the former laws regarding clean air, noise and environmental permit procedures and introduce major changes in those applying to water, waste disposal, health protection and relations between neighbours.

Trends in environmental protection

Total industrial expenditure on environmental protection has remained almost unchanged in the last few years. This category accounted for approximately 10% of all industrial invest-

11. Industrial expenditure on environmental protection (FIM million)

	1992	1993	1994	1995	1996
Energy supplies	819	939	418	276	383
Pulp, paper and timber	990	940	932	1 371	1 308
Chemicals and minerals	497	642	428	602	665
Metallurgy	530	332	449	564	721
Other industries	360	274	285	300	305
Total	**3 196**	**3 124**	**2 512**	**3 113**	**3 383**
of which					
Investments	1 841	1 614	1 022	1 538	1 706
Operating costs	1 355	1 510	1 491	1 575	1 677

ments in 1992 and 1993, slightly less than 6% in 1994 and almost 7% in 1995 and 1996. 41% of such environmental investments in 1996 were concerned with the reduction of emissions into the air, 48% with water pollution and 9% with waste management and the protection of the soil and groundwater.

The programme of water protection objectives approved in March 1998 and extending to the year 2005 obliges the industrial sector to cut down its emissions considerably, a process which will entail additional costs of approximately FIM 1000 million per year. The aim is to reduce phosphorus and nitrogen emissions by 50% from the 1995 level by the year 2005 and chemical oxygen consumption by 45%. The latter requirement will concern mainly the wood processing sector which will have to continue to develop its processes and water purification techniques over the next few years. The programme also requires a 55-60% reduction in chromium, oil, nickel, copper and zinc emissions by the year 2005, so that the chemicals and metallurgical industries in particular will have to increase the efficiency of their waste water purification systems.

The trend in the industrial sector has been towards the adoption of voluntary environmental management systems, a process accelerated by the increased importance of customer and interest groups relations. Companies have had an opportunity to adopt the global ISO 14001 environment system since autumn 1995, and they also have access to EMAS, a voluntary environment administration and audit system for industrial companies operating within the EU, which the first companies joined in spring 1996. Environmental management systems have aroused interest among companies in the wood processing and chemicals industries in particular, as their use can facilitate the management of environmental affairs and lend increased credibility to the measures taken. More than a hundred ISO environmental certificates and 11 EMAS certificates had already been obtained by Finnish companies in May 1998.

12. Industrial plants recorded in the EMAS register, 31.3.1998

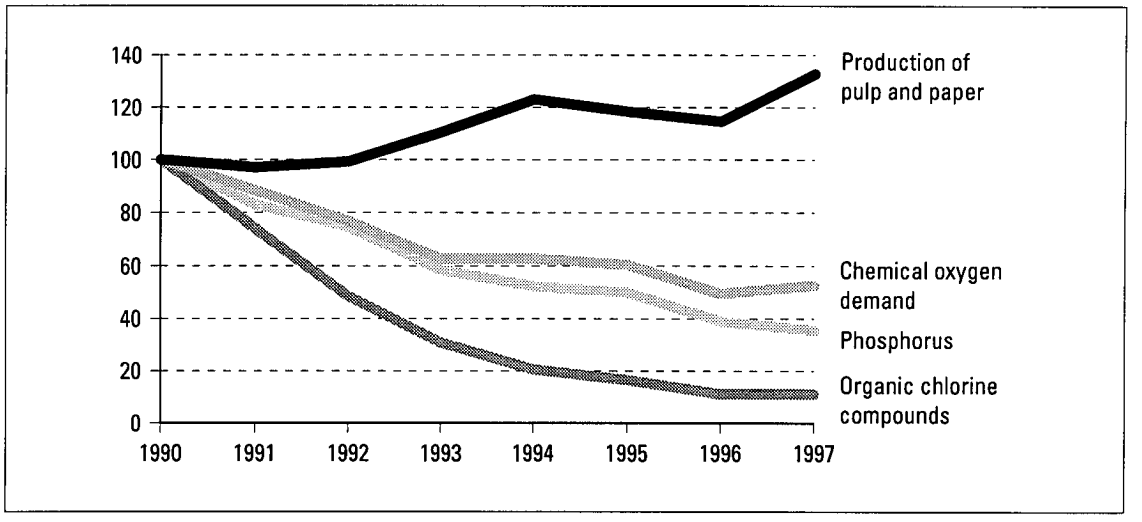
Germany	1 127
Austria	112
Sweden	90
Denmark	54
Britain	50
Norway	38
Netherlands	20
France	16
Spain	11
Finland	**10**
Ireland	4
Belgium	3
Italy	3
Luxembourg	1

The pulp, paper and timber industries

Finland has produced record quantities of paper and forest products in the last few years, the total volume of production increasing by just over 14% from 1996 to 1997, by which time the companies concerned were operating at 94% capacity. At the same time, however, the environmental impact of this industrial activity has decreased substantially, so that the main forms of emissions are now at only one tenth of the levels recorded in 1980.

Thus the growth in production has not increased emissions, at least for the time being. The industry has already adopted practicable effluent purification techniques, so that its environmental protection investments fell by almost 60% in 1997 compared with the previous year. In addition, the focus of such investments has moved towards developing environmentally friendly production processes. It is estimated in the industrial sector that the radical reduction in emissions achieved in the 1990's is now evening out and the sector is

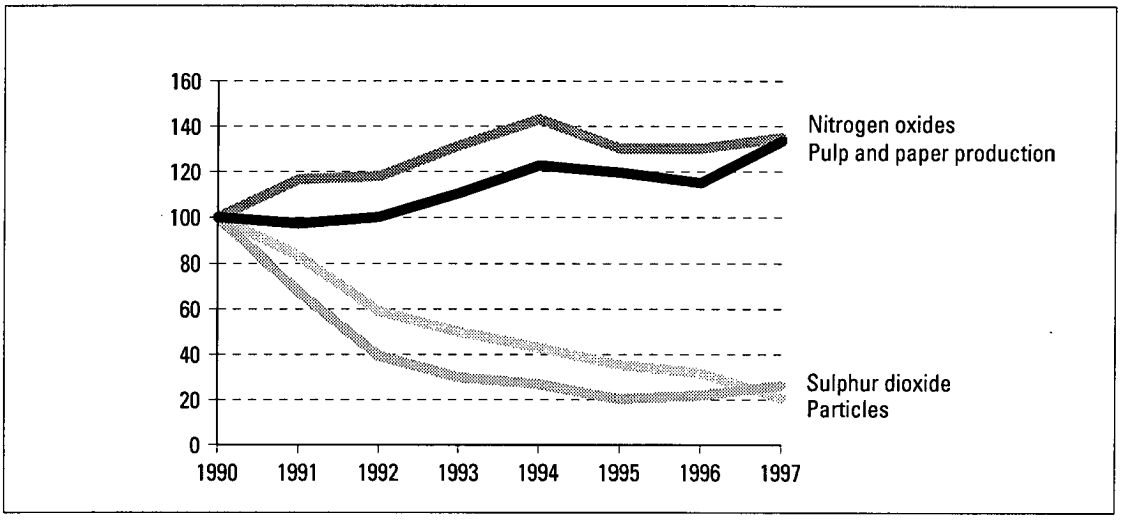
Figure 10. Production and emissions into lakes and rivers in the pulp and paper industry (1990=100)



slowly approaching a stage of slow development in which any further increase in production may easily increase emissions. The actual focus in environmental protection is currently on constructing environmental systems, and this requires a great deal of work. Almost all the companies operating in the pulp and paper industry are developing environmental management systems with the aim of continuously improving their environmental protection record.

The pulp and paper industry has invested in the last few years in developing closed water circuits, production processes and new bleaching techniques, and in improving the purification of its waste water. The use of elemental chlorine in bleaching, for example, has been eliminated completely, and the amounts of water used have been reduced, closed water circulation systems have been introduced in the production processes and greater efficiency has been achieved in waste

Figure 11. Production and atmospheric emissions in the pulp and paper industry (1990=100)



water purification. Slightly less than a half of all investments in the pulp and paper industry were concerned with water protection, while the emphasis with regard to air pollution is now on the treatment of odorous gases and the reduction of nitrogen oxide emissions.

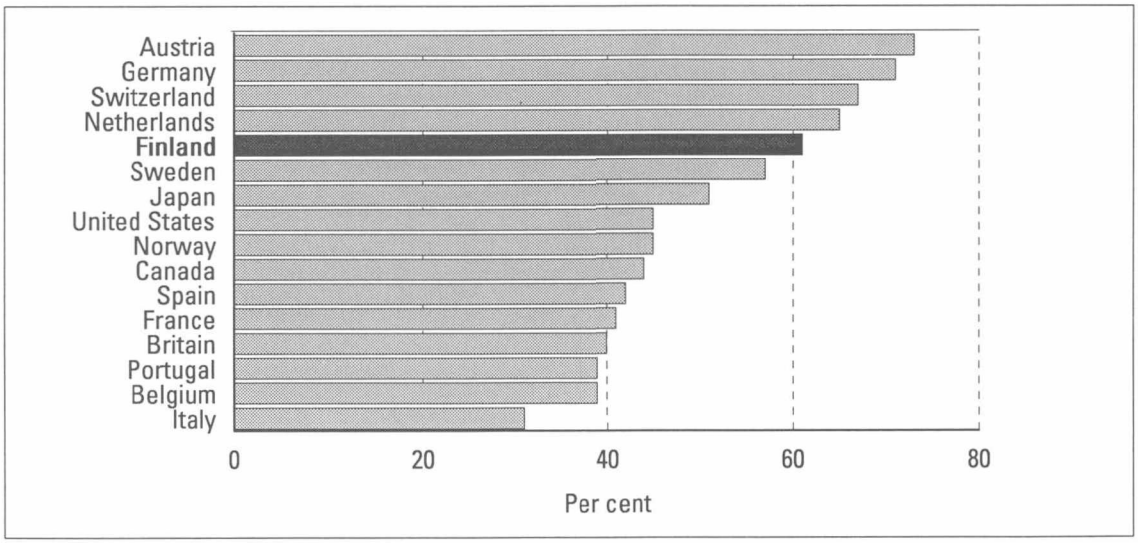
The rate of utilisation of timber by-products such as bark, wood chips, sawdust and offcuts suitable for building purposes is high, as much as 95% of these being re-used for energy production or pulping. In addition, 98% of all recycled paper and cardboard is re-used as a raw material and a half of the sludge resulting from biological purification of the waste water is utilised as a source of energy. The majority of the waste that requires disposal consists of ash remaining from energy production, sodium carbonate residue and caustic sludge. The processing and utilisation of sludge, ashes, de-inking waste and lye residue should now be intensified further. Opportunities for their utilisation are currently being examined.

Out of a total of 12.1 million tonnes of paper and board produced in Finland in 1997, 90% was exported. A total of 607,400 tonnes of paper was recovered through recycling, representing 61% of the paper and board consumed in Finland. This recycling rate is high as compared with those reported in most Central European countries, and a further 72,000 tonnes of waste paper were imported for the production of recycled fibre. The proportion of recycled material amongst the raw fibre material used in for paper and board production was 5.1%. Given the long distances and sparse population in Finland, which imply high transport costs, there is only limited scope for any further cost-effective expansion of recycling. It may be possible to increase the recycling rate, however, by improving the quality of the waste paper returned to the mills, which will require campaigns to promote consumer awareness of the need for more accurate sorting.

The chemicals industry

Chemicals form an important branch of industrial production in Finland in terms of both end products and intermediate products supplied to other branches. It should be noted, however, that even small quantities of many

Figure 12. Recovery of paper for recycling in 1996



of the hazardous substances used and processed in the chemicals industry may have serious environmental effects, which underlines the need for reliable, comprehensive protection measures. Of the various industrial sectors, it was the manufacture of chemicals and chemical products where the proportion of environmental investments was greatest in 1996, over 15%.

The majority of the environmental protection investments made in the chemical industry still involve traditional external measures aimed at purifying emissions, so that the scope of investments in process technology is still small. The chemicals industry has nevertheless managed to cut down some of its emissions into rivers and lakes and into the atmospheric, and the amounts of waste generated have diminished annually since 1994.

The chemicals industry has taken voluntary steps towards raising the standards of its environmental protection and industrial safety in the context of the international Responsible Care programme. 88 companies in Finland have committed themselves to this programme, accounting together for more than 80% of the total production of chemicals. The number of companies participating in the programme increased by 40% in 1997. All in all there are some 300 chemical companies in Finland of which 61% are small in size, with a staff of less than 50 persons. 76% of the companies engaged in the programme in 1997 possessed an ISO environmental or quality certificate.

The companies involved in the programme have managed to reduce their emissions into lakes, river and the atmosphere relative to production over the last ten years. Sulphate loading of lakes and rivers have fallen by 54% since 1988, phosphorus loading by 35%, nitrogen by 45%, mercury by 69%, cadmium by 35% and lead by 78%.

13. Emissions from oil refining and the petrochemical industry (tonnes)

	1993	1996
Volatile hydrocarbons	8 900	3 450
Nitrogen oxides	4 920	4 452
Sulphur dioxide	6 724	6 300
Oil spills	11	4
Hazardous waste	1 080	1 380

The metallurgical industry

The volume of production in the smelting industry has increased steadily since the early 1990's, whereas that in the electronics and electrical industry has increased more than five-fold. In fact it was not until 1995 that the machinery and metal products sectors exceeded the level of production prevailing before the economic recession.

Finland's remaining ore resources are small relative to the volume of industrial production, and are rapidly being exhausted. Since the metallurgical industry in Finland is highly sophisticated and competitive, metal processing will probably continue for a long period time, although relying largely on imported raw materials and recycling. The rate of utilisation of scrap iron and steel in Finland is approximately 90%, if one also includes direct circulation of scrap within the industry itself. The Finnish smelting industry is among the most successful in the world as regards the efficiency with which it uses its of raw materials and energy input and the way in which emissions have been reduced, thanks to the work done in developing its production processes.

Extensive recycling of metal can reduces the need for extracting virgin ores, as scrap metal is almost entirely recyclable. Steel is the most actively recycled material in the world in terms of volume, as more of it is recycled annually than of all other materials put together. Some 350 million tonnes of scrap were processed globally in 1996 to produce 757 million tonnes of steel, i.e. almost half of the steel produced was manufactured from recycled material. Another highly recyclable metal is copper, as indicated by the fact that 80% of all the copper manufactured in the world so far is still in circulation. Investigations also indicate that steel production based on the recycling of scrap is as a rule more environmentally friendly than the corresponding production using virgin natural resources. Manufacturing steel from scrap iron, for example, requires some 28% less energy per unit of production than does the use of virgin raw materials.

Since the manufacture of metals requires a large amount of energy, atmospheric emissions are the greatest environmental hazard. Investments in environmentally acceptable process technology the metalworking industry exceeded the costs arising from the purchase of traditional emission purification technologies for the first time in 1996. The majority of the investments directed against air pollution in this branch concern the recovery of emitted particles and dust of one kind or another. Water protection investments involve reducing waste water loads by developing production processes and purification methods. The aim of waste water management investments is to reduce the amount of waste and increase recycling and utilisation. The metallurgical industry accounted for 23% of all environmental protection investments made in the industrial sector in 1996.

14. Savings in energy when manufacturing certain metals from scrap

	Savings (%)
Aluminium	96
Nickel	89
Copper	84
Zinc	72
Steel	58

15. Emissions from the production of metals

	1990	1996
Volume of production (index)	**100.0**	**135.6**
Emissions into the atmosphere (thousands of tonnes)		
Sulphur dioxide	22.9	8.3
Nitrogen dioxides	3.6	3.4
Emissions into water (thousands of tonnes)		
Nitrogen	691.0	431.8
Chromium	2.0	1.9
Nickel	20.2	5.9
Copper	6.9	8.7
Zinc	17.3	10.0

The emphasis in environmental protection in the metallurgical industry is currently on reducing the adverse effects of surface dressing and painting, cutting down materials consumption and to improving recycling. This will require the widespread adoption of environmental management systems and related life-cycle analyses. The focus in the electrical and electronics industries will be on eliminating the use of CFC compounds and recovering and utilising scrap.

Waste management

A total of some 80-90 million tonnes of waste accumulates in Finland each year, slightly over 15 million tonnes of which is industrial

waste. Almost 60% of the latter is further utilised within industry, mostly as fuels, raw materials or landfill material, while some 2.5 million tonnes has to be disposed of. The utilisation rate is highest for scrap metal, the recycling of which is economically profitable. Exceptionally high recycling rates are also recorded for glass, wood and wastepaper.

The national aim is to halve the amount of waste to be disposed of by the year 2000. This means that the turnover in waste collection, transport and disposal would fall by some FIM 300 million a year. At the same time, however, the transport of exploitable waste would increase. The current Waste Disposal Act essentially aims at minimising the amount of waste, and a resolution has been issued by the Council of State on the basis of this Act which calls for a reduction in the amount of building waste and in its harmful nature and the creation of a system for the recovery and utilisation of such waste. A total of 7-10 million tonnes of superfluous material accumulates each year, four times the amount of domestic waste. The guideline issued with this resolution is that a situation should be reached by the year 2000 in which at least a half of all building and demolition waste can be re-used, a proportion that should then increase to 70% by the year 2005.

The handling of domestic waste is usually organised jointly by local councils, either based on agreements or through an organisation specifically set up for the purpose. This usually involves cooperation over the use of refuse tips, although the collection of waste from sparsely populated areas, advisory services and the management of hazardous waste etc. are often covered as well. This collaboration has centralised the demand for waste disposal services. The total environment management market is estimated to amount to approximately FIM 4000 million, and almost 5000 persons are employed in this field. There are currently almost 500 private companies providing refuse collection and transportation services in Finland, of which some 200 operate on a full-time basis. Operations have become more centralised in the last few years, mainly as a result of mergers.

The demand for waste management sector services is expected to increase in future despite the fact that one objective of sustainable development is to prevent the creation of waste or at least to reduce the amounts involved. The increasingly strict environmental norms, including regulations governing refuse tips, will refuse disposal fees, and this can be assumed to improve the outlets for utilising waste and thereby to increase the demand for waste management services. Services connected with the maintenance and auditing of quality environment management systems can also be expected to arouse more interest in the future. The increased sorting and recycling of waste will improve the business prospects for companies specialising in these functions.

In addition to domestic waste disposal legislation, there are also international regulations that call for greater efficiency in the re-use of waste materials. It is laid down in the EU packaging directive, for example, that all packaging materials should be rendered recyclable by the year 2001 and that at least 15% of each type of material should actually be recycled. The directive came into force in Finland in December 1997 under a resolution of the Council of State setting Finland's national objectives at a stricter level than those presupposed by the directive. The aim is to reduce the amount of packaging waste by 6% by the year 2001 as compared with the level in 1995. At that point, 870,000 tonnes of packaging material were used in Finland, of which 43% was reutilised. There are now plans in existence to raise the utilisation rate to 61% by the year 2001.

5 Energy supplies

Energy generation

Finland has a high level of per capita energy consumption, due to its northern location, the resulting need for heating in winter, the domination of its economic structure by heavy industry and the long transport distances brought about by the sparse distribution of population. The main market areas for the country's export industries are also located far away. Energy generation in Finland is extremely efficient, thanks partly to the combined production of heating energy and electricity.

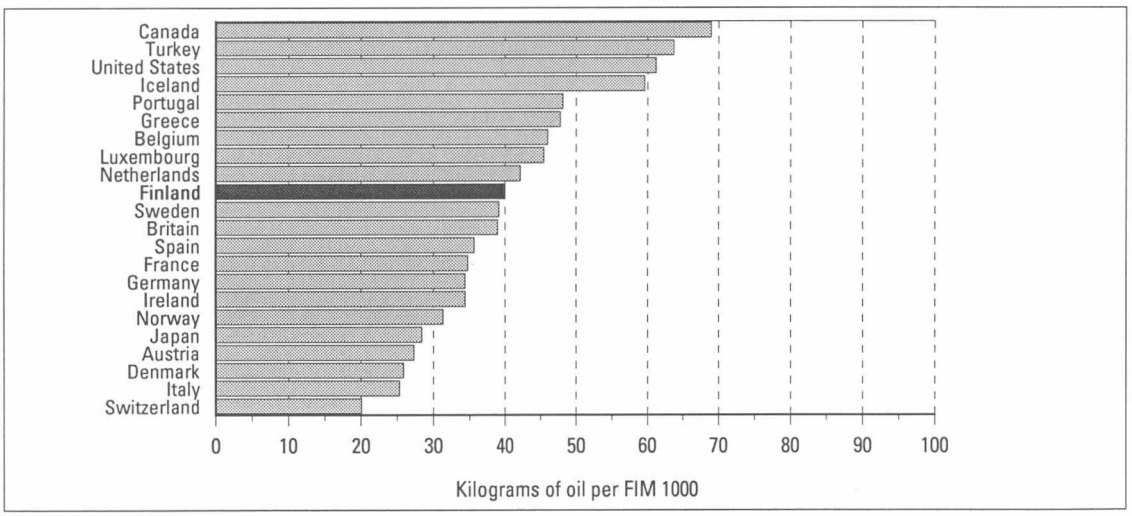
Finland's total energy consumption in 1997 was 30.4 Mtoe, the structure in terms of sources of energy having remained unchanged for the past ten years: oil 27%, coal 15%, natural gas 10%, nuclear power 17% and peat 7%. Non-imported fuels, including peat, accounted for 29% of total consumption. Electricity consumption amounted to 73,500 million kWh, of which slightly over 37,000 million kWh were used in industry. Nuclear power was used to produce 20 TWh of electricity in 1997 (27.2% of total electricity consumption) and hydroelectric power 16.1 TWh (19%). According to the Central Association of Energy Producers, annual energy consumption can be expected to increase to some 78,000 million kWh by the year 2000 and 92,000 million kWh by 2010. It is predicted that industry will account for 70% of this increase in the late 1990's and some 60% in the next decade. The electricity needs of households and services will increase at a considerably slower rate.

According to the energy policy report submitted to Parliament by the Council of State in

16. Total energy consumption in 1997

	Mtoe	%
Industry	14.8	49
Heating	6.6	22
Transport	5.5	18
Others	3.3	11
Total	**30.2**	**100**

Figure 13. Total energy consumption relative to GDP in certain countries in 1995



1997, the intention is to bring the growth in energy consumption to a halt by the year 2010 by increasing the consumption of natural gas, promoting the production and utilisation of wood for energy generation and introducing more effective energy saving measures. These plans have been triggered by a concern over rising carbon dioxide emissions. The stricter energy saving programme will nevertheless be adopted in such a way that it will not jeopardise economic growth nor impose any unnecessary restrictions on consumers. To this effect, the government together with various industrial, energy producing and local government organisations signed voluntary skeleton agreements in November 1997 for the saving of energy. The provisions of these agreement will be used in the future to implement the necessary economy measures in a systematic and comprehensive manner.

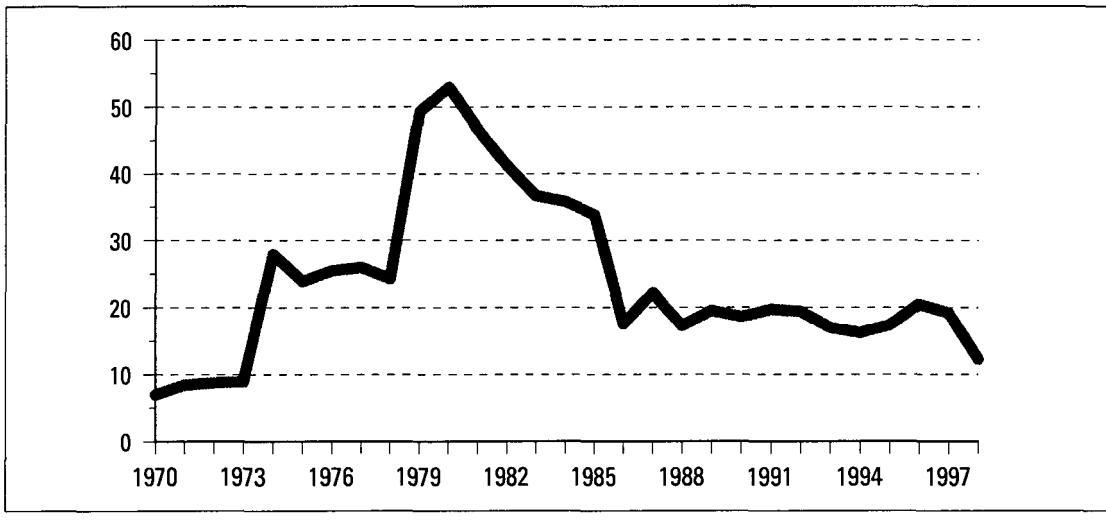
Use of fossil fuels

The depletion of energy sources will not, to the best of our knowledge, pose a threat to continued economic growth within the next few decades, thanks to technological progress, the discovery of reserves and the reassessment of existing ones. The world's exploitable oil resources increased by 60% between 1973 and 1993, and annual increments since 1989 have kept pace with consumption. Natural gas resources increased by 140% between 1973 and 1993, but the use of this fuel only by 70%. It is estimated that, given the current known fossil fuel reserves, the world's oil resources will suffice for the next 40 years, those of natural gas for 60 years and those of coal for 200 years.

Global market prices for oil have dropped during the 1990's, by virtue of the supply greatly exceeding the demand. Crude oil prices fell below USD 12 barrel in real terms early in 1998 and again at the beginning of June, having been well over USD 19 in 1997. The last time that the price was so low was in 1973, just before the first oil crisis.

Oil consumption in Finland reached a peak at 10-12 million tonnes a year in the 1970's, but following the oil crisis the role of nuclear power, natural gas and non-imported sources in energy generation was increased and measures were taken to conserve energy.

Figure 14. Trends in the real market price of oil (in 1996 US dollars per barrel)



17. Total oil and coal consumption in Finland (millions of tonnes)

	Oil	Coal
1990	10.0	6.2
1991	9.7	6.1
1992	9.6	5.2
1993	9.1	6.0
1994	9.6	7.6
1995	9.3	6.1
1996	9.6	7.6
1997	9.1	6.1

These measures meant that oil consumption diminished rapidly in the 1980's, so that the annual consumption during the present decade has fallen to 9 million tonnes. A total of 8.4 million tonnes of motor and aviation fuel was consumed in 1997. If the figure were to remain at this level and the price at approximately USD 12 per barrel, Finland would save some FIM 2,300 million on its crude oil purchases in 1998 relative to the situation in 1997.

Greenhouse gases

One of the major environmental effects of the use of fossil fuels is the emission of greenhouse gases. It has been estimated by an international climate panel that the mean global temperature will rise by some 4 degrees by the year 2100 unless greenhouse gas emissions can be reduced. An agreement was reached at the Kyoto Climate Meeting of December 1997 to do this, the largest reduction quota being assigned to the European Union, i.e. 8% of the 1990 level by the years 2008-2012. At the meeting of the EU Ministers of the Environment in Luxembourg in June 1998, Finland also committed itself to the above aim, but at the same time had recorded in the minutes a statement to the effect that the chances of succeeding in this are closely bound up with the progress of EU internal legislation on such matters as CO_2/energy taxation.

Finland's carbon dioxide emissions from energy generation totalled 58 million tonnes in 1997, i.e. they had decreased by three million tonnes from the previous year, largely thanks to a reduction in the consumption of fossil fuels. The Luxembourg meeting raised by 10% Finland's greenhouse gas emissions for 1990, a decision guided by corrections to the emission figures for individual power stations and the inclusion of changes in land use and the whole life span of peat in the calculations. The exceptionally high imports of electricity in 1990 did not occasion any changes to the initial figure, however.

18. Greenhouse gas emissions in Finland (millions of equivalent tonnes of carbon dioxide)

	1995	2000f	2010f
Carbon dioxide	56.0	58–60	56–71
Methane	5.1	4.7	4.0
Nitrous oxide	5.8	6.4	7.7
Oxides of nitrogen	10.4	9.0	8.0
Carbon monoxide	1.3	1.2	0.9
Hydrocarbons	2.0	1.7	1.2
Total	**80.6**	**81–83**	**78–93**

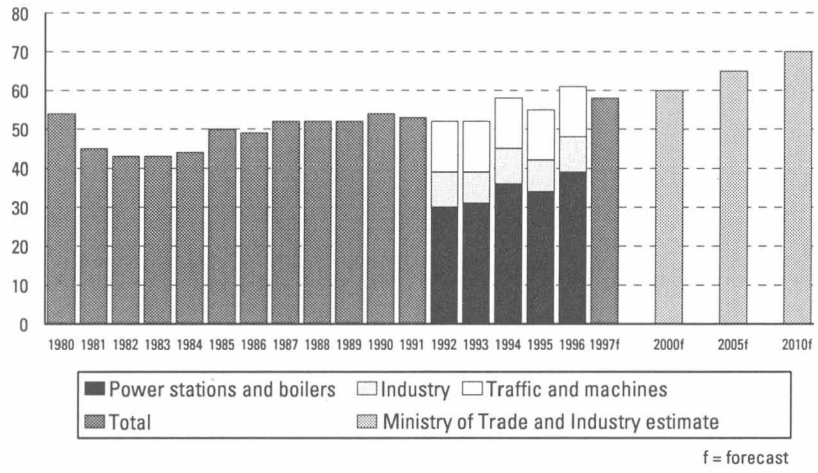
f = forecast

19. Greenhouse gas emissions (in carbon dioxide equivalents) in the EU countries in 1990 and distribution of the quota for reductions by 2008-2012

	CO_2 mill. tonnes	CH_4 mill. tonnes	N_2O mill. tonnes	Total	Reduction quota*)
Luxembourg	13	1	0	14	– 28 %
Germany	1 014	119	70	1 204	– 21 %
Denmark	52	9	11	72	– 21 %
Austria	62	12	4	78	– 13 %
Britain	614	92	35	741	– 12.5 %
Belgium	116	13	10	139	–7.5 %
Italy	442	82	36	560	– 6.5 %
Netherlands	168	23	16	207	– 6 %
France	378	63	56	498	0 %
Finland	**59****)	**8**	**6**	**73**	**0 %**
Sweden	55	7	3	65	+ 4 %
Ireland	31	17	10	57	+ 13 %
Spain	226	45	27	298	+ 15 %
Greece	85	20	7	112	+ 27 %
Portugal	45	17	4	66	+ 27 %

*) = applies to all six gases
**) = corrected emission figure

Figure 15. Carbon dioxide emissions from fossil fuels and peat (millions of tonnes)



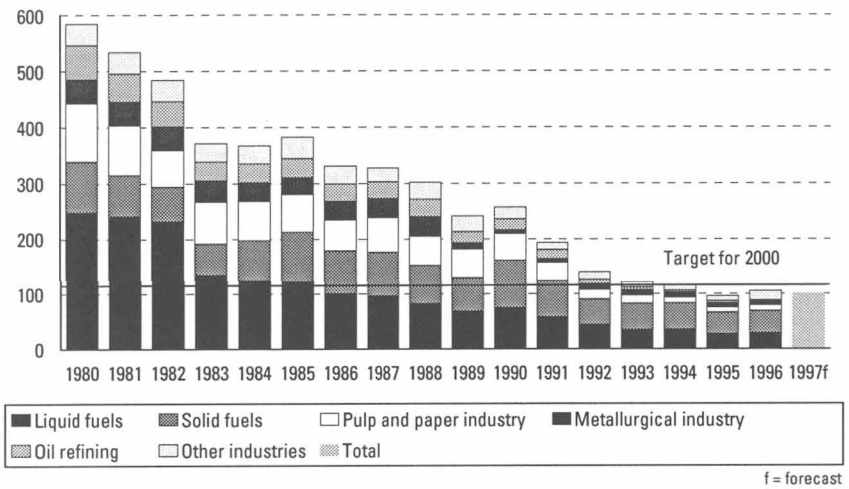
The Kyoto Agreement set emission reduction targets for a basket of six gases: carbon dioxide (CO_2), methane (CH_4), nitrogen oxide (N_20), fluorohydrocarbons (HFC), perfluorohydrocarbons (PFC) and sulphur hexafluoride (SF_6). The most significant greenhouse gas is carbon dioxide which accounts for about 80 per cent of the greenhouse effect of the six gases in the EU. The highest emission reduction potentials can be reached in the energy sector. Limited use of forest sinks is also possible. The greenhouse effect of methane is 21 times greater than that of carbon dioxide. Methane emissions can be reduced by improving waste dumping methods and by sealing up leakages in natural gas pipelines. Finnish waste management still has some potentials for reducing methane emissions.

Emissions of nitrogen oxide originate from industrial processes and the use of fertilisers and catalysers. The greenhouse effect of nitrogen oxide is over 300-fold in comparison with carbon dioxide. In the EU reduction potentials are the highest in the process development of the chemical industry. The greenhouse effect of industrial gases HFC, PFC and SF_6 is thousands of times greater than that of carbon dioxide. There are, however, small amounts of them both in the whole EU and in Finland, only about 2 per cent of the total amount. HFC gases are used to replace compounds that destroy the ozone layer, which means that their amount will grow in the near future.

Air pollution and acid deposition

Acidification affects the soil and water of the areas of Finland that are the most sensitive and receive the most serious loading. The major sources of acid deposition are emissions of sulphur dioxide and the oxides of nitrogen, mostly from energy generation. Finland's sulphur dioxide emissions in 1997 totalled 100,000 tonnes, i.e. only 17% of the 1980 level. This reduction resulted from changes in the structure of energy production, a reduction in the use of heavy fuel oil, a fall in the sulphur content of fuels and improvements in process technology. Finland's sulphur dioxide emissions per GDP are about one third below average for the European OECD countries. 28% of the emissions arose from the generation of electricity and heating energy and 37% from industry. Some 12% of

Figure 16. Finland's sulphur emissions and targets for their reduction (thousands of tonnes of sulphur dioxide)



the sulphur dioxide deposition occurring in Finland comes from sources within the country itself, while 68% of its own emissions are deposited outside its borders. Finland had already reached by 1994 the objectives laid down for the year 2000 in the second sulphur protocol signed in Oslo.

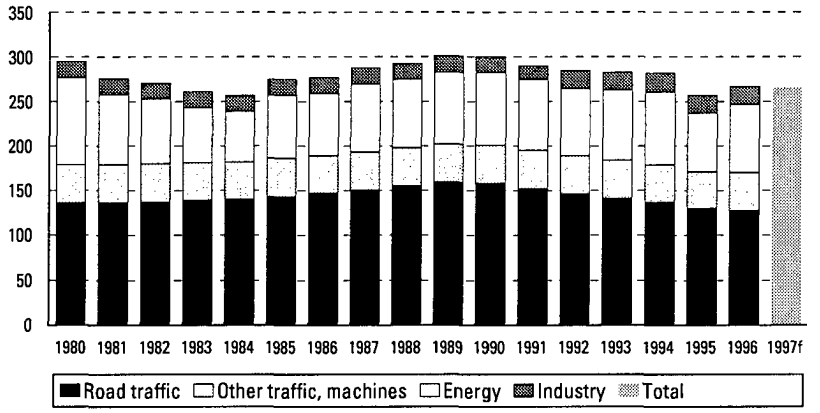
Finland's total emissions of the oxides of nitrogen were some 265,000 tonnes in 1997, i.e. 10% less than in 1980. 64% of these were caused by traffic and 29% by energy generation. Measured against the GDP, these emissions are quite high, some 70% above the average for the European OECD countries. Approximately 16% of the deposition comes from Finnish sources, while 81% of the emissions drift outside Finnish territory. Finland has achieved the objectives set in the Sofia protocol, according to which emissions should be halted at the 1987 level by the year 1994. It seems very likely that the objective of a 30% reduction in emissions set by the EU for large-scale combustion plants will be reached.

Acid deposition has caused damage to a number of fish populations in Finland, and acidification has also been observed in some 2000 lakes in Southern and Central Finland. There have been signs of recovery, during the last few years, however, in that sulphate concentrations in lakes are falling and their resistance to acidification has improved markedly during the past ten years. Despite this admittedly favourable development, critical loads will still be exceeded in some parts of Finland in the year 2000. The EU is currently preparing its own programme for the prevention of acidification.

20. Emissions of sulphur dioxide, oxide of nitrogen and ammonium in the EU countries in 1995 (thousands of tonnes)

	SO_2	NO_x	NH_3
Germany	2 995	2 200	622
Britain	2 365	2 295	320
Spain	2 061	1 223	345
Italy	1 437	2 157	388
France	989	1 666	668
Greece	556	575	77
Portugal	272	254	92
Belgium	253	345	96
Ireland	166	116	124
Denmark	150	250	114
Netherlands	147	518	155
Finland	**95**	**257**	**31**
Sweden	94	362	60
Austria	55	177	93
Luxembourg	8	20	8

Figure 17. Emissions of nitrous oxide in Finland (thousands of tonnes)



f = forecast

NB. The principles for calculating emissions have changed, so that the figures for 1992–1996 cannot be compared directly with the earlier data.

Groundwater pH values have dropped slightly in many places in Finland and the buffer capacity of well water has deteriorated. There does not seem to be any great risk of groundwater acidification, however, nor can acidification be expected to pose any major threat to the well-being of the forests in the next few years. The situation may change in the long term, however, unless deposition can be reduced below the critical load levels throughout the country.

According to a report prepared by the Acidification Committee in July 1998, sulphur and nitrogen reductions in Finland are sufficient for the time being and no additional reductions are needed to fulfil present international agreements. As reductions in Finland's own emissions have only little effect on the reduction of the acidifying total deposition, it is vital for Finland to exert her influence so as to reduce emissions in other parts of Europe, especially in the immediate neighbourhood of Finland.

Sustainable energy supplies

Sustainable development requires that energy should produced in an economic, efficient and safe manner and that its consumption should be adjusted to the bearing capacity of the environment. Special attention should be paid to promoting the use of renewable energy sources and improving the efficiency of its use. The main factor acting against this is the high cost of renewable sources as compared

21. Origins of acid deposition in Finland in 1995 (%)

	Sulphur	Nitrogen
Finland	12	16
EU and EES	18	44
Eastern Europe	12	7
Baltic States	7	4
Russia etc.	21	8
Other countries	31	21
Total	**100**	**100**

22. Places of deposition of emissions of Finnish origin in 1995 (%)

	Rikki	Typpi
Finland	32	19
EU and EES	7	9
Eastern Europe	1	3
Baltic States	4	4
Russia etc.	31	44
Other countries	26	23
Total	**100**	**100**

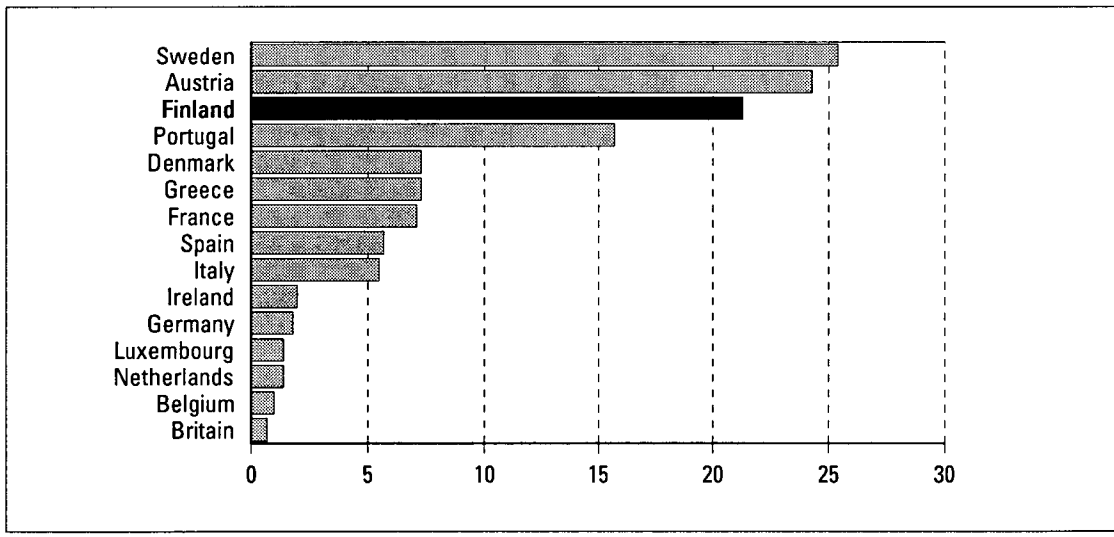
with traditional ones when external expenditure is not taken into consideration.

The European Union has devoted considerable attention to promoting the use of renewable energy sources during the 1990's, advocating such solutions as solar energy, wind-powered generators, biomass and waste, geothermal energy and small-scale hydroelectric schemes. It published a White Paper to this effect at the end of 1997, in which the objective was to double the proportion of renewable energy sources from 6% to 12% by the year 2010. The ALTENER research programme pursued by the EU in 1993-1997, which was concerned with energy sources of the above kinds, was aimed in at promoting the introduction of renewable energy sources and trade in the relevant equipment and technology. The aim was to reduce carbon dioxide emissions by 180 million tonnes by doubling the use of renewable sources to 8% of total consumption by the year 2005. A further two-year ALTENER II programme was launched in January 1998 in order to continue the work of promoting the use of renewable energy sources. Its budget for 1998-1999 is ECU 22 million and its objectives support in many ways those of the earlier ALTENER programme. A corresponding SAVE II programme exists to promote the conservation of energy.

The EU will also endeavour to increase the adoption of renewable energy sources in 1998-2010 through a major investment campaign aimed at the construction of solar panel systems capable of generating 1 million 1 KWh of electricity, wind generator parks producing 10,000 MW and a biomass capacity of 10,000 MW and at the creation of 100 model communities that will rely on the use of renewable energy only. The total costs of this campaign will amount to ECU 20,500 million. All in all, attainment of the 12% objective by the year 2010 will require investments totalling ECU 165,000 million in renewable energy sources. This would reduce carbon dioxide emissions by 402 million tonnes.

The commercial utilisation of wind and solar energy began in the 1980's and has been increasing rapidly ever since. Wind generation costs have fallen by as much as 30-40% since the early 1990's and the cooperative body for centres of research into renewable energy

Figure 18. Renewable energy sources as a proportion of total energy consumption in 1995 (%)



headed by the EU expects that the costs will fall to the level of that generated by condensing power plants by the year 2005. The current level in Denmark and Britain is FIM 0.20 per kWh. The bulk of the world's wind generation capacity is currently located in Denmark, Germany and California. The technology required for extensive exploitation of solar energy already exists, although at the laboratory level only. According to calculations by international experts, current market trends and technological progress will render the direct use of solar energy competitive as compared with conventional sources around 2010-2020. Modern solar panels convert solar radiation to electricity at 5-15% efficiency.

The maximum government support paid for the adoption of renewable energy sources and energy saving measures in Finland is 30% of the investment costs, although the proportion may be greater, as much as 50%, in projects connected with the development of new technology. Finland has good opportunities for increasing the utilisation of wind energy rapidly in the next few years, thanks to the accumulation of knowhow and the favourable wind conditions. The country also possesses high-level expertise in the use of solar energy. A total of 16.6 GWh of electricity was produced by wind generators in Finland in 1997, with an overall capacity of 12 MW. The average price of electricity generated by wind power in Finland is FIM 0.25 per kWh.

Wood and peat account for more than 18% of total energy production in Finland, one of the largest figures recorded anywhere in the EU. Yet there are abundant unexploited resources still to be found in the forests, mires and fields. Some 100,000 hectares of mires are either in use or in preparation for fuel peat cutting, and the total mire resources available for this purpose are approximately 600,000 hectares. Given the current combustion rate, fuel peat resources will suffice for the next 300 years. Most of the peat mining areas are located in Central and Northern Finland and act as a major source of employment in regional terms. Promoting energy saving is an important part of Finland's energy policy, and the measures taken to this effect will naturally help the country to achieve the environmental objectives to which it is committed under international agreements.

Energy generation in Finland is highly efficient, largely thanks to the combined production of electric power and heating energy. The efficiency of fuel can rise as high as over 90 per cent in combined heat and power generating plants, while in conventional power generating condensate plants this efficiency is only half of that. In Finland these so-called CHP plants generated 22.9 terawatt-hours, i.e. 31 per cent of electricity in 1997. The proportion of Finland is one of the highest in the world, only Denmark and Holland are able to reach the same level. The proportion of power plants operating in connection with industrial processes was less than half of combined heat and power production. Community power plants generated 12.1 terawatt-hours of electricity and 20.7 terawatt-hours of district heat.

In 1997 a total of 26.2 terawatt-hours of district heat was produced, 79 per cent of which originated from combined heat and power production. About 44 per cent of the population lives in dwellings connected to the district heating network. In Helsinki 93 per cent of the population lives in district heated dwellings, in Tampere 71 per cent, in Lahti 90 per cent and in Oulu 81 per cent. The average price of district heating energy was FIM 0.188 per kWh.

Energy taxes

The taxation of energy in Finland was revised at the beginning of 1997 by shifting the emphasis to taxing of the end product, i.e. electricity. Although the fuels used to generate electricity are exempt from taxation, a tax is still levied on fuels used to produce heating energy. The electricity tax was divided into a lower and a higher tax bracket, the former applying to industry and market gardeners using hothouses and the latter to households, the service sector, agriculture and the public sector. The change reduced the price of electricity slightly for those in the lower tax bracket, whereas those in the higher one were faced with a markedly higher tax burden and a rise of several percent in the price of electricity. In the case of fuels used to generate heating energy, the tax is no longer based on the energy content but on the carbon content alone. This doubled the rate to FIM 70 per tonne of carbon dioxide. The result was an increase of a couple of percent in the price of district heating produced from taxable fuels.

23. Energy taxes in Finland in 1997 and 1998*)

	1.1.1997	1.1.1997	1.9.1998
Petrol p/l (Unleaded)	312.3	332.3	332.3
Diesel fuel (Sulphur free)	165.6	180.6	180.6
Light fuel oil	31.0	34.8	40.0
Heavy fuel oil	23.8	27.5	33.8
Coal FIM/t	176.0	205.8	253.0
Peat FIM/MWH	4.2	4.9	9.0
Natural gas	7.6	8.8	10.8
Electricity, tax bracket I	1.675	2.095	2.575
Electricity, tax bracket II	3.1	3.375	4.175

*) = includes payment for maintenance support performace

The reform improved the competitiveness of electricity generation in Finland in relation to imported electricity and removed the difficulties for the Nordic electricity grid caused by the previous tax system. It also favoured the use of low-emission fuels in heating energy production, although at the same time detracting from the environmental control exercised over electricity generation through the taxation system.

The electricity surtax payable by industrial companies and private consumers was increased by an additional 24% in September 1998. This rise was offset in the case of traffic fuels by reducing the basic tax on these so that the overall tax burden remained unchanged. Higher taxes were also levied on the use of coal, peat and natural gas for the production of heating energy. The principle behind the increase in the electricity tax was to provide more incentive for the exploitation of renewable sources of energy. The tax refund on electricity generated by wind power was consequently increased from 2 pennies to over 4 pennies per kWh. The rises are expected to increase energy tax revenues by FIM 700 million a year, of which households will pay slightly less than FIM 300 million, the service and transport sectors FIM 150 million and industry FIM 250 million. On account of tax refunds, the net effect in the industrial sector will remain at FIM 165 million. Further revenues of some FIM 300 million will accrue from the VAT levied on energy supplies and the rise in energy consumption. On these grounds the revenue from the surtax can be calculated at almost FIM 4,900 million in 1999.

6 Transport

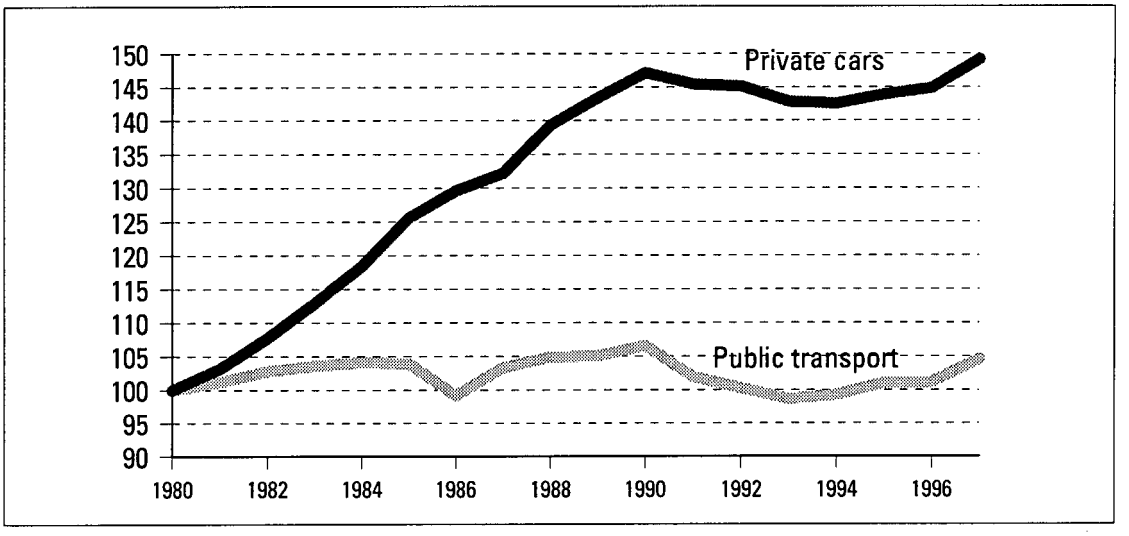
Trends in traffic volumes

The annual distance travelled per head of population in Finland is one of the highest in the European Union. These transport demands and the resulting costs are a consequence of the sparse distribution of population, the decentralised community structure and the country's remote location relative to its main export markets. Internal goods transport has increased by 14% since 1980 and road traffic by more than 30%, while other forms of transport have decreased in proportional terms. A far greater proportion of goods are transported by than in Central Europe, but in spite of this, freight costs are 2-3 times higher than in most competing countries in Europe.

Traffic volumes and the number of cars increased by almost 60% in the 1980's, only to fall temporarily during the recession of the early 1990's. Public transport as a proportion of total passenger traffic has remained more or less unchanged for the past 20 years, and has even risen in some urban areas. Of the domestic per capita passenger traffic, private cars accounted for 80% in 1996, buses and coaches for 14%, railways 5%, air transport 1.5% and boat traffic 0.2%. Passenger traffic has been predicted to increase by 30% between 1995 and the year 2010 and freight transport by 42%.

The efficiency of the transport system has increased during the 1990's, while costs have decreased by almost 10%. Most exports and imports are conveyed by sea. The proportion of the total internal freight transport per capita that takes place by road has remained almost unchanged at 65% throughout the 1990's. The railways account for one fourth of all internal freight transport. The fairly sparse railway network nevertheless means that only certain long-distance hauls could reasonably be transferred to the railways.

Figure 19. Trends in public transport and the use of private cars (1980=100)



Environmental impact

Transport has the following environmental consequences:

- greenhouse gas emissions, e.g. carbon dioxide, methane and nitrous oxide
- other exhaust gas emissions, e.g. oxides of nitrogen, sulphur dioxide, carbon monoxide and particles
- emissions of volatile organic compounds
- pollution of groundwater
- noise
- fragmentation of ecosystems and landscapes
- waste

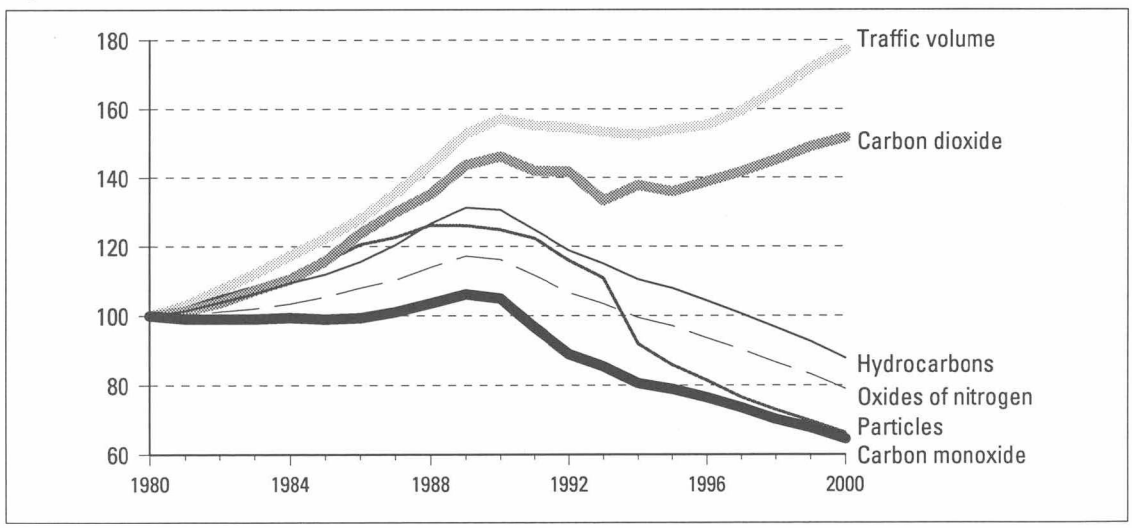
Vehicle emission limits have been tightened considerably in the 1990's in order to reduce environmental hazards. Lead emissions from petrol engines and sulphur emissions from diesel engines have been practically eliminated during this decade through changes in fuel additives, and the new, cleaner fuels have also reduced nitrogen, hydrocarbon and carbon monoxide emissions below the 1980 level despite a 40% rise in fuel consumption. The introduction of catalytic convertors in the early 1990's reduced carbon monoxide, hydrocarbon, nitrogen dioxide and methane emissions, but increased the amounts of nitrous oxide, which is formed in these convertors. It is estimated that some 840,000 persons are exposed to traffic noise in excess of 55 dB each year.

Environmental loading from railways has been reduced by electrification of many lines, and plans exist for a continuation of this programme. Efforts have been made to combat railway noise by polishing the tracks, for example. Shipping is becoming responsible for an increasing proportion of total emissions, so that 90% of all transport sector

24. Traffic emissions as a percentage of total emissions in Finland

Type of emission	Percentage attributable to traffic
Carbon monoxide	75
Oxides of nitrogen	60
Hydrocarbons	60
Carbon dioxide	23
Sulphur dioxide	20

Figure 20. Trends in road traffic emissions (1980=100)



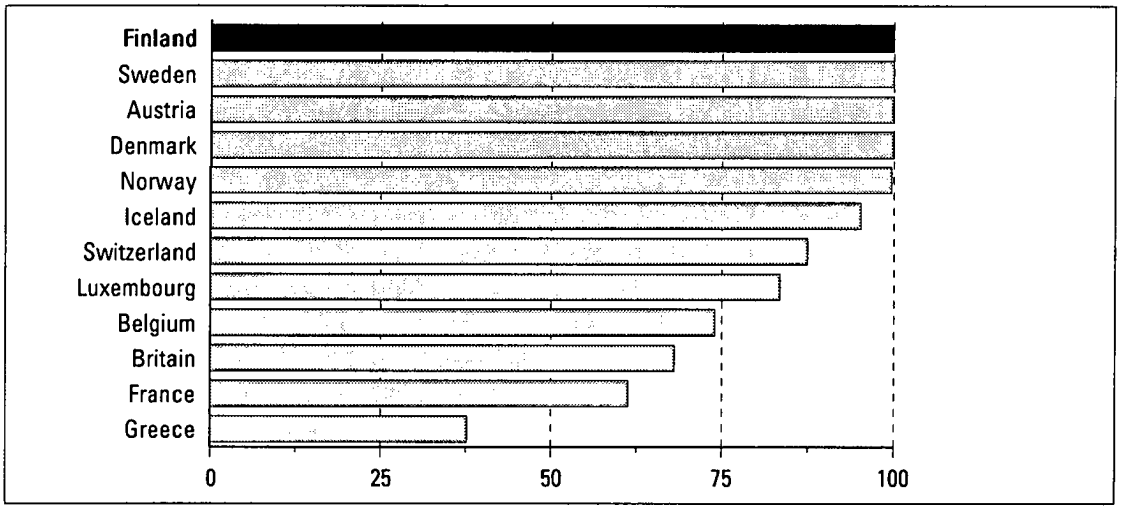
sulphur emissions are now traceable to this source. An agreement concluded in autumn 1997 stipulates that the sulphur content of fuels employed in international shipping must not exceed 4.5%, and the limit set for the Baltic Sea is still stricter, 1.5%.

Air traffic is predicted to expand by 6-8% a year in the near future, and an EU survey suggests that its carbon dioxide emissions will increase in Europe by 3-4% a year. Air traffic accounts at present for 5% of all traffic-induced carbon dioxide emissions in Finland, and the growth in its volumes effectively cancels out the reductions in emission achieved through the improved fuel utilisation efficiency of modern aircraft engines. The marked expansion in air traffic is predicted to continue for the next twenty years or so.

The Kyoto Protocol mentioned the restricting of carbon dioxide emissions as an increasingly powerful challenge for our efforts to ameliorate the environmental effects of traffic. Traffic-induced carbon dioxides can only be expected to increase slightly by the year 2015, thanks to improvements in the energy efficiency of new vehicles, and as these emissions tend to rise with fuel consumption, measures should also be taken to influence people's need for travelling from place to place. Effective reductions in emissions of the oxides of nitrogen call for the use of catalytic convertors in private cars and the introduction of new engine technologies for heavy vehicles. As the cars on the road are renewed slowly, it will not be until around the year 2010 that all petrol-driven cars in Finland are fitted with catalytic convertors, even though almost a half of all private cars have them now. All the petrol sold in Finland is unleaded, as is also the case in Sweden, Austria and Denmark, and almost all the diesel fuel sold here is free of sulphur.

Car emissions are controlled more extensively by means of annual analyses in Finland than in the other EU countries, and threshold air quality values are nowadays violated less frequently, thanks to progress in fuel technology. The limit for carbon monoxide emissions is seldom broken, but the norms for particles and the oxides of nitrogen are exceeded on occasions. The limits imposed on particle emissions from heavy vehicles and improved street cleaning can be expected to reduce particle emissions in the future.

Figure 21. Unleaded petrol as a percentage of total petrol sales in 1996 (%)



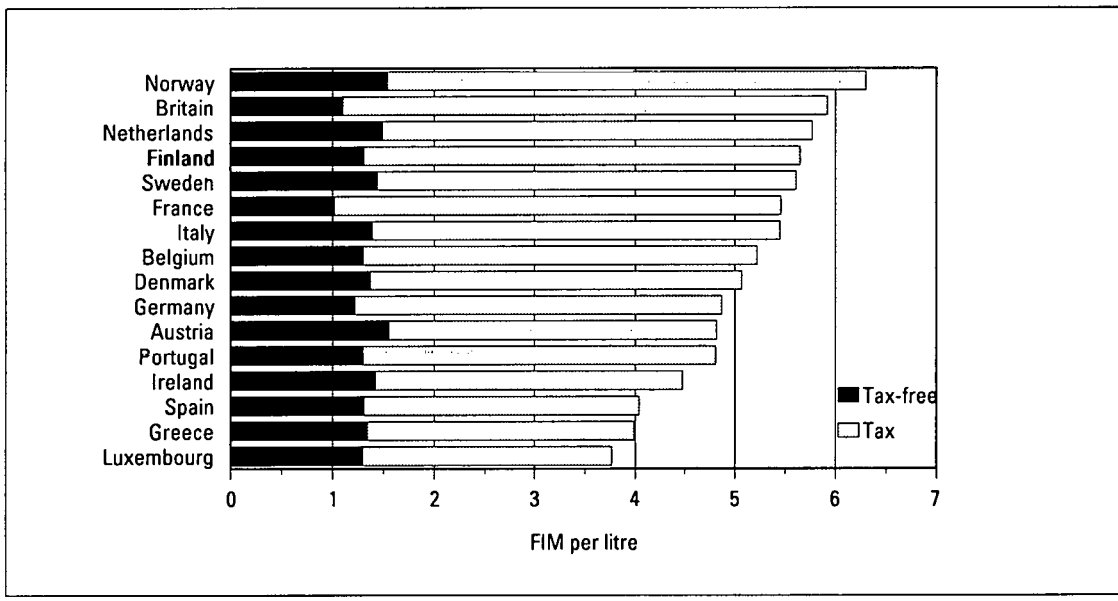
The EU member states agreed in June 1997 on stricter fuel quality requirements, with the aim of reducing traffic emissions in the EU countries by 60-70% from the 1990 level by the year 2010. The requirements will be tightened gradually over the period 2000-2005. On the other hand, the EU strategy for reducing carbon dioxide emissions from private cars does not seem to be implementable merely through agreements concluded with the automotive industry. The aim was to reduce fuel consumption in private cars to approximately 5 litres per 100 km by the year 2005 and that of diesel vehicles to 4.5 litres per 100 km.

The salt used on the Finnish roads in winter, amounting to some 100,000 tonnes a year in the last few years, also has a major environmental impact. A half of the major groundwater areas, for example, have roads which must be salted in winter. An extensive research programme launched in 1992 to examine the long-term adverse effects of road salt on groundwater reserves has shown that the water at 25% of the 250 groundwater supply plants has a chloride content in excess of the norms. Other de-icing substances are at present under investigation for possible for use on the roads in Finland, and instructions for the use of some of these at airports were issued in 1996.

Transport costs and taxation

More than FIM 12,200 million will be spent on the maintenance of transport routes in 1998, including FIM 4,100 million on roads, FIM 3,100 million on streets, FIM 2,500 million on railway tracks, FIM 600 million on waterways, FIM 1,200 million on air traffic and airports and FIM 800 million on harbours. In its Green Paper entitled 'Towards equitable, effective traffic pricing', the EU defined as its long-term target a system of taxes and fees for different modes of transport that would also cover the incidental costs, i.e. the costs arising from emissions, noise, traffic jams and accidents that are not met directly by those causing them. Research indicates that road transport in Finland does meet such costs in full.

Figure 22. Retail prices of petrol (95E) on 15.7.1998



In addition to economic instruments, the environmental effects of traffic can be reduced by altering the proportions of the different modes of transport and through improved planning of community structures. Attempts are now being made to avoid the environmental problems caused by the use of land for transport purposes by developing a system for evaluating the environmental impact in advance. All in all, 34% of the environmental impact assessments completed or in preparation are concerned with transport projects.

Most of the revenue from environmental taxes and payments accrues from taxes on traffic, particularly those on fuels, even though these are mainly collected on fiscal grounds. Fuel taxes amounted to some FIM 14,100 million in 1997. These taxes are discriminatory on environmental grounds and have had the effect of ensuring that the reformulated, more oxygen-rich petrols have in practise replaced the 'ordinary' grades.

Taxes make up 74% of the price of unleaded petrol in Finland, which is the fifth highest figure in the OECD countries after Norway, Britain and the Netherlands. The tax on diesel fuel is slightly below the OECD average, however.

25. Taxes levied on road traffic (FIM million)

	1994 R	1995 R	1996 R	1997 R	1998 B	1998 BP
Vehicle licence tax	618	1 046	1 110	1 129	1 140	1 120
Vehicle fuel tax	844	668	929	980	900	1 000
Excise duty/ VATon motor vehicle tax	450	590	792	924	990	1 166
Motor vehicle tax	2 054	2 685	3 611	4 210	4 500	5 300
Excise duty/ VATon fuel tax	2 150	2 550	2 797	3 057	3 337	3 586
Fuel tax	9 815	11 628	12 714	13 895	15 170	16 300
Total	**15 931**	**19 167**	**21 953**	**24 195**	**26 037**	**28 472**

7 Towards sustainable development

Despite the ongoing economic revival in Finland and the increase in economic returns, environmental loading has decreased until recent years. Even so, the old burden of pollution and waste still imposes a major strain on the environment in places, and it is always possible that substantial economic growth could lead to renewed environmental effects without a far-reaching preventive policy. According to an OECD evaluation of the profitability of Finland's environmental policy in 1996-97, Finland has developed its environmental legislation well and has succeeded in reducing conventional forms of environmental loading through administrative measures. It is also stated in the OECD report that Finland has reduced its atmospheric emissions in particular, chiefly the deposition of sulphur dioxide, lead and acidifying substances, and its household and industrial waste water emissions. Finland's environmental policy will be faced with entirely new challenges in the future, however, despite the good results achieved so far.

Economic globalisation will reduce individual countries' possibilities for influencing the standards of environmental protection in their own areas. It has become more difficult, for example, to adopt environmental taxes in an independent manner, and to some extent also to create a national environmental legislation, while at the same time the increased freedom of trade may lead to economic growth of such proportions that environmental loading becomes substantially greater. Such changes will place more emphasis on the role of international agreements in environmental protection. However, the effectiveness of such agreements is dependent on the achievement of a broad consensus on both the objectives and the ways in which these should be fulfilled, and it is not necessarily easy to reach such a consensus.

Finland hopes to contribute actively to the development and implementation of a policy for sustainable development. Although many positive environmental results have been gained in this respect in the last few years, current policies have not yet produced any major changes in the state of the environment or in the use of natural resources. The challenge for environmental administrations in the future will be to develop ways in which a comprehensive approach which takes into consideration all the forms of complex interaction between environmental and economic factors can be converted into practical policies.

Some progress has been made in environmental protection in Europe in the last few years, even though the changes are not yet reflected directly in the state of the environment. The reduction of factors contributing to the greenhouse effect, nitrogen emissions, diffuse loading into lakes, rivers and sea areas and emissions giving rise to ozone formation in the lower atmosphere are aspects that will call for major additional efforts in the future. As a member of the European Union, Finland is committed to its environmental protection objectives. Sustainable development will require changes in production and consumption habits in particular. The use of instruments of economic control, particularly environmental taxation, to back up administrative initiatives have not proved sufficient, because no agreement has been reached on their effective use as a means of altering production and consumption habits. A successful environmental policy in the future will require the development and adoption of new methods of control in environmental matters.

Principal agreements on the conservation of natural resources and the environment to which Finland is committed

Agreement	Objectives	Implementation
Climatic change Kyoto Protocol on Climate Change, 1998	To stabilise greenhouse gas concentrations in the atmosphere at a safe level. To reduce greenhouse gas emissions by at least 5% from the 1990 level over the period 2008-2012. The target varies from one country to another, that for Finland being to reduce emissions at least to the 1990 level, while the EU countries as a whole will be aiming at an 8% reduction.	The protocol has not yet come into force. The signatories will implement their emission reductions through an operative policy and measures adjusted to their national conditions. The document also enables the trading of emission reduction quotas, to be agreed on in more detail in Buenos Aires in autumn 1998.
Substances depleting the ozone layer in the upper atmosphere Montreal Protocol, 1987.	To arrest the depletion of the ozone layer and to restore it to a level which is safe from the point of view of human health and the environment. To restrict and eventually stop the manufacture and consumption of substances that affect the ozone layer.	Substances that cause depletion of the ozone layer are no longer manufactured in Finland, and the importation of CFC substances and halogenated hydrocarbons has decreased by over 95% since 1990. The use of such substances has been restricted by decision of the Council of State. The most recent restrictions concern HCFC and HBFC compounds and methyl bromide.
Sulphur emissions Sulphur Reduction Protocol, 1994.	To ensure in the long run that sulphur deposition does not exceed the critical load for each area. The first step will be to reduce the excess by 60% by the year 2000. To this end, Finland is committed to cutting down its sulphur emissions by 80% from the 1980 level by the year 2000.	The protocol took effect in August 1998. Finland's emissions in 1997 were already 83% lower than in 1980. Keeping emissions at this level will require additional action, however.
Emissions of oxides of nitrogen Protocol on the Control of Nitrogen Oxide Emissions and their Transboundary Fluxes, 1988. Declaration on the reduction of nitrogen oxide emissions, 1988.	Finland was committed to freezing its emissions of the oxides of nitrogen at the 1987 level by the end of 1994. In the declaration Finland announced its intention to reduce emissions by 30% from the 1980 level by 1998.	Emissions of the oxides of nitrogen had decreased in 1997 by well nearly 8% from the 1987 level.
Volatile organic compounds International Protocol on the control of Volatile Organic Compound Emissions and their Transboundary Fluxes, 1991.	To cut down emissions of volatile hydrocarbons by 30% from the 1988 level by 1999.	The protocol took effect on 29.9.1997.

Agreement	Objectives	Implementation
Biological diversity Agreement on Biological Diversity, 1992.	To protect the diversity of global ecosystems, animal and plant species and their genes, to establish a pattern for their sustainable use and to achieve an equitable division of the benefits gained from the use of biological natural resources.	A national action programme on biological diversity was completed in summer 1997, and a national report assessing the state of biodiversity in Finland will be submitted in autumn 1998.
Protection of the Baltic Helsinki Convention, 1974. Helcom Recommendations 1980-. Ministerial statements 1988, 1998. Baltic Environmental Programme 1992. Baltic Protection Agreement 1992.	To reduce the loading of nutrient, heavy metals and non-degradable or toxic substances imposed on the Baltic Sea by 50% by 1995 and to protect the marine environment.	The targets will be pursued by integrating them into the national legislation and programmes, and into decisions of the Water Court in individual cases, and by economic incentives and the dissemination of information.
Hazardous waste Basel Agreement on the Transboundary Transport of Hazardous Waste and Supervision of its Handling, 1989.	To reduce the production of hazardous waste and its transportation from one country to another and to prevent its conveyance to countries that lack the facilities for handling it properly.	Finland has a sufficient number of facilities for the final processing of hazardous waste, so that only an extremely small proportion of such waste has had to be processed overseas. Most of the waste exported, a total of 25,000-30,000 tonnes a year, was sent to Western European countries. Exports of hazardous waste to non-OECD countries is prohibited by law.
ECE general agreement on long-distance transport of air pollution across national boundaries.		
Protocol on heavy metals.	Restriction of emissions of mercury, cadmium and lead into the atmosphere.	Finland signed the protocols in June 1998.
Protocol on non-degradable organic compounds.	Restriction or total abolition of the use of non-degradable organic compounds	

1. Trends in real GDP and atmospheric emissions in Finland

	GDP at 1990 price level, FIM thousand million	Carbon dioxide emissions, millions of tonnes	Sulphur dioxide emissions, thousands of tonnes	Emissions of oxides of nitrogen, thousands of tonnes
1980	379.3	54	584	295
1981	386.4	45	534	276
1982	398.9	43	484	271
1983	409.7	43	372	262
1984	422.0	44	368	258
1985	436.3	50	383	275
1986	446.6	49	331	278
1987	464.9	52	327	288
1988	487.7	52	303	293
1989	515.4	52	242	301
1990	515.4	54	258	300
1991	479.0	53	195	290
1992	462.0	52	141	285
1993	456.6	52	122	283
1994	477.3	58	118	282
1995	501.5	55	95	257
1996	519.3	61	105	267
1997	550.5	58*)	100*)	265*)

Source: Statistics Finland, national economic accounting and environmental accounting. *) forecast

2. Trends in the world market prices of certain metals (1965=100)

	Pig iron	Copper	Lead	Zinc
1965	100.0	100.0	100.0	100.0
1975	103.3	112.5	134.5	157.0
1985	77.4	96.8	82.9	118.2
1995	75.1	103.2	67.1	117.5
1998	63.3	94.5	59.7	95.6

Source: United Nations, United Nations Conference on Trade and Development - UNCTAD, Monthly Commodity Price Bulletins.

3. Mining of ores and industrial minerals and quarrying of limestone in 1980-97 (millions of tonnes)

	Ore	Limestone	Industrial minerals
1980	10.5	3.1	3.1
1981	9.9	5.0	3.5
1982	9.7	5.5	5.1
1983	9.0	6.0	6.0
1984	9.5	5.6	7.1
1985	8.4	5.8	7.2
1986	6.9	5.0	7.2
1987	6.1	5.0	7.9
1988	6.1	5.4	8.3
1989	5.5	5.5	8.6
1990	5.5	5.7	8.3
1991	5.5	5.3	7.2
1992	4.7	4.4	8.0
1993	4.9	4.1	8.7
1994	4.6	3.9	9.2
1995	3.2	3.4	9.3
1996	3.4	3.4	9.3
1997	3.5	3.7	9.9

Source: Mining Industry Association.

4. Forest increment and total drain (million solid cubic metres)

	Increment	Total drain
1980	68.4	58.8
1981	68.4	56.1
1982	68.4	52.9
1983	68.4	50.6
1984	68.4	52.6
1985	77.1	55.0
1986	77.1	49.6
1987	77.1	54.1
1988	77.1	57.1
1989	75.4	58.7
1990	75.4	55.0
1991	75.4	44.6
1992	75.4	50.8
1993	75.4	53.7
1994	75.4	61.5
1995	75.4	63.6
1996	75.4	56.9
1997	75.4	64.1

Source: Finnish Forest Research Institute; Inventory of the Finnish forests.

5. Use of fertilisers in agriculture (kilogrammes per arable hectare)

Year of fertilisation	Nitrogen	Phosphorus
1979/80	83.3	27.9
1980/81	82.4	27.8
1981/82	78.7	26.8
1982/83	91.4	29.9
1983/84	90.7	30.9
1984/85	88.9	30.8
1985/86	90.0	30.2
1986/87	94.4	31.0
1987/88	98.2	32.0
1988/89	100.3	29.7
1989/90	111.5	30.7
1991/91	109.4	26.3
1991/92	92.8	19.9
1992/93	94.3	19.4
1993/94	94.1	19.0
1994/95	101.6	20.0
1995/96	92.3	16.1
1996/97	86.0	11.8

Source: Ministry of Agriculture and Forestry, Information Service.

6. Use of pesticides in agriculture (thousands of kilogrammes of active ingredient)

	Weedkillers	Others	Total
1980	2099.1	345.0	2444.1
1990	1580.1	413.8	1993.9
1991	1375.4	312.3	1687.7
1992	1006.7	332.8	1339.5
1993	842.8	364.8	1207.6
1994	929.2	342.5	1271.7
1995	791.4	244.2	1035.6
1996	677.3	234.8	912.1
1997	773.9	264.5	998.4

Source: Ministry of Agriculture and Forestry, Information Service Centre.

7. Sources of water loading in 1995 (tonnes)

	Phosphorus	Nitrogen
Agriculture	3 300	32 900
Industry	357	4 333
Households	660	17 270
Deposition from air	400	6 940
Fish farming	158	1 211
Other human activities	269	1 858
Natural runoff	1 800	45 000
Total	**6 994**	**110 512**

Source: Finnish Environment Institute.

8. Phosphorus loading from industry, households and fish farming (tonnes)

	Industry	Fish farming	Households
1985	836	134	518
1986	751	145	511
1987	840	170	479
1988	885	210	454
1989	832	250	436
1990	699	250	458
1991	578	245	296
1992	501	219	279
1993	414	188	242
1994	379	167	274
1995	357	154	245
1996	297	153	247

Source: Finnish Environment Institute.

9. Implementation of nature conservation programmes, 1.1.1998 (hectares of land area)

	Total land area	Founded	Not yet founded	
			On state land	On private land
National parks and nature reserves	838 130	833 100	4 030	1 000
Herb-rich woodland protection programme	5 200	2 200	1 400	1 600
Mire protection programme	588 000	410 700	113 600	64 000
Shore protection programme	145 500	5 600	77 300	62 600
Bird sanctuary protection programme	83 000	5 000	3 700	74 300
Protection programme for ancient forests	344 100	9 800	314 600	19 700

Source: Ministry of the Environment: Department of Areal Use.

10. Production in the pulp and paper industry and loading of rivers and lakes (thousands of tonnes per year)

	Paper and board	Pulp oxygen	Chemical demand	Organic chlorine compounds	Phosphorus
1990	8 958	5 093	430	9.7	641
1991	8 777	4 894	380	7.2	532
1992	9 145	4 913	330	4.7	480
1993	9 953	5 589	270	3.0	375
1994	10 909	6 331	270	2.0	335
1995	11 012	5 797	260	1.6	320
1996	10 442	5 739	213	1.1	250
1997	12 149	6 620	227	1.1	228

Source: The Forest Industry Association, Yearbooks on Environmental Protection.

11. Production in the pulp and paper industry and emissions into the atmosphere (thousands of tonnes per year)

	Production of paper and board	Production of pulp	Sulphur dioxide	Oxides of nitrogen	Particles
1990	8 958	5 093	24 100	16 200	22 000
1991	8 777	4 894	16 300	18 900	18 300
1992	9 145	4 913	9 500	19 100	13 000
1993	9 953	5 589	7 200	21 300	11 000
1994	10 909	6 331	6 500	23 000	9 500
1995	11 012	5 797	4 900	21 100	7 800
1996	10 442	5 739	5 300	21 100	7 000
1997	12 149	6 620	6 315	21 878	4 609

Source: The Forest Industry Association. Yearbooks on Environmental Protection.

12. Recovery of waste paper in certain countries in 1996 (per cent)

Austria	73
Germany	71
Switzerland	67
Netherlands	65
Finland	**61**
Sweden	57
Japan	51
United States	45
Norway	45
Canada	44
Spain	42
France	41
Britain	40
Belgium	39
Portugal	39
Italy	31

Sources: Pulp and Paper International and the Forest Industry Association.

13. Total energy consumption in certain countries relative to GDP in 1995

	Total energy consumption, kilogrammes of oil /FIM 1000	Total energy consumption kilogrammes of oil/inhabitant	Electricity consumption kWh/inhabitant
Canada	69.0	7 881	16 549
Turkey	63.8	1 009	1 165
United States	61.2	7 900	12 797
Iceland	59.6	8 027	17 233
Portugal	48.2	1 941	3 065
Greece	47.8	2 267	3 748
Belgium	46.0	5 167	7 381
Luxembourg	45.5	8 240	14 873
Netherlands	42.2	4 744	5 760
Finland	**40.0**	**5 613**	**13 560**
Sweden	39.1	5 733	15 427
Britain	38.9	3 786	5 560
Spain	35.7	2 639	3 969
France	34.8	4 151	6 777
Ireland	34.4	3 200	4 564
Germany	34.4	4 155	6 330
Norway	31.3	5 442	24 798
Japan	28.4	3 960	7 587
Austria	27.3	3 279	6 302
Denmark	25.9	3 918	6 463
Italy	25.4	2 818	4 563
Switzerland	20.1	3 551	7 362

Source: IEA/OECD; Energy Balances of the OECD countries 1994-1995.

14. Trends in oil prices in real terms on the global market (USD per barrel at 1996 monetary level)

	Current prices	Real prices (at 1996 monetary level)
1970	2.1	7.0
1971	2.6	8.4
1972	2.8	8.8
1973	3.1	8.9
1974	11.2	27.9
1975	10.6	23.9
1976	11.8	25.5
1977	12.8	26.0
1978	12.9	24.3
1979	29.2	49.4
1980	35.5	52.9
1981	34.1	46.6
1982	31.4	41.2
1983	28.4	36.7
1984	28.3	35.8
1985	27.0	33.8
1986	13.8	17.5
1987	17.8	22.2
1988	14.2	17.3
1989	16.9	19.5
1990	17.6	19.6
1991	18.3	19.7
1992	18.2	19.4
1993	16.1	17.0
1994	15.5	16.2
1995	16.9	17.4
1996	20.4	20.4
1997	19.2	19.2
1998*)	14.1	12.2

*) = I–IV/98

Source: United Nations, United Nations Conference on Trade and Development - UNCTAD, Monthly Commodity Price Bulletins. NB. Concerns Crude Petroleum/Dubai, UK Brent and Alaska Average, spot, FOB.

15. Carbon dioxide emissions from fossil fuels and peat in Finland (millions of tonnes)

	Total	Power stations and boilers	Industry	Traffic and machinery
1980	54	..	..	..
1981	45	..	..	..
1982	43	..	..	..
1983	43	..	..	..
1984	44	..	..	..
1985	50	..	..	..
1986	49	..	..	..
1987	52	..	..	..
1988	52	..	..	..
1989	52	..	..	..
1990	54	..	..	..
1991	53	..	..	..
1992	52	30	9	13
1993	52	31	8	13
1994	58	36	9	13
1995	55	34	8	13
1996	61	39	9	13
1997	58	..	..	..
2000	60*)	..	..	..
2005	65*)	..	..	..
2010	70*)	..	..	..

*) = Ministry of Trade and Industry forecast .. = data missing
Source: Ministry of Trade and Industry, Statistics Finland.

16. Sulphur emissions in Finland in 1980-97 (thousands of tonnes of sulphur dioxide)

	Liquid fuels	Solid fuels	Pulp and paper industry	Metallurgical industry	Oil refining	Other industries	Total
1980	248	91	104	42	61	38	584
1981	241	74	89	42	50	38	534
1982	232	62	65	42	45	38	484
1983	135	57	75	38	34	33	372
1984	125	73	71	33	34	32	368
1985	122	91	68	30	34	38	383
1986	100	79	56	33	31	32	331
1987	96	80	62	34	30	25	327
1988	82	70	53	35	32	31	303
1989	68	62	52	11	20	29	242
1990	75	87	48	7	20	21	258
1991	58	67	33	7	17	13	195
1992	44	47	17	10	9	14	141
1993	35	47	15	9	5	11	122
1994	35	48	11	9	4	11	118
1995	27	38	9	7	4	10	95
1996	29	40	10	6	3	17	105
1997*)	..	..	..	..	..	..	100

.. = data missing *) = forecast
Source: Ministry of the Environment; Department of Environmental Protection, Statistics Finland; ILMARI calculation model, Imatran Voima Ltd.

17. Emissions of the oxides of nitrogen in Finland (thousands of tonnes)

	Road traffic	Other traffic	Energy	Industry	Total
1980	136	43	98	18	295
1981	136	43	79	18	276
1982	137	43	73	18	271
1983	139	43	62	18	262
1984	140	43	57	18	258
1985	143	43	71	18	275
1986	147	43	70	18	278
1987	150	43	77	18	288
1988	155	43	77	18	293
1989	159	43	81	18	301
1990	158	43	82	17	300
1991	152	43	80	15	290
1992	146	43	76	20	285
1993	141	43	79	20	283
1994	137	42	82	21	282
1995	130	41	66	20	257
1996	127	43	77	20	267
1997*)	..	..	..	..	265

.. = data missing *) = forecast
Source: Ministry of the Environment; Department of Environmental Protection, Statistics Finland; ILMARI calculation model, Imatran Voima Ltd.

18. Renewable sources of energy as a percentage of total energy consumption in 1995 (%)

Sweden	25.4
Austria	24.3
Finland	**21.3**
Portugal	15.7
Denmark	7.3
Greece	7.3
France	7.1
Spain	5.7
Italy	5.5
Ireland	2.0
Germany	1.8
Netherlands	1.4
Luxembourg	1.4
Belgium	1.0
Britain	0.7

Source: EU White Book on renewable sources of energy and Eurostat.

19. Trends in public transport and the use of private cars, millions of passenger kilometres

	Total	Private cars	Public transport
1980	48 051	34 800	12 451
1981	49 300	35 900	12 600
1982	51 100	37 500	12 800
1983	53 000	39 300	12 900
1984	54 960	41 200	12 960
1985	57 445	43 700	12 945
1986	58 245	45 100	12 345
1987	59 669	46 000	12 869
1988	62 364	48 500	13 064
1989	63 779	49 900	13 079
1990	65 273	51 200	13 273
1991	64 196	50 600	12 696
1992	63 884	50 500	12 484
1993	62 882	49 700	12 282
1994	62 855	49 600	12 355
1995	63 540	50 060	12 580
1996	63 890	50 400	12 590
1997	65 820	51 900	13 020

Source: Statistics Finland.

20. Trends in emissions from road traffic (thousands of tonnes)

	Carbon monoxide	Hydrocarbons	Oxides of nitrogen	Carbon dioxide	Particles
1980	386.2	47.0	135.7	7 645.4	9.3
1981	382.9	47.7	135.7	7 447.9	9.5
1982	382.7	48.8	137.3	7 930.0	9.8
1983	382.6	50.0	138.5	8 203.1	10.1
1984	384.3	51.4	140.4	8 453.6	10.4
1985	382.3	52.6	143.0	8 851.8	10.7
1986	383.7	54.3	146.6	9 459.7	11.2
1987	390.3	56.6	149.6	9 929.8	11.4
1988	400.0	59.5	154.7	10 334.6	11.7
1989	410.2	61.7	159.1	10 985.0	11.7
1990	405.4	61.4	157.6	11 179.0	11.6
1991	373.3	58.7	151.5	10 858.6	11.4
1992	343.6	55.8	144.6	10 834.7	10.8
1993	329.8	54.0	140.4	10 196.5	10.3
1994	311.4	51.9	135.0	10 535.9	8.5
1995	304.9	50.7	131.8	10 391.7	8.0
1996	295.5	49.0	127.0	10 300.8	7.6
1997	284.4	47.3	122.6	10 837.9	7.1
1998*)	271.2	45.4	117.6	11 102.2	6.8
1999*)	262.0	43.6	113.0	11 399.3	6.5
2000*)	249.4	41.2	107.2	11 598.8	6.2

*) = forecast

Source: Technical Research Centre of Finland; LIISA calculation model.

21. Unleaded petrol as a proportion of all petrol sales in 1996 (per cent)

Finland	**100.0**
Sweden	100.0
Austria	100.0
Denmark	100.0
Norway	99.7
Iceland	95.2
Switzerland	87.5
Luxembourg	83.5
Belgium	74.0
Britain	68.1
France	61.3
Greece	37.7

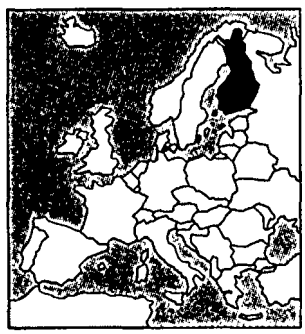
Source: Europe's Environment: Statistical Compendium for the Second Assessment, Eurostat.

22. Retail prices of motor fuel (95E) on 15.7.1998 (FIM/litre)

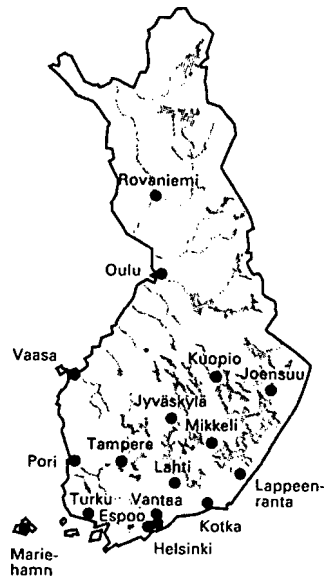
	Consumer price	Price exc. tax	Taxes
Luxembourg	3.77	1.30	2.47
Greece	3.99	1.34	2.65
Spain	4.04	1.31	2.73
Ireland	4.48	1.42	3.06
Portugal	4.81	1.30	3.51
Austria	4.82	1.55	3.27
Germany	4.87	1.22	3.65
Denmark	5.07	1.37	3.70
Belgium	5.22	1.30	3.92
Italy	5.45	1.39	4.06
France	5.46	1.02	4.44
Sweden	5.61	1.44	4.17
Finland	**5.65**	**1.31**	**4.34**
Netherlands	5.77	1.49	4.28
Britain	5.92	1.10	4.82
Norway	6.30	1.54	4.76

Source: EU/Oil Petrolier and ÖKL - The Finnish Petroleum Federation.

Finland in Figures



Suomi
Finland



Population : *5.1 million, with average density of only 17 persons per square kilometre; annual growth 0.3 per cent. Average household size 2.2 persons. 76 per cent urban-dwellers, with 0.9 million living in the capital city Helsinki and its suburbs. 93 per cent speak Finnish and six swedish. 86 per cent are lutheran and 1 per cent orthodox. 53 per cent have completed post-primary education and 11 per cent have university degree or equivalent.*

Area : *Situated in the northern Europe. 338,000 square kilometres. Land boundary with Sweden 586 kilometres, Norway 727 and Russia 1 269 kilometres. The greatest length is 1 157 kilometres from Hanko to Utsjoki and highest point Halti 1 328 metres above sea level. Of the total area 10 per cent is covered by water. There are 188,000 fresh water lakes in Finland. Forests, mainly pine and spruce, cover 69 per cent of the country and 8 per cent of the land area is under cultivation, with barley and oats being the main crops.*

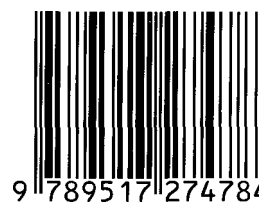
Govenment : *Sovereign parliamentary republic since 1917. The head of state being the peresident elected every six years. The post is held by Martti Ahtisaari since March 1, 1994. The Parliament compirises of 200 members elected for four-year terms. State divides to 5 provinces and self-autonomous territory of the Åland Islands. Member of the European Union since January 1995.*

Economy : *GDP 1997 FIM 618,042 billlion (USD 112,025 billion) ie. FIM 120,242 per capita (USD 21,795). One of the highest standard of living in the world. Of the total workforce 22 per cent employed by industry, 31 by services, 15 by commerce, 11 by financial services, 8 by transport and communications, 7 by agriculture and forestry and 6 by construction. Unemployment rate 14.6 per cent according to EU standards in June 1998.*

Foreign trade : *Major trade-partners are Germany, Sweden, Great Britain and United States of America. The value of imports in 1996 totalled FIM 141.0 billion (USD 30.7 billion) and exports FIM 185.8 billion (USD 40.5 billion). Of the imports 56,5 per cent were raw materials and 21.7 consumer goods. Main exports are metal and engineering products, paper, products of chemical industry and wood industry.*

Finlands´s Natural Resources and the Environment 1998

Finland´s Natural Resources and the Environment 1998 is a review of the state of Finland´s natural resources and the environment. It presents the salient principles of economic and environmental interaction. It also reviews trands in the main sectors of the economy as they affect the environment. These sectors are industry, energy, transport, natural resources and environmental protection. Finally, a list is given of the main conventions on the protection of natural resources and the environment to which Finlands is a signatory.



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