

# *Finland's Natural Resources and the Environment 1999*

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YMPÄRISTÖMINISTERIÖ  
MILJÖMINISTERIET  
MINISTRY OF THE ENVIRONMENT

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*Statistikcentralen*  
*Statistics Finland*

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*Inquires:*

*Jukka Hoffrén*  
*tel. +358 9 17341*

*SVT Suomen virallinen tilasto*  
*Finlands officiella statistik*  
*Official Statistics of Finland*

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*Helsinki 1999*

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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 give a broad definition of the measures required to implement 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 come closer to a sustainable future. The final communiqué issued by the 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 focal aims in this respect, alongside restrictions on greenhouse gas emissions.

In its programme for the period 1999-2003 the II Government led by Paavo Lipponen has stated its objective to make systematic allowance for the principle of sustainable development in the various sectors of society. The programme particularly stresses the importance of international cooperation in solving environmental issues and of environmental protection in the northern dimension. 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. 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 environmental auditing. The government programme for sustainable development states that the “Natural Resources and the Environment” survey published in connection with the state budget will in the near future be developed as a tool of use in establishing a policy for sustainable development.

This review was compiled by a working group appointed by the Ministry of the Environment and chaired by Markku Nurmi, Director General at the Ministry of the Environment. The other members of the group were Heikki Sourama and Pekka Pelkonen, Special Advisors at the Ministry of Finance, Risto Ranki, Special Advisor at the Ministry of Trade and Industry, Sami Niemi, Senior Inspector at the Ministry of Agriculture and Forestry, Tia Laine-Ylijoki, Senior Inspector at the Ministry of Transport and Jarmo Muurman, Senior Inspector, and Anne Brax, Information Officer, at the Ministry of the Environment. The secretaries to the working group were Jukka Hoffrén, Senior Researcher at Statistics Finland, and Kimmo Silvo, Limnologist, and Jorma Leivonen, Special Planner at the Finnish Environment Institute.

Helsinki, September 1999

**Ministry of the Environment**  
Minister of the Environment  
Satu Hassi

**Statistics Finland**  
Director General  
Timo Relander

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## Statistical appendix

# 1 *The national economy and the environment*

## *The 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, is still widely used as the basis for both national and international environmental policies. This has been particularly so since the nations confirmed their commitments to the Rio decisions at the follow-up meeting, the United Nations General Assembly Special Session (UNGASS) on sustainable development, in summer 1992. As part of the process beginning in Rio, the first legally binding global agreement on reducing greenhouse gas emissions in the face of the threat of climate change was concluded at the UN Climate Meeting in Kyoto, Japan in December 1997. This agreement has already been signed by over 80 countries. Under this agreement, the industrialised countries will reduce their greenhouse gas emissions by an average of 5.2 per cent from the 1990 level by the period 2008-2012, the requirement of the United States being seven per cent, that for the EU member states eight per cent and that for Canada, Japan and Poland six per cent. The objective for Russia, New Zealand and Ukraine is a freezing of their emissions at the level of 1990. No obligations to reduce their emissions have been imposed on the developing countries.

At the Climate Meeting held in Buenos Aires in November 1998 it was concluded from the national reports that the combined greenhouse gas emissions by the industrialised states were in 1995 about 4.6 per cent down on the 1990 level and would by the year 2000 still be approximately three per cent below the 1990 level. There would then be a rapid increase in emissions, and by 2010 the 1990 level would already be exceeded by

eight per cent unless measures were taken to combat this. Some delegates at the Buenos Aires meeting expressed the opinion that the requirements of the climate agreements would have to be made stricter if the long-term objectives were to be achieved. The trend in the greenhouse gas emissions by the parties to the agreement will be examined in the interim assessment scheduled for 2005.

The EU's objective at Buenos Aires was to progress by developing joint measures. The joint measures strictly advocated by France, Denmark and Finland in particular were written into the working programme for the climate negotiations. These measures include the regulations on energy policy, agriculture and waste management. The next UN climate meetings will be held in Bonn in autumn 1999 and The Hague in 2000.

The emphasis in the European Union environmental policy in 1999 is on climate. The aim during Finland's presidency of the EU is for allowance to be made for environmental considerations and sustainable development in all sectors of society, for attention to be paid to environmental issues in the EU enlargement process, for preparations to be made for an EU strategy on climate change and the climate meetings to be held in Bonn and The Hague, and for the role of environmental protection to be enhanced in developing the northern dimension of the EU. Environmental issues were also prominent on the agenda for the German presidency in the first half of 1999. Germany insisted that the environmental aspect be allowed for in all the major items on the agenda, and one of its primary goals was to promote a high level of environmental protection in Europe.

The Cardiff summit of the European Council held in June 1998 proposed that a special

strategy be devised to make allowance for the environment and to implement sustainable development in the different sectors. The meeting of the Council held in Vienna in December 1998 decided to continue this work. A strategy, a schedule for future action and a selection of indicators to measure the trend are to be presented at the Helsinki meeting of the Council in December 1999. The finalisation of the strategy reports for the inclusion of environmental considerations and sustainable development in other sectors of EU policy will thus coincide with the Finnish presidency. The main lines of EU environmental policy in the new millennium are therefore to be laid down at the Helsinki summit. The EU is to issue its strategy for sustainable development by the year 2001.

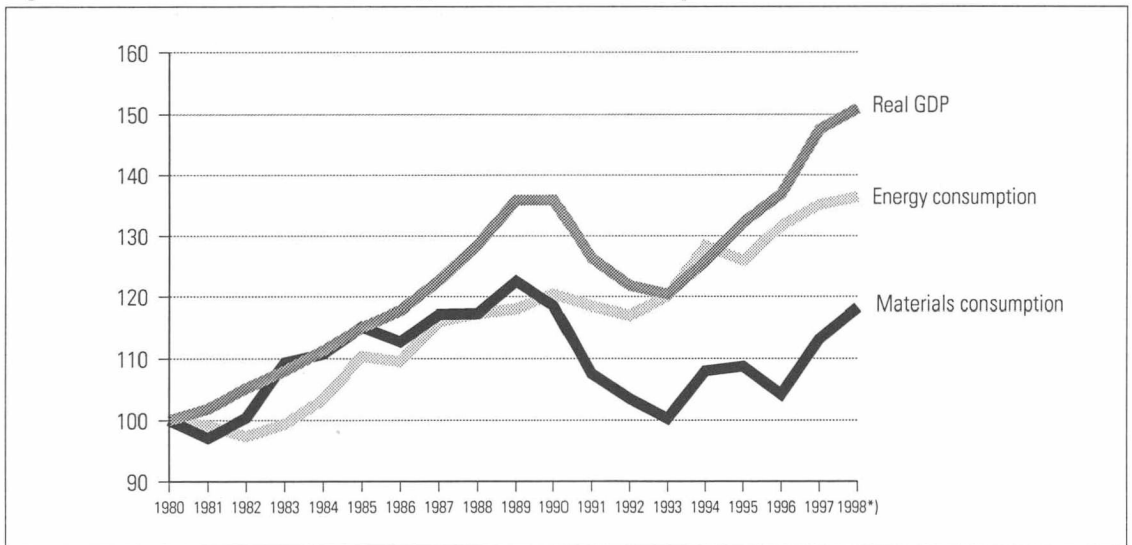
### Promoting sustainable development

The programme drawn up by the Finnish government in April 1999 states as one of its objectives the systematic allowance for the principles of sustainable development in the various sectors of society during the period 1999-2003. The government is also committed to furthering the integration of EU en-

vironmental policy in the various sectors and to stressing the importance of environmental protection in the "Northern Dimension". The government programme particularly stresses the importance of international cooperation in solving environmental problems. Efforts will be made to avert environmental threats by means of international cooperation in accordance with the Rio, Kyoto and other agreements, and to reduce Finland's greenhouse gas emissions as prescribed in the international obligations. Special attention is also paid in the government programme to the protection of the Baltic Sea and to the ecological rehabilitation of the Baltic Sea.

The Finnish Committee for Sustainable Development set up as a consequence of the Environment and Development Conference held in Rio de Janeiro has set itself the task of promoting sustainable development, of acting as a forum for debate and of putting forward initiatives for items to be prepared by the authorities. It was decided in spring 1998 to continue the committee's mandate until the end of 2002 to bring it in line with the UN Committee on Sustainable Development (CSD).

**Figure 1. Trends in real GDP, energy and materials consumption in Finland**



\* = preliminary data

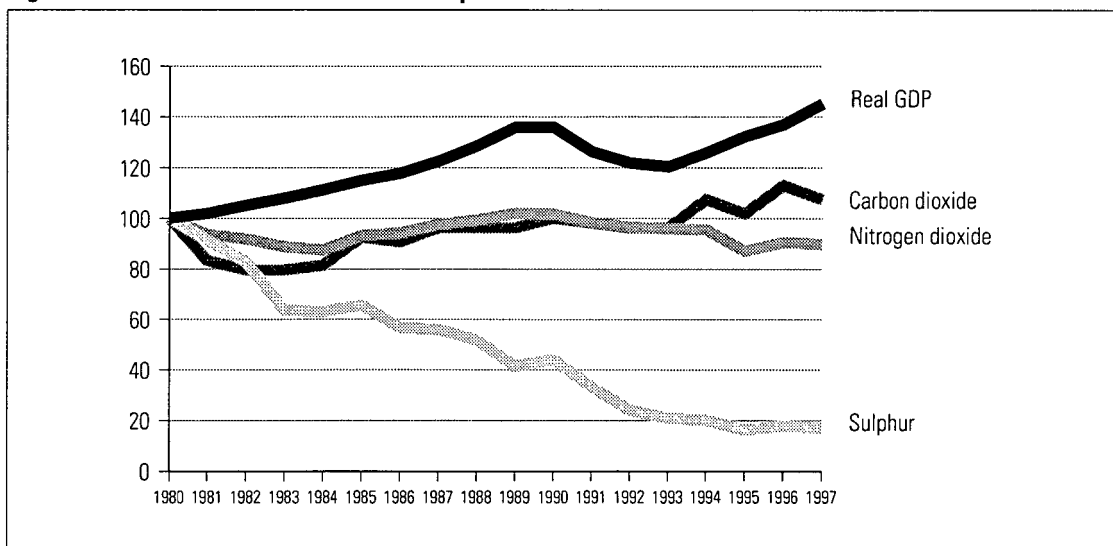
According to the decisions made by the Rio Environment and Development Conference, all countries must have a sustainable development strategy by the year 2002. The Finnish sustainable development strategy was approved in June 1998, and Finland was one of the first countries to establish a policy. According to its main objectives, the policy is, among other things, committed to slowing the climate change process, moulding production and consumer habits, reducing the use of non-renewable natural resources, and maintaining the biodiversity. The objective in the case of production and consumer habits is to reduce the strain on the environment caused by production and consumption to a level tolerable to nature, and to promote the effective use of natural resources in the production of goods and services. The various sectors of the administration will be reporting on the implementation of this policy to the Committee on Sustainable Development by summer 2001. The evaluation of the implementation of sustainable development is also being developed by means of the national indicators of sustainable development now being prepared, the national accounting methods and the systems for monitoring the use of natural resources.

The first list of indicators suitable for measuring sustainable development was issued by the secretariat of the UN Committee on Sustainable Development in spring 1996. Along with 20 other countries, Finland has been testing the relevance of these indicators. A proposal on Finland's indicators of sustainable development was submitted in January 1999 and is at present being revised. Drawing on the reports by the various sectors of the administration, the national indicators of sustainable development and other investigations and development projects the Finnish Committee on Sustainable Development will be making an overall evaluation of the effectiveness of Finland's sustainable development programmes and the state of sustainable development in Finland. This evaluation is scheduled for completion by Earth Summit +10, the follow-up to the Rio Environment and Development Conference, in 2002.

### *Instruments of environmental protection*

The governmental control supporting sustainable development has been greatly developed in recent years. The revision of

**Figure 2. Trends in real GDP and atmospheric emissions in Finland**



## 1. Environmental taxes and fees (FIM million)

	1993	1994	1995	1996	1997	1998	1999	2000
	A	A	A	A	A	A	B	BP
Alcoholic beverage surtax	16	48	88	52	55	60	50	50
Soft drink surtax	19	16	15	9	10	9	10	9
Fertiliser tax	516	267	—	—	—	—	—	—
Pesticide fee	6	6	6	6	9	9	9	9
Electricity tax	656	56	—	—	—	—	—	—
Energy taxes	8 404	9 815	11 628	12 714	13 895	15 306	16 300	17 200
Oil waste tax	21	19	21	20	20	20	20	20
Motor vehicle tax	1 609	2 054	2 685	3 611	4 210	5 259	5 500	6 000
Charter flight tax	111	80	—	—	—	—	—	—
Water protection tax	2	2	3	3	2	3	3	3
Oil pollution control fee	34	31	34	29	33	30	32	32
Vehicle licence tax ("user fee")	—	618	1 046	1 110	1 129	1 198	1 120	1 270
Diesel engine vehicle tax	885	844	668	929	979	1 042	1 000	1 090
Waste tax	—	—	—	41	127	182	170	190
<b>Total</b>	<b>12 279</b>	<b>13 856</b>	<b>16 194</b>	<b>18 524</b>	<b>20 469</b>	<b>23 118</b>	<b>24 214</b>	<b>25 873</b>

A = Final accounts B = Budget BP = Budget proposal — = not in use

the Land Use and Building Act (132/99) to conform with the principle of sustainable development was approved in January 1999 and will come into force at the beginning of 2000. The regulations on the location of supermarkets did, however, begin to be applied in March 1999 already. Attempts are also being made to reduce the environmental damage caused by building and property maintenance under the policy decision made by the government in December 1998 on ecologically sustainable building. The purpose of this programme is to improve the energy and water efficiency, waste disposal and indoor air quality of building and real estate, and to assure buildings a longer life. Urban, regional and land use planning are not yet included at this stage.

The Act on Compensation for Environmental Damage (81/98) by means of environmental damage insurance came into force at the beginning of 1999. The Act on the assessment of environmental damage (468/94) was also amended as of the beginning of April 1999 to correspond to the updated EU directive and

the interpretation of the Act was defined more clearly by a decree. An Environmental Protection Act is also in preparation. The reformed Waste Disposal Act (1072/93), Forest Act (1093/96), Environmental Protection Act (1096/96) and Extractable Land Resources Act (463/97) conforming with the principles of sustainable development are already in force.

In addition to the new legislation, various economic instruments have been introduced in the 1990s, such as environmental taxes, environmental markings on goods, and voluntary agreements. The government has also undertaken to increase the use of economic control, environmental taxes and fees both at national level and in international cooperation, while nevertheless allowing for international competitiveness. The government also intends to investigate the level, targeting and consequences of environmental taxes.

All taxes and fees which have an obvious regulatory impact on the state of the environ-

ment are regarded as environmental taxes, though not all of these are itemised in the state budget. There is a separate fund for collecting the oil pollution control fee. Many of these taxes and fees have been imposed for reasons other than environmental protection. The regulatory effect of environmental taxes and fees is most marked in the surtaxes levied on alcoholic beverages and soft drinks, 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*

According to the government programme, ecologically sustainable development is to be promoted by pursuing an environment-conscious purchasing policy in the public sector, as the public sector is a major purchaser of industrial investment and consumer goods. Environmental aspects can be taken into consideration in public sector purchases when determining the items to be purchased and when drawing up the technical specifications. In addition, the environmental

### **2. Government expenditure on environmental protection (FIM million)**

	1992	1993	1994	1995	1996	1997	1998	1999	2000**)
Environmental administration	426	389	402	440	469	479	495	502	533
<i>Central government</i>	108	95	128	127	135	139	145	143	152
<i>Local government</i>	318	294	274	313	334	340	350	359	381
Cooperation with neighbouring areas	86	55	57	57	57	62	66	58	63
Nordic environmental finance company	8	9	9	8	7	7	7	7	7
Research and development*)	576	585	652	717	781	919	954	1 006	1 000
<i>Environmental conservation and management</i>	175	168	205	170	229	256	269	269	270
<i>Use and management of natural resources<sup>2)</sup></i>	98	88	85	119	128	143	149	166	159
<i>Universities</i>	166	166	184	204	227	235	245	251	250
<i>Development of environmental technology<sup>3)</sup></i>	110	136	149	193	168	255	261	290	290
<i>Other environmental research<sup>4)</sup></i>	27	27	29	31	29	30	30	30	31
Grants to environmental NGOs	6	6	6	6	6	6	6	6	5
Environmental protection	92	119	152	85	119	189	175	156	118
<i>Clean air and waste management</i>	25	38	47	45	41	56	52	53	30
<i>Water protection</i>	24	25	22	8	33	32	14	11	9
<i>Environmental management and decontamination</i>	43	56	83	32	45	101	109	92	79
Nature conservation	235	264	366	312	325	479	567	407	355
Promotion of energy saving	8	6	10	6	8	9	15	15	15
Renewable energy investment support*)	87	77	99	37	33	51	117	..	..
Environmental protection of road traffic*)	123	123	131	139	182	136	241	186	187
Rail transport*)	..	..	..	..	79	93	93	101	116
Manure pit investment support	47	55	84	–	80	65	36	18	15
Environmental support for agriculture	–	–	–	1 420	1 570	1 631	1 640	1 690	1 287
<i>Basic support</i>	–	–	–	1 330	1 367	1 372	1 410	1 390	..
<i>Special support</i>	–	–	–	90	203	259	230	300	..
Environmental support for forest management	–	–	–	–	10	15	13	22	8
<b>Total</b>	<b>1 694</b>	<b>1 687</b>	<b>1 977</b>	<b>3 227</b>	<b>3 726</b>	<b>4 141</b>	<b>4 425</b>	<b>4 174</b>	<b>3 709</b>

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

<sup>1)</sup> Environmental Administration and Academy of Finland <sup>2)</sup> Agriculture and Forestry Administration <sup>3)</sup> Technical research

<sup>4)</sup> Other administrative sectors

effects and costs can be considered when assessing the overall profitability of alternative quotations while still complying with such requirements as impartiality and non-discrimination.

The central 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. An estimated 33 per cent of the environmental research done at the universities is funded from these sources, the bulk (56%) out of their own budget funds. The funding of environmental protection is mainly targeted at industry and the local authorities for improving the state of the environment and repairing environmental damage, and the nature conservation expenditure at 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 use of which will be discussed in more detail in Chapter 2.

### *Cooperation with neighbouring regions*

In 1997 the European Union adopted the northern dimension as one of its official objectives in the hope that this would have a favourable impact on the level of environmental protection, above all in the Baltic region and Northern Russia. Finland has been promoting the improvement of the environment in its neighbouring countries and the state of the Baltic Sea since 1991 by supporting environmental protection in Northwest Russia, the Baltic states and Poland. The cooperation between the Baltic Sea countries aiming at improving the state of the environment is regarded as exemplary.

The cooperation has mainly been in the development of the environmental administration, water and air protection, and waste management. The long-term objective of cooperation over environmental protection projects has been to develop the capabilities of the countries involved to solve and prevent their environmental problems.

Between 1991 and the first quarter of 1999 Finland issued grants towards nearly 300 investment projects and over 700 technical aid projects connected with environmental protection. During this period Finland invested a total of some FIM 540 million in environmental projects to be carried out in the target areas. The primary goal of technical aid cooperation is to enhance the progress of environmental investments. The environmental administration in the neighbouring regions has been developed by arranging training in the environmental legislation, water and air protection and waste management for environmental authorities. Training has also been provided for representatives of industry, agriculture and water utilities. Training programmes lasting many years in the measurement of emissions have further been run for environmental laboratory personnel in the Baltic countries, Murmansk and the Karelian Republic.

### **3. Finland's contribution to projects in neighbouring countries by country 1991-1999 (FIM million)**

	Investment projects	Technical aid projects
Estonia	141.5	22.8
Latvia	43.1	4.3
Lithuania	31.2	4.5
Russia	91.4	47.2
Ukraine	6.0	0.1
Poland	95.1	0.5
Others	0.2	27.1
International financing	0	25.7
<b>Total</b>	<b>408.5</b>	<b>132.3</b>

Finland's membership of the European Union has increased the funding potential for joint projects and Finland has sought to further enhance its cooperation with the international funding establishments and organisations. More than half the funds earmarked by Finland for environmental projects are already directed at multilateral cooperation with international funding establishments and organisations.

### *Environmental protection by local authorities*

An international agreement, Local Agenda 21, requiring local authorities to draw up a plan of action for sustainable development was signed in Aalborg, Denmark in 1994. More than 400 urban and rural authorities have so far joined this campaign aimed at the sustainable development of Europe's cities. Each municipality is further obliged by law to monitor and promote environmental protection in its area, one of the objectives being sustainable development. The action programme for sustainable development up to 2005 drawn up by the Association of Finnish Local and Regional Authorities was approved in March 1997. So far projects connected with the local agenda for sustainable development have got under way in 245 municipalities; these cover 80 per cent of the Finnish population.

The local authorities' campaign to reduce greenhouse gas emissions was launched in autumn 1997 and is part of an international project aimed at reducing urban greenhouse gas emissions. The project already covers Finland's largest cities, such as Helsinki, Espoo, Vantaa, Tampere, Lahti, Oulu and Pori, and involves the drawing up of 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 generation, transport, industrial plants and refuse dumps. The campaign will end in autumn 2000.

A local environmental protection administration was established in Finland in the latter half of the 1980s. Under the Act on local environmental protection administration that came into force in 1986, nearly 400 local authorities set up a board to handle environmental protection affairs. The local authorities also began appointing environmental protection personnel. The Act on local environmental protection administration and the provisions of seven other Acts applying to the administration and handling of environmental protection by the local authorities were amended in 1997. These amendments gave the municipalities greater authority in the field of environmental protection. As a result, municipalities may agree to handle the work of the environmental protection authority together, but each is still responsible for ensuring that allowance is made for environmental considerations in its own operations.

Community waste disposal has undergone major structural changes in the course of the 1990s. These have sprung mainly from the entry into force of the new Waste Disposal Act (1072/93) and the issuing of a number of new statutes on waste disposal. To some extent the change has also been influenced by the establishment of national and regional waste disposal plans and the levying of a waste tax. There are now fewer, bigger refuse dumps that can be built and managed more efficiently. Meanwhile recycling has increased and waste treatment been intensified. Numerous treatment plants have been set up alongside and often adjoining the refuse dumps.

The management of municipal waste has improved and become more concentrated in

that local authorities have banded together for the joint disposal of their waste. This cooperation already covers 323 local authorities and 83 per cent of the population, as against only an estimated twenty or so local authorities at the beginning of the decade. The waste disposal and recycling systems have also improved.

Table 4 shows the expenditure on environmental protection by local authorities, their joint bodies and utilities. The bulk of this expenditure is on sewerage and waste water treatment. The costs arising from waste management, sewerage and waste water treatment are for the most part covered by

#### 4. Local authority expenditure on environmental protection (FIM million)

	1993	1994	1995	1996	1997	1998*)
<b>Waste management</b>						
Investments	51	98	87	71	97	112
Operating costs	415	409	404	476	542	604
<b>Water supply</b>						
<b>Waste supplies</b>						
<b>Expenditure</b>						
Investments	287	224	203	216	213	204
Operating costs	849	768	760	668	587	598
<b>Sewerage</b>						
Investments	557	512	469	523	643	493
Operating costs	1 038	919	910	780	687	699
<b>Energy supply</b>						
<b>Clean air</b>						
Investments	655	169	34	86	223	121
Operating costs	143	156	158	139	154	157
<b>Environmental management</b>						
Investments	16	29	20	38	21	26
Operating costs	188	188	200	209	244	249
<b>Total</b>						
Investments	1 666	1 032	813	934	1 197	956
Operating costs	2 633	2 440	2 432	2 272	2 214	2 307

\*) = preliminary data

the fees paid by users, but investments in such projects have to some extent been funded out of the national budget. Expenditure on environmental management is financed out of the local authorities' tax revenues and through government grants.

### *Environmental health*

According to a report published recently by the European Environment Agency (EEA) and the World Health Organisation (WHO), many environmental problems are clearly reflected in human health. The most serious problems are, according to the EEA and the WHO, related to air pollution, water contamination and traffic accidents.

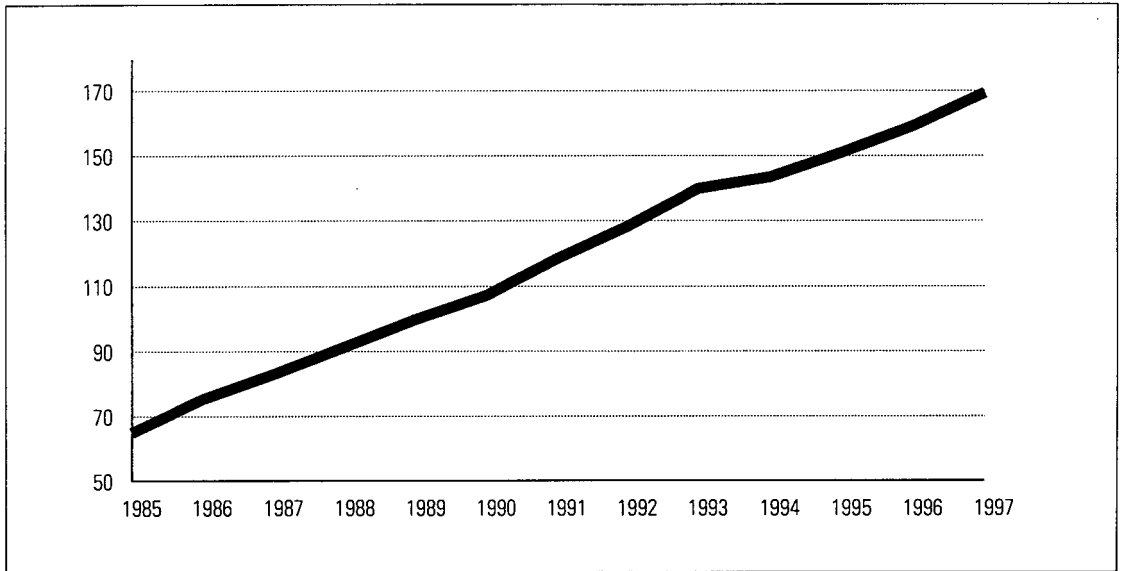
The health of the Finnish people has, as the result of better housing conditions, nutrition and health care improved steadily in the course of this century. Even so, there has been an obvious increase in the prevalence of asthma and various allergies in the past few decades. Whereas in the 1960s about one per cent of the adult population suffered from asthma, the figure had risen to approximately 4 per cent by the end of the 1990s. The increase has been particularly marked in children. The reasons for the growing prevalence of allergies are varied and to some extent still unclear.

The factors contributing to the increased prevalence of allergies include smoking, the quality of the indoor and outdoor air, and exposure to chemicals. It has been estimated that the marked migration of the Finnish population from the rural to the urban regions in the past few decades has increased their tendency towards allergic diseases. Some 40 per cent of the Finns are exposed to air pollution in built-up areas, and this has been estimated as leading to aggravations of asthma in some 30,000 persons a year and to infections of the respiratory organs in

30,000-40,000 children. Exposure to risk factors in the living environment is, however, slight in Finland compared with

the industrialised regions of Europe and the exposure is not expected to increase in the near future.

**Figure 3. Persons suffering from asthma and obstructive pulmonary diseases (1000 persons)**



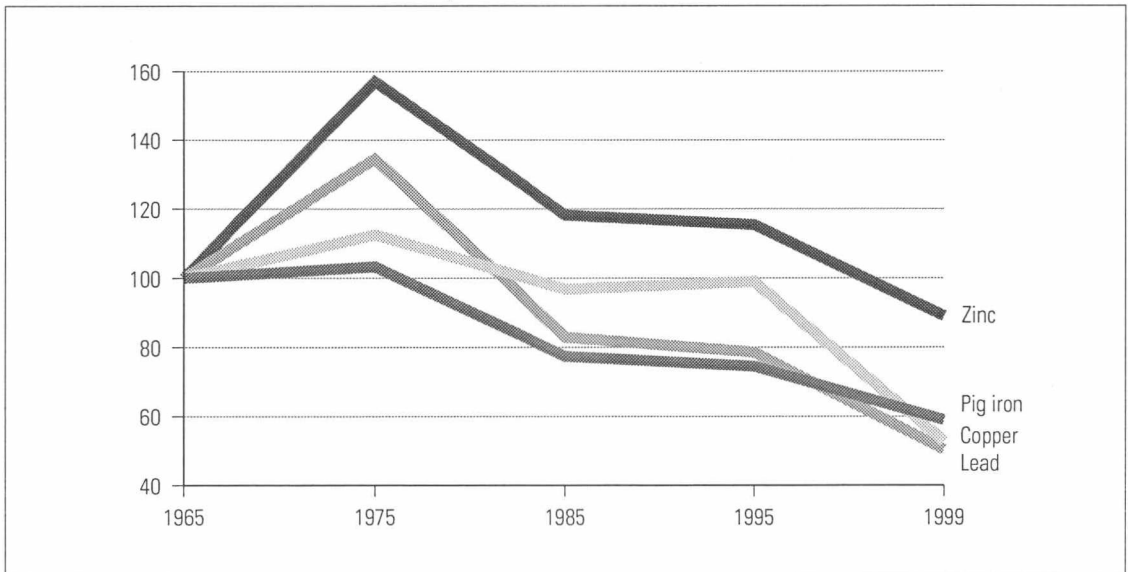
## 2 Natural resources

### *Reducing the exploitation of natural resources*

The UN forecasts that the world population of six billion reached in October 1999 will have risen to close on nine billion by the year 2050. The population of the industrialised states will, it projects, remain at approximately the present 1.2 billion, but that of the developing countries will rise from the present 4.8 billion to 7.8 billion. The increase in the population will inevitably raise the material consumption that is one of the main factors contributing to well-being. One of the biggest challenges facing sustainable development is in fact how to make the present production and consumption habits more sustainable without losing economic competitiveness, because the damage to the environment caused by the growing use of fossil fuels and natural resources is rapidly endangering the renewal and tolerance of the environment.

Economic growth will not, in the light of the present knowledge, be threatened by a shortage of natural resources in the next few decades. The production of most raw materials has steadily increased and the real prices of them have fallen in the 1980s and 1990s. The current market pricing system has not, however, always been able to allow for the external costs that arise from inadequate rights of ownership and utilisation, and this has led to the inefficient use of resources and loss of well-being. 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 aim being to reduce the natural resources used in order to alleviate the environmental consequences of overburdening the global ecosystem.

**Figure 4. Trends in the world market prices of certain metals (1965=100)**



At the beginning of the new millennium Finland will, according to the programme of the II Government led by Paavo Lipponen, be paying greater attention to the efficient use of natural resources in both production and consumption. The aim is to improve Finland's eco-efficiency and to make the structure of consumption more sustainable. The direct overall consumption of natural resources per GDP unit has fallen steadily in the 1980s and 1990s. In other words, more affluence has been produced using less resources. This trend is to be enhanced.

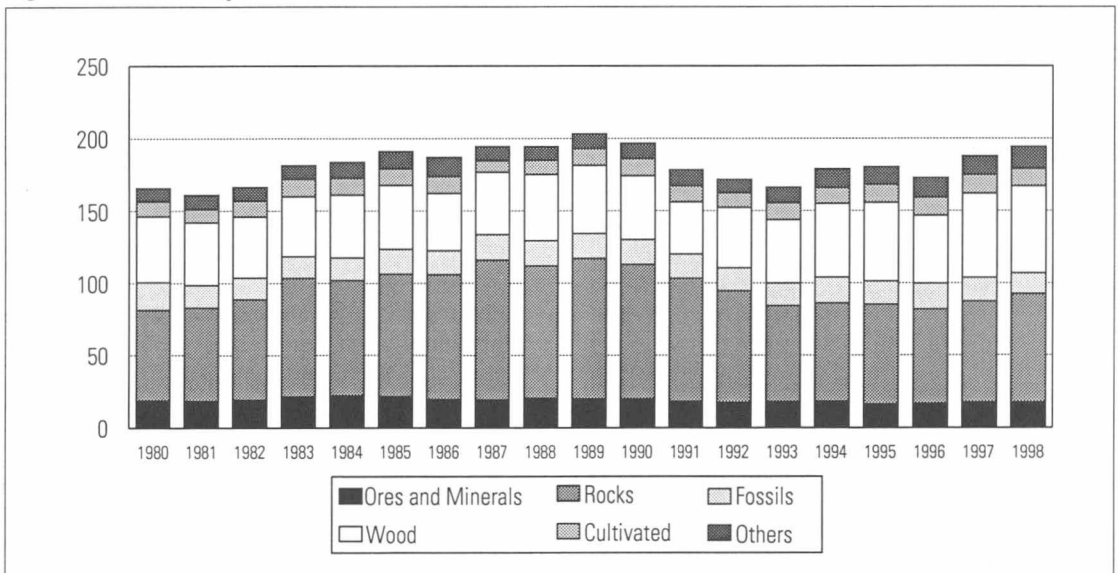
All in all Finland consumed a total of 196 million tonnes of primary materials in 1998: 114 million tonnes of non-renewable natural resources and 60 million tonnes of renewable. Gravel, sand and rock materials accounted for 38 per cent of the total consumption of natural resources in 1998, wood for 31, domestic ores, minerals and limestone for a good nine, fossil fuels for just under nine and cultivated resources for just on six per cent.

### *Ores and other extractable resources*

The currently known ore reserves are relatively small in proportion to the volume of industrial production, and most of them are rapidly being 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 to a great extent on imported raw materials and recycling. Steel, for example, is mainly manufactured from concentrates imported from Sweden and Russia and from scrap iron.

While ore production in domestic mines has suffered a radical drop in the 1990s, metal imports have expanded greatly. In 1998, extraction by the ore mines amounted to 3.2 million tonnes and metal imports to 5.5 million tonnes. Iron makes up more than 95 per cent of imports in terms of quantity. Limestone production totalled just under four million tonnes and domestic industrial mineral production over 10 million tonnes in

**Figure 5. Consumption of materials in Finland 1980-1998 (million tonnes)**



1998. The most important metals are chromium, zinc, nickel, copper and gold. Despite the depletion of the known ore resources, experts nevertheless consider that the Finnish soil still has good potential for the discovery of new ores.

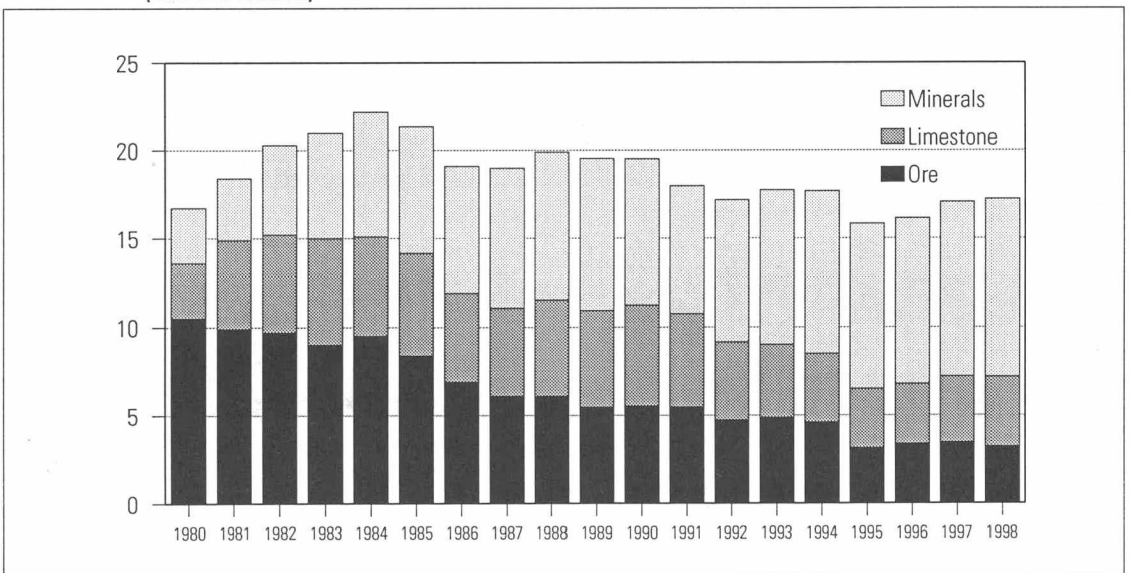
The production of building and natural stone is expected to double by the year 2005. The value of production and refinement in this sector totalled FIM 1.2 billion in 1998, when natural stone amounting to 300,000 tonnes was exported. The consumption of gravel and other rock materials reached its peak in the late 1980s, followed by a fall in the early 1990s due to the marked decline in the building sector. Thus consumption in 1998 was an estimated at 75 million tonnes, even though the existing permits would have permitted the extraction of over 200 million cubic metres. The use of natural rock as a substitute for gravel has greatly increased in the past few years as the gravel resources close to residential centres are becoming exhausted. Whereas in 1990 rock materials accounted for just under 27 per cent of the total consumption, it had risen to close on 44 per cent by 1998. The value of production in

the rock sector was about FIM 900-1000 million and that of the associated transport services FIM 600-700 million in 1998.

Peat production reached a peak in 1997, when a total of 32 million cubic metres were raised. The annual production volumes vary greatly depending on the summer rainfall. Most of the peat produced is fuel peat. The value of peat production stands at around one billion FIM and the related transports to about FIM 400 million. Seven per cent of Finland's total energy demand has in recent years been produced by peat. At the present rate at which it is used, Finland's peat is expected to be sufficient for about 300 years.

The Extractable Land Resources Act (555/81) of 1981 was amended in June 1997 to conform more closely with the principles of sustainable development. It applies to the extraction of rock, gravel, sand, clay and soil. The aim is to ensure their availability and to safeguard supplies of the groundwater which occurs in the related landforms without endangering the biodiversity. Other objectives are the restrained, economically practicable utilisation of soil resources, recycling,

**Figure 6. Mining of ores and industrial minerals and quarrying of limestone in 1980-98 (million tonnes)**



and the 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*

Finland's most important natural resource in economic terms is its forests, and most of the country is covered in naturally regenerated forest in commercial use. Finland has a good 26 million hectares of forestry land constituting 86 per cent of its total land area. Of this, 20 million hectares are forest land proper and the remainder is low-productivity wasteland. 54 per cent of the forest land is owned privately, 33 per cent by the state, eight per cent by companies and five per cent by others. The proportion of actual forest land that is privately owned is, however, somewhat higher: 62 per cent. The total volume of growing stock is just under two billion cubic metres; 69 per cent is owned privately, 18 per cent by the state, eight per cent by companies and five per cent by others. The total annual increment, a good 75 million cubic metres, is well in excess of the total drain. A record figure of 61 million cubic metres of timber felled for industrial and other uses was achieved in 1998. Allowing for waste and natural losses, the total drain was 69.4 million cubic metres. A total of 11 million cubic metres (solid measure) to the value of FIM 2.2 billion were imported into Finland in 1998.

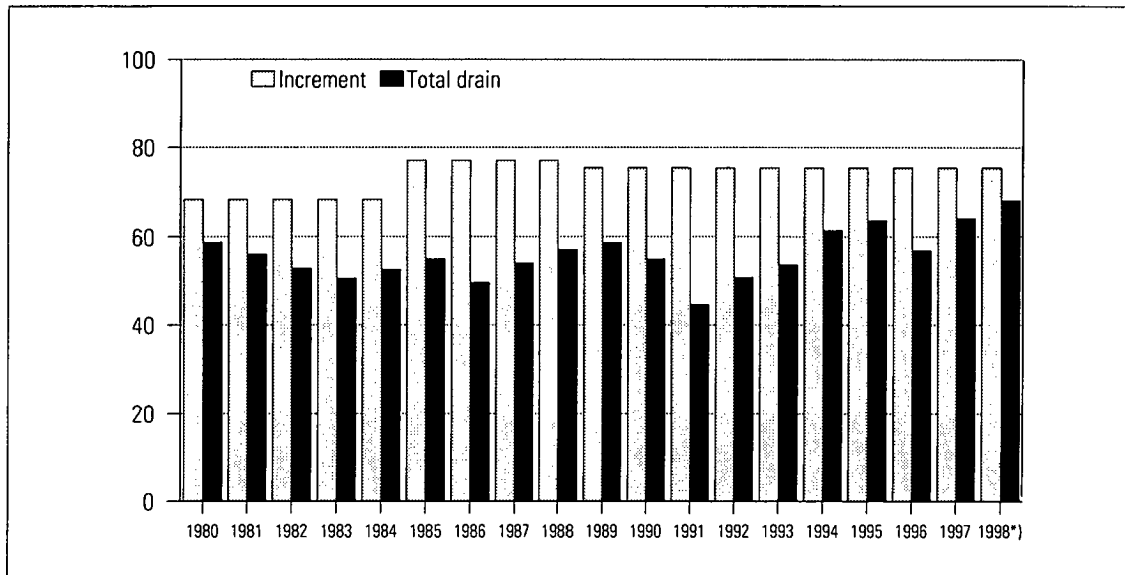
The purpose of the government's National Forest Programme 2010 completed at the beginning of 1999 is to develop the management, use and protection of the forests so that they will remain healthy and viable while preserving their biodiversity and at the same time satisfying the economic and recreational needs of the Finns in a way that

is both versatile and sustainable. According to the Forest Programme, the total cut is to be increased gradually to 63-68 million cubic metres (solid measure) a year up to the year 2010 by at the same time ensuring a high level of silviculture and environmental management. Since the estimated stemwood growth is, according to the Finnish Forest Research Institute, at present 75 million and in the year 2030 an estimated 90 million cubic metres (solid measure), increasing the cut to about 70 million cubic metres (solid measure) would fix the total volume of growing stock at around 70 million cubic metres. The aim is to double the export income of the forest industry by increasing the cut and raising the degree of conversion. All the main groups and interested parties have helped to prepare the proposal.

The way the commercial forests are treated is of key significance in the protection of Finland's biodiversity. The systematic increasing of the country's timber resources by means of intensive silviculture measures has resulted in a reduction in the diversity of the forest nature, such as of old-growth forests, tree species of little commercial value and rotting timber. According to a survey carried out by the Forestry Development Centre Tapio and the regional forestry centres in May 1999, there were an estimated 100,000 forest sites protected under the Forest Act in privately-owned forests. These sites covered a total area of 60,000-70,000 hectares, which is 0.4 per cent of the private forest area. It is estimated that as much as 20 per cent of these major sites get overlooked in land surveys.

The aim of the statutory regional objective programmes for forestry first drawn up in 1997-98 is to reconcile the objectives for the various uses to which commercial forests may be put. Compiled jointly with forest owners and various NGOs and interest groups, they provide an overall impression of the state of forestry in each district administered by a forestry centre, the items which

**Figure 7. Forest increment and total drain (million solid cubic metres)**



\* = preliminary data

need attention and the development potential for the sector in general. The programmes also include surveys of forest resources, forest protection and diversity, the effects of forestry on employment and forest-related enterprise. The national forest programme 2010 is in the main based on the objective programmes.

A proposal for a forest certification system suited to conditions in Finland was completed in spring 1997, with virtually all the forestry organisations and NGOs taking part in its formulation. A further project designed to develop the system was initiated in March 1998. The official body responsible for the administration of the state forests, the Finnish Forest and Park Service, has in recent years been making greater allowance for social and environmental considerations in its operations by drawing up natural resource plans in collaboration with the major interest groups and the inhabitants of the areas concerned. These plans seek to reconcile the potential for forest management and utilisation with

the expectations aroused by these. The Forest and Park Service was awarded an ISO 14001 environment certificate in April 1998.

According to a forest health survey conducted by the European Commission and the ECE, a quarter of the forests in Europe were suffering from crown damage in 1997. The state of the crowns of both conifers and deciduous species has in general deteriorated in Europe. The damage is particularly marked in oak and beech forests. Improvements have been noted in the regions of Central and Eastern Europe where the emissions have been reduced, but these regions still have the largest proportion of damaged trees. The biggest causes of needle and leaf loss are air pollution and the droughts from which Southern Europe, especially, has suffered. Compared with the rest of Europe, the forests in Finland have clearly suffered less defoliation. Defoliation is in Finland mainly attributable to ageing of the stock and to inclement 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 lichens sensitive to sulphur deposition are beginning to return to their former habitats in Central Finland.

### Cultivated resources

Some eight per cent of Finland's land area is in agricultural use, i.e. for cultivated fields and gardens. This means a total of around 2.2 million hectares, of which some 1.98 million hectares were under cultivation in 1999. There were in Finland 159,581 farms with more than one hectare under cultivation in 1997, the mean area under cultivation being 15.8 hectares. 57 per cent of farms pursue active production, and their mean arable land area is 24 hectares. Only one third of farms are run on a full-time basis. According to a survey conducted by the Agricultural Economics Research Institute, there will be less than half the present number of farms by the year 2008. Agricultural production in Finland is based mainly on animal husbandry, so that 80 per cent of

the arable land is devoted to growing grass, silage and fodder crops or used for grazing. Dairy products and meat account for nearly half the total agricultural production. The total agricultural turnover in Finland was, according to the national accounts, FIM 18.7 billion in 1998, of which various subsidies accounted for FIM 8.5 billion or 45 per cent.

The most obvious direct adverse environmental effect of agriculture is the runoff of nutrients from fertilisers into lakes, rivers and aquifers. As a result of the use of phosphorous fertilisers in the past few decades, considerable phosphorous deposits have accumulated in the soil. Although the phosphorus uptake and phosphorus fertilisation are fairly well balanced at the moment, the considerable accumulation in the soil is decreasing only slowly. The spreading of manure on the fields along with chemical fertilisers has a significant effect on the leaching of nitrates. The nitrate runoff into the lakes and rivers is, however, still too great in areas with large-scale stock breeding. 40 per cent of the total phosphorus load imposed on lakes and rivers and 30 per cent of the nitrogen load can be traced to agricul-

Figure 8. Use of fertilisers in agriculture



ture, the proportions being over half in Southern and Southwest Finland. Under a resolution passed by the Council of State in March 1988, 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 fertilisers when spread on the land.

The environmental programme for agriculture (1995-1999) has been an aid to improving the water protection level of farms, reducing the harmful emissions into the air and maintaining the traditional rural landscape and its biodiversity. FIM 1.5-1.7 billion a year has been paid out to farmers since 1995 in environmental support, the EU putting up half. This has compensated farmers for the costs and loss of income resulting directly from implementation of the programme and guaranteed them a living under changing circumstances. Participation in the programme is voluntary, but the programme actually covers around 90 per cent of active farmers and the arable land under cultivation. In order

to qualify for 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 fertilisers and to establish protective zones and embankments between their arable land and any lakes, rivers, brooks and major ditches.

According to the Agricultural Economics Research Institute, 63 per cent or FIM 850 million of the basic annual environmental support amounting to FIM 1,390 million is paid as compensation for the costs or loss of income resulting from making allowance for environmental aspects. The crop yield has fallen due to the fertiliser restrictions imposed by the environmental support, resulting in estimated income losses of FIM 245 million, while close on FIM 270 million has been spent on enhancing the landscape. Other costs have been incurred in improving the manure storage facilities, the keeping of accounts, planning, filling in forms and establishing vegetation zones. Not all the costs can be expressed in terms of money. 66,000 farms have, for example, had to limit the amount of fertiliser they have used, while 12,000 have managed without. The

## 5. Environmental support for agriculture (FIM million)

	1995	1996	1997	1998	1999	2000
	A	A	A	A	B	BP
1. Basic support	1 329.7	1 367.0	1 372.0	1 410.0	1390.0	..
2. Special support	76.5	158.0	195.0	222.5	300.0	..
2.1 Organic production	36.5	99.5	123.5	134.9	..	..
2.2 Protective zones	1.1	2.8	5.3	7.1	..	..
2.3 Treatment of runoff	33.2	41.7	47.2	55.2	..	..
2.4 More efficient use of manure	0.9	1.1	1.2	1.8	..	..
2.5 Landscape management and biodiversity	2.3	9.4	14.4	20.9	..	..
2.6 Diversification of production	0.1	0.1	0.1	0.2	..	..
2.7 Native breeds	2.4	3.4	3.5	3.6	..	..
3. Training and advisory services	8.7	10	7.0	7.0	..	..
4. Experimental projects	5.0	8	6.0	0.0	..	..
5. Other environmental management systems	-	27.0	51.0	0.0	..	..
<b>Total</b>	<b>1 419.9</b>	<b>1 570.0</b>	<b>1 631.0</b>	<b>1 639.5</b>	<b>1 690.0</b>	<b>1 287.0</b>

A = Final accounts B = Budget BP = Budget proposal -- = not in use .. = data missing

## 6. Organic farming and "transition phase area" in certain European countries in 1997

	Arable hectares	% of total arable land
Austria	345 375	9.9
Switzerland	71 790	6.7
<b>Finland</b>	<b>102 235</b>	<b>4.8</b>
Sweden	126 175	4.5
Italy	550 000	3.2
Denmark	59 964	2.2
Germany	351 062	2.0

environmental support has been of vital significance to the farms' economy. The average support paid out per farm has amounted to FIM 16,700, while the average income per farm was FIM 70,400 in 1995. The support has been most important to grain-growing farms, relatively small farms and farms in Southern Finland.

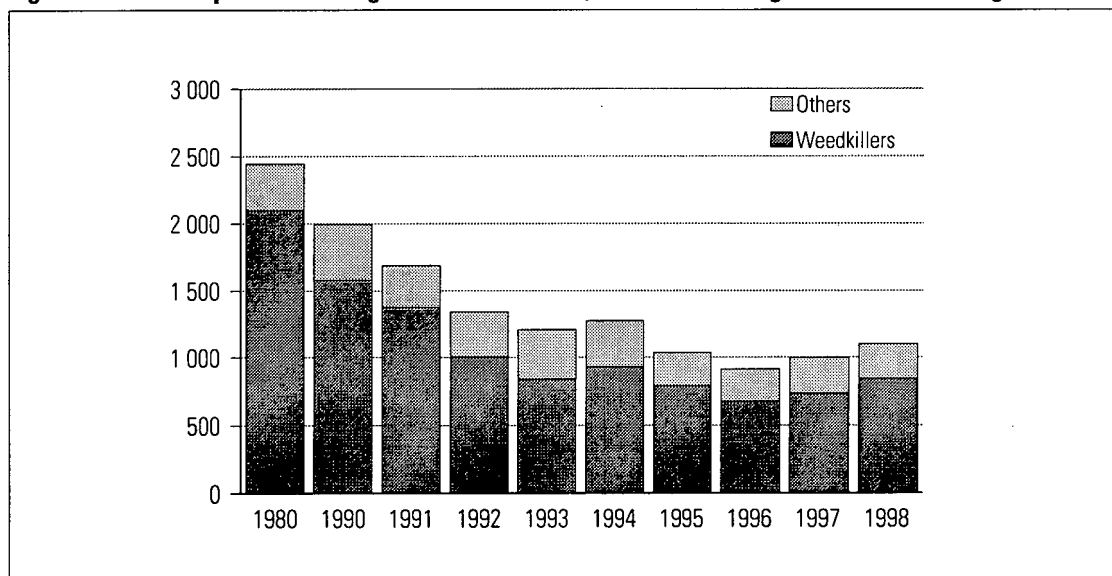
The Agricultural Economics Research Institute estimates that the support has reduced the annual phosphorus emissions from agriculture by 10-20 per cent and the nitrate emissions by 10-20 per cent. The benefits of

the support programme at the level of the national economy have been estimated at FIM 12-18 billion and the costs at FIM 6-8 billion. According to one survey, even better allowance for conditions on individual farms would have to be made in order to enhance the environmental impact of the basic support. This will be done in the environmental management programme to be drawn up for agriculture for the period 2000-2006.

Most of the special forms of environmental support for agriculture aim to reduce the pollution of the waterways. These include the establishment of wide protective vegetation zones around fields, the establishment of sinks to collect erosion material and nutrients, the establishment and management of wetlands and support for organic production. In 1997 there were 4,381 farms with a total arable land area of 102,235 hectares either already engaging in organic farming or planning to do so shortly. By 1998 the organic arable land area had risen to about 127,000 hectares.

In December 1998 the European Council decided in Vienna to include environmental

Figure 9. Use of pesticides in agriculture 1980-1997 (thousands of kilogrammes of active ingredient)



issues in its Agenda 2000 aimed at renewing the common agricultural policy. The policy agreed in March 1999 is the biggest EU agricultural policy reform since the early 1960s. Agenda 2000 aims to constitute a comprehensive, all-round approach to the development of the rural regions, the protection of the environment and the preservation of Europe's rural heritage as part of agriculture. It stresses the prevention of pollution, the minimisation of agricultural measures harmful to the environment, and urges the use of cultivation methods that conserve the environment. In Finland the reform will reduce the producer prices by an estimated 15 per cent and will, according to the Agricultural Economics Research Institute, encourage organic farming.

### Water resources

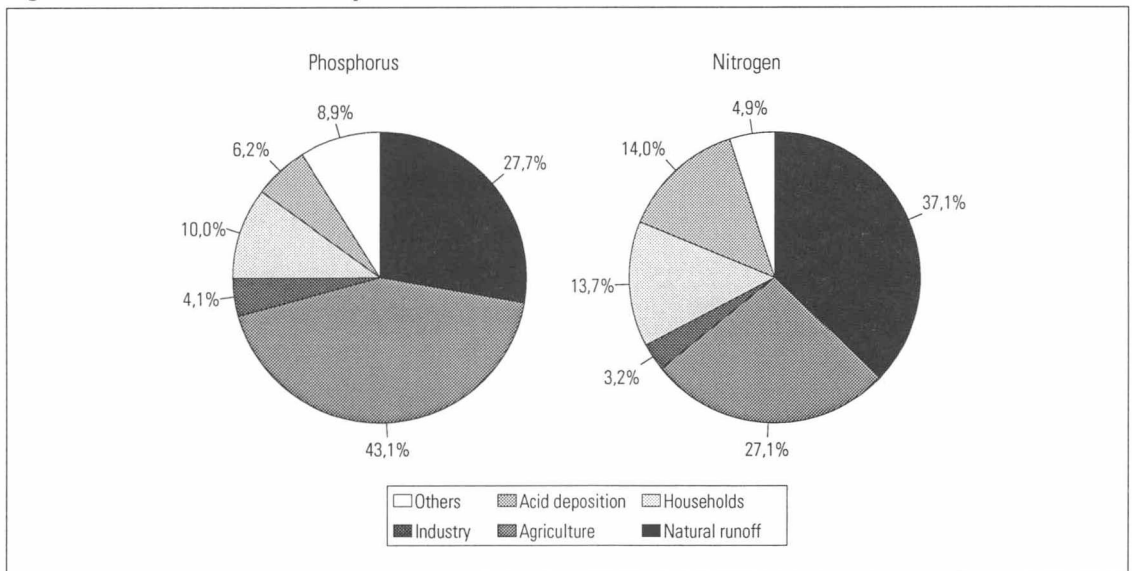
Finland has abundant surface and ground-water resources in proportion to its population and water consumption. Its inland watercourses cover some 10 per cent of the

total area, i.e. 33,500 square kilometres, and its territorial waters amount to 36,000 square kilometres. The total groundwater yield is estimated to be 10-30 million cubic metres a day, of which some six million is suitable for water supply. Approximately 15 per cent of this latter figure is actually utilised. Almost 60 per cent of the water used by waterworks

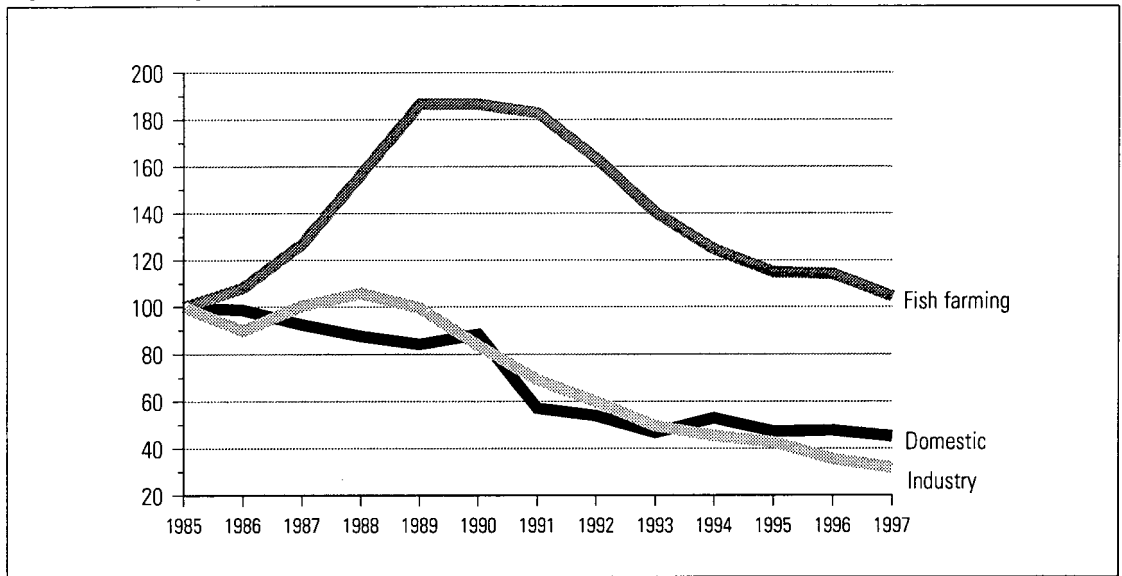
### 7. Use of water resources in certain European countries (million cubic metres per year)

	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
United Kingdom	120 000	14 237	12
Greece	58 650	6 945	12
Denmark	13 000	1 200	9
Russia	1 500 000	106 227	7
<b>Finland</b>	<b>108 000</b>	<b>3 001</b>	<b>3</b>
Sweden	168 000	2 932	2
Switzerland	54 000	1 166	2
Norway	39 200	2 025	1

Figure 10. Sources of water pollution in 1997



**Figure 11. Phosphorus load from industry, households and fish farming sources (tonnes)**



in Finland is derived from aquifers or artificial groundwater. The consumption of water distributed through the public water supply system was 252 litres a day per consumer outlet in 1997, households representing 140 litres. The water consumption by industry, households and energy production totals some 2.5 billion cubic metres a year. The more isolated rural areas obtain most of their domestic water from their own wells, although there are frequent problems regarding the continuity of supplies under all conditions. Some 2-4 per cent of Finland's exploitable water resources are used each year.

An extensive groundwater classification and survey conducted in 1996 revealed that Finland has 2,226 significant groundwater areas, 1,300 areas suitable for water supply use and 3,615 other classified aquifers. The Finnish aquifers are characteristically small, shallow and usually isolated from one another. 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 increases the risk of contamination in many places.

The quality of the groundwater varies greatly from one area to another. Depending on the bedrock and soil, an aquifer may occasionally contain hazardous quantities of arsenic, fluoride, radon, etc., while the consequences of human action are reflected in the form of elevated nitrate, chloride, hydrocarbon and heavy metal concentrations. The 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 the groundwater quality to some extent in Southern and Southeast Finland. The implementation of the EU 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.

## 8. Trend in A-chlorophyll content indicating the nutrient content of surface waters (milligrams per cubic metre)

	National monitoring lakes	Gulf of Finland	Gulf of Bothnia
1990	4.9	..	3.7
1991	5.7	..	3.4
1992	5.4	5.1	3.9
1993	5.5	4.8	4.0
1994	5.0	8.4	6.5
1995	5.1	8.0	3.2
1996	4.4	10.0	3.4
1997	4.6	3.8	..

.. = data missing

The total surface area of heavily polluted lakes has decreased in recent years, especially in the areas affected by communities and industry. Meanwhile, however, the total area of completely unpolluted, natural water has decreased on account of the increase in nonpoint source pollution. A significant proportion of the nitrogen and phosphorus load is nowadays caused by agriculture. Over the ten-year period 1987-1996 the readily decomposable organic emissions by industry fell nearly 80 per cent, those of phosphorus by more than 60 per cent and those of nitrogen by close on 40 per cent. The emissions from domestic sources have also decreased, particularly of organic matter and phosphorus.

The water quality of approximately 80 per cent of Finland's total lake area is classified as good or excellent, that of about four per cent as polluted and poor and some 0.3 per cent as heavily polluted and poor. The corresponding figures for the rivers are 39, 30 and 31 per cent, those for the coastal waters 88, 11 and 0.03 per cent. More than 2,000 lakes are suffering from a marked rise in eutrophication and their fish populations are nowadays dominated by roach. Ten lakes have been rehabilitated by means of fishing programmes and similar programmes are

either under way or being planned for 65 more.

The most obvious environmental problem in the Gulf of Finland is the serious eutrophication that has taken place in the past few decades. As a result of the exceptionally hot and sunny summer in 1997, a vast, intensive bloom consisting partly of toxic blue-green algae was experienced. Although the increase in nitrogen concentration in the Gulf of Finland came to a halt in the early 1990s, considerable quantities of phosphorus have accumulated in the bottom mud over the past few decades and are still affecting the quality of the water. Further action will have to be taken both in Finland and elsewhere in the Baltic basin in order to arrest the eutrophication process. Only 10-12 per cent 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 per cent in fact - are from the St. Petersburg area. Finland's own emissions do, however, have a major impact on the state of the coastal waters, so it is essential that the phosphorus and nitrogen emissions from agriculture be reduced in Southwest Finland in particular. Fish farming also has a considerable local impact 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 and ground-water sources. The primary objective is to ensure waters of a good ecological level in the lakes, rivers and coastal areas. The actions to be taken, monitoring and administration should focus on entire catchment areas at a time and coordination within them. The state of water areas and the required measurements should be defined by reference to the ecological functioning of the biocommunities and the presence of hazardous substances. The directive is expected to be approved in the year 2000.

### 3 Nature conservation

Intensive forestry and agriculture have done most to reduce Finland's biodiversity. There has been a significant reduction in the total area of old-growth forests in their natural state, thereby widely endangering the many species and especially those dependent on rotten wood, forest fires and extensive old-growth forests. Many of the traditional rural landscapes, such as meadows and pastures, have also been reduced, thus impairing the viability of many species. Climate change, emissions and chemicalisation are clearly lesser threats to the biodiversity of the countryside than forestry and agriculture. The building of housing areas, holiday homes and roads also reduces the biodiversity. The trend in the biological diversity of nature is at present being investigated under a national biodiversity programme. The total budget for this programme, covering the period 1997-2002, is over FIM 120 million.

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 with the demands of land-use planning. Strictly protected areas and areas in which cautious harvesting is permitted amount to 1,739,000 hectares in all, i.e. 7.6 per cent of Finland's total forest and low-productivity forest land. The strictly protected forest and low-productivity forest land totals 1,528,000 hectares or 6.6 per cent, strictly protected forest land 714,000 hectares or 3.6 per cent. the country's network of nature conservation areas has been gradually expanded since the late 1970s 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

1.38 million hectares and wilderness areas totalling 1.5 million hectares have been established on state-owned land. Conservation programmes applying to privately-owned land have been implemented to the extent of 195,000 hectares, and the government still has plans for the conservation of a further 270,000 hectares and options on certain other areas, including the Natura 2000 areas to be conserved under the Nature Conservation Act.

The objective of the overall financial plan already ratified for the nature conservation programmes 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. Conservation areas in accordance with the Nature Conservation Act were either purchased or protected to a total of 28,000 hectares in 1998, the emphasis being on areas covered by the programmes for the protection of peatlands, wetlands, and old-growth forests in Southern Finland. The aim from now on will be to

#### 9. Financing of nature conservation areas and programmes 1995-2000 (FIM million)

	1995	1996	1997	1998	1999	2000
	A	A	A	A	A	BP
Purchase of land	183	184	321	362	214	184
<i>Purchase of private land</i>	89	87	111	117	84	74
<i>Land exchanges</i>	87	80	110	150	70	60
<i>Income from sale of land</i>	7	17	100	95	60	50
Management of conservation areas	75	69	75	75	82	82
Compensation payments	19	19	43	47	77	69
Protection of rapids	35	45	25	45	10	10
Life (Natura)	-	8	15	39	24	10
<b>Yhteensä</b>	<b>312</b>	<b>325</b>	<b>479</b>	<b>567</b>	<b>407</b>	<b>355</b>

- = not in use

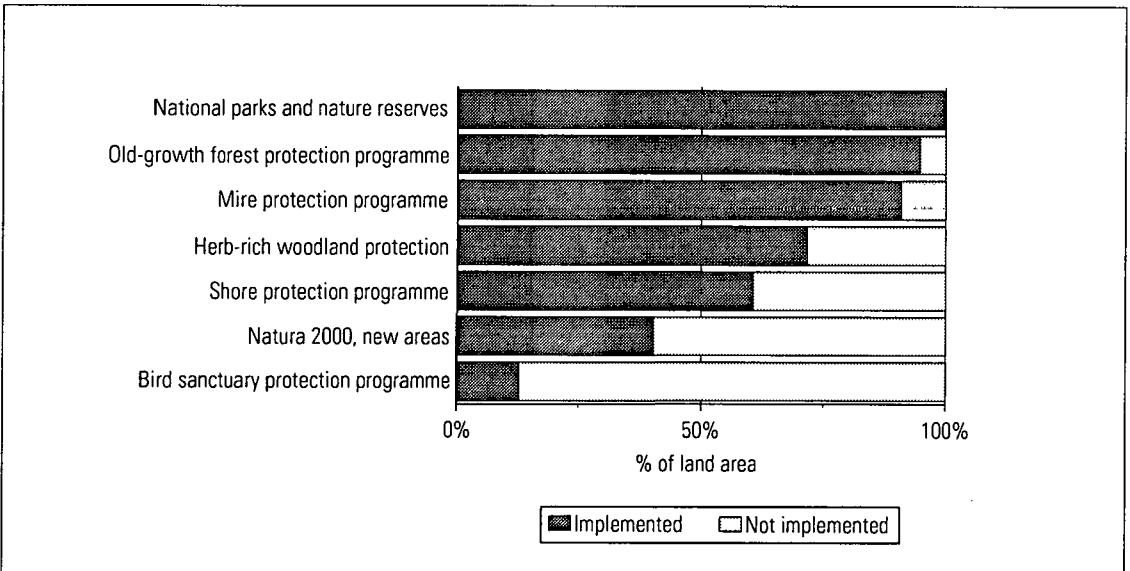
A = Final accounts BP = Budget proposal

target the resources of the overall financial plan for the nature conservation programmes in a way that will achieve the objectives as effectively and economically as possible. The protection may also be carried out by establishing private conservation areas or by means of funds granted for a fixed term.

Finland is endeavouring to implement the EU wildlife and birdlife directives by creating a uniform network of protected areas known as Natura 2000. The Finnish proposal for areas in accordance with the wildlife directive was submitted to the EU Commission in December 1998. The proposal for Finland's Natura 2000 network comprises a total of 4.78 million hectares, of which 3.224 million hectares are state land and 41,000 hectares have not been protected before. The revised proposal covers 324,000 hectares of private land, of which 66,000 hectares have not previously been protected. The conservation of the Natura areas can be implemented in various ways, depending on the need for protection of each biotope and species. The final decision on the Natura 2000 network will be made by the European Commission.

The sufficiency and coverage of the areas proposed by Finland and Sweden for the Natura 2000 network on the basis of the wildlife directive were audited for the first time in April 1999. For the purposes of the audit the Europe Union is divided into six physical types so that most of Finland belongs to the boreal zone and the fells of Lapland to the Alpine zone. According to a statement issued by the European Commission in May 1999, Finland must supply further information on six biotopes and 19 species. In order to ensure that the network is sufficiently representative, Finland must also present new areas for a further 15 biotopes and the habitats of 17 species. Finland will be making these additions during 1999 and submitting its proposals for the new areas by autumn 2000. Finland and Sweden will be trying to make their phase two proposals in the course of the year 2000. A final assessment will then be made of the significance of each area proposed for the network to the achievement of a favourable level of protection of biotopes and species throughout the EU territory.

**Figure 12. Implementation of nature conservation programmes 1.1.1999 (hectares of land area)**



The EU LIFE fund set up by the European Union in 1992 has been subsidising nature conservation and environmental projects supporting the development of community environmental policy and legislation. The budget for phase two of the programme covering the period 1996-1999 is about EUR 450 million, 40 per cent of which will be allocated to nature conservation (LIFE Nature) and about 50 per cent to innovative environmental technology projects (LIFE Environment). LIFE Nature is designed for the protection of the species and biotopes listed under the bird and wildlife directives and in particular for the implementation of the Nature 2000 network.

The Commission will be allocating a total of some FIM 380 million to the LIFE Nature project in 1999. Finland will be receiving EU funds amounting to a good FIM 27 million in all for seven different projects. Between 1995 and 1998 Finland received a total of FIM 79 million for 18 different projects and FIM 45 million of LIFE Environment funds for 20 different projects. In 1999, Finland will receive a total of FIM 14.3 million of LIFE environment funding for seven different projects.

## 10. The Natura barometer in the EU countries 30.4.1999

	Proposal for programme	Number of reserves	Total area (km <sup>2</sup> )	% of land area
Denmark	Final	194	10 259	23.8
Greece	Final	230	25 745	19.6
Netherlands	Final	76	7 078	17.1
Italy	Final	2 480	49 304	16.4
Spain	Final	684	74 907	15.0
<b>Finland</b>	<b>Final</b>	<b>1 380</b>	<b>47 113</b>	<b>14.0</b>
Luxembourg	Final	38	352	13.6
Portugal	Final	65	12 150	13.1
Austria	Final	113	9 450	11.3
Sweden	Final	1 919	46 300	10.3
United Kingdom	Final	333	16 885	7.0
Belgium	Final	102	913	3.0
France	Partly completed	814	20 830	3.7
Germany	Partly completed	781	9 784	2.7
Ireland	Partly completed	103	970	1.4
<b>Total</b>		<b>9 312</b>	<b>332 040</b>	<b>10.2</b>

## 11. Natural 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
Interest	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	–	–	–
Income from sale of land	50	100	90	40	–	–	–	–	–	–	–	–

– = not in use

## 4 Industry

### *Control over environmental protection*

Finland's competitiveness on global markets is largely the result of advanced expertise and know-how. The proportion of GDP accounted for by the industrial sector has increased in the 1990s, accompanied by drops in the service sector, construction and agriculture. The metallurgical industry generated 45 per cent of all industrial output in 1998, the forest industry 21 per cent and chemicals 10 per cent, their corresponding proportions of the value of Finnish exports in the same year being just under 53 per cent, just under 29 per cent and a good 9 per cent.

Much has been done to intensify environmental protection in the industrial sector in Finland, the current 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 states by the end of October 1999. This underlines the responsibility of companies for using the best available technology (BAT) in their processes and other functions. This requirement has already been included in the Finnish legislation on water (264/61) and air pollution control (67/82), waste disposal (1072/93) and the protection of sea areas (1415/94), 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 speed up and simplify the processing of permit applications and complaints. The new Act will annul the former laws regarding clean air, noise (382/87) and environmental permit procedures (735/91) and introduce

major changes in those applying to water, waste disposal, health protection (763/94) and relations between neighbours (26/26).

An Act requiring businesses to take out environmental damage insurance came into force at the beginning of 1999. This ensures compensation for those suffering from environmental damage and funding for prevention and rehabilitation measures in the case of an unknown or insolvent source. The compensation will in this case be paid by the Environmental Damage Centre. Any enterprise whose business carries a substantial risk of environmental damage or whose operations generally harm the environment is obliged to take out environmental insurance. In practice this applies to companies with an emission permit under the Water Act, an environmental permit issued by the regional environmental institute or a permit on the handling and storage of chemicals issued by the safety technology centre. The insurance has been compulsory for these companies since April 1999.

### *Trend in environmental protection*

Total industrial expenditure on environmental protection accounted for approximately ten per cent of all industrial investments in 1992 and 1993, slightly less than six per cent in 1994, almost seven per cent in 1995 and 1996, and seven per cent in 1997. 63 per cent of such environmental investments in 1997 were in the reduction of emissions into the air and 12 per cent in 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 1 billion per year. The aim is to reduce phosphorus and nitrogen emissions by 50 per cent from the 1995 level by the year 2005 and the chemical oxygen demand by 45 per cent. The latter requirement will mainly concern 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 per cent reduction in chromium, oil, nickel, copper and zinc emissions by the year 2005, so that the chemical and metallurgical industries in particular will have to increase the efficiency of their waste water purification systems.

The trend in the industrial sector has in the 1990s been towards the adoption of voluntary environmental management systems, a process accelerated by the increased importance of customer and interest group 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 environmental management and audit system for

## 12. Expenditure by industry on environmental protection (FIM million)

	1992	1993	1994	1995	1996	1997
Energy and water supply	819	939	418	276	406	601
Forest industry	990	940	932	1 371	1 311	998
Chemical and mineral industry	497	642	428	602	670	764
Metallurgical industry	530	332	449	564	723	565
Other industries	360	274	285	300	309	399
<b>Total</b>	<b>3 196</b>	<b>3 124</b>	<b>2 512</b>	<b>3 113</b>	<b>3 418</b>	<b>3 327</b>
<i>of which</i>						
Investments	1 841	1 614	1 022	1 538	1 704	1 930
Operating costs	1 355	1 510	1 491	1 575	1 714	1 397

## 13. Industrial plants recorded in the EMAS register 7.7.1999

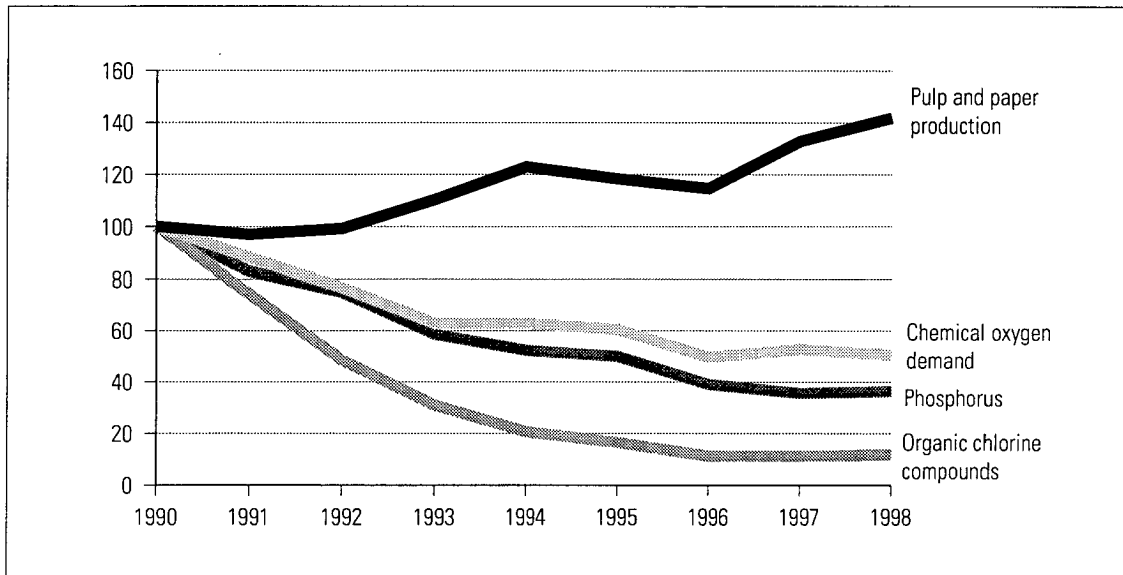
Germany	1 785
Austria	158
Sweden	146
Denmark	102
United Kingdom	71
Norway	50
Spain	36
France	33
Netherlands	22
<b>Finland</b>	<b>19</b>
Italy	18
Belgium	9
Ireland	6
Luxembourg	1
Greece	1

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 greater credibility to the measures taken. ISO environmental certificates have already been awarded to 220 Finnish companies and EMAS certificates to 27.

## The forest industry

The forest industry has in the past few years been producing record quantities of paper and wood products, the total volume of production being a good four per cent up on the previous year in 1998, while companies were operating at 94 per cent capacity. At the same time, however, the environmental impact of this industrial activity has been substantially reduced, mainly by renewing the production plant. The plant suitable for the reduction of emissions is, however, already for the most part in use in the forest

**Figure 13. Production by the pulp and paper industry and load on the rivers and lakes (1990=100)**



industry and the sharp drop in emissions of the 1990s is, according to the industry itself, now bottoming out. The emphasis in environmental protection is at the moment on the building up of environmental management systems; this applies to almost all the forest industry undertakings.

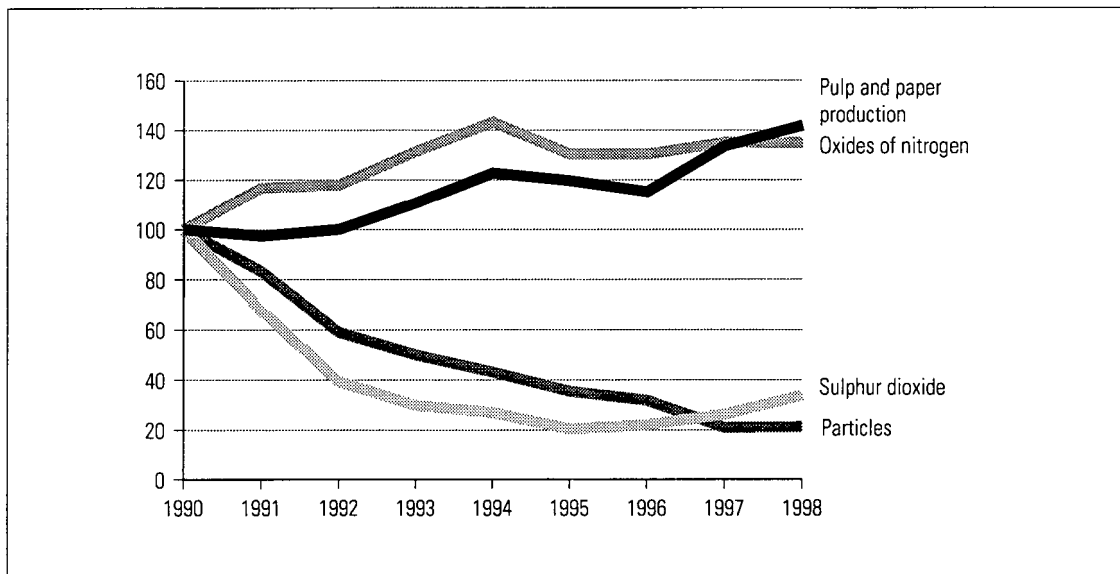
Minimising the forest industry emissions calls for good control of the entire production process. The aim in developing the pulp and paper industry processes is to minimise the raw material consumption, such as that of wood, water, chemicals and pigments. In 1998 the forest industry used a total of 67.7 million cubic metres (solid measure) of wood: 75 per cent from private forests, six from state forests, three from companies' own forests and 16 per cent imported.

The chemical pulping processes need large quantities of water. The pulp and paper industry has in the past few years invested particularly in developing closed water circuits, production processes and new bleaching techniques, and in improving the

purification of its waste water. Bleaching is still the stage of pulp production placing most strain on the environment, though efforts have in recent years been made to improve the situation by optimising the consumption of chemicals and using chemicals less harmful to the environment. The use of elemental chlorine in bleaching, for example, has been eliminated completely. The emphasis with regard to air pollution is now on the treatment of odorous gases and the reduction of nitrogen oxide emissions. Mechanical pulping is a great consumer of electricity and the environmental impact thus depends mainly on the fuels used to generate this.

The rate of utilisation of timber by-products such as bark, wood chips, sawdust and off-cuts suitable for building purposes is high, as much as 95 per cent of these being recycled for energy production or pulping. In addition, 98 per cent of all recycled paper and paperboard is re-used as a raw material. The waste water is efficiently treated by a biological method in active sludge plants

**Figure 14. Production by the pulp and paper industry and emissions into the atmosphere (1990=100)**



capable of reducing the biological oxygen demand (BOD7) by more than 95 per cent. The chemical oxygen demand (COD) can be reduced by 50-80 per cent, the organic chlorine compounds by 50-75, the phosphorus in the effluent nutrients by 40-70 and the nitrogen by 30-50. Half the sludge resulting from biological effluent purification is utilised as a source of energy. The bulk of the waste that requires disposal consists of ash from energy production, sodium carbonate residue and caustic sludge. The processing and utilisation of sludge, ashes, de-inking waste and lye residue will in future be intensified further. Opportunities for their utilisation are currently being examined.

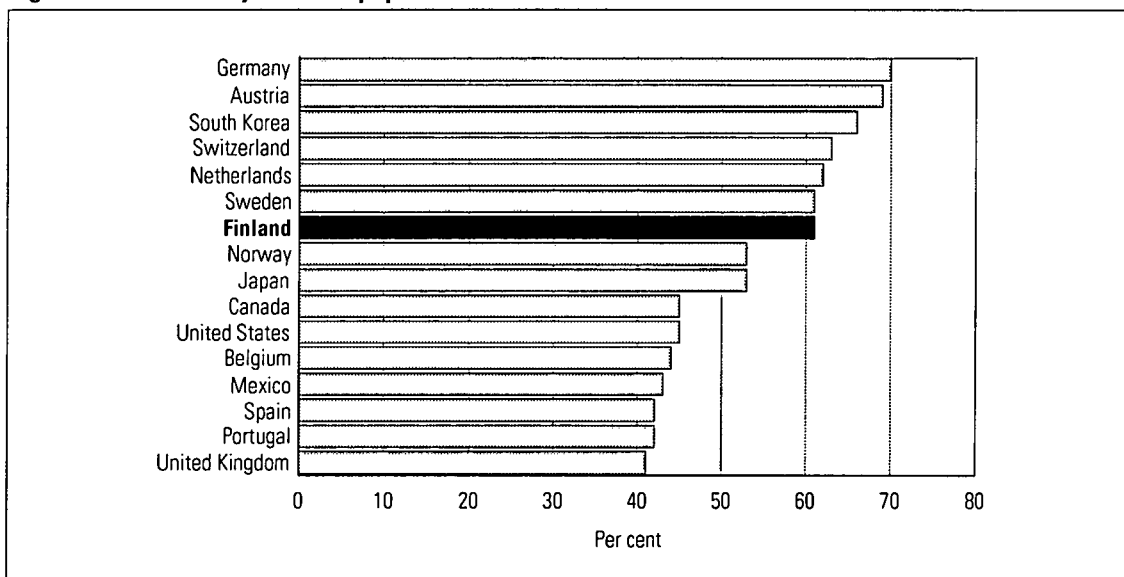
Finland accounts for five per cent of the world's forest industry production and for 10 per cent of forest industry exports. The value of exports of forest industry products was FIM 67.5 billion in 1998. Out of a total of 12.7 million tonnes of paper and board produced in Finland in 1998, 89 per cent was exported. A total of 665,000 tonnes of paper

was recovered through recycling, representing 63 per cent of the paper and board consumed in Finland. This recycling rate is high compared with that reported by most Central European countries, and Finland further imported waste paper for the production of recycled fibre. Under a decision made by the government in November 1998, the recovery and recycling of waste paper is to be intensified so that by the year 2000 at least 70 per cent of the volume of paper products sold in Finland will be re-used primarily as recycled material and by the year 2005 at least 75 per cent. The primary responsibility for the collection and recycling of waste paper was shifted to the manufacturers and importers of paper products, who can decide between themselves how to share the responsibility.

### *The chemical industry*

Chemicals are an important branch of industrial production in Finland in terms of both end products and intermediate products

**Figure 15. Recovery of waste paper in certain countries in 1997**



supplied to other branches. Even small quantities of many of the hazardous substances used and processed in the chemical industry may, however, have serious environmental effects, which underlines the need for reliable, comprehensive protection measures. The bulk of the investments by the chemical industry in environmental protection is still in conventional external measures designed to purify emissions, and the volume of process technology investments is still slight. The chemical industry has, however, succeeded in reducing some of its emissions into water and air, and the volume of waste has been falling since 1994.

The chemical 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. 118 companies in Finland had committed themselves to this programme by May 1999, accounting together for more than 80 per cent of the total production of chemicals. The number of companies joining in the programme

increased by 105 in 1998. 69 per cent of the companies possessed an ISO environmental or quality certificate and twelve companies were constructing an ISO system. Four already have an EMAS and a fifth is working on its system.

The companies involved in the programme have managed to reduce their emissions into lakes, river and the atmosphere relative to production over the past ten years. The sulphate emissions into lakes and rivers have fallen by 62 per cent since 1988, phosphorus emissions by 16 per cent, nitrogen by 45 per cent, mercury by 85 per cent,

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

	1993	1996	1997
Volatile hydrocarbons	8 900	3 450	3 699
Nitrogen oxides	4 920	4 452	4 300
Sulphur dioxide	6 724	6 300	6 000
Oil spills	11	4	5
Hazardous waste	1 080	1 380	498

cadmium by 61 per cent and lead by 98 per cent.

## *The metallurgical industry*

The volume of production in the smelting industry has increased steadily since the early 1990s, whereas that in the electronics and electrical industry has increased almost five-fold. In 1998 the electronics and electrical industry accounted for 43 per cent of the gross value of output by the metallurgical and electronics industry, the machinery and metal products industry for 41 per cent and the smelting industry for 15 per cent. The bulk of the environmental pollution caused by the metallurgical industry originates in the smelting industry converting natural resources for use by other industries.

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

Extensive recycling of metal reduces the need for extracting virgin ores, as metals are 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 360 million tonnes of scrap

were processed globally in 1997 to produce 799 million tonnes of steel, i.e. almost half of the steel produced was manufactured from recycled material. 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 58 per cent 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 in the sector. The Finnish smelting industry has, by improving its production processes, significantly raised the efficiency of its raw materials and energy use and reduced its emissions. 50 per cent of the world's copper is produced by the Finnish flash smelting method, which has a low external energy demand and in which the sulphurous gases can well be recovered. Investments in environmentally acceptable process technology in the metalworking industry exceeded the costs arising from the purchase of traditional emission purification technologies for the

## **15. Emissions from the production of metals**

	1990	1995	1996	1997
<b>Volume of production</b>	<b>100</b>	<b>129.4</b>	<b>137.0</b>	<b>144.5</b>
<b>Emissions into the atmosphere (thousand tonnes)</b>				
Sulphur dioxide	22.9	8.5	8.3	7.8
Nitrogen oxides	3.6	3.6	3.4	3.8
<b>Emissions into water (thousand tonnes)</b>				
Nitrogen	691	424	431.8	421.6
Chromium	2.0	3.5	1.9	3.9
Nickel	20.2	11.6	5.9	10.3
Copper	6.9	8.3	8.7	8.9
Zinc	17.3	10.7	10.0	9.4

first time in 1996. The majority of the investments directed at combating 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 the production processes and purification methods. The aim of waste water management investments has been to reduce the amount of waste and increase recycling and utilisation. The development of environmental protection in the smelting industry has been one consequence of the introduction of environmental management programmes and the related life-cycle analyses. The electrical and electronics industry has also been striving to reduce the use of CFC compounds and to achieve greater recovery and recycling of scrap.

### *Waste management*

Some 65-70 million tonnes of waste accumulate in Finland each year; this includes all the waste from primary production apart from the harvesting waste left in the forests. About 95 per cent of the waste springs from production, in industry, agriculture and con-

struction. The industrial waste consists of production, mining, energy and water supply waste. The volume of construction waste is magnified particularly by the large earth volumes created during construction.

Industrial waste in 1992 amounted to 15.4 million tonnes, plus waste waters, emulsions and sludge. The biggest producers of waste are the pulp and paper industry, the mechanical forest industry, the metallurgical and chemical industries. More than a third of the industrial waste consists of waste wood and bark from the pulp and paper industry, though this is nowadays well utilised in the manufacturing processes or for energy production.

In order to intensify the use of waste, Finland has begun to apply the producer obligation. According to this, the manufacturer of a product is obliged to take an active part in the disposal of the waste that will in time be incurred. This obligation is already applied in the case of old tyres, waste paper and packaging materials and will in time be extended to cover electronic and electrical devices and cars.

# 5 Energy supplies

## Energy generation

Finland's total energy consumption in 1998 was 30.8 Mtoe, the structure in terms of sources of energy having remained unchanged for the past ten years: oil 28 per cent, coal 11 per cent, natural gas 11 per cent, nuclear power 18 per cent and peat six per cent. Non-imported fuels, including peat, accounted for 29 per cent of total consumption. Finland has a high level of per capita energy consumption, due to its northern location, the resulting need for heating in winter, the dominant role of heavy industry in its economic structure and the long transport distances brought about by the sparse population. The highest consumption in proportion to GDP was in 1993, since when the economy has become less energy intensive.

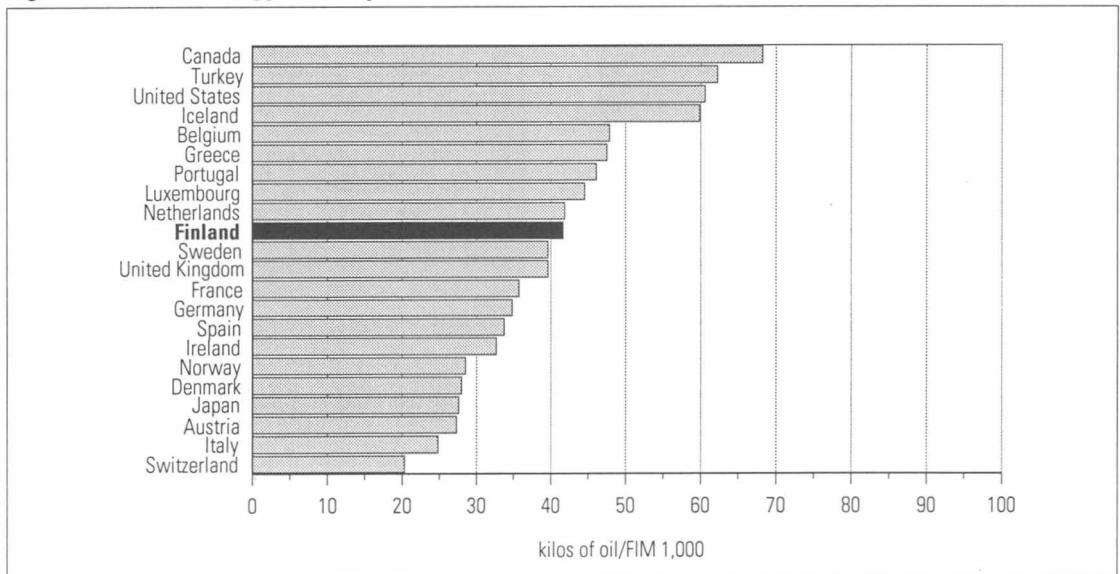
Electricity consumption amounted to 76.5 TWh in 1998, i.e. 3.9 per cent more than in the previous year. Nuclear power was used to produce 21 TWh of electricity in 1998 (27 per cent of the total electricity demand) and hydroelectric power 19.1 TWh (19 per cent). Net imports amounted to 12 per cent or 9.3

### 16. Total energy consumption 1998

	PJ	%
Industry	497	50
Heating	231	23
Transport	164	16
Others	105	10
<b>Total</b>	<b>996</b>	<b>100</b>

PJ = petajoule

Figure 16. Total energy consumption in certain countries relative to GDP in 1996



TWh. Industry accounted for 55 per cent of the electricity demand or a good 41 TWh, households and agriculture for a good 24 per cent and services and the public sector for 17 per cent. The growth in electricity demand in 1997 and 1998 exceeded the forecasts but is expected to fall off in 1999 to 2-3 per cent, making a total demand of 78 TWh in 1999. The demand was previously not expected to meet this figure until the year 2000, and the earlier forecast for the year 2010 was 92 TWh.

According to the energy policy report submitted to Parliament by the Council of State in 1997, the intention is to bring the growth in energy consumption to a halt by the year 2010 by introducing more effective energy saving measures and use. These plans have been triggered by a concern over rising carbon dioxide emissions. 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. A similar agreement was signed in May 1999 with the property and construction sectors, the aim being to reduce the heat consumption of properties by 15 per cent on 1988 by the year 2010.

### *Use of fossil fuels*

Most of the detrimental effects of energy generation on the environment arise from the use of fossil fuels. The environmental damage caused by the growing use of fossil fuels is considerable and is in many places threatening the ability for renewal and tolerance of nature. The depletion of energy sources will not, according to the forecasts, pose a threat to continued economic growth within the next few decades. The existing fossil fuel resources have proved to be greater than was previous thought and many new sources have been discovered. Technological innovations have, furthermore, meant

that previously unprofitable sources can now be used. 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.

The global market prices of oil have dropped during the 1990s, by virtue of the supply greatly exceeding the demand. Crude oil prices fell below USD 10 a barrel in real terms in 1998 at the 1996 rate of the US dollar. The last time the price was so low was in 1973, before the first oil crisis. The price has risen again in 1999 as the producers have reduced their production under common agreements. In August 1999 the price of crude oil rose to more than USD 20. According to some estimates, oil production will, however, peak in 2003, and thereafter decline. This will lead to a steep rise in the price of oil. World production of oil amounted to 3.5 billion tonnes in 1998.

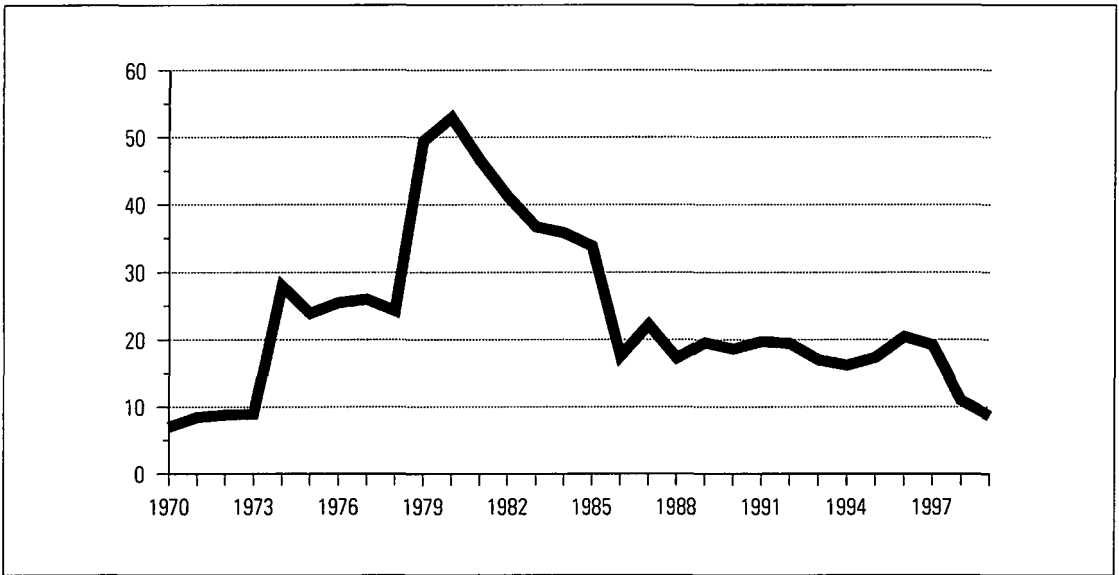
Oil consumption in Finland reached a peak at 10-12 million tonnes a year in the 1970s, but following the oil crisis the role of nuclear power, natural gas and non-imported sources in energy generation was increased and measures were taken to conserve energy. These measures meant that oil consumption

#### **17. Total consumption of oil, coal and natural gas in Finland**

	Oil, million tonnes	Coal, million tonnes	Natural gas, 1000 million cubic metres
1973	12.3	4.0	–
1980	11.0	6.7	0.9
1985	9.2	6.4	0.9
1990	9.0	6.2	2.5
1995	8.2	6.1	3.3
1996	8.5	7.6	3.4
1997	8.4	7.0	3.4
1998 *)	8.6	5.7	3.9

– = not in use    \*) = preliminary data

**Figure 17. Trend in real world price of oil (USD per barrel)**



diminished rapidly in the 1980s, so that the annual consumption during the present decade has fallen to 9 million tonnes. Consumption of petrol and lubricants continued to fall in 1998, whereas that of other oil products increased.

### *Greenhouse gases*

One of the major environmental effects of the use of fossil fuels is the emission of greenhouse gases. The carbon dioxide content of the atmosphere is, according to research, now about 29 per cent higher than it was before the Industrial Revolution. A group of UN experts reckons that the climate will be 1-3.5 degrees warmer by 2100, while the northern regions can expect a rise in temperature of as much as 2-3 times this. The mean rise in the world temperature has in the course of this century been about 0.5 degrees, and 1998 was the hottest year ever.

The reduction of greenhouse gas emissions was agreed at the UN Climate Meeting in

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

	1990 emissions, million tonnes	% of EU emissions	Quota objective	Change 1990-95 (%)
Luxembourg	14	0.3	-28%	-45.0
Germany	1 201	27.7	-21%	-12.3
Denmark	72	1.7	-21%	10.0
Austria	74	1.7	-13%	0.6
United Kingdom	775	17.9	-12.5%	-8.5
Belgium	139	3.2	-7.5%	4.4
Netherlands	208	4.8	-6%	7.5
Italy	542	12.5	-6.5%	1.7
France	637	14.7	0%	-1.1
<b>Finland</b>	<b>73</b>	<b>1.7</b>	<b>0%</b>	<b>-0.5</b>
Sweden	69	1.6	4%	-2.6
Ireland	57	1.3	13%	2.6
Spain	301	7.0	15%	8.0
Greece	104	2.4	25%	4.6
Portugal	69	1.6	27%	+6.0*)
<b>Total</b>	<b>4 334</b>	<b>100</b>	<b>-8%</b>	<b>3.6</b>

\*) = change in 1990-94

Kyoto in December 1997. The Kyoto Agreement set emission reduction targets for a basket of six gases: carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), fluorohydrocarbons (HFC), perfluorohydrocarbons (PFC) and sulphur hexafluoride (SF<sub>6</sub>). Of these, carbon dioxide has the smallest greenhouse gas effect, that of methane being about 20-fold, that of nitrous oxide more than 300-fold, and the other three 1000-fold. The reductions to be assigned each of the EU member states were decided at the meeting of the Informal Council of Environment Ministers in Luxembourg in June 1998.

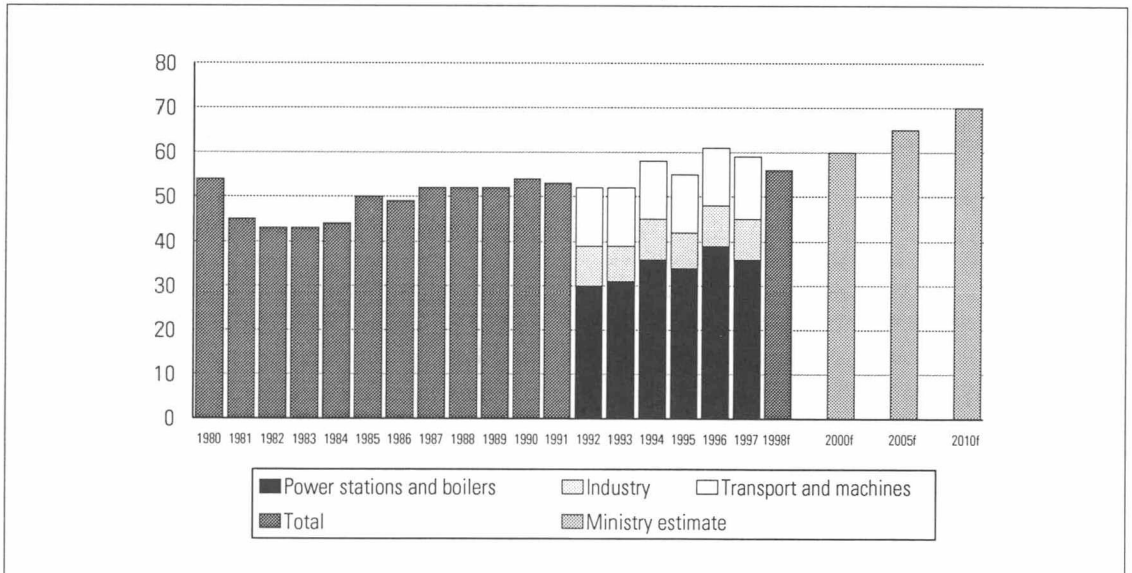
At the Luxembourg meeting Finland agreed to reduce its greenhouse gas emissions to the 1990 level by the years 2008-2012, on condition that the EU takes efficient steps to implement measures affecting all member states, such as energy taxes. 84 per cent of Finland's greenhouse gas emissions are carbon dioxide. Finland's carbon dioxide emissions from energy generation totalled

56 million tonnes in 1998, i.e. they had decreased by three million tonnes from the previous year, largely thanks to the more or less maximum production of hydro power and larger imports. The carbon dioxide emissions were, however, still higher than in 1990, the baseline year.

### 19. Greenhouse gas emissions in Finland (million equivalent tonnes of carbon dioxide)

	1990	1995	1996	1997
Carbon dioxide (CO <sub>2</sub> )				
– fuels	53.9	55.9	61.3	59.6
– peat cultivation & production	3.5	3.5	3.5	3.5
– industrial processes	1.2	0.8	0.84	0.9
– others	0.6	0.7	0.7	0.6
Methane (CH <sub>4</sub> )	7.5	5.6	5.7	5.7
Oxides of nitrogen (N <sub>2</sub> O)	5.8	5.6	5.7	5.9
Others (SF <sub>6</sub> , HFC, PFC)	0.3	0.3	0.5	0.7
<b>Total</b>	<b>72.9</b>	<b>72.5</b>	<b>78.3</b>	<b>76.9</b>

Figure 18. Carbon dioxide emissions from fossil fuels and peat in Finland (million tonnes)



f = forecast

# Air pollution and acid deposition

Acidification affects the soil and water of the areas of Finland that are the most sensitive and receive the biggest loads. 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 1998 totalled 96,000 tonnes, i.e. only 16 per cent 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 the average for the European OECD countries. 28 per cent of the emissions arise from the generation of electricity and heat and 37 per cent from industry. Some 12 per cent of the sulphur dioxide deposition occurring in Finland comes from sources within the country itself, while 78 per cent of its own emissions are deposited outside its borders. Finland

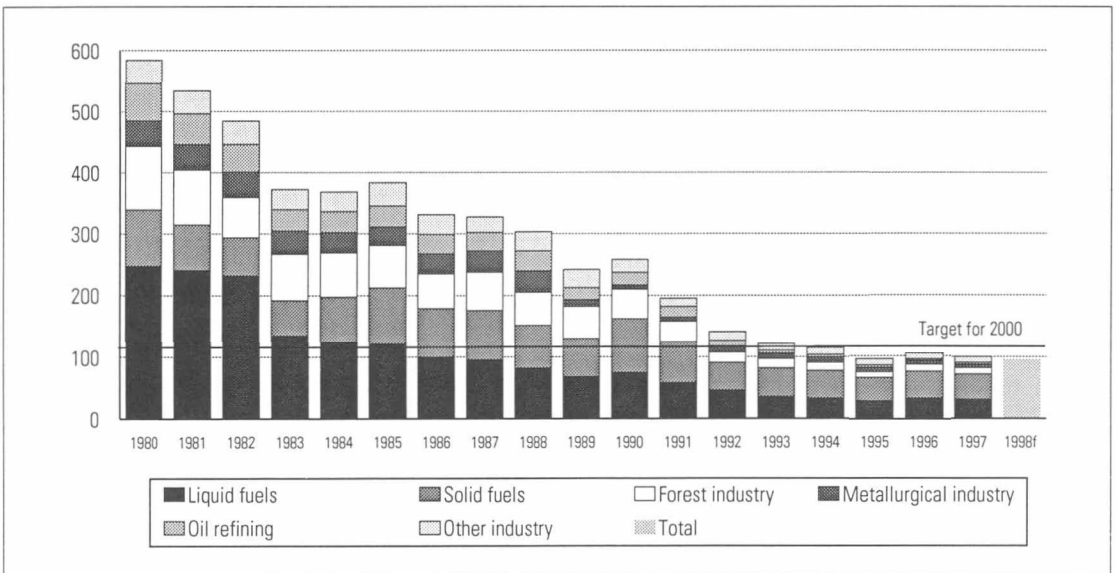
had by 1994 already reached the objectives laid down for the year 2000 in the second sulphur Protocol signed in Oslo.

## 20. Emissions of sulphur dioxide, oxides of nitrogen and ammonia in the EU countries in 1996 (thousand tonnes)

	SO <sub>2</sub>	NO <sub>x</sub>	NH <sub>3</sub>
Spain*)	2 071	1 223	345
United Kingdom	2 028	2 060	319
Germany	1 851	1 858	651
Italy	1 490	2 157	389
France	1 031	1 641	668
Greece**)	556	357	78
Belgium	240	334	97
Portugal**)	272	249	92
Ireland	143	115	128
Denmark	186	288	99
Netherlands	136	489	144
<b>Finland</b>	<b>105</b>	<b>267</b>	<b>35</b>
Sweden	83	302	61
Austria***)	60	175	79
Luxembourg***)	8	20	8

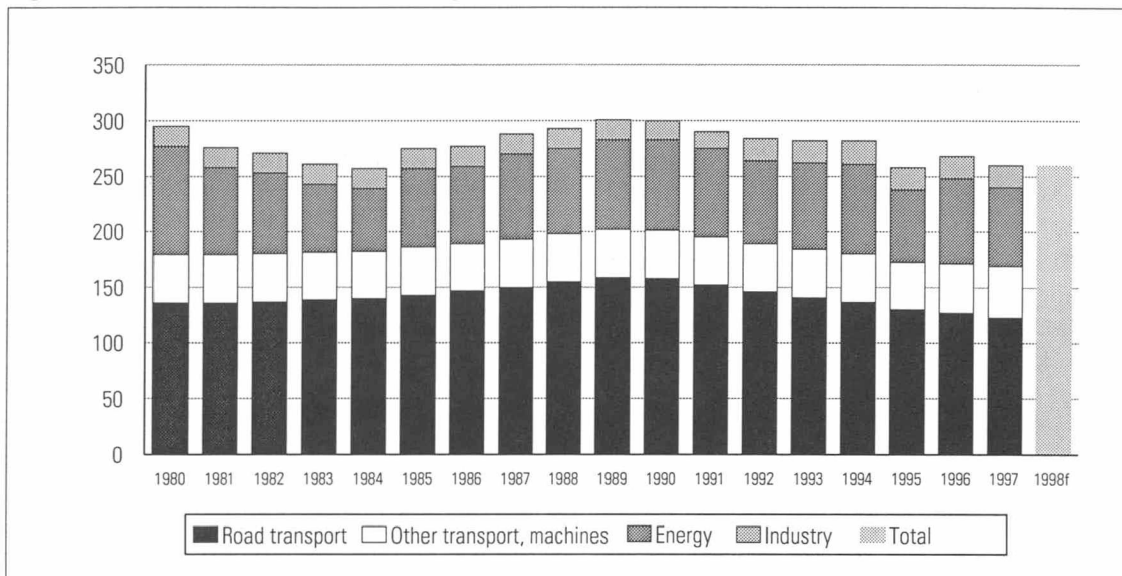
\*) = data for 1993  
 \*\*) = data for 1994  
 \*\*\*) = data for 1995

Figure 19. Sulphur emissions in Finland and their reduction objectives (thousand tonnes of sulphur dioxide)



f = forecast

**Figure 20. Emissions of oxides of nitrogen in Finland (thousand tonnes)**



f = forecast

Note: The criteria for calculating the emissions have changed. The data for 1992-1996 are not fully commensurable with those for previous years.

Finland's total emissions of the oxides of nitrogen were some 260,000 tonnes in 1998, i.e. 12.2 per cent less than in 1980. 65 per cent of these were caused by traffic and 27 per cent by energy generation. Measured against the GDP, these emissions are quite high, some 70 per cent above the average for the European OECD countries. Approximately 20 per cent of the deposition comes from Finnish sources, while 80 per cent of the deposition comes from 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 per cent 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, however, been some signs of

recovery during the past few years, in that the sulphate concentrations in the lakes of Southern and Central Finland 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.

## 21. Origin of acid deposition in Finland in 1997 (%)

	Sulphur	Nitrogen
Finland	12	20
Western Europe	10	36
Russia	26	6
Baltic States	5	3
Other Eastern Europe	7	6
Others (background deposition)	40	29
<b>Total</b>	<b>100</b>	<b>100</b>

## 22. Deposition of emissions of Finnish origin in 1997 (%)

	Sulphur	Nitrogen
Finland	22	12
Western Europe	7	8
Russia	18	24
Baltic States	3	3
Other Eastern Europe	3	4
Others (background deposition)	47	49
<b>Total</b>	<b>100</b>	<b>100</b>

The groundwater pH values have dropped slightly in many places in Finland, though the drop appears from surveys to have halted. The buffer capacity of well water has also deteriorated. There does not, however, seem to be any great risk of groundwater acidification, 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 unless deposition can be reduced below the critical load levels throughout the country.

### Ozone

One of the main global threats to the environment is, along with climate change and acidification, the ozone depletion in the upper atmosphere and the formation of ozone in the lower atmosphere. The ozone depletion in the upper atmosphere, which is causing an increase in the ultra-violet rays harmful to humans, flora and fauna, is expected to gain momentum in the first half of the next millennium, especially over the northern regions. The legislation limiting the use of substances contributing to ozone depletion is stricter in Finland than in many other EU member states. The EU Council

of Environment Ministers decided in December 1998 to tighten the restrictions on the manufacture and use of substances contributing to ozone depletion. It also placed further restrictions on the use of methyl bromide and HCFC compounds. The use of methyl bromide will gradually be phased out in the EU by the year 2005 and production of HCFC compounds will be frozen at the present level by the end of the year 2025. As a result of this decision, the EU is ahead of the Montreal Protocol on almost all scores.

The high ozone contents in the lower atmosphere are having harmful effects on vegetation and health. Ozone is formed by the reaction of certain emissions from transport and industry, such as nitrogen oxides and carbon monoxide, with particles in the atmosphere. The most important cause of ozone build-up in Western Europe is considered to be traffic emissions. In Finland the volume of nitrogen oxides in particular is a factor decisive to ozone formation. The formation of ozone is by nature non-linear and greatly depends on the meteorological conditions and background concentrations in the northern hemisphere. For this reason the cause and effect of emissions and concentrations is not always clearly evident.

It is estimated that the critical ozone exposure times during the crop growing season are exceeded almost annually in Finland. The critical forest levels are exceeded in Southern and Central Finland, especially in hot, sunny summers. According to the EU ozone directive, the health threshold is repeatedly exceeded every year over large areas of Finland. In order to bring about a significant decrease in the ozone content in the lower atmosphere, the emissions of nitrogen oxides and volatile hydrocarbons will have to be appreciably reduced throughout the northern hemisphere.

## Sustainable energy supply

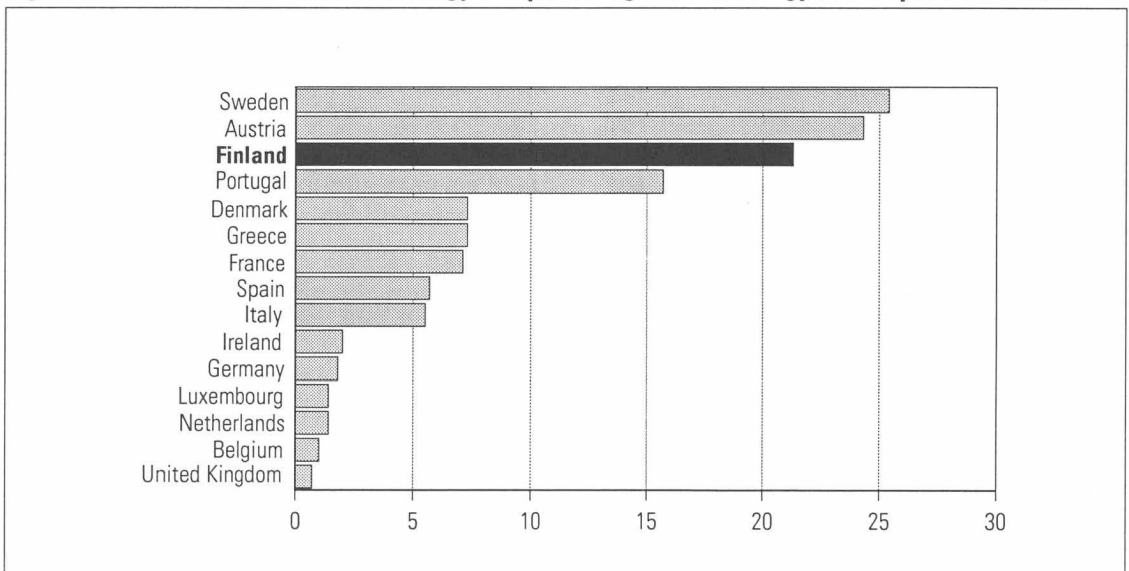
Promotion of the use of renewable energy sources and greater energy use efficiency are vital conditions for sustainable development. According to the forecasts, the production of oil will reach its peak in the first half of the 21st century. Thereafter the demand will probably exceed the supply, resulting in major problems unless new energy sources can be developed before then to take its place. The biggest obstacle to the wider use of renewable energy seems at the moment to be the high costs compared with the traditional energy sources, not allowing for the external costs.

The European Union has devoted considerable attention to promoting the use of renewable energy sources during the 1990s, advocating such solutions as solar energy, wind-powered generators, biomass and waste, geothermal energy and small-scale hydroelectric schemes. The EU White Paper to this effect published at the end of 1997 states that the objective is to double the proportion of renewable energy sources from 6

per cent to 12 per cent by the year 2010. The ALTENER I and II research programmes have aimed to promote the introduction of renewable energy sources and trade in the relevant equipment and technology. The objective is to reduce carbon dioxide emissions by 180 million tonnes by doubling the use of renewable sources. Corresponding SAVE programmes exist to promote the conservation of energy.

Under the framework energy policy agreed in November 1998, the EU will, over the period 1998-2002, be investing ECU 213 million in a framework energy programme, allocating ECU 74 million to the promotion of the use of renewable energy sources (ALTENER) and ECU 64 million to the intensification of energy use (SAVE). Between 1998 and 2010 the EU also intends to promote the transfer to renewable energy sources by a large investment-boosting campaign aiming to build one million solar panel systems capable of generating 1 kWh of electricity, 10,000 MW of wind power park capacity, 10,000 MW of biomass capacity and 100 model communities based on renewable energy only. All in all achieving

Figure 21. Renewable sources of energy as a percentage of total energy consumption in 1995 (%)



the 12 per cent target by the year 2010 will call for investments estimated at ECU 165 billion.

The commercial utilisation of wind and solar energy began in the 1980s and has been increasing rapidly ever since. Wind generation costs have fallen by as much as 30-40 per cent since the early 1990s and the cooperative body for centres of research into renewable energy headed by the EU expects the costs to fall to the level of that generated by condensing power plants by the year 2005. The technology required for extensive exploitation of solar energy already exists, though some of it at the laboratory level only. Present estimates reckon that the direct use of solar energy will become competitive in around 2010-2020.

According to a report issued by the Technical Research Centre of Finland in May 1999 as a background to the programme for the promotion of renewable energy sources, a 50 per cent increase in the use of renewable sources by the year 2010 would be possible in Finland at relatively low cost. 90 per cent of the increase would come from bio-energy, three from wind energy, three from hydro power, four from heat pumps and less than 0.5 per cent from solar power. The objective would mean an increase in the proportion of renewable sources by 3-4 per cent units of the total energy consumption compared with 1995. The need for public funding for research and development into renewable sources would be an estimated FIM 200 million a year.

The use of bio-energy could be increased considerably in industry, district heating and small-scale applications. The costs of producing bio-energy have fallen due to R&D and it has become more competitive with other sources. Research into bio-energy has, in the 1990s, been financed to the sum of about FIM 40 million a year. Bio-fuels emit less harmful greenhouses gases and

sulphur into the air than fossil fuels. The net greenhouse gas emissions of bio-energy are almost nil when fuels with only a low degree of refinement are used.

Finland has all the know-how and wind conditions needed to achieve a rapid increase in the exploitation of wind energy in the next few years. Its wind energy capacity in 1998 was 17 MW and the capacity will, it is estimated, increase to 35 MW in 1999. In 1998 Finland produced 23.5 GWh of energy by wind power, i.e. 0.03 per cent of the country's electricity demand. The know-how in the use of solar energy is also of a high standard. The present commercial applications of solar energy are at the moment mainly in electricity supply for summer cottages and remote regions. Some 30,000 solar panel units have been sold to generate electricity for summer cottages, solar energy is used to light 1,500 shipping beacons, and four solar power stations have been connected to the electricity network as a pilot scheme. The electricity supply undertakings have in the past few years also begun to offer their clients a chance to buy 'eco-electricity' generated by means of old hydro power, bio-, wind and solar energy.

Although Finland's energy supply system relies to a great extent on the conventional forms of energy, it is nevertheless highly efficient, due in particular to the combined production of heat and electricity; 33 per cent of all Finland's electricity is generated in combination with heat. Of this, industry accounted for 12 TWh and community district heating for 13 MWh in 1998. These cogenerating plants generated 23.9 TWh of district heat. All in all Finland produced 27.6 TWh of district heat in 1998, 78 per cent of it in combined heat and electricity plants. Some 44 per cent of the Finns live in housing connected to a district heating system: 93 per cent in Helsinki, 71 in Tampere, 90 in Lahti and 81 in Oulu. The mean price of district heat was FIM 0.192 in 1998.

## Energy taxes

Finland's energy taxation system focuses on the end product, i.e. electricity. Electricity tax is divided into a lower and a higher bracket, the former applying to industry and market gardeners using hothouses and the latter to households, the service sector, agriculture and the public sector. Unlike in electricity generation, tax is levied on the fuel used to produce heat according to the carbon content. The tax is FIM 102 per carbon dioxide tonne.

The electricity surtax payable by industrial companies and private consumers was increased by an additional 24 per cent at the beginning of September 1998. This rise was offset in the case of transport 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

### 23. Finland's energy tax revenue in 1998 excluding natural gas (FIM million)

	Basic tax	Surtax	Main-tenance support fee	Total
Petrol				
– unleaded	7 430	501	97	8 028
– leaded	133	7	1	143
Diesel oil	3 001	459	41	3 500
Light fuel oil	310	673	60	1 043
Heavy fuel oil	–	272	20	291
Coal	–	279	9	288
Peat	–	69	–	69
<b>Total</b>	<b>10 874</b>	<b>2 260</b>	<b>228</b>	<b>13 362</b>

– = not in use

### 24. Trend in energy taxes in Finland

	1.1.1997	1.1.1998	1.9.1998
Petrol (p/l)	308.3	328.3	328.3
Diesel oil (p/l)	163.5	178.5	178.5
Light fuel oil (p/l)	29.0	32.7	37.9
Heavy fuel oil (p/l)	22.1	25.8	32.1
Coal (FIM/t)	169.0	198.6	246
Peat (FIM/MWh)	4.2	4.9	9.0
Natural gas (p/m <sup>3</sup> )	7.1	8.3	10.3
Electricity, tax bracket I (p/kWh)	3.1	3.3	4.1
Electricity, tax bracket II (p/kWh)	1.675	2.02	2.5

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 these grounds the revenue from the surtax can be calculated at just under FIM 4.9 billion in 1999. On account of tax refunds, the net effect of the extra costs to the industrial sector will remain at FIM 130 million. Further revenues of some FIM 300 million will accrue from the VAT levied on energy supplies and the rise in energy consumption.

The Finnish electricity markets were opened up to competition for small consumers in 1998. As a result of the competition, the price of electricity including tax fell 2-6 per cent. According to estimate, just under one per cent of Finland's 2.8 million small consumers changed to another electricity supplier. The opening up of the market has also forced the supply companies to streamline their operations and sales, to cut their costs in other ways, too, and to seek greater efficiency through various ownership arrangements.

# 6 Transport

## Trend in traffic volumes

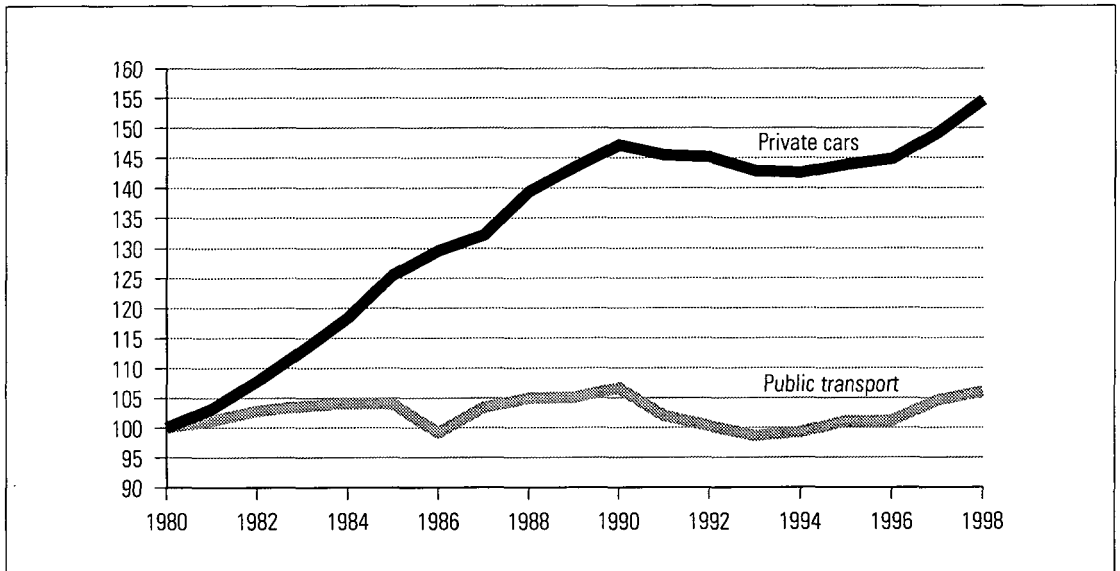
The annual distance travelled per head of population in Finland is one of the highest in the European Union. These transport demands and the resulting costs are a consequence of the sparse population distribution, the decentralised community structure and Finland's remote location relative to its main export markets. Internal goods transport has increased by 14 per cent since 1980 and road traffic by more than 30 per cent, while other forms of transport have decreased in proportion. A far greater proportion of goods are transported by rail 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 per cent in the 1980s. There was a slight but only temporary fall of four per cent due to the recession of the early

1990s, but both figures have since taken an upward turn again. 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 81 per cent in 1998, buses and coaches for 12 per cent, railways five per cent, air transport two per cent and boat traffic 0.2 per cent. Passenger traffic has been predicted to increase by 30 per cent between 1995 and the year 2010 and freight transport by 42 per cent.

The efficiency of the transport system has increased during the 1990s, while costs have decreased by almost 10 per cent. 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 per cent throughout the 1990s. The railways account for one fourth of all internal freight

Figure 22. Trends in use of public transport and private cars (1986=100)



transport. The fairly sparse railway network nevertheless means that only certain long-distance hauls could reasonably be transferred to the railways.

### Environmental impact

Transport has the following environmental consequences:

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

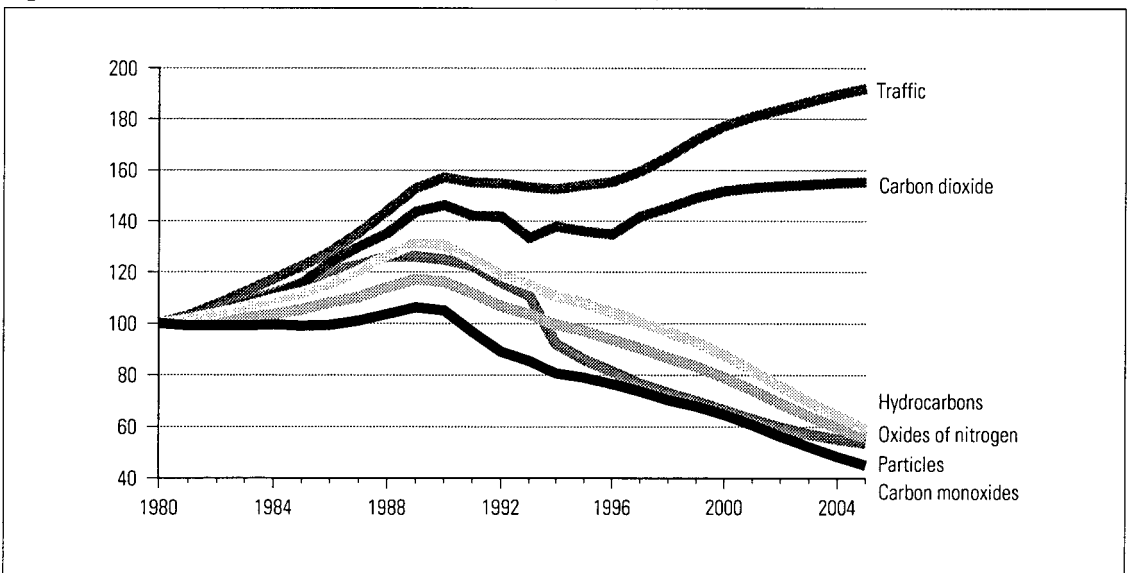
Various investigations are at present being carried out with a view to pinpointing the problems caused by traffic in the environment and ways of solving them. The two programmes, Mobile 2 and Promotor, in the second stage of the technology-oriented

Mobile launched in 1993 are trying to find ways of reducing the energy consumption and emissions of passenger and goods transport. Other major research projects include the programme known as LYYLI seeking to determine a community structure and transport system that is favourable to the environment, an environmental cluster project commercialising ways of reducing the load on the environment, a programme called LINKKI concentrating on energy conservation, and another called SYTTY concerned with environmental health. The findings of these research projects will be used to guide transport policy in the next few years.

### 25. Traffic emissions as a percentage of total emissions in Finland

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

Figure 23. Trends in emissions from road traffic (1980=100)



The limits on vehicle emissions have been made considerably tighter in the 1990s in order to reduce the damage caused by road traffic in the environment. The 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 to below the 1980 level despite a 40 per cent rise in fuel consumption. The introduction of catalytic converters in the early 1990s has also reduced the emissions of carbon monoxide, hydrocarbon, nitrogen dioxide and methane.

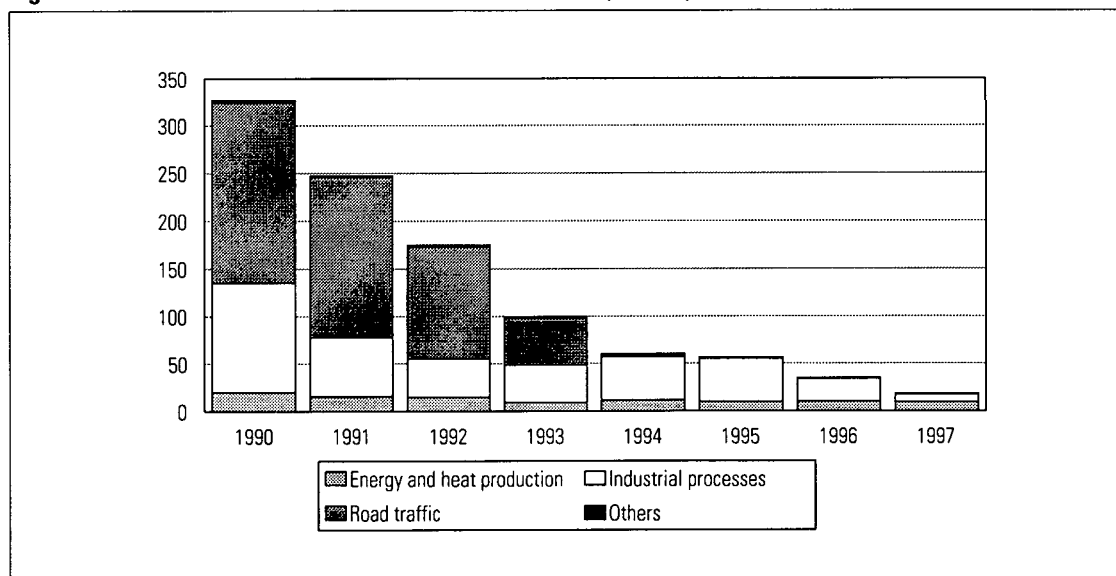
The environmental impact of rail traffic has been reduced by electrifying many of the lines. Efforts have been made to combat railway noise by polishing the tracks. A recycling system for the old wooden track sleepers was introduced in 1998. As tracks are re-laid, the old wooden sleepers are as a rule being replaced by concrete ones. Shipping is becoming responsible for an increasing proportion of total emissions, so that, for example, over 90 per cent of all

transport sector sulphur emissions are now traceable to this source. The sulphur content of fuels employed in international shipping must not exceed 4.5 per cent, and the limit set for the Baltic Sea is still stricter, 1.5 per cent. Air traffic is predicted to expand by 6-8 per cent a year in Europe in the near future, and its carbon dioxide emissions will, according to an EU survey, increase by 3-4 per cent a year. The growth in air traffic is effectively cancelling out the reductions in emissions achieved through the improved fuel utilisation efficiency of modern aircraft engines. In Finland, air traffic accounts for

**26. Emissions from water transport in Finland (thousand tonnes)**

	Carbon monoxide	Hydrocarbons	Nitrogen dioxide	Sulphur dioxide	Carbon dioxide
Passenger vessels	1.4	0.5	18.5	2.6	845.8
Freighters	1.9	1.0	41	15.2	1546.5
Pleasure craft	22.1	0.8	1.3	0.1	164.4
Fishing and work vessels	0.4	0.1	3.0	0.1	138.7
Ice-breakers	0.1	0.0	1.6	0.2	55.2
<b>Total</b>	<b>25.9</b>	<b>9.7</b>	<b>65.4</b>	<b>18.2</b>	<b>2750.6</b>

**Figure 24. Trend in total emissions of lead in Finland (tonnes)**



five per cent of the carbon dioxide emissions by transport.

The restricting of carbon monoxide emissions has become an increasingly powerful challenge as a result of the Kyoto Protocol. Road traffic accounts for 16 per cent of Finland's total carbon dioxide emissions, i.e. 9.6 million tonnes - passenger traffic for 58 per cent or about six million tonnes of this. Due to the improved energy efficiency of new cars, only a slight increase is to be expected by the year 2015 in the carbon dioxide emissions of road traffic. In order to reduce the emissions of oxides of nitrogen, it will be necessary to adopt new technology in the catalytic converters of passenger cars and in the engines of heavy vehicles. Nearly half the passenger traffic is at present handled by cars with catalytic converters. The car stock is, however, renewed only slowly, and not until 2010 will all petrol cars be fitted with a catalytic converter. The petrol sold in Finland is unleaded and almost all the diesel fuel is free of sulphur. With the change-over to unleaded fuel, lead emissions have fallen by 95 per cent since the beginning of the 1990s. The upper limits for emis-

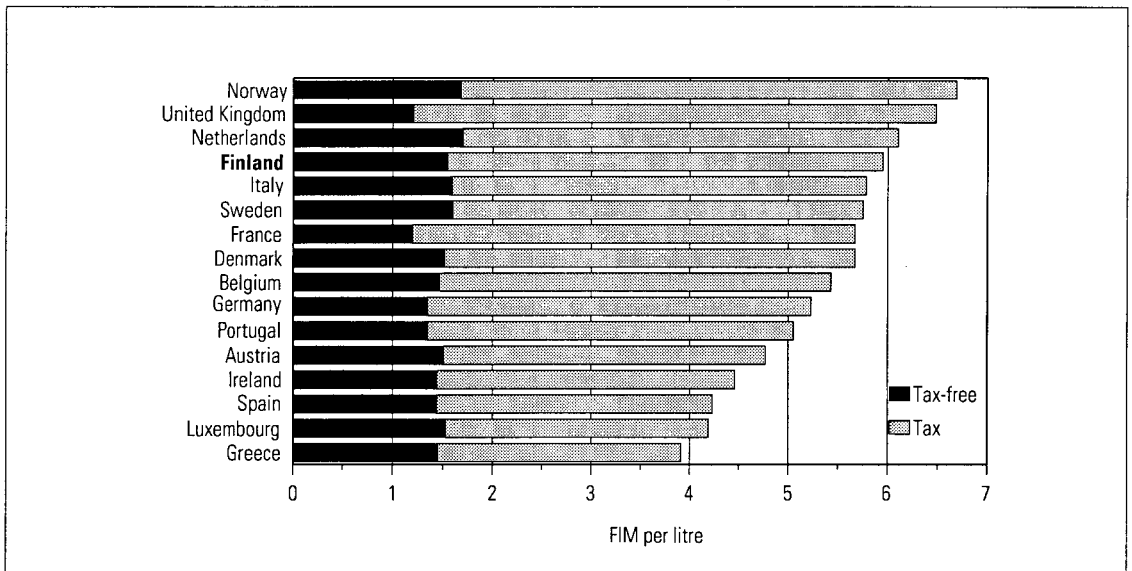
sions are exceeded less and less as fuels improve, the limit for carbon monoxide emissions is seldom broken, but the norms for particles and the oxides of nitrogen are still sometimes exceeded. The limits imposed on particle emissions from heavy vehicles and improved street cleaning can be expected to reduce particle emissions in the near future.

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 per cent from the 1990 level by the year 2010. The requirements will be tightened gradually over the

## 27. Material flows in road maintenance (thousand tonnes)

	1997	1998
<b>Construction</b>		
Rock material from outside	6 051	7 703
Surfacing materials	1 082	722
<b>Maintenance</b>		
Salt	120	102
Grit	646	611
Waste collected	11	13

Figure 25. Consumer prices of motor fuel (95E) on 15.7.1999 (FIM per litre)



period 2000-2005. On the other hand, the EU strategy for reducing carbon dioxide emissions from private cars does not seem to be feasible 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.

According to the decision made by the EU Environment Ministers in December 1998, the emissions from heavy vehicles will be reduced by 60-70 per cent on the present level by the year 2005. Limits were also imposed on the emissions of nitrogen compounds by heavy vehicles. According to the directive on the exhaust emissions of light commercial vehicles, the carbon dioxide emissions from passenger vehicles must be reduced to at most 5.22 grams of carbon dioxide per kilometre by the year 2000, and those of diesel cars to 0.95 grams. By the year 2005 the upper limit must have been reduced to 2.27 grams for petrol passenger cars and 0.74 grams for diesel.

The salt used on the Finnish roads in winter, amounting to some 119,682 tonnes in 1997 and 102,130 tonnes in 1998, also has a major environmental impact. About half the major groundwater areas 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 per cent 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 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 12.2 billion was spent on the maintenance of transport routes in 1998: FIM 4.1 billion on roads, FIM 3.1 billion on streets, FIM 2.5 billion on railway tracks, FIM 600 million on waterways, FIM 1.2 billion 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. The aim is to charge those causing them for the costs incurred, so that all forms of transport will be charged equally with respect to the incidental costs. Research indicates that road transport in Finland meets these costs in full.

#### **28. Special taxes levied on road traffic (FIM million)**

	1994	1995	1996	1997	1998	1999	2000
	A	A	A	A	A	B	BP
Vehicle licence tax	618	1 046	1 110	1 129	1 198	1 120	1 270
Diesel engine vehicle tax	844	668	929	980	1 042	1 000	1 090
Excise duty/VAT on motor vehicle tax	450	590	792	924	1 157	1 210	1 320
Motor vehicle tax	2 054	2 685	3 611	4 210	5 259	5 500	6 000
Excise duty/VAT on fuel tax	1 949	2 188	2 425	2 527	2 536	2 640	2 786
Fuel tax	8 861	9 946	11 021	11 487	11 528	12 000	12 660
<b>Total</b>	<b>14 776</b>	<b>17 123</b>	<b>19 888</b>	<b>21 257</b>	<b>22 720</b>	<b>23 470</b>	<b>25 126</b>

A = Final accounts B = Budget BP = Budget proposal

In addition to economic instruments, the environmental effects of traffic can be reduced by altering the proportions of the different modes of transport and by improving the planning of community structures. The value of civil engineering in 1998 came to a total of FIM 19.5 billion. 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, more than half the environmental impact assessments completed or in preparation are concerned with transport projects.

Most of the revenue from environmental taxes and charges accrues from taxes on traffic, particularly those on fuels, even though these are mainly collected on fiscal

grounds. Fuel taxes amounted to some FIM 14.6 billion in 1999. These taxes are graded on environmental grounds and have had the effect of ensuring that the reformulated, more oxygen-rich petrol grades have in practice replaced the older ones. In April 1999, in order to encourage product development to seek even more environmentally friendly petrol grades, the definition of reformulated petrol was made stricter and more versatile in the tax classification.

Taxes make up a good 75 per cent of the price of unleaded petrol in Finland, which is the fifth highest figure in the OECD countries after Norway, Britain, Germany and France. The tax on diesel fuel is slightly below the OECD average, however.

## 7 *Towards sustainable development*

The strain placed by Finland on the environment has, despite the economic boom and rising production of the past few years, been falling. Although the emissions are on the decrease, the old pollution and waste is still a significant burden in places. Strong economic growth may, in the future, constitute a threat in that it may, in the absence of a far-reaching, preventive environmental policy, easily lead to an increase in the environmental impact.

Finland's own means of influencing the level of environmental protection in its own territory are hampered by the globalisation of the economy. The independent levying of, say, environmental taxes and to some extent national legislation on the environment have already been made more difficult. Under the decision made by the EU Environment Ministers in December 1998, the newest members of the European Union - Finland, Sweden and Austria - will be allowed to continue observing stricter environmental norms than the other members. When these countries joined the European Union, they were allowed a four-year transitional period that ended in 1998. Many of the strictest norms in Finland, Sweden and Austria have subsequently been adopted by the EU or soon will be. Raising the level of environmental protection in Finland and the European Union will to an increasing extent call for international cooperation and agreements. At European level, reducing the greenhouse phenomenon, nitrogen emissions, non-point water pollution and the formation of ozone in the lower atmosphere will necessitate considerable extra effort. The economic instruments applied alongside the administrative means of guidance, particularly environmental taxation, have not been sufficient, and agreement has not yet been reached on their

sufficiently effective use to bring about changes in production and consumer habits.

The European Union's environmental policy has been rather successful in protecting the ozone layer and preventing transboundary emission fluxes. On many environmental issues it has, however, been no more than satisfactory. Nor has the intended effective integration of environmental considerations with the various sector policies been achieved. The state of the environment thus continues to be a source of concern in the European Union. Many trends connected with the environment are diametrically opposed, and it is difficult to form an overall picture of the trend in the state of the environment. It is, however, clear that many environmental problems have a considerable impact both on the state of the environment and on human health in the region covered by the European Union. Between 1995 and 2010 the per capita consumption is expected to rise by 50 per cent in the European Union, which will increase the pressure on the environment and the use of natural resources.

One of the objectives of Finland's presidency of the European Union in the latter half of 1999 is to allow for environmental considerations and sustainable development in the various Union policies, to prepare an EU strategy on climate change and future climate meetings, and to strengthen the position of environmental protection in developing the northern dimension of EU policy. The informal meeting of EU environment ministers in Helsinki in July 1999 noted that it is no longer possible to concentrate exclusively on repairing the damage caused by humans in the environment. Instead, the focus should be turned on the fundamental reasons for problems. Efforts to think along eco-efficient lines and to reduce the

consumption of materials were considered important in seeking to reduce the strain on the environment.

The EU Commission is at present preparing two major proposals on the environment, according to which member states would be obliged to bring about significant cuts in their emissions of four polluting gases. According to the proposal on national emission levels, the aim is to reduce the acid deposition and, above all, the smog harmful to the respiratory organs. The member states

would, according to this plan, therefore have to cut their emissions of sulphur dioxide, nitrous oxide, ammoniac and volatile organic compounds by 78 per cent by the year 2010. Meanwhile the objective of the proposal on environmental damage is the even more effective implementation of the environmental regulations in the EU member states, the creation of a common liability system and the establishment of minimum norms.

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

Agreement	Objectives	Implementation
<p><b>Climate change</b> Kyoto Protocol on Climate Change, 1998</p>	<p>To stabilise greenhouse gas concentrations in the atmosphere at a safe level. To reduce greenhouse gas emissions by at least 5 per cent from the 1990 level over the period 2008-2012. The target varies from one country to another, that for the EU being to stabilise its emissions at the 1990 level</p>	<p>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, the agreement and rules on which were agreed in Buenos Aires in autumn 1998.</p>
<p><b>Substances depleting the ozone layer in the upper atmosphere</b> Montreal Protocol, 1987.</p>	<p>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.</p>	<p>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 per cent 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.</p>
<p><b>Sulphur emissions</b> Sulphur Reduction Protocol, 1994.</p>	<p>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 per cent by the year 2000. To this end, Finland is committed to cutting down its sulphur emissions by 80 per cent from the 1980 level by the year 2000.</p>	<p>The Protocol took effect in August 1998. Finland's emissions in 1998 were already 84 per cent lower than in 1980. Keeping emissions at this level will require additional action, however.</p>
<p><b>Emissions of oxides of nitrogen</b> Protocol on the Control of Nitrogen Oxide Emissions and their Transboundary Fluxes, 1988. Declaration on the reduction of nitrogen oxide emissions, 1988.</p>	<p>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 per cent from the 1980 level by 1998.</p>	<p>Emissions of the oxides of nitrogen had decreased in 1998 by 10 per cent from the 1987 level.</p>

Agreement	Objectives	Implementation
<p><b>Volatile organic compounds</b> International Protocol on the Control of Volatile Organic Compound Emissions and their Transboundary Fluxes, 1991.</p>	<p>To cut down emissions of volatile hydrocarbons by 30 per cent from the 1988 level by 1999.</p>	<p>The Protocol took effect on 29.9.1997. The emissions in 1997 were 18 per cent lower than in 1988.</p>
<p><b>Biological diversity</b> Agreement on Biological Diversity, 1992.</p>	<p>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.</p>	<p>A national action programme on biological diversity was completed in summer 1997, and a follow-up team was set up in 1998. Finland's report assessing the state of biodiversity in Finland was submitted in late 1998. The Academy of Finland is carrying out a research programme into biodiversity in 1997-2002.</p>
<p><b>Protection of the Baltic Sea</b> Helsinki Convention, 1974. Helcom Recommendations 1980- Ministerial statements 1988, 1998. Baltic Environmental Programme 1992. Baltic Protection Agreement 1992.</p>	<p>To reduce the emissions of nutrients, heavy metals and non-degradable or toxic substances into the Baltic Sea by 50 per cent by 1995 and to protect the marine environment.</p>	<p>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.</p>
<p><b>Hazardous waste</b> Basel Agreement on the Transboundary Transport of Hazardous Waste and Supervision of its Handling, 1989.</p>	<p>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.</p>	<p>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 30,000-50,000 tonnes a year, was sent to Western European countries. Exports of hazardous waste to non-OECD countries is prohibited by law.</p>
<p><b>ECE general agreement on long-distance transport of air pollution across national boundaries.</b></p> <p>Protocol on heavy metals.</p> <p>Protocol on non-degradable organic compounds.</p>	<p>Restriction of emissions of mercury, cadmium and lead into the atmosphere.</p> <p>Restriction or total abolition of the use of non-degradable organic compounds.</p>	<p>Finland signed the Protocol in June 1998.</p>

## 1. Trends in real GDP, energy and materials consumption in Finland

	GDP at 1990 prices FIM thousand million	Materials million tonnes	Energy (1000 Mtoe)
1980	379.3	166	22 606
1981	386.4	161	22 404
1982	398.9	166	22 005
1983	409.7	181	22 463
1984	422.0	184	23 369
1985	436.3	191	24 946
1986	446.6	187	24 748
1987	464.9	194	26 218
1988	487.7	194	26 517
1989	515.4	203	26 679
1990	515.4	197	27 220
1991	479.0	178	26 775
1992	462.0	172	26 436
1993	456.6	166	27 149
1994	477.3	179	29 014
1995	501.5	180	28 478
1996	519.3	173	29 766
1997	559.5	188	30 550
1998	566.7*)	196	30 841

\*) = estimate in accordance with the SNA-68 recommendation.

Source: Statistics Finland and Ministry of Trade and Industry; Energy Survey.

## 2. Trends in real GDP and atmospheric emissions in Finland

	GDP at 1990 prices FIM thousand million	Carbon dioxide missions million tonnes	Sulphur dioxide emissions thousand tonnes	Emissions of oxides of nitrogen thousand 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	284
1993	456.6	52	122	282
1994	477.3	58	115	282
1995	501.5	55	96	258
1996	519.3	61	105	268
1997	559.5	59	100	260

Source: Statistics Finland.

### 3. Persons suffering from asthma and obstructive pulmonary diseases

1985	64 870
1986	75 207
1987	82 992
1988	91 403
1989	99 831
1990	107 128
1991	118 430
1992	128 323
1993	139 824
1994	143 379
1995	150 868
1996	159 105
1997	169 239

Source: Finnish Environment Institute.

### 4. 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	74.5	99.0	78.6	115.4
1999*)	59.0	52.8	50.4	89.0

\*) = I-IV/99

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

### 5. Consumption of materials in Finland 1980-1998 (million tonnes)

	Minerals	Rocks*)	Fossils	Wood	Cultivated	Others	Total
1980	19	63	19	46	10	9	166
1981	18	65	16	45	9	10	161
1982	19	70	15	42	11	9	166
1983	21	82	15	41	12	9	181
1984	22	80	16	43	12	11	184
1985	21	85	17	44	11	12	191
1986	19	87	16	40	12	13	187
1987	19	97	17	43	8	10	194
1988	20	92	18	46	10	9	194
1989	20	97	17	47	11	10	203
1990	20	93	17	44	12	11	197
1991	18	85	17	36	11	11	178
1992	17	77	16	42	10	9	172
1993	18	66	16	44	12	11	166
1994	18	68	18	51	11	13	179
1995	16	69	16	54	12	12	180
1996	16	65	18	47	12	14	173
1997	17	70	16	58	13	13	188
1998	17	75	14	60	12	17	196

\*) = estimate

Source: Statistics Finland; Research Reports 226.

## 6. Mining of ores and industrial minerals and quarrying of limestone in 1980-98 (million 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
1998	3.2	4.0	10.0

Source: Mining Industry Association.

## 7. 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
1998	75.4	69.4

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

## 8. Use of fertilisers in agriculture (kilograms per arable hectare)

Year of fertilisation	Nitrogen	Phosphorus
197-30.6		
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
1997/98	85.9	12.3
1998/99	84.5	10.6

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

## 9. Use of pesticides in agriculture (thousand kilograms of active ingredient)

	Weedkillers	Others	Total
1980	2 099.1	345.0	2 444.1
1990	1 580.1	413.8	1 993.9
1991	1 375.4	312.3	1 687.7
1992	1 006.7	332.8	1 339.5
1993	842.8	364.8	1 207.6
1994	929.2	342.5	1 271.7
1995	791.4	244.2	1 035.6
1996	677.3	234.8	912.1
1997	773.9	264.5	998.4
1998	843.9	255.3	1 099.2

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

## 10. Sources of water pollution in 1997 (tonnes)

	Phosphorus	Nitrogen
Agriculture	2 800	32 900
Households	649	16 583
Industry	266	3 841
Deposition from air	400	17 000
Others	575	5 916
Natural runoff	1800	45 000
<b>Total</b>	<b>6 490</b>	<b>121 240</b>

Source: Finnish Environment Institute.

## 11. Phosphorus load from industry, domestic and fish farming sources (tonnes)

	Industry	Fish farming	Domestic
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
1997	266	140	234

Source: Finnish Environment Institute.

## 12. Implementation of nature conservation programmes 1.1.1999 (hectares of land area)

	Objective	Implemented	%	Not implemented	%
National parks and nature reserves	838 130	837230	99.9	900	0.1
Old-growth forest protection prog.	344 450	326150	94.7	18 300	5.3
Mire protection programme	591 160	537260	90.9	53 900	9.1
Herb-rich woodland protection prog.	5 200	3 730	71.7	1 470	28.3
Shore protection programme	145 540	88 240	60.6	57 300	39.4
Natura 2000, new areas	107 000	43 000	40.2	64 000	59.8
Bird sanctuary protection programme	83 090	10 490	12.6	72 600	87.4

Implemented = area already protected or purchased by state but no protection decision proper made.

Not implemented = private lands included in programme but not yet purchased by state.

Source: Ministry of the Environment.

**13. Production by the pulp and paper industry and load on the rivers and lakes (tonnes per year)**

	Paper and board production	Pulp production	Chemical oxygen demand	Organic chlorine compounds	Phosphorus
1990	8 958 000	5 093 000	430 000	9 700	641
1991	8 777 000	4 894 000	380 000	7 200	532
1992	9 145 000	4 913 000	330 000	4 700	480
1993	9 953 000	5 589 000	270 000	3 000	375
1994	10 909 000	6 331 000	270 000	2 000	335
1995	11 012 000	5 797 000	260 000	1 600	320
1996	10 442 000	5 739 000	213 000	1 100	250
1997	12 149 000	6 620 000	227 000	1 300	228
1998	12 704 000	6 718 000	217 000	1 100	233

Source: Forest Industry Association; Yearbooks on Environmental Protection.

**14. Production by the pulp and paper industry and emissions into the atmosphere (tonnes per year)**

	Paper and board production	Pulp production	Sulphur dioxide (S)	Oxides of nitrogen (NO <sub>2</sub> )	Particles
1990	8 958 000	5 093 000	24 100	16 200	22 000
1991	8 777 000	4 894 000	16 300	18 900	18 300
1992	9 145 000	4 913 000	9 500	19 100	13 000
1993	9 953 000	5 589 000	7 200	21 300	11 000
1994	10 909 000	6 331 000	6 500	23 000	9 500
1995	11 012 000	5 797 000	4 900	21 100	7 800
1996	10 442 000	5 739 000	5 300	21 100	7 000
1997	12 149 000	6 620 000	6 315	21 878	4 609
1998	12 702 000	6 718 000	5 435	21 834	6 219

Source: Forest Industry Association; Yearbooks on Environmental Protection.

**15. Recovery of waste paper in certain countries in 1997 (%)**

Germany	70
Austria	69
South Korea	66
Switzerland	63
Netherlands	62
Sweden	61
Finland	61
Norway	53
Japan	53
Canada	45
United States	45
Belgium	44
Mexico	43
Spain	42
Portugal	42
United Kingdom	41

Source: Pulp and Paper International and Forest Industry Association.

## 16. Total energy consumption in certain countries relative to GDP in 1996

	Total energy consumption kilo of oil/FIM 1,000
Canada	68.2
Turkey	62.2
United States	60.6
Iceland	59.9
Belgium	47.9
Greece	47.5
Portugal	46.1
Luxembourg	44.5
Netherlands	41.8
Finland	41.6
Sweden	39.6
United Kingdom	39.6
France	35.7
Germany	34.8
Spain	33.7
Ireland	32.6
Norway	28.5
Denmark	28.0
Japan	27.6
Austria	27.3
Italy	24.8
Switzerland	20.3

Source: IEA/OECD; Energy Balances of OECD countries 1995-1996.

## 17. Trends in real world price of oil (USD per barrel)

	Current prices	Real prices (1996 prices)
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	13.1	11.5
1999*)	12.8	10.4

\*) = I - IV/99

Source: United Nations. United Nations Conference on Trade and Development - UNCTAD. Monthly Commodity Price Bulletins. Note. Concerns crude petroleum/Dubai, UK Brent and Alaska Average/W.Texas Average, spot, FOB.

## 18. Carbon dioxide emissions from fossil fuels and peat in Finland (million tonnes)

	Total	Power stations	Industry	Traffic
1980	54.0	..	..	..
1981	44.7	..	..	..
1982	42.8	..	..	..
1983	42.4	..	..	..
1984	43.4	..	..	..
1985	49.5	..	..	..
1986	48.1	..	..	..
1987	51.9	..	..	..
1988	51.6	..	..	..
1989	51.9	..	..	..
1990	53.1	..	..	..
1991	53.2	..	..	..
1992	51.4	29.5	8.5	13.4
1993	52.0	31.0	8.2	12.8
1994	58.3	36.6	8.6	13.1
1995	55.2	34.3	8.1	12.8
1996	61.6	39.3	9.3	13.0
1997	59.1	36.0	9.4	13.7
1998f	56.0	..	..	..
2000	60.0*)	..	..	..
2005	65.0*)	..	..	..
2010	70.0*)	..	..	..

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

## 19. Sulphur emissions in Finland 1980-97 (thousand tonnes of sulphur dioxide)

	Liquid fuels	Solid fuels	Forest industry	Metallurgical industry	Oil refining	Other industry	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	46	45	17	10	9	14	141
1993	36	46	15	9	5	11	122
1994	33	45	13	9	4	11	115
1995	29	37	9	7	4	10	96
1996	33	43	11	6	3	9	105
1997	31	41	10	6	3	9	100
1998*)	..	..	..	..	..	..	96

.. = data missing \*) = forecast

Source: Ministry of the Environment, Statistics Finland; ILMARI calculation model and Fortum Power and Heat Ltd.

## 20. Emissions of oxides of nitrogen in Finland (thousand 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	75	20	284
1993	141	43	78	20	282
1994	137	43	81	21	282
1995	130	42	66	20	258
1996	127	44	77	20	268
1997	123	46	71	20	260
1998*)	..	..	..	..	260

.. = data missing \*) = forecast

Source: Ministry of the Environment, Statistics Finland and Fortum Power and Heat Ltd.

## 21. 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
United Kingdom	0.7

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

## 22. Trends in use of public transport and private cars (million 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
1998	66 833	53 830	13 003

Sources: Finnish National Road Administration, VR Ltd., Finnish Maritime Administration, Civil Aviation Administration, Helsinki City Transport.

### 23. Trends in emissions from road traffic (thousand tonnes)

	Carbon dioxide	Hydrocarbons	Oxides of nitrogen	Particles	Carbon monoxides
1980	7 645.40	47.0	135.7	9.3	386.2
1981	7 747.90	47.7	135.7	9.5	382.9
1982	7 930.40	48.8	137.3	9.8	382.7
1983	8 203.10	50.0	138.5	10.1	382.6
1984	8 453.60	51.4	140.4	10.4	384.3
1985	8 851.80	52.6	143.0	10.7	382.3
1986	9 459.70	54.3	146.6	11.2	383.7
1987	9 929.80	56.6	149.6	11.4	390.3
1988	10 334.60	59.5	154.7	11.7	400.0
1989	10 985.10	61.7	159.1	11.7	410.2
1990	11 179.00	61.4	157.6	11.6	405.4
1991	10 858.60	58.7	151.5	11.4	373.3
1992	10 834.70	55.8	144.6	10.8	343.6
1993	10 196.50	54.0	140.4	10.3	329.8
1994	10 535.90	51.9	135.0	8.5	311.4
1995	10 391.70	50.7	131.8	8.0	304.9
1996	10 300.80	49.0	127.0	7.6	295.5
1997	10 837.90	47.3	122.6	7.1	284.4
1998*)	11 102.20	45.4	117.6	6.8	271.2
1999*)	11 399.40	43.6	113.0	6.5	262.0
2000*)	11 598.80	41.2	107.2	6.2	249.4
2001*)	11 695.10	38.4	100.6	5.8	234.0
2002*)	11 752.20	35.5	93.4	5.5	216.7
2003*)	11 795.20	32.7	86.9	5.3	201.5
2004*)	11 846.40	30.2	81.0	5.1	186.6
2005*)	11 870.30	27.8	75.9	5.0	173.9

\*) = forecast

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

### 24. Trends in total emissions of lead in Finland (tonnes)

	Energy and heat production	Industrial processes	Road traffic	Others
1990	20.2	115.2	189	1.8
1991	15.6	62.3	168	1.5
1992	15.0	40.3	118	1.4
1993	9.1	39.7	49	1.9
1994	11.5	45.7	1	1.9
1995	9.7	45.6	0	1.0
1996	10.1	23.8	0	1.0
1997	9.3	8.2	0	1.0

Source: Finnish Environment Institute.

**25. Consumer prices of motor fuel (95E) on 15.7.1999 (FIM per litre)**

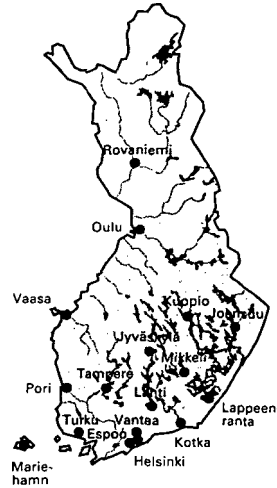
	Refinery price	Consumer price	Taxes	Tax %
Norway	1.68	6.69	5.01	74.9
United Kingdom	1.21	6.48	5.27	81.3
Netherlands	1.70	6.10	4.40	72.1
Finland	1.55	5.95	4.40	73.9
Italy	1.59	5.78	4.19	72.5
Sweden	1.60	5.75	4.15	72.2
France	1.20	5.67	4.47	78.8
Denmark	1.52	5.67	4.15	73.2
Belgium	1.47	5.43	3.96	72.9
Germany	1.35	5.23	3.88	74.2
Portugal	1.35	5.05	3.70	73.3
Austria	1.51	4.77	3.26	68.3
ireland	1.44	4.46	3.02	67.7
Spain	1.44	4.23	2.79	66.0
Luxembourg	1.53	4.19	2.66	63.5
Greece	1.45	3.91	2.46	62.9

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

# Finland in Figures



Suomi  
Finland



**Population** : 5.2 million, with average density of only 17 persons per square kilometre; annual growth 0.2 per cent. Average household size is 2.2 persons. 76 per cent urban dwellers, with 0.9 million living in the capital city of Helsinki and its surrounds. 93 per cent speak Finnish and six per cent Swedish. 85 per cent are Evangelic-Lutheran and one per cent Greek Orthodox. 56 per cent have completed post-comprehensive education and 13 per cent have university degree or equivalent.

**Area** : Situated in northern Europe with an area of 338,145 square kilometres of which 304,530 square kilometres land area. Land boundary with Sweden 586 kilometres, with Norway 727 kilometres and with Russia 1,269 kilometres. Coastline approximately 1,100 kilometres. The greatest length is 1,157 kilometres, from Hanko to Utsjoki, and the 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 while 6 per cent of the land area is under cultivation, with barley and oats as the main crops.

**Government** : Finland has been a sovereign parliamentary republic since 1917. The head of the state is the president, elected every six years. The post has been held by Mr Martti Ahtisaari since 1 March 1994. The Parliament comprises 200 members, elected for a four-year term. The country is divided into 5 provinces and the Autonomous Territory of the Åland Islands. Member of the European Union since January 1995.

**Economy** : GDP in 1998 totalled FIM 676 billion (USD 122.7 billion), i.e. FIM 131,212 (USD 23,813) per capita. One of the highest standards of living in the world. Of the total labour force 21 per cent are employed in industry, 32 per cent in services, 16 per cent in trade, 12 per cent in financial services, 7 per cent in transport and communications, 6 per cent in agriculture and forestry and 6 per cent in construction. Unemployment rate, calculated according to EU standards, was 10.3 per cent in June 1999.

**Foreign trade** : Main trading partners are Germany, Sweden, United Kingdom and USA. The value of imports totalled FIM 172 billion (USD 31 billion) and that of exports FIM 229 billion (USD 42 billion) in 1998. Of the imports, 41.5 per cent were raw materials and 23.5 per cent consumer goods. Main exports are electrical equipment, pulp and paper products, machinery, and metal and chemical products.

## The catchment area of the Baltic Sea



0 200 400 600 Kilometers

(c) Finnish Environment Institute

# *Finland's Natural Resources and the Environment 1999*

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*Finland's Natural Resources and the Environment 1999* is a review of the state of Finland's natural resources and the environment. It presents the main principles of interaction between the national economy and the environment and describes the extent to which the objectives of sustainable development have been realised in Finland. It also reviews trends in the main sectors of the economy as they affect the environment. These sectors include industry, energy, transport, natural resources and environmental protection. Finally, the publication contains a presentation of the principal agreements on the conservation of natural resources and the environment to which Finland is committed.

*Tilastokeskus, myyntipalvelu*  
PL 3B  
00022 TILASTOKESKUS  
puh. (09) 1734 2011  
faksi (09) 1734 2474  
tilastomyynti@tilastokeskus.fi  
www.tilastokeskus.fi

*Statistikcentralen, försäljningstjänsten*  
PB 3B  
00022 STATISTIKCENTRALEN  
tfn (09) 1734 2011  
fax (09) 1734 2474  
tilastomyynti@stat.fi  
www.stat.fi

*Statistics Finland, Sales Services*  
P.O.Box 3B  
FIN-00022 STATISTICS FINLAND  
Tel. +358 9 1734 2011  
Fax +358 9 1734 2474  
tilastomyynti@stat.fi  
www.stat.fi

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