MINISTRY OF THE ENVIRONMENT SVT Environment and Natural Resources 2001:3 C

Statistics Finland

Finland's Natural Resources and the Environment 2001

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Foreword

The extensive programme adopted at the UN Development and Environment Conference in Rio de Janeiro in 1992 (Agenda 21) aimed to give a broad definition of the measures that are needed to implement a policy of sustainable development. In June 2001, the Council of Europe in Gothenburg agreed on a strategy for sustainable development for Europe and added an environmental dimension to the Lisbon process for employment, economic reform and social cohesion. The EU sustainable development strategy is a long-term strategy, which closely incorporates ecological, social and economic sustainability. In addition the so-called Cardiff process, which was initiated by the Cardiff European Council in 1998, is aimed at integrating environmental considerations into different sectoral policies for the advancement of sustainable development. The European Union's Council of Ministers achieved a consensus on a proposal for the Union's sixth Environment Action Plan in June 2001. These documents and especially EU's Sustainable Development Strategy form a part of the Union's preparations for the UN Conference in 2002, the 10-year follow-up to the Rio meeting.

In its programme for 1999–2003, the Finnish Government says that the principles of sustainable development in regard to the environment will be consistently taken into account throughout the various levels of society. To meet the targets set out for the reduction of greenhouse gas emissions in the Kyoto Climate Protocol, the Government ratified a national climate strategy in March 2001. The Government programme requires that these commitments are met in such a manner that the measures applied do not impair economic growth and actions to strengthen employment nor prejudice steps to reduce the national debt. Implementation of a sustainable development policy means combining the principles of ecological, social and economic sustainability in all social functions and at all levels of decision-making. In line with the Government programme for sustainable development, work will continue on developing the "Natural Resources and the Environment" as an important tool in establishing a policy of sustainable development.

This review has been drawn up 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 Pekka Pelkonen, Counsellor at the Ministry of Finance; Meri Obstbaum, Economist at the Ministry of Finance; Timo Ritonummi, Senior Adviser at the Ministry of Trade and Industry; Elina Nikkola, Senior Adviser at the Ministry of Agriculture and Forestry; Maria Rautavirta, Senior Adviser at the Ministry of Transport and Communications; and Jarmo Muurman and Sauli Solhagen, Senior Advisers at the Ministry of the Environment. The secretaries to the working group were Jukka Hoffrén, Senior Researcher at Statistics Finland, who has also edited the review, and Maire Repo, Planning Officer, and Ulla Oksanen, Senior Researcher at the Finnish Environment Institute.

Helsinki, September 2001

Ministry of the Environment
Minister of the Environment
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Director General
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Contents

1 The economy and the environment

International environmental policy

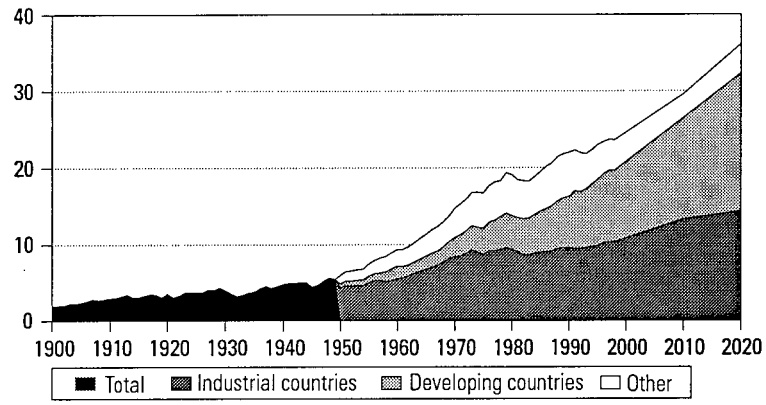
Environmental policy is distinctively and emphatically about international collaboration, and there are now more than 100 international environmental conventions in force. Both on the international and national level, environmental policies today are largely grounded in the policy of sustainable development as defined at the Rio de Janeiro Environment and Development Conference in summer 1992. In addition to ecological sustainability, the importance of economic sustainability and social sustainability has been increasingly recognised in recent times. As agreed by the European Council in Gothenburg in June 2001, the point of departure for the current EU sustainable development strategy is to further harmonise these three dimensions of sustainable development.

One of the biggest challenges for sustainable development is to prevent the acceleration of the greenhouse effect. The Intergovernmental Panel on Climate Change (IPCC) has estimated that global temperatures will rise by 1.4 - 5.8 degrees by 2100. As part of the process that began in Rio, the first binding global agreement on reducing greenhouse gas emissions was concluded at the UN Climate Meeting in Kyoto in December 1997. Under the Kyoto Protocol, industrial countries are required to reduce their greenhouse gas emissions by an average of 5.2 per cent from the 1990 level by 2008–2012; the requirement for the United States is a reduction of seven per cent, for EU Member States, eight per cent, and for Canada and Japan, six per cent. No obligations have been imposed on developing countries. The Kyoto Protocol is a first step towards bringing greenhouse gas levels down to a safe level, though this will not yet have a significant effect in slowing down climate change. That, according to the IPCC, would require global reductions in the region of 50-90 per cent.

At the United Nations Climate Change Conference held in Bonn in July 2001 an agreement was reached on issues left open in the Kyoto Protocol – such as ground rules for the Kyoto mechanisms, carbon sinks, monitoring compliance with the Climate Convention and the financing of developing country climate projects. The United States remained outside the agreement because it saw the agreement as serving against the country's economic interests. The U.S. share of industrial country greenhouse emissions is roughly 36 per cent. The Kyoto Protocol will come into force when the industrial countries that have ratified it together account for at least 55 per cent of the industrial countries' carbon dioxide emissions levels of 1990. The next Kyoto process meeting will be in Marrakech in October 2001.

According to a UN estimate published in March 2001, the costs to industrial countries of implementing the Kyoto Protocol are between 0.1 – 1.1 per cent of GDP a year, if no limits are set on emissions trading. Without emissions trading the costs are doubled. Though recent technological developments offer many opportunities to reduce greenhouse emissions, individual technical solutions – such as combined heat and electricity production, the increased use of bio-fuels, hybrid cars, technology separating carbon dioxide from fossil fuels and more efficient wind power facilities and fuel cells – are not enough, however. What is needed are wide-ranging changes in the economy and all sectors of society. The UN has estimated that, between 2010–2020, it is possible to achieve more than half of potential emissions reductions by increasing the efficiency of energy use.

Figure 1.
World carbon dioxide emissions from fossil fuels 1900–1999 and forecast to 2020 (billion tonnes)



NB. Figures for 2000–2020 are OECD estimates.

A set of recommendations concerning sustainable development was adopted by the Meeting of OECD Environment Ministers on May 16, 2001. The recommendations stress the need to unify the economic, social and ecological dimensions of sustainable development and to decouple the link between economic growth and environmental damage. There should also be increasing recourse to market-based instruments and every effort should be made to combat climate change, the most significant global environmental challenge of today. Natural resources should be allocated in such a way that market prices reflect external costs.

The EU approved its strategy for sustainable development at the meeting of the European Council in Gothenburg, June 15–16, 2001. Strategy implementation will continue in such a way that the ecological dimension of sustainable development will be tied (in the Barcelona summit in spring 2002) to the Lisbon long-term strategy, which has the aim of making the EU the world's most competitive and dynamic information society, having the ability to maintain sustainable economic growth, to create new and better employment opportunities and to foster social solidarity.

The European Commission submitted its proposal for the 6th EU Environmental Action Programme in January 2001, covering a ten-year period. The programme is to promote sustainable development and to contribute to its implementation – by identifying top priority environmental actions, for example. The programme's key challenges are climate change, health, the environment and quality of life, nature and biodiversity, as well as the sustainable use of natural resources and waste management. On the part of climate policy, the programme's primary goal is the ratification of the Kyoto Protocol and the achievement of reductions in emissions accordingly. The programme also emphasises that Member States must better implement present environmental legislation. The Commission intends to pressure Member States by publicising inadequate implementation more broadly and openly. The programme calls for the greater integration of environmental issues with other EU policies and, for example, also envisions that all Commission initiatives will be evaluated from the perspective of the environment. Market mechanisms should also play a greater role in environmental issues and there should be a greater use of scientific knowledge in decision-making. Consumer

habits should also be directed towards a more sustainable direction.

The 6th Environmental Action Programme specifies that nature and biodiversity will be given greater emphasis in farming and fishing policy, among others. The most important environmental issues pertaining to health are the evaluation of the EU chemical risk management system, reducing pesticide risks and improving the quality of air and water. With respect to the use of natural resources, emphasis is on sustainability and reducing waste. A key instrument in achieving this goal is unified product policy, the main features of which were presented by the European Commission in February 2001.

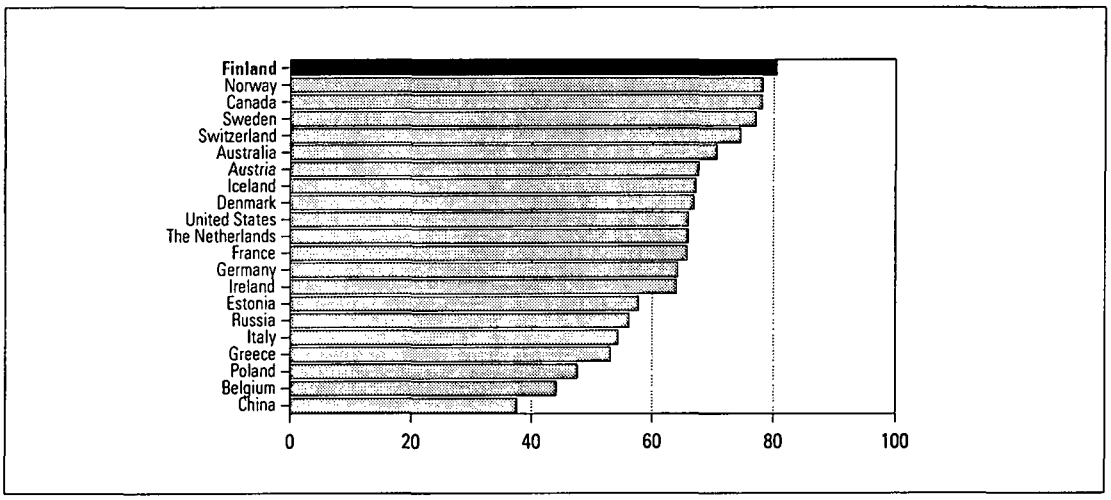
Sustainable development in Finland

The level of environmental protection in Finland is high by global standards. Finland received the highest marks in the Environmental Sustainability Index (ESI) of the World Economic Forum for spring 2001. The index tells how well a country has achieved environmental sustainability in comparison with other countries. Finland ranked the highest in the quality of water and in responsible social policy. Finland also ranked high in the availability of environmental information, science and technology, private sector initiative, air quality, strictness of environmental regulations, and commitment to international agreements. Finland was poorly ranked in cumulative environmental emissions and in consumption of natural resources per capita, however.

In the past decades, much work has been done in Finland for environmental protection and the promotion of sustainable development. Finland adopted a programme for sustainable development in June 1998, one of the first countries to do so. Key objectives of the programme include slowing down the process of climate change, changing production and consumption habits, reducing the use of non-renewable natural resources and maintaining biodiversity. Sustainable development is also promoted by the Finnish Committee on Sustainable Development, which submits initiatives to the relevant authorities for drafting.

The Finnish Committee on Sustainable Development published a list of national indicators for sustainable development in spring 2000. The relevant administrative sectors and other entities will report to the committee on the implementation of the sustainable

Figure 2. Environmental sustainability index (ESI) for designated countries, 2001

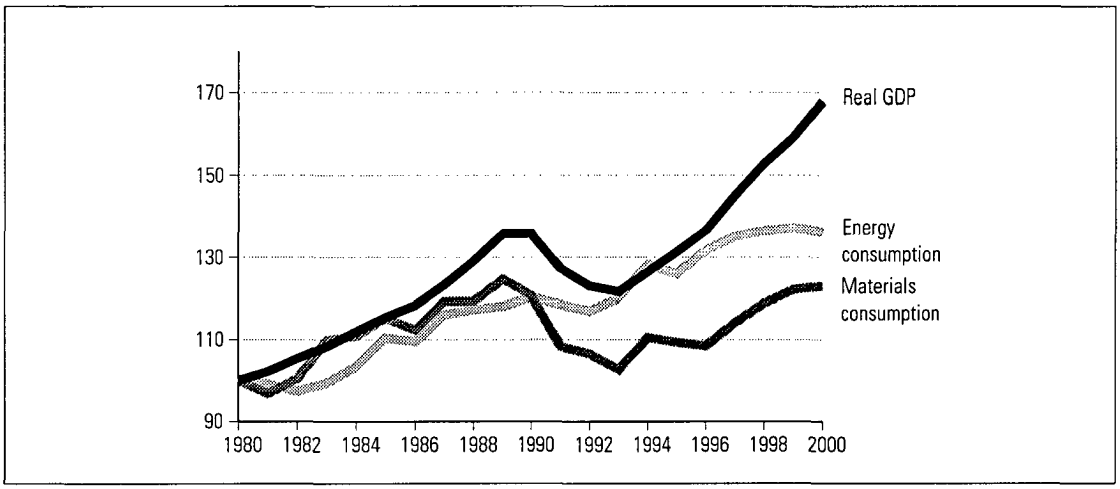


development programme by summer 2001. Drawing on the reports by the various administrative sectors and other investigations and development projects, the Finnish Committee on Sustainable Development will compile an overall evaluation of the effectiveness of Finland's sustainable development programmes and the state of sustainable development in Finland. This evaluation is scheduled for completion by the time of the World Summit on Sustainable Development in 2002, the follow-up to the Rio Environment and Development Conference.

Finland's national climate strategy was completed in March 2001, when the Finnish Government also presented it to the Parliament. The strategy emphasises that Finland's greenhouse gas emissions will exceed Kyoto targets unless determined efforts are taken to combat this trend. The strategy also notes that greenhouse gas emissions are crucially dependent on economic growth, the structure of the economy and the structure of the electricity sector. To achieve the Kyoto objectives, actions are needed in energy production and consumption, transportation, the construction sector, community planning, control of agricultural and forest industry emissions as well as in waste management. Actions are also needed in research and development, the development of economic policy instruments (such as taxation and subsidy policy, regulations and ordinances), voluntary agreements and the promotion of consumer initiative.

Growing electricity consumption and the need to replace old power plants demands the construction of new power plants. It has been estimated that more efficient energy use and a greater use of renewable energy sources can cover up to one-half of the required reductions in greenhouse emissions. The climate strategy notes that in place of coal one needs to choose either the construction of new nuclear power capacity or replacement of coal with natural gas. Nevertheless, the production of co-generated heat and electricity by either natural gas or renewable energy sources should be fully promoted. The national climate strategy estimates that the government's financing need and the funds channelled through energy taxation will grow by roughly FIM 300 million by 2010. The most significant outlays are planned for the support of energy saving and the promotion of renewable energy sources.

Figure 3. Trends in real GDP and the consumption of energy and materials in Finland (1980=100)



Instruments of environmental protection

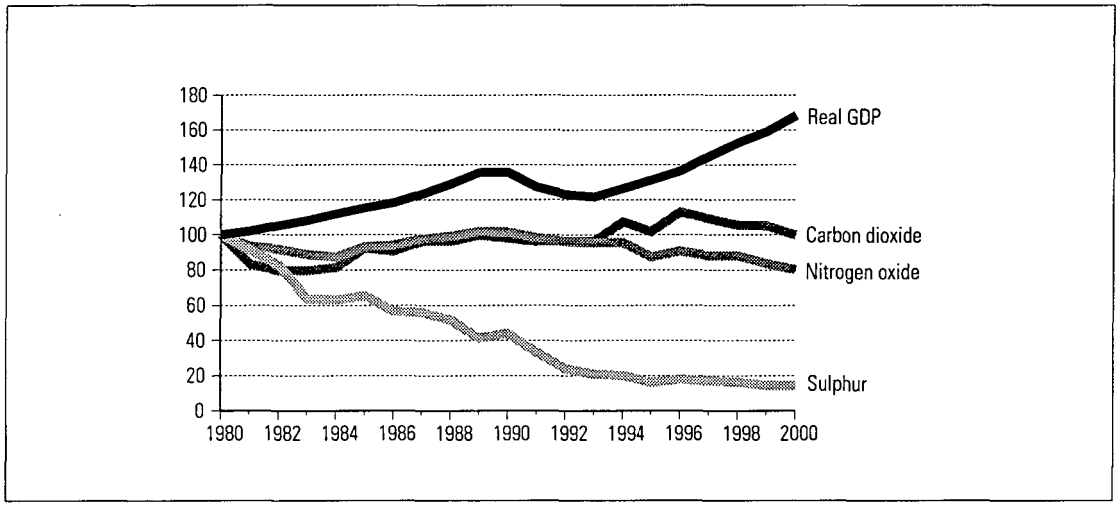
Government intervention in the realm of sustainable development has clearly stepped up in recent years. The current legislation on environmental protection took effect at the beginning of March 2000, updating and harmonising existing legislation and licensing procedures. The environmental protection legislation aims to unify emissions control and management. Special emphasis is on applying the principle of best available technology (BAT), risk management and the efficiency of energy use.

A new Land Use and Building Act, supporting sustainable development, came into force at the beginning of 2000 and was reviewed in 2001. Key objectives of the law include the promotion of a good living environment and of sustainable development in communities as well as increasing citizen involvement and influence at the grassroots level. Other environmental laws revised to meet the requirements of sustainable development include the Act on Compensation for Environmental Damage (1999), the Act on the Assessment of Environmental Damage (1999), the Waste Act (1994), the Forest Act (1997), the Nature Conservation Act (1997) and the Extractable Land Resources Act (1997).

These legislative instruments have been complemented in the 1990s by a range of economic measures, such as environmental taxes, environmental labelling schemes and voluntary agreements. Measured in terms of the amount of environmental taxes levied relative to GDP, Finland ranks well above the OECD average. In 1999 these taxes and fees equalled 3.4 per cent of GDP. In all countries, the major source of government revenue from environmental taxes is taxation on fossil fuels, particularly petrol and diesel. In 1997, environmental taxes as a proportion of total taxation increased to around 7 per cent in the OECD countries.

A government survey in February 2000 indicated that increases in environmental taxes had helped to check carbon dioxide emissions in the 1990s: in 1998 emission volumes were a few million tonnes smaller than they would have been otherwise. However, the survey was a reminder that any increases in energy taxation place a particularly heavy burden on energy-intensive industries and low-income households.

Figure 4.
Trends in real GDP and atmospheric emissions in Finland (1980=100)



1. Government taxes and fees relating to the environment (FIM million)

	1995	1996	1997	1998	1999	2000	2001	2002
	A	A	A	A	A	A	B	BP
Alcoholic beverage surtax	88	52	55	60	73	73	70	71
Soft drink surtax	15	9	10	9	7	7	7	7
Pesticide fee	6	6	9	10	10	10	10	11
Energy taxes	11 628	12 714	13 895	15 306	15 765	15 435	15 500	15 845
Oil waste tax	21	20	20	20	20	20	20	20
Motor vehicle tax	2 685	3 611	4 210	5 259	6 115	6 295	5 300	5 271
Water protection tax	3	3	2	3	3	3	2	2
Oil pollution control fee	34	29	33	33	35	32	32	33
Vehicle licence tax	1 046	1 110	1 129	1 198	1 245	1 306	1 345	1 408
Diesel engine vehicle tax	668	929	979	1 042	1 101	1 074	1 190	1 242
Waste tax	–	41	127	182	202	198	200	202
Total	**16 194**	**18 524**	**20 469**	**23 122**	**24 576**	**24 453**	**23 676**	**24 112**

A = Final accounts. B = Budget. BP = Budget proposal. – = not in use. .. = not available.

NB. FIM 1 = 0.168188; EUR 1 = FIM 5.945730.

Environmental protection in central government

In its sustainable development programme, the current Government says that it shall foster ecologically sustainable development by means of environmentally conscious purchasing policy. The public sector is indeed a major purchaser of industrial investment goods and consumer goods. Public sector purchasing can take environmental views into account for example in the choice of the items to be purchased and in establishing technical criteria. In addition, when assessing how different offers compare overall, government purchasing can weigh environmental impacts and costs while still complying with such requirements as impartiality and non-discrimination.

2. Government expenditure and Ministry of the Environment (MoE) environment expenditure (FIM million)

	Govt.spending total	MoE environmental spending	Per cent
1998	194 292	1 095	0.56
1999	211 713	1 066	0.50
2000	228 744	1 125	0.49
2001	212 298	1 116	0.53
2002	209 646	1 171	0.56

The central administration plays a significant role in conducting and funding environmental research and development. Environmental research is funded, among others, by the Academy of Finland, the National Technology Agency (TEKES), as well as ministries operating in the environment, energy and natural resources sectors. It is estimated that these sources account for 33 per cent of university environmental research funding. Most university environmental research funding (56%) is self-financed, however. Other (mainly private) funding is not included in the figures shown in Table 3. Environmental protection funds are primarily allocated to industry and local authorities for purposes of improving the state of the environment and repairing environmental damage. Nature conservation funds, in turn, are primarily directed to the purchase and management of conservation areas. The biggest item in the government's environmental protection budget is the environment support paid to agriculture, which will be further discussed in Chapter 2.

3. Government environmental expenditure (FIM million)

	1995	1996	1997	1998	1999	2000	2001	2002**)
Environmental administration	440	469	479	506	510	547	581	602
Central government	*127*	*135*	*139*	*153*	*151*	*157*	*158*	*160*
Local government	*313*	*334*	*340*	*353*	*359*	*390*	*423*	*442*
Development cooperation	276	243	295	295	355	..	..	..
Cooperation with neighbouring areas	57	57	62	66	58	57	57	78
Nordic Environment Finance Corporation	8	7	7	7	7	7	7	–
Research and development*)	640	657	764	799	859	945	945	951
Environmental conservation and management [1]	*93*	*104*	*101*	*114*	*112*	*118*	*120*	*123*
Use and management of natural resources [2]	*119*	*129*	*143*	*149*	*176*	*180*	*183*	*168*
Universities	*204*	*227*	*235*	*245*	*251*	*261*	*281*	*298*
Development of environmental technology [3]	*193*	*168*	*255*	*261*	*290*	*350*	*325*	*325*
Other environmental research [4]	*31*	*29*	*30*	*30*	*30*	*36*	*37*	*37*
Grants to environmental NGOs	6	6	6	6	7	6	7	6
Environmental protection	85	119	189	174	155	129	150	156
Clean air and waste management	45	41	56	53	49	29	46	57
Water protection	8	33	32	7	13	13	12	10
Environmental management and decontamination	32	45	101	114	93	87	92	89
Nature conservation	312	325	479	569	402	431	365	338
Promotion of energy saving	6	8	9	15	15	15	15	20
Renewable energy investment support*)	37	33	51	117	120	120	150	101
Environmental protection of road traffic*)	139	128	78	105	121	118	134	134
Rail transport*)	..	79	93	93	101	102	102	102
Manure pit investment support	–	80	65	36	24	6	22	20
Environmental support for agriculture	1 420	1 570	1 631	1 690	1 606	1 642	1679	1 771
Basic support	*1 330*	*1 367*	*1 372*	*1 410*	*1 388*	*1 485*	..	..
Special support	*90*	*203*	*259*	*230*	*218*	*157*	..	..
Environmental support for forest management	–	10	15	13	22	27	25	25
Total	**3 426**	**3 791**	**4 223**	**4 491**	**4 362**	**4 151**	**4 239**	**4 304**

– =not in use. .. = not available. *) =estimate. **) =forecast.
[1] Environmental Administration and the Academy of Finland. [2] Agriculture and Forestry Administration.
[3] Technical research. [4] Other administrative branches.

NB. FIM 1 = 0.168188; EUR 1 = FIM 5.945730.

Cooperation with neighbouring regions

Finland has actively promoted environmental improvement in neighbouring regions and the Baltic Sea since 1991. The Ministry of the Environment has supported environmental projects in northwestern Russia, the Baltic states and Poland. These projects have been coordinated by the Ministry of Foreign Affairs. EU expansion and the applicant country convergence will increase the role of the EU as a promoter of sustainable development in the vicinity of Finland. Finland has aimed to foster the ability of cooperating countries to solve environmental problems on their own as well as to prevent them before they occur. Areas of cooperation have included the development of environmental administration, water and air protection as well as waste management. Finland has based its actions for the protection of the Baltic Sea on the Baltic Sea environmental programme and cooperation has focused on

132 urgent locations, the so-called "hot spots". From 1991 until the first quarter of 2001, Finland has supported over 300 investment projects for environmental protection and over 900 technical projects relating to environmental protection. All in all, Finland has used a total of FIM 660 million on these undertakings.

According to a study by the Ministry of Foreign Affairs conducted in spring 2000, Finland's cooperation with neighbouring regions has been successful. Cooperation between environmental authorities has produced several fast and successful solutions. In the summer of 2000, the European Union and Russia agreed on an agenda for action in conjunction with the Partnership and Cooperation Agreement (PCA) and also determined the main topics to be addressed. Long-term cooperation has been somewhat hindered by the reorganisation of environmental administration in Russia. Things have been difficult as environmental protection is not prioritised on the local or national level and the designated cooperative authorities often change. Cooperation with Russia and environmental protection are emphasised in the EU Action Plan for the Northern Dimension, however.

Cooperation between Finland and Russia has aimed to reduce environmental damage in northwestern Russia, the Barents Sea and Baltic Sea. Finland has actively participated in EU initiatives in northwestern Russia. In the Gulf of Finland, the most urgent undertaking has been to improve wastewater management in St. Petersburg. Finland's key aims include the implementation of a Baltic Sea protection programme and the development of environmental management in nearby regions. The Baltic states, in fact, rate environmental protection high in their list of priorities. Cooperation in the Baltic has focused on water and air protection, waste management and the implementation of EU environmental legislation, which is a prerequisite for EU membership. Cooperation between Finland and Poland in environmental protection and the saving of energy, i.e. the so-called ecoconversion cooperation, began in 1990 and continues. Environmental investments in Poland have essentially involved wastewater management and the modernisation of power plant and industrial plant technologies.

The primary aim of technical aid cooperation is to support existing environmental investments. The most important projects in this respect have involved environmental education and research as well as the implementation of a programme for clean production in Russia and the Baltic states. The projects aim to promote the development of sustainable, environmentally friendly and economically efficient industrial production.

In cooperation with the authorities of the countries involved, 1999 saw the initiation of a broad survey of the basic geochemical state of soil and surface water in northwestern Russia, Finland and northern Norway. The survey aims to comprehensively chart the chemical compounds, both natural and those arising from human activity, in the soil of these areas. Project results will be available in 2003.

4. Finland's contribution to projects in neighbouring regions by country 1991–2001 (FIM million)

	Investment projects	Technical aid projects
Estonia	154.3	28.4
Latvia	68.9	7.8
Lithuania	45.8	7.3
Russia	119.6	55.2
Ukraine	8.2	0.1
Poland	96.8	0.5
Joint projects*)	0.5	65.6
Total	**494.1**	**164.9**

Environmental protection by local authorities

Local Agenda 21, signed in Aalborg, Denmark, in 1994, is an international agreement that requires local authorities to draw up a local plan of action for sustainable development. In Finland there are currently 250 local municipalities (out of a total of 448) with ongoing projects related to Local Agenda 21, covering almost 80 per cent of the population. Finnish legislation concerning the local administration and organisation of environmental protection was broadened in 1997. The local council may assign the duties of the environmental protection authority to joint municipal bodies, but it will still remain responsible for taking environmental considerations into account in the municipality's activities.

The EU initiative on local-level indicators of sustainable development was introduced in Hannover in February 2000. The aim of the initiative is to create a more integrated system for monitoring the sustainability of development in European cities. Five Finnish cities and towns signed an agreement indicating their commitment, i.e. Helsinki, Tampere, Turku, Pori and Kouvola. In addition, the environment barometer project launched by the Association of Finnish Local and Regional Authorities is aimed at establishing an indicator system describing the performance of local authorities in terms of environmental protection. The purpose of the system is to describe the progress made in each municipality and in this way to encourage movement towards ecologically sustainable development.

The campaign by local authorities to reduce greenhouse gas emissions, begun in 1997, was continued in November 2000 and broadened to cover 40 municipalities, including some of the largest Finnish cities. In May 2001, the campaign covered 41 municipalities, which represents over 45 per cent of Finland's population. The campaign is a part of the International Council for Local Environmental Initiatives (ICLEI) "Cities for Climate Protection" project to reduce the greenhouse gas emissions of cities. Participating municipalities first formulate their greenhouse gas balance and emissions forecast with the Kasvener programme. The next stages involve the formulation and implementation of an emissions reduction plan. The measures to be taken are primarily based on the municipality's ability to directly influence its own energy use and production solutions, landfill sites and waste management. Transportation and community structure solutions are also important in reducing the greenhouse gas emissions of both citizens and the business sector.

Community waste disposal underwent major structural changes during the 1990s. The number of landfill sites has been reduced and their size increased. This has in turn increased waste disposal fees, which have gone up from an average of FIM 50 to FIM 295 in the past decade. The annual waste disposal fees for private homes have risen 60 per cent and waste transportation costs 20 per cent. Municipalities are also increasingly solving their waste management together in the form of broad cooperative solutions to waste management. This cooperation already covers 323 municipalities or 83 per cent of the population. At the same time, waste recycling has increased and waste treatment intensified. Waste can now be sorted better and several recycling centres, hazardous waste collection depots and regional collection centres have been established. The wider acceptance of the principle of producer responsibility has effectively eliminated many materials from the municipal waste management system. Such materials include refrigerators, scrapped vehicles, car tires, newspaper, glass bottles and other packaging.

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

	1995	1996	1997	1998	1999	2000*)
Waste management						
Investments	87	71	97	112	91	115
Operating costs	404	476	542	607	624	640
Water supply						
Waste water treatment						
Investments	203	216	213	204	215	233
Operating costs	760	668	587	602	627	648
Sewerage						
Investments	469	523	516	494	586	565
Operating costs	910	780	687	703	733	757
Energy supply						
Clean air						
Investments	23	86	223	..	..	..
Operating costs	158	139	154	..	..	..
Environmental management						
Investments	20	38	21	26	26	38
Operating costs	200	209	244	250	278	294
Total	**3 234**	**3 206**	**3 284**	**2 998**	**3 183**	**3 290**
Investments	802	934	1070	836	919	951
Operating costs	2 432	2 272	2 214	2 162	2 264	2 339

*) = preliminary data. .. = not available.

The biggest expense items for local authorities, joint municipal boards and municipal corporations involve sewerage and waste water treatment. Most of the costs arising from waste management and sewerage and waste water treatment are covered by fees collected from users, but part of the monies for investments in these projects come from the national budget. Expenditure on environmental management is financed out of the local authorities' tax revenues and through government transfers. Finland's water management legislation was renewed in March 2001. The new legislation views water management as a necessary service, for which the fees are to remain reasonable and fairly distributed and which must ensure a minimum level of consumer protection. The legislation treats municipal and private institutions equally. Municipalities no longer name such institutions as communal water and sewerage facilities and general ordinances have been replaced by general terms of delivery, in the formulation of which a consumer ombudsman also participates. Though the costs of water management are to be collected from customers in principle, the legislation also allows recourse to public finances when necessary.

Environmental health

A recent report by the European Environment Agency (EEA) and the World Health Organization (WHO) indicates that several environmental problems are clearly reflected in people's health. The main health hazards, according to the EEA and the WHO, are related to air pollution, water contamination and traffic accidents. For instance, the WHO's estimate is that air pollution, chiefly in the form of small particulates, causes 100,000 premature deaths each year in Europe alone.

The environment and health have been prioritised in several international processes. WHO's European office initiated a process relating to the environment and health in 1989 and has to date hosted three meetings at the ministerial level. As a result most European countries have now formulated their own national environmental and health programmes. WTO negotiations have also included trading rules for biotechnology and genetically modified organisms as key themes. The Nordic countries have strongly emphasised the use of the principle of carefulness. In Nordic cooperation, the most important issues from the perspective of environmental health have been chemicals, noise and air quality.

The main emphasis in environmental health care, also in Finland, was for a long time on preventing the health risks presented by different kinds of chemicals. The Stockholm

Convention on Persistent Organic Pollutants (POPs) was signed in May 2001. It was agreed that the production and use of 12 of the most poisonous and accumulating chemicals would end. It has been shown that already small amounts of POP compounds hinder animal reproduction and the functioning of their nervous and immunological systems. Though most industrial countries prohibited the most hazardous POP compounds already in the 1970s and the 1980s, the production and use of these substances has continued especially in the developing countries. POP compound levels remain high in Arctic areas, for example, due to long range transport. Good decisions from the perspective of Finland and the environmental burden of the north were the decisions to take PCB equipment out of use by 2025 and to remove the PCB contained in them by 2028.

Finland has an excellent environmental health record in the areas of household water supply, food hygiene and safety from radiation. By contrast, there is still room for improvement in the quality of indoor and outdoor air, in noise reduction, accidents and in containing the psychological and social health risks of the environment. Studies indicate that poor indoor air quality in the workplace results in an annual cost of FIM 8.2 billion, of which absences due to illness account for FIM 3 billion, allergies FIM 3 billion, poorer work efficiency FIM 1.2 billion, tobacco smoke FIM 500 million and asbestos and radon FIM 200 million. The main indoor air problems are dry and stuffy indoor air, humidity and mould damage as well as dust and dirt.

Key challenges for the future are to halt the depletion of the ozone layer, to eliminate noise through community planning, to prevent mould growth through better construction practices, and to increase citizen participation and research and development work. With continuing urbanisation, noise is also fast becoming an increasingly common environmental concern hampering quality of life. Twenty per cent of Finns live in areas where traffic noise exceeds the harmful level of 55 decibels. The significance of road, rail and air traffic, as well as industrial areas and harbours, as sources of noise, is on the increase. The main way to prevent and manage noise is zoning.

Significant factors for food quality are the origin of production animals, their health and wellbeing as well as their medication and the possible use of growth intensifiers. These quality factors can be ensured only by monitoring the whole production chain. In Finland, this monitoring takes place from the field to the table. As in other Nordic countries, monitoring food has shifted away from research on the final product to the different stages of the production chain and especially on ensuring the hygiene of primary production.

The Ministry of Agriculture and Forestry has set up a food quality management working group, the aims of which are to manage a national competitiveness strategy based on food quality, the preparation of the content and quality objectives of a quality programme and their integration with an export strategy based on quality. Other tasks of the quality

6. Trends in environmental health expenditure (FIM million)

	Government institutions	Grants to local authorities	Local authority expenditure	Expenditure total
1990	193.1	205.1	205.1	603.3
1991	237.5	224.0	224.0	685.5
1992	282.8	214.7	214.8	712.3
1993	165.0	152.0	152.0	469.0
1994	224.3	146.0	145.0	515.3
1995	247.3	152.0	152.0	551.3
1996	231.1	149.6	149.9	530.6
1997	225.3	204.9	204.9	635.1
1998	226.6	205.5	205.5	637.6
1999	242.8	203.6	203.6	650.0

management working group include the development of projects targeted to promote market benefits related to food quality, responsibility for the aims of agriculture quality system work and other designated quality projects, the implementation of a national quality strategy, as well as the monitoring and supervision of the cooperation and results of projects relating to food quality, organic production and native breeds that receive state funding.

2 Natural resources

Sustainable use of natural resources

The continuing growth of the world population and rise in the standard of living are leading to increased material consumption, which is one of the key components of welfare. Especially the environmental damage caused by accelerating use of fossil fuels and natural resources is seriously jeopardising the renewal and tolerance of the natural environment. One of the greatest challenges for sustainable development is indeed to change existing production and consumption habits without allowing those changes to affect economic competitiveness. In the light of what we know today there is no threat of natural resources being depleted over the next few decades: the utilisation of most raw materials has steadily increased and their real prices have declined over the past 25 years.

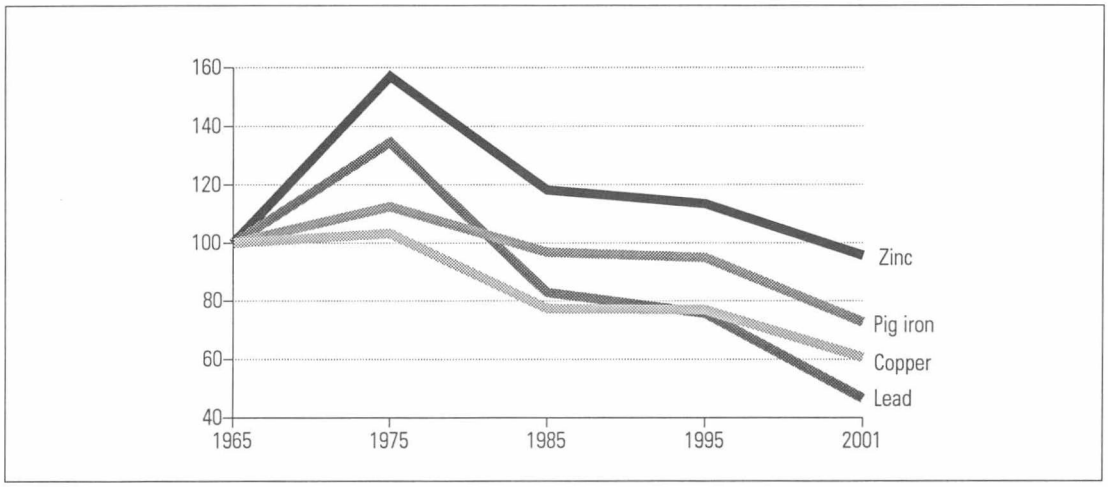
Market prices do not allow for the so-called external costs that result from the inadequate proprietary rights and underpricing of natural resources, and this gives rise to inefficient resource use and welfare losses. One solution is now being sought in the concept of eco-efficiency, which combines the sparing use of natural resources, economic efficiency and considerations of environmental protection, the ultimate aim being to reduce the excessive use of natural resources with a view to alleviating the adverse environmental consequences that exceed the tolerance of the global ecosystem.

7. World trends 1950–1997

	1950	1972	1997
Population (billions)	2.5	3.8	5.8
Major cities (pop. over 8 million)	2	9	25
Nutrition (calorie production per capita)	1 980	2 450	2 770
Water usage (million tonnes)	1 300	2 600	4 200
Cars (million)	70	280	629
Fishing (million tonnes)	19	58	91
Fertiliser use (million tonnes)	37	84	140
Area of rainforest (1950=100)	100	85	75
Number of elephants (million)	6.0	2.0	0.6

According to the Government's programme for sustainable development, efficiency in natural resource use will be advanced in Finland both in production and consumption. In

Figure 5. Trends in world market prices of selected metals (1965=100)



2000 Finland consumed 200.5 million tonnes of primary materials, over 120 million tonnes of non-renewable natural resources and 80 million tonnes of renewable natural resources. Direct overall consumption of natural resource per GDP unit declined steadily in the 1980s and 1990s. In other words, greater economic wealth has been produced with fewer resources.

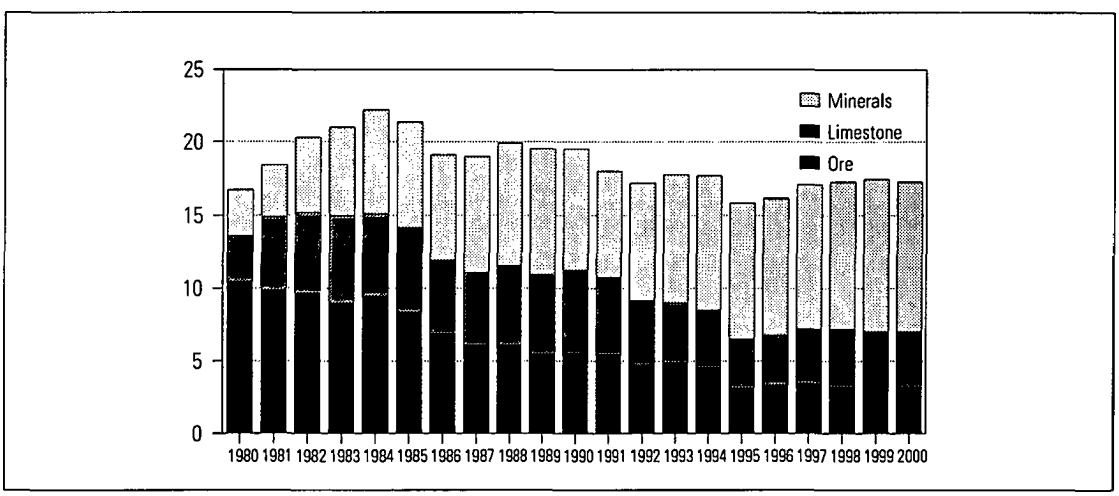
Ores and other extractable resources

Finland is self-sufficient in just two metallic minerals, i.e. chromium and zinc, but other known ore deposits are becoming rapidly depleted. However, experts say there is still considerable potential for the discovery of new deposits in the Finnish bedrock. Since the metallurgical industry in Finland is modern and highly competitive, there is every reason to believe that the processing of metals will continue in the country for quite some while, even though it will largely have to rely on imported raw materials and recycling. For instance, most of the steel that is produced in Finland is manufactured from concentrates imported from Sweden and Russia and from scrap iron.

While ore production in domestic mines declined quite considerably in the 1990s, metal imports increased very sharply. In 2000 ore production in Finland amounted to 3.3 million tonnes, metal imports totalled 5.5 million tonnes. Limestone production was 3.8 million tonnes and domestic industrial mineral production 10.2 million tonnes. The most important metals are chromium, zinc, nickel, copper and gold; the main industrial minerals are limestone, granite and talc.

Consumption of gravel and other aggregates declined from the record level of 97 million tonnes reached in 1989 by one-third during the recession of the early 1990s. The figures started to rise again towards the late 1990s with the revival of the building sector. In 1999, 56 million tonnes of gravel and sand and 28 million tonnes of rock materials were consumed. In recent years the use of natural rock as a substitute for gravel has sharply increased as gravel resources close to residential areas are becoming depleted. In 1990 rock materials accounted for 27 per cent of total consumption, in 2000 the figure was 46 per cent.

Figure 6. Mining of ores, industrial minerals and quarrying of limestone in Finland in 1980–2000 (million tonnes)



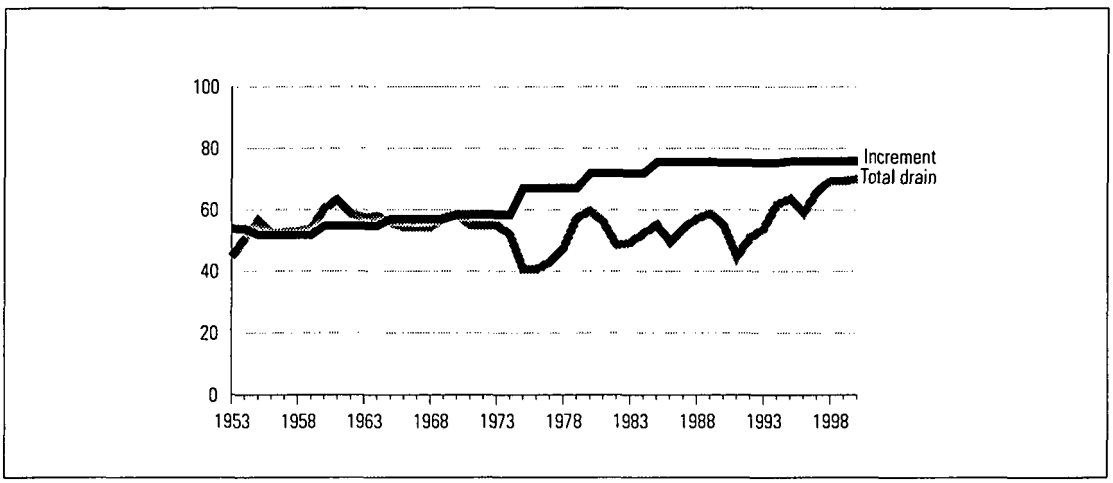
Forest resources

The forests are Finland's most important natural resource. Most of the country is covered by naturally regenerated forests that are in commercial use: Finland has over 26 million hectares of forestry land, accounting for 86 per cent of its total land area. Forestland proper amounts to 20 million hectares. Over half or 54 per cent of the forestland is in private ownership, 33 per cent is owned by the state, 8 per cent by business companies and 5 per cent by others. The figure for state-owned forestland also comprises areas set aside for conservation. The total volume of growing stock is just under two billion cubic metres. Over two-thirds or 69 per cent of this is owned privately, 18 per cent by the state, 8 per cent by business companies and 5 per cent by others. The total annual increment of 75.8 million cubic metres exceeds the total drain. A record figure of 61.5 million cubic metres was felled in 2000 for industrial and other uses. Allowing for waste and natural losses, the total drain was 70.0 million cubic metres. Timber imports to Finland in 2000 were 12.7 million cubic metres (solid measure).

The purpose of the Government's National Forest Programme 2010 is to develop the management, use and protection of the country's forests so that considerations of economic, ecological, social and cultural sustainability are taken into account in the exploitation of forests. The target identified in the Forest Programme is gradually to increase the total cut to 63-68 million solid cubic metres a year by 2010. As the Finnish Forest Research Institute's estimates put the annual growth of timber at 90 million solid cubic metres by 2030, the increase in felling would fix the total volume of growing stock at its current level. The first National Forest Programme report appeared during the spring of 2001.

The way that Finland's commercial forests are managed is of key significance to preserving the biodiversity of Finnish nature. Intensive silviculture has had negative effects on the diversity of forests, especially regarding for instance the amount of old-growth forests and rotting wood. However, the new silviculture recommendations for private forests also take into account the requirements of biodiversity. Finnish forest owners also have a positive attitude towards developing silviculture in a more natural direction. According to a poll carried out in 2000 by the Forestry Development Centre Tapio, attitudes have become more positive

Figure 7. Growing stock increment and drain in 1953–2000 (million solid cubic metres)



during the past five years. For example, 79 per cent of forest owners are ready to leave a valuable nature site untouched, 65 per cent would preserve the site in all cases and 15 per cent if it were small and 12 per cent required a reasonable compensation for sparing the natural site.

Drawn up for the first time in 1997-98 and revised in 2001, the aim of the statutory regional target programmes for forestry is to reconcile the objectives set for the different uses of commercial forests. Compiled jointly with forest owners and various stakeholders, the programmes provide an overall picture of the state of forestry in each district administered by forestry centres, the development needs within that district and the sector's development potential more generally. The programmes also include surveys of forest resources, forest protection and diversity and the employment effects of forestry and related business. The National Forest Programme is based essentially on these target programmes.

Certifications based on the Finnish Forest Certification System (FFCS) were started in summer 1999 and by December 2000 all of Finland's 13 forestry districts had a certificate for practising sustainable silviculture. Altogether 21.9 million forest hectares, or 95 per cent of Finnish forests, have been awarded FFCS certificates. These forests belong to 311,500 forest owners. Finland's national forest certification system was adopted as part of the Pan-European Forest Certification Scheme (PEFC) in the summer of 2000. The PEFC logo was introduced in November 2000.

Experience has shown that the FFCS is becoming firmly established in Finland as a useful tool for practising silviculture and forestry that combine sustainable wood production with biodiversity. However, during inspections made by independent certification companies in 1999 and 2000, minor deviations were detected in connection with the preservation of valuable living environments within commercial forests and care of the protection zones for lakes and rivers. An attempt will be made to correct these shortcomings and to increase the commitment of forest owners and others involved in forestry by way of training, advice and disseminating information. This requires efficient cooperation between forestry societies, forest centres, forest industry and other companies involved in forest certification. The Finnish Forest Certification Council (FFCC) is in charge of the forest certification system.

In recent years the government body responsible for the administration of state forests, the Finnish Forest and Park Service, has made greater allowance for social and environmental considerations by working closely with stakeholders and local residents to draw up natural resource plans for areas covering 0.5-2 million hectares. These plans seek to reconcile the different uses of forests in a manner that is widely approved. The plans also provide the framework for the Service's landscape ecology, which deals with large forest areas covering between 40,000 and 100,000 hectares as single entities. Regional landscape ecology is aimed at securing nature's biodiversity and the diverse utilisation of commercial forests. For example, rotting wood is left in forests and protection zones are established. Valuable forest sites are left intact and where necessary ecological corridors are established to connect these areas. The regional landscape ecology plans for the land areas owned by the Forest and Park Service were completed at the end of 2000.

Cultivated resources

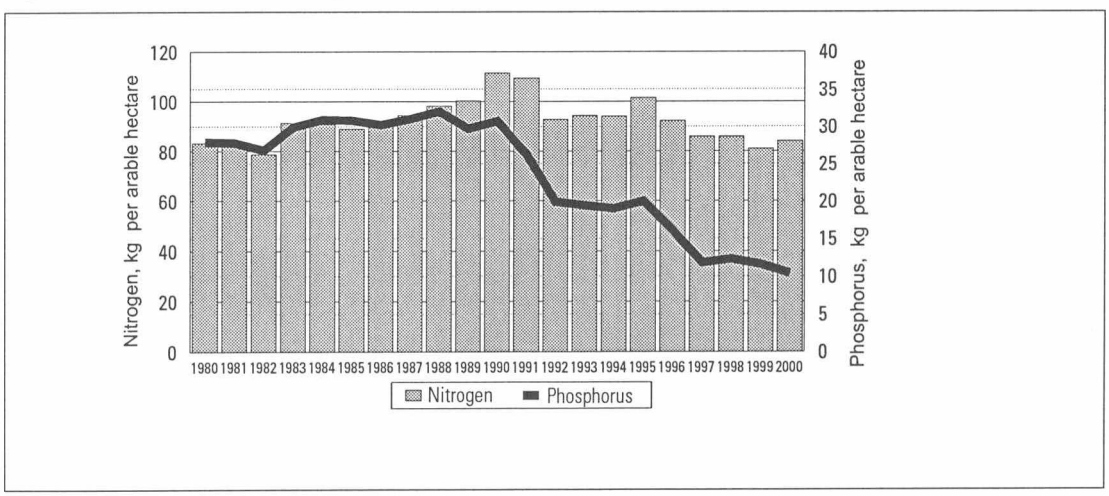
Some eight per cent of Finland's land area is in agricultural use. There is a total of some 2.2 million hectares of farmland, i.e. fields and gardens, of which 1.99 million hectares were under cultivation in 2000. Agricultural

production in Finland is based primarily on animal husbandry, and 80 per cent of the arable land is devoted to growing grass, silage and fodder crops or used for grazing. In 2000 there was a total of 79,783 farms with more than one hectare under cultivation, 50,000 farms less than in 1990. Their mean cultivated area was 25 hectares. According to estimates the number of farms will continue to decline. The majority of farms engage in productive activities entitled to agricultural subsidies, and their mean arable land area is 28.3 hectares. Since 1994, 25 per cent of active farms have folded due to low profitability and an uncertain future in their line of work. The mean cultivated area of farms has increased by 24 per cent since Finland joined the EU. Dairy products and meat accounted for 36 per cent in 2000. In 2000 the total agricultural turnover in Finland was FIM 22.3 billion, of which subsidies accounted for 44 per cent or 9.7 billion. In 2001 agricultural subsidies will rise to FIM 10.1 billion.

The adverse effects of agriculture on the environment include the runoff of nutrients from fertilisers and farmyard manure into lakes, rivers and groundwater. Apart from cultivation and animal husbandry, other, more diffuse sources of waterway pollution include natural runoff, forestry as well as settlement in sparsely populated areas and holiday homes. Estimates by the Finnish Environment Institute indicate that in 1997, around 60 per cent of the total phosphorus load and about 50 per cent of the nitrogen load caused by human activity can be traced to agriculture. The impacts of agriculture on eutrophication are most clearly visible in coastal areas and in small rivers. The first EU environmental support programme, implemented in 1995–1999, changed agricultural conventions towards a much more environmentally friendly direction. In spite of reductions in fertilisation and other measures, target levels for decreasing agricultural pollution of waterways were not met. Environmental support was estimated to reduce the amount of total phosphorus originating from agriculture and ending up in the waterways by 40 per cent and total nitrogen by 30 per cent. However, the estimated reduction in nitrate was only 4–15 per cent and the reduction in phosphorus from erosion was only 5–13 per cent.

The nitrate regulation passed in 2000 (931/2000) will be used to fulfil the European Council's directive (91/676/EEC) on the protection of lakes and rivers against agriculturally caused nitrate pollution. The reg-

Figure 8. Use of fertilisers in agriculture



ulation includes directions for the storage, application and quantity of manure and the location and maintenance of livestock shelters and exercise areas. It also deals with matters concerning the size of manure storage facilities, periods during which manure may not be spread on the land as well as the maximum nitrogen content of manure and fertilisers.

Agenda 2000, adopted in 1999, represents a major reform of the European Union's agricultural policy, giving greater prominence to environmental considerations in common agricultural policy. The aim is to encourage an integrative and comprehensive approach to agriculture and the development of rural areas, the protection of the environment and the maintenance of the European rural heritage. When the price and subsidy system in accordance with the Agenda 2000 reform was applied in 2000, the total sum of agricultural subsidies in Finland increased. The productivity of agriculture in Finland is clearly below the EU average because of the unfavourable climactic conditions. For this reason, subsidies have far more significance to Finnish agriculture when compared to the other EU countries. In 2000, fully or partly EU-financed subsidies were given out for a total of FIM 6.381 billion. The total national agricultural subsidies amounted to FIM 3.5 billion. A partial revision of the EU's agricultural policy is aimed for next in 2002–2003.

In summer 2000 the EU Commission approved Finland's proposal for a horizontal rural development plan, which also includes a new environmental aid scheme for agriculture in 2000-2006. Total appropriations for environmental aid will be reduced from the current level of FIM 1.7 billion to FIM 1.4 billion because LFA (Less Favoured Areas) grants will be made available in the whole country. Of all farmers 91 per cent are committed to the new environmental aid scheme and its coverage is 96 per cent of the arable land area. It will more easily take into account the differences in environmental management between individual farms, even though the measures required will largely re-

8. Environmental support for agriculture (FIM million)

	1995	1996	1997	1998	1999	2000	2001	2002
	A	A	A	A	A	A	B	BP
1. Basic support	1 329.7	1 367.0	1 372.0	1 410.0	1 387.5	1 485.0	..	..
2. Special support	76.5	158.0	195.0	222.5	210.3	153.7	..	..
2.1 Special support	36.5	99.5	123.5	134.9	113.6	97.9	..	..
2.2 Protective zones	1.1	2.8	5.3	7.1	7.1	6.9	..	..
2.3 Treatment of runoff	33.2	41.7	47.2	55.2	61.3	23.8	..	..
2.4 More efficient use of manure	0.9	1.1	1.2	1.8	1.9	4.5	..	..
2.5 Landscape management and biodiversity	2.3	9.4	14.4	20.9	22.9	19.4	..	..
2.6 Diversification of production	0.1	0.1	0.1	0.2	0.2	0.2	..	..
2.7 Native breeds	2.4	3.4	3.5	3.6	3.3	1.0	..	..
3. Training and advisory services	8.7	10.0	7.0	7.0	6.4	3.6	..	..
4. Experimental projects	5.0	8.0	6.0	0.0	1.7	–	..	..
5. Other environmental management programmes	–	27.0	51.0	55.5	–	–	..	..
Total	**1 419.9**	**1 570.0**	**1 631.0**	**1 690.0**	**1 605.9**	**1 642.3**	**1 679.0**	**1 771.0**

A = Final accounts. B = Budget. BP = Budget proposal.
– = not in use. .. = data not available.

main unchanged. It is estimated that in the long term, the environmental support provided to agriculture in 1995–2006 will reduce the phosphorus and nitrogen load on the waterways.

One of the areas receiving special support under the scheme is organic farming: this is an area whose growth is encouraged. Organic farming methods imitate and make use of nature's own processes by means of diverse crop rotation. Organic farms are not allowed to use fertilisers or synthetic pesticides, and they are regularly inspected at least once during the growing season. In 2000 a total of some 147,000 hectares were organically farmed in Finland.

A disease caused by bacteria, viruses, fungi or parasites and which may be transmitted between humans and animals is called a zoonosis. Protecting against zoonoses has traditionally been emphasised in Finland. Controlling the risks has been found to be easiest and cheapest at the primary production stage. Hygienic handling of food products and screening personnel for salmonella are also an important part of preventing diseases. Because of Finland's remote geographical location, sparse population and positive attitude towards disease prevention, it has been easy to limit the number of contagious diseases in animals.

9. Organic farming and transition phase area in EU Member States in 1999

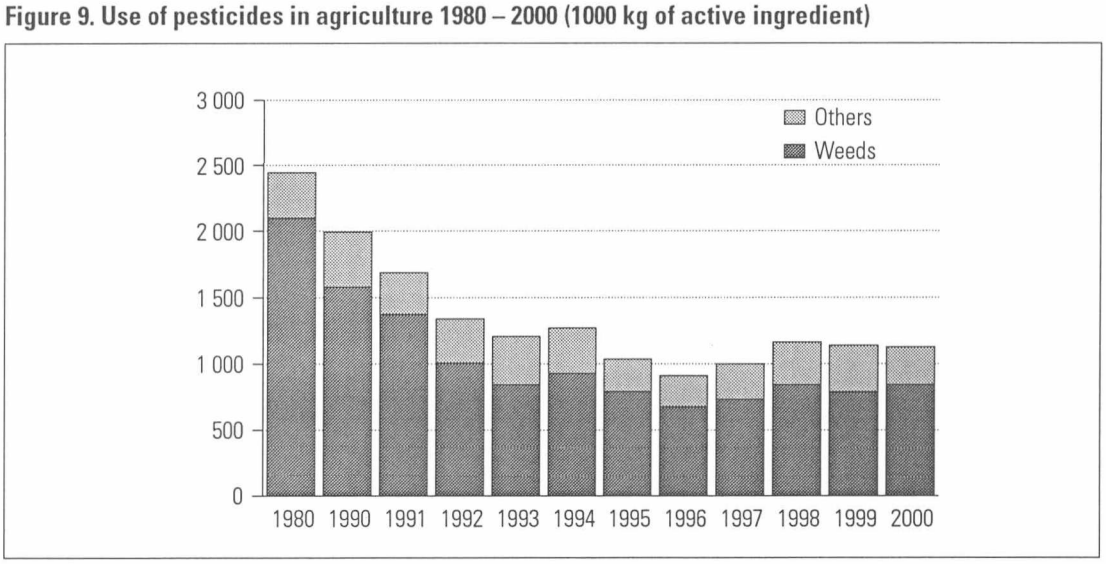
	Hectares	Per cent of arable land
Austria	287 900	8.4
Finland	**136 665**	**6.2**
Denmark	160 369	6.0
Sweden	154 000	5.5
Italy*)	788 000	5.3
Germany*)	357 715	2.4
Spain	352 163	1.4
Belgium	18 572	1.4
United Kingdom	240 000	1.2
Portugal	47 974	1.2
The Netherlands	22 997	1.2
France	316 000	1.1
Ireland	32 478	0.7
Luxembourg	1 002	0.8
Greece*)	15 849	0.5

*) = 1998.

Water resources

Finland has abundant surface and groundwater resources in proportion to its population and water consumption. Inland waterways cover some 10 per cent of the country's total

Figure 9. Use of pesticides in agriculture 1980 – 2000 (1000 kg of active ingredient)



area, i.e. 33,500 square kilometres, and territorial waters amount to 36,000 square kilometres. The total groundwater yield is estimated at 10–30 million cubic metres a day, of which approximately 6 million cubic metres is suitable for water supply purposes. Around 15 per cent of this latter figure is actually utilised. Almost 60 per cent of the water used by waterworks consists of groundwater or artificial groundwater.

In 1999 consumption of water distributed through the public water supply system was 240 litres a day per subscriber outlet, of which household consumption represented 150 litres. In sparsely populated areas households obtain most of their water from their own wells, although there are frequent problems with the adequacy of the water supply in all conditions. Community water intake plants have approximately 3,500 wells, households and holiday homes have 6,000. Fresh surface water and groundwater consumption by industry, communities, and energy production totals around 2,500 million cubic metres a year. In addition, industry and energy production use seawater for their processes. Each year 2-4 per cent of Finland's accessible water resources are utilised.

Aquifers in Finland are typically rather small, shallow, and usually isolated from one another. Total consumption of groundwater amounts to around 250 million cubic metres a year. All groundwater sources are extremely sensitive to acidification as the Finnish bedrock is composed of acidic rock types. The soil layers protecting the aquifers

10. Water use in Finland in 1980–1999 (billion cubic metres)

	Groundwater	Fresh surface water	Seawater
1980	193	2 461	3 741
1990	241	2 120	4 760
1995	250	2 265	5 115
1999	248	2 020	5 515

11. Use of water resources in selected European countries (million cubic metres per year)

	Renewable water resources	Water intake	Utilisation intensity (%)
Belgium	12.5	9.0	72
Spain	117.0	36.9	32
Italy	175.0	56.2	32
Estonia	15.0	3.3	22
England	120.0	14.3	12
Greece	58.7	6.9	12
Denmark	13.0	1.2	9
Russia	1 500.0	106.2	7
Finland	**108.0**	**3.0**	**3**
Sweden	168.0	2.9	2
Switzerland	54.0	1.2	2
Norway	39.2	2.0	1

are also relatively thin, which in many places increases the risk of contamination.

There is considerable variation in the quality of groundwater from one area to another. Depending on the bedrock and soil type, groundwater may occasionally contain detrimental quantities of arsenic, fluoride, radon, and so on, while the consequences of human activity are reflected in the form of elevated nitrate, chloride, hydrocarbon and heavy metal concentrations. Risk factors for groundwater contamination include agriculture, the use of de-icing salt on roads, the transport and storage of oil products and other toxic substances, industrial emissions, urban development, sand and gravel extraction and the percolation of waste water into the ground. In addition, air pollution has to some extent begun to affect groundwater quality in southern and southeast Finland.

A million people are still living without concentrated sewerage, mainly in sparsely populated areas. There are 560 sewage treatment plants in Finland. At the treatment plants 94 per cent of the organic matter and 93 per cent of the phosphorus are separated from wastewater. One of the great challenges for the near future is in decreasing the amount of

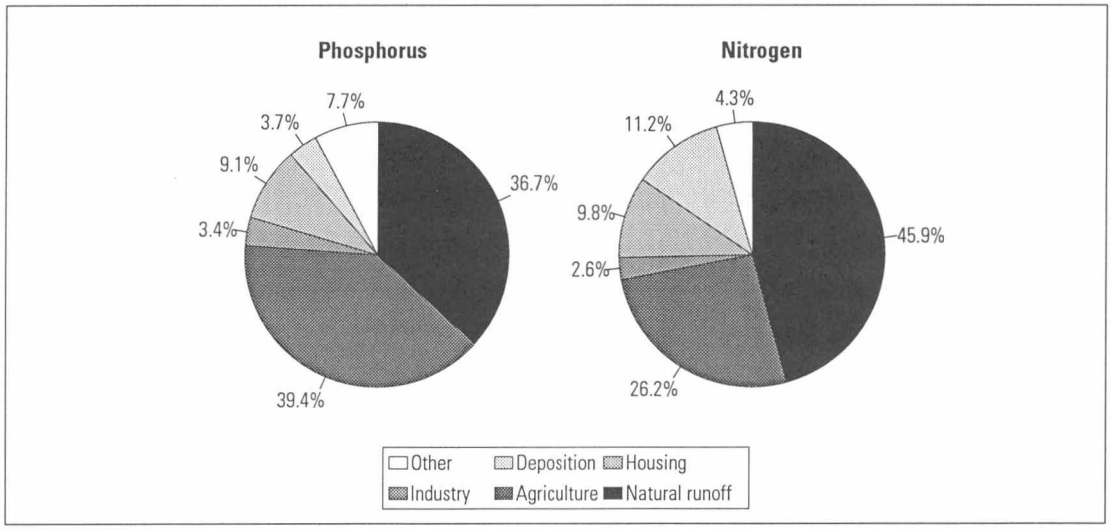
nitrogen in wastewater. At the moment an average of 44 per cent of all nitrogen can be removed.

By international comparison the quality of inland waters in Finland is rather good. The most significant threat in this regard is eutrophication, which is steadily progressing in areas affected by nonpoint source pollution. The water quality of some 80 per cent of Finland's total lake area is classified as good or excellent. The quality of water in rivers is generally somewhat poorer than in lakes. The water quality of around 40 per cent of the total length of Finnish rivers is excellent or good. The vast majority or 88 per cent of the total area of Finland's coastal waters is classified as good or excellent in terms of water quality. The total surface area of heavily polluted waters has decreased in recent years particularly in areas affected by communities and industry. At the same time, however, the area of completely unpolluted water has decreased on account of increasing nonpoint source pollution.

The target set for water protection is to achieve, by 2005, a reduction of 30–55 per cent in the phosphorus and nitrogen load caused by human activity compared to the levels recorded in the early 1990s. Efforts to reduce the nitrogen loads that are causing further eutrophication in the Baltic Sea will be concentrated on the coastal regions and along the rivers that flow into the sea. As for inland waters, measures aimed at reducing nitrogen discharges by industry and communities will be considered on a case-by-case basis. Nitrogen discharges from agriculture will be controlled within the framework of the target programme, the EU Nitrate Directive and the agricultural environment programme.

Work was finished in June 2001 on a conservation programme aimed at restoring the ecological balance of the Baltic Sea. The programme is based on the implementation of two existing mechanisms, viz. the national water protection programme and the Baltic Sea sustainable development programme. Already international collaboration to protect the Baltic Sea has yielded results in that the eutrophication process was halted around the turn of the 1980s and 1990s after decades of accumulation. The immediate effects of the decrease in the nutrient load is restricted to coastal water close

Figure 10. Sources of water pollution and natural runoff



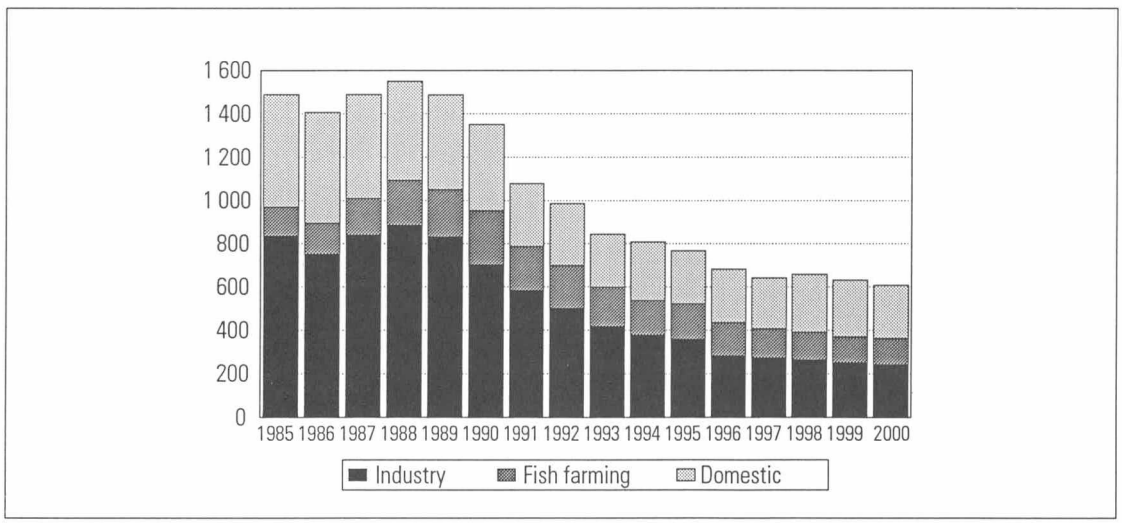
to the sources, but a substantial reduction in the loads will also help to alleviate the situation in the Baltic basin, even though it may take decades before any marked improvement will be seen.

Eutrophication increases in the Baltic Sea areas that surround Finland from the northern stretches of the Gulf of Bothnia through the Archipelago Sea down to the Gulf of Finland. In the eastern parts of the Gulf of Finland where the loads are highest, algae concentrations in the summertime are on average three times greater than in the open seas up in the Gulf of Bothnia. Many of the bays and island areas along the coast suffer from eutrophication to a much greater extent than open sea areas on account of local point source inputs and low levels of water turnover. Especially in the coastal waters of the Gulf of Finland that are dotted with small islands, a number of separate areas with presumably local eutrophication effects appear to be activated towards the end of the summer as nutrients are released from the load that has accumulated in the seabed over the decades. The extensive blooms of algae during the latter half of the 1990s, and during the summer of 1997 in particular, were a consequence of an intensified internal nutrient load in the open seas. Observations during winter 2000 indicate that the phosphorus concentration in the sea areas has dropped back to the levels recorded at the beginning of the decade.

It is possible by means of domestic measures to combat the problems caused by excessive algae in the coastal waters of the Gulf of Finland, including slimy beaches and muddy waters. However, it is estimated that measures taken in St. Petersburg would be 40 times as cost-effective as those taken in Finland in terms of reducing these problems in Finnish territorial waters. More effective removal of phosphorus at St. Petersburg's current sewage treatment plant would reduce the phosphorus load that the Gulf of Finland algae can use by 16 per cent or 570 tonnes a year, which is almost ten times the reduction that will be achieved in this area through the water protection target programme.

The EU framework directive on water policy, the purpose of which is to reform community legislation governing surface and

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



groundwater sources, was adopted in 2000. The primary objective is to ensure good ecological standards of water in lakes, rivers and coastal areas. The actions to be taken, monitoring and administration should focus on entire catchment areas at a time and co-ordination within them. In the definition of the state of water areas and the measures required, the accent should be on the ecological viability of the biocommunities and the presence of hazardous substances. The preparation of measures required by the directive, legislative, administrative and water classification and monitoring, has been put into motion in Finland.

12. Trends in A-chlorophyll content describing nutrient content of surface waters (mg/m³)

	Lake	Eastern Gulf of Finland	Gulf of Bothnia
1985	15.0	4.1	3.3
1986	11.0	4.7	2.6
1987	8.5	5.5	4.1
1988	13.0	4.8	3.9
1989	16.0	6.3	2.6
1990	7.5	4.6	3.7
1991	10.6	5.5	3.4
1992	8.2	6.0	3.9
1993	8.0	5.8	4.3
1994	6.7	4.0	5.4
1995	6.6	8.1	3.2
1996	7.2	6.0	3.4
1997	7.1	6.2	3.8
1998	6.7	6.3	5.3
1999	..	6.7	2.2

.. = data not available.

3 Nature conservation and the built environment

Nature conservation

Intensive forestry and agriculture are the main culprits behind the loss of biodiversity in Finland. According to a survey completed in 2000 on endangered species in Finland, one in ten of the 15,000 or so species included in the study or a total of 1,505 species are currently endangered. There are 186 species that have become extinct and 1,060 species need to be closely watched. The most important habitat for endangered species is the forest, but the threat of extinction has increased most among species living in different kinds of traditional biotopes.

One of the aims of nature conservation is maintaining 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, i.e. 7.6 per cent of Finland's total forest and low-productivity forestland. The area of strictly protected forest and low-productivity forestland totals 1,528,000 hectares, or 6.6 per cent; the figures for forestland proper are 714,300 hectares and 3.6 per cent. Nature conservation areas covering some 1.4 million hectares and protected wilderness areas totalling some 1.4 million hectares have been established on state-owned and private land.

The concentration of protected areas in northern Finland, and hence the neglect in protecting the forests in southern Finland, is a problem facing nature conservation. The conclusion of a group of specialists charting the conservation needs of the forests in southern Finland and East Bothnia in September 2000 was that the current network of protected areas will not secure the survival of southern Finland's natural forest. In southern Finland, only 1.1 per cent of the forest has been fully protected while 1.8 per cent is less strictly protected. In addition to commercial forests and strictly protected forests, it is necessary to have commercial forests that are managed in accordance with the goals of nature conservation. For example, recreational forests and parks would be such partially commercially utilised areas. Forest areas left outside forestry by individual owners would act as supplementary and support areas. The aim of the overall funding plan already ratified for the nature conservation programmes is to have them completed by 2004, with funding extending to 2007 due to the staggering of payments.

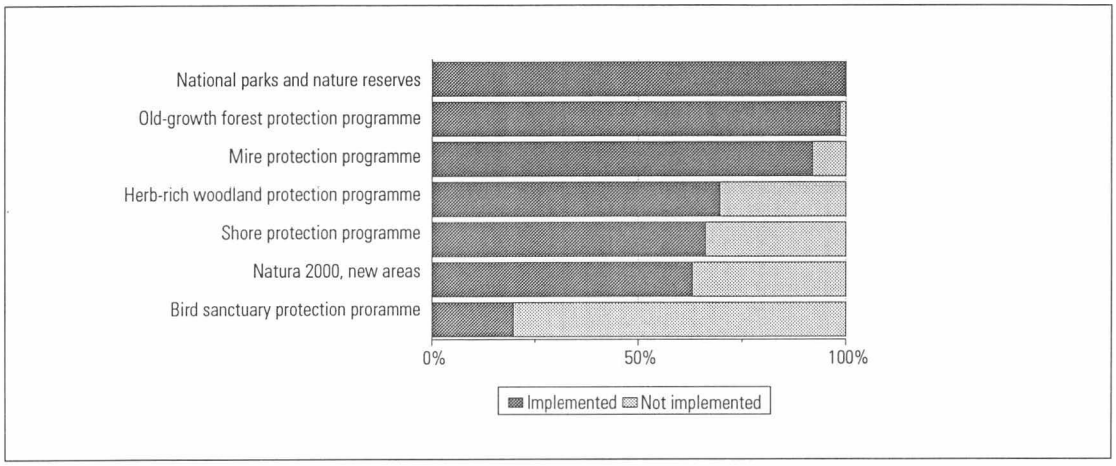
Finland is committed to implementing the EU habitats directive by creating a network of protected areas known as Natura 2000. The Finnish proposal for the areas to be included in the network was submitted to the European Commission in December 1998. The proposal for Finland's Natura 2000 net-

13. Funding for nature conservation areas and programmes (FIM million)

	1998 A	1999 A	2000 A	2001 B	2002 BP
Purchase of land	362	214	184	192	162
Purchase of private land	*117*	*84*	*74*	*102*	*102*
Land exchanges	*150*	*70*	*60*	*90*	*60*
Income from sale of land	*95*	*60*	*50*	–	–
Management of conservation areas	76	77	78	84	90
Compensation payments	47	77	69	69	69
Protection of rapids	45	10	90	5	2
Life (Natura)	39	24	10	15	15
Total	**569**	**402**	**431**	**365**	**338**

A = Final accounts. B = Budget. BP = Budget proposal.
– = not in use.

Figure 12. Implementation of nature conservation programmes on private land, 1 Jan 2001



work comprises a total of 4.78 million hectares, of which 3.224 million hectares are state land and 41,000 hectares have not been previously protected. The revised proposal comprises 324,000 hectares of private land, of which 66,000 hectares have not been previously protected. In 1999 some 4,500 hectares of these lands were claimed under the Nature Conservation Act. The conservation of Natura areas can be implemented in various ways depending on the need for protection in the case of each biotope and species. A final decision on the Natura 2000 network will be made by the European Commission.

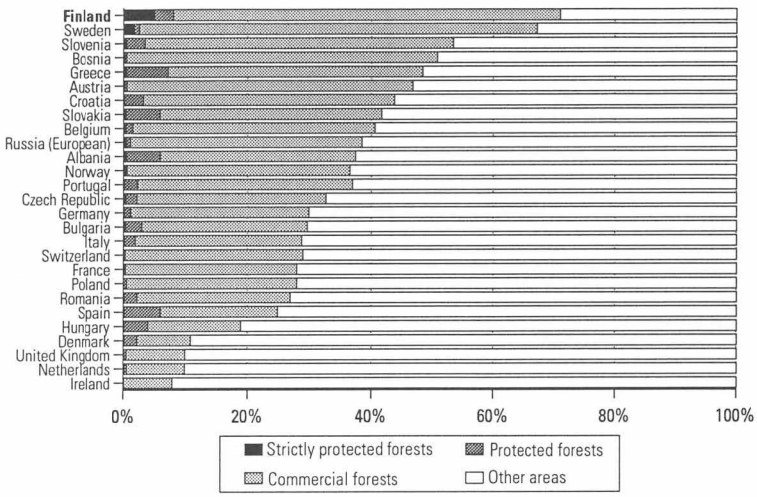
The sufficiency and coverage of the areas proposed by Finland and Sweden for the Natura 2000 network on the basis of the habitats directive were audited for the first time in April 1999. For the purposes of the audit the European Union is divided into six physical types so that most of Finland belongs to the boreal zone and the fells of Lapland to the Alpine zone. In May 1999, Finland was requested by the European Commission to complement its Natura 2000 proposal with a further 15 biotopes and the habitats of 17 species. The process requires full consultation procedures as well as a decision by the Council of State. Finland submitted its proposals for the new areas in the autumn of 2000. Phase II audits of the Finnish and Swedish proposals should be arranged during the course of 2001: these will involve final assessments of the significance of each area proposed for inclusion in the network to the achievement of a favourable level of protection of biotopes and species throughout the EU territory.

14. Natura barometer in the EU countries, 31 Jan 2001

	Number of reserves	Total area (km^2)	Per cent of land area	Hectares per capita
Denmark	194	10 259	23.8	0.19
Greece	234	26 522	20.1	0.26
Spain	937	88 076	17.9	0.22
Portugal	94	12 150	17.9	0.12
The Netherlands	76	7 078	17.0	0.05
Italy	2 507	49 364	16.4	0.08
Ireland*)	362	3 091	14.1	0.09
Finland	**1 381**	**47 154**	**13.9**	**0.92**
Luxembourg	38	352	13.6	0.09
Sweden	2 454	50 996	12.4	0.59
Austria	127	9 144	10.9	0.12
United Kingdom*)	386	17 660	7.4	0.03
Germany*)	2 196	15 176	5.8	0.02
France*)	1 030	31 440	5.7	0.05
Belgium*)	209	1 105	3.5	0.01
Total	**12 225**	**388 243**	**12.2**	**0.10**

*) = Proposal for programme partly completed.

Figure 13. Forests and forest conservation in selected European countries (per cent of land area)



The LIFE fund that was set up by the European Union in 1992 subsidises nature conservation and environment projects that support the development of community environmental policy and legislation. The budget for phase three of the programme in 2000-2004 is expected to be around EUR 640 million, 47 per cent of which will go towards nature conservation (LIFE Nature) and around 47 per cent to innovative environmental technology projects (LIFE Environment). LIFE Nature is designed for the protection of the species and biotopes listed under the EU habitats directive and in particular for the implementation of the Natura 2000 network.

In 1999 the Commission allocated some FIM 400 million to LIFE Nature projects. Seven Finnish projects received a total of over FIM 27 million. Between 1995 and 1999 Finland received a total of FIM 79 million for 18 LIFE Nature projects. According to advance information, the Commission will grant five Finnish LIFE Environment projects approximately FIM 15.5 million in 2000 and 2001. LIFE Environment funding to Finland in 1995-99 totalled EUR 9.9 million, or FIM 59.5 million, granted to 27 different projects.

The built environment and zoning

The Land Use and Building Act and Decree came into effect at the beginning of 2000 and are more clearly than before advancing sustainable development and promoting a good living environment. The aim of the law

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

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Funds allocated	106	149	175	185	185	185	185	185	185	185	185	185
Interest	0	9	12	15	12	10	10	10	10	6	3	3
Land exchanges	180	110	120	100	60	60	60	60	60	–	–	–
Income from sale of land	50	100	90	40	–	–	–	–	–	–	–	–

– = not in use.

is to organise land use and building in areas in such a way so as to create the requirements of a good living environment and advance ecologically, economically, socially and culturally sustainable development. The preservation of biodiversity and other nature values, the advancement of nature conservation and sparing use of resources and preventing environmental damage are among the general aims of the law. In addition, the law requires the advancement of the utilisation of the existing urban structure and building stock and the continuous maintenance of the built environment and building stock.

Monitoring the land use and the state and development of the built environment by all levels of administration has also been incorporated into the legislation. The environmental administration will improve monitoring of the built environment by means of monitoring systems illustrating trends in community structure and the living environment. As more information on the changes in the built environment, community structure and living environment becomes available, it will be easier to get an idea of the state of the environment and the problems, and to influence development.

Zoning is the most important tool in planning land-use. The quality of zoning affects not only the citizens' wellbeing, but also the functioning of society at large, the economy and sustainable development. From the viewpoint of sustainable development, it is important how residences, work places, services and other businesses are located in relation to one another and what the distances and traffic will be like between them. In zoning, a certain area will be treated as a whole by fitting together measures targeted at different sectors. The quality of the environment may be affected and environmental damage prevented with zoning. When drafting zoning plans the environmental effects of their implementation must be assessed to a necessary degree.

The development of the built environment is strongly affected by the concentration of work places and the subsequent migration. The long-standing migration to the cities and population centres is quickly emptying the countryside. Differentiation is also going on inside cities. In 1960, 56 per cent of the population lived in population centres of over 200 inhabitants. In 1995 these population centres were already inhabited by 81 per cent of the population or over 4 million people. In 1995 only about one million people lived in sparsely populated areas. It seems that active migration will continue. For example, in 1999 approximately 800,000 people changed residence and 260,000 of them also changed municipality. The growth of population centres is causing sprawl on the outskirts. Because work places are mainly located in the city centre, the mean distance to the work place has increased. In 1995 this distance as the crow flies was eight kilometres, which was two kilometres more than ten years earlier. On the one hand, concentration of residences enhances the opera-

16. Population density and living structures in EU countries

	Population density inhabitants/ km²	Private houses in 1997 (%)	Single person households (%)
The Netherlands	384	71.0	33
Belgium	343	60.0	31
United Kingdom	245	..	29
Germany	230	45.6	35
Italy	191	..	23
Denmark	124	58.8	36
Portugal	109	98.3	14
France	108	56.2	28
Austria	96	66.1	30
Greece	80	67.4	16
Spain	78	37.6	13
Ireland	53	92.4	20
Sweden	20	45.7	14
Finland	**15**	**40.5**	**37**

.. = data not available.

tional possibilities of public transport. On the other hand, the rise in living standards increases car use and holiday trips.

Migration makes it harder to sustain the quality of the living environment in the areas of net loss emigration and also causes problems in the rapidly growing urban centres. In the areas of net loss emigration, the infrastructure, service network and building stock are under-utilised. In the growing population centres people need more housing and services. The Land Use and Building Act's aim of utilising the existing urban structure and building stock is in many cases difficult to realise.

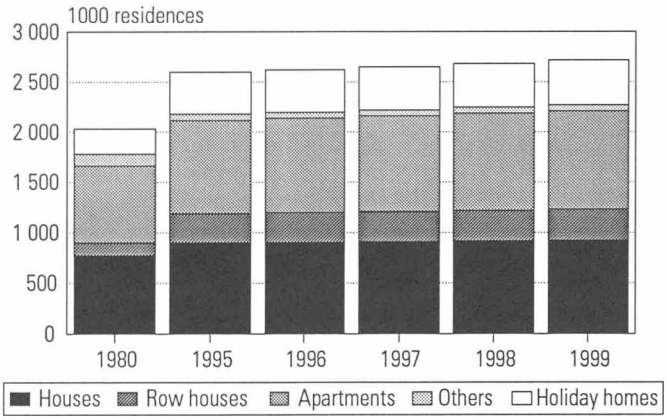
Commuting between the residence and school, work place, kindergarten and other services and recreational activities is part of the people's daily routine. For example, grocery stores have undergone a great structural change in recent years, as many small shops have disappeared and new shops are larger and more centralised. Centralisation of services is a problem especially in the countryside but also in many residential areas. There were 4,500 grocery stores in 1999, 57 per cent of these were small shops, 24 per cent were supermarkets, 5 per cent were hypermarkets or department stores and 14 per cent were speciality stores or market halls. In two years the number of small shops had declined by 13 per cent.

The built environment comprises many buildings, structures, roads, streets, parks and various operations. In Finland, 71 per cent, or FIM 2,130 billion, of the national wealth is composed of buildings, transport facilities, networks and structures. Of the 2.6 million buildings with a building permit in Finland, 2.5 million are residences and 450,000 are holiday homes. Even though the traditional Finnish residence has been a house or a farmhouse, the numbers of these have decreased due to urbanisation, with the proportion of apartments and row houses growing correspondingly.

17. The components of Finland's national wealth in 1999

	FIM billion	Per cent
Residential buildings	761	27.5
Other buildings	532	19.2
Machinery, equipment etc.	338	12.2
Land and water structures	311	11.2
Built land	323	11.7
Forest	290	10.5
Farmland	46	1.7
Other wealth	167	6.0
Total	**2 768**	**100.0**

Figure 14. Different types of residences and holiday homes



Greater commuting distances have led to more demand for transport services. The increase in the number of jobs caused by the economic upswing of the late 1990s has almost totally been directed at the large cities and their neighbouring municipalities. At the same time jobs are disappearing from the countryside. In addition to the greater commuting distances, more frequent holiday travel has also increased overall traffic. More traffic has led to increased pollution and noise. Traffic has a marked detrimental effect on air quality in urban areas.

Slightly over 20 per cent of the total energy expenditure is used for heating buildings. The production of heating energy causes significant carbon dioxide emissions. In 1998, the Council of State approved a programme for sustainable construction, the aim of which was to decrease the environmental load, increase environmental know-how and technology and create the basis for environmentally based and customer-oriented decision making. The building industry's environmental programme has created basic principles and recommendations for the environmental specifications of construction products, methods for calculating environmental load, estimating the reusability of subsidiary materials and recovered materials and for decreasing the amount of construction waste.

4 Industry

Development of environmental protection

In the 1990s an increasing proportion of Finland's GDP was accounted for by industrial production; the corresponding shares of the service sector, construction and agriculture were all on the decline. Growth has been fastest in the electronics industry, which showed a seven-fold increase in production in the wake of soaring sales. In 2000 the metal and electronics industry accounted for 51 per cent of total industrial output, the forest industry for 20 per cent and the chemical industry for 10 per cent. Electronics generated 31 per cent of the value of Finnish exports in 2000, the metallurgical industry generated just under 25 per cent, the forest industry just over 26 per cent and the chemical industry just under 11 per cent.

The industrial sector in Finland has invested increased efforts in environmental protection in recent years, and the emphasis has now shifted to the introduction of environmental management systems. EU Member States were required to implement a combined directive on the prevention and control of emissions by the end of October 1999. The directive underlined the responsibility of companies for using the best available technology (BAT) in their processes and other functions. In Finland the BAT requirement has been included in legislation on water and air pollution control, waste disposal, the protection of sea areas and the new Environmental Protection Act. The new Act contains the main body of national anti-pollution legislation, creating much greater uniformity in this field. According to the new Environmental Protection Act and the related decree, any business or operation involving a risk of environmental damage requires an environmental permit.

Industrial investment in environmental protection accounted for 4.8 per cent of all industrial investments in 1998. In 1997, the corresponding figure was 7.3 per cent, and in 1996 less than 7 per cent. Investment in environmental protection was at its highest in 1992 and 1993, at 10 per cent of all industrial investments. In 1998, 36 per cent of environmental investments were spent on air pollution control, 40 per cent on water protection and 22 per cent on waste disposal and on soil and groundwater protection.

18. Expenditure by industry on environmental protection (FIM million)

	1995	1996	1997	1998
Energy and water supply	276	406	601	235
Forest industry	1 371	1 311	998	1 168
Chemical and mineral industry	602	670	764	598
Metallurgical industry	564	723	565	731
Other industries	300	309	399	440
Total	**3 113**	**3 418**	**3 327**	**3 172**
of which				
Investments	1 538	1 714	1 397	1 115
Operating costs	1 575	1 704	1 930	2 057

The water protection programme adopted in 1998 and extending to 2005 and the respective plan of action oblige the industrial sector to considerably reduce its dicharges. The obligations primarily concern the forest industry. By 2005, the aim is to reduce phosphorus and nitrogen discharges by 50 per cent compared to 1995, the target for biochemical oxygen demand is a reduction of 45 per cent. The targets of a 55-90 per cent reduction in chromium, oil, nickel, copper and zinc discharges have been established. In 2000 phosphorus discharges from industry were 35 per cent, the biochemical oxygen demand was 22 per cent and nitrogen discharges were 7 per cent lower than in 1995.

19. Environmental management systems applied in Europe, 1 March 2001

	EMAS	ISO 14001
Germany	2 607	2 400
Austria	366	223
Sweden	234	1 370
Denmark	170	783
Great Britain	122	2 010
Spain	88	1 444
Norway	78	235
Italy	43	724
France	37	906
Finland	**35**	**526**
Netherlands	26	849
Belgium	9	130
Ireland	9	200
Portugal	2	28
Greece	2	57
Luxembourg	1	9
Iceland	0	2
Liechtenstein	0	19
Total	**3 829**	**11 912**

With the exception of copper, the other metal and oil discharges had dropped to the 2005 target level.

The industrial sector has moved increasingly towards voluntary environmental management systems in the 1990s. Companies have been able to adopt the global ISO 14001 environment system since 1995. The voluntary environmental management and audit system (EMAS) for industrial companies operating within the EU was joined by the first companies in spring 1996. Since the ISO was clearly more popular in most EU countries, an effort was made to improve the usability of EMAS with a revision in February 2001. The revision allows not only industrial but also other business units to join the system. Admission from ISO to EMAS is further facilitated such that the only requirement from the company is that they publish a confirmed environmental report.

In numerous countries those companies who have joined the EMAS have been given relief toward permit and supervision procedures in the form of discounts on permit and supervision fees, reductions on frequency of supervision visits, replacing environmental reporting with an EMAS report and giving the priority to EMAS companies in public purchases. In Finland EMAS companies can receive discounts on permit processing costs if their permit processing is faster than normal. It was decided to revise also the ISO 14001 standard in June 2000. The revision concentrates on making the system more clear and understandable as well as improving the compatibility with the ISO 9000 quality standard. The first draft is due to be ready in November 2001 and the new standard will undergo its final completion in 2003. To date, ISO has awarded nearly 530 environmental certificates to Finnish companies and EMAS has awarded 35.

Forest industry

Finland accounts for five per cent of the world forest industry production and for ten per cent of its exports. Ninety per cent of the 13.5 million tonnes of paper and board produced in Finland in 2000 was exported. Indeed the forest industry has in the past few years been producing record quantities of paper and other wood products. In 2000 production in the Finnish forest industry increased by nearly five per cent on 1999. Capacity utilisation in the paper industry at the end of 2000 averaged over 95 per cent. The environmental impacts of the forest industry remained well under control in 2000; indeed the figures for several emissions kept on decreasing.

Virtually all companies now have an environmental management system in place and they publish progress reports in connection with their annual reports. The net sales of Finnish forestry companies tripled during

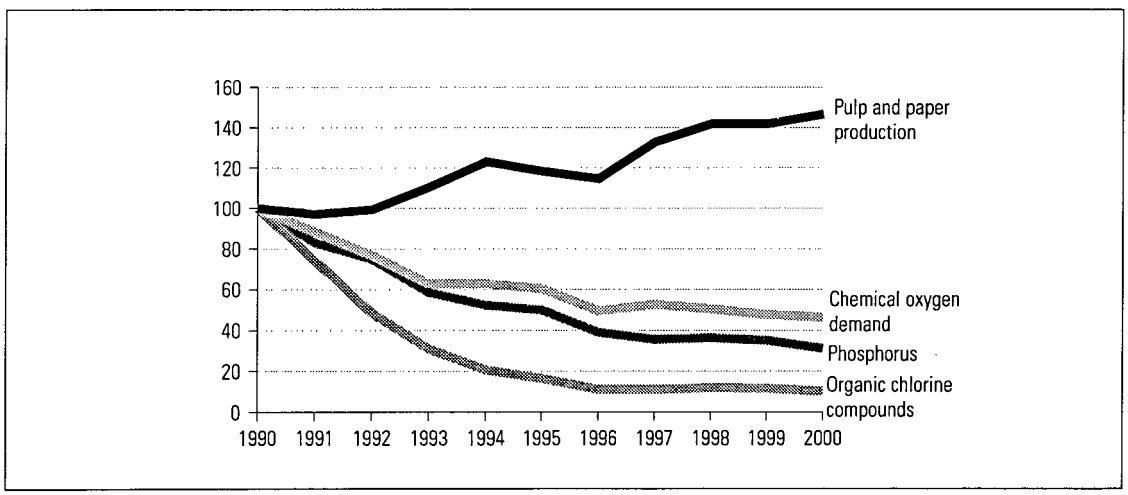
the 1990s; paper production was up by 45 per cent, pulp production by 35 per cent and sawn goods production by 45 per cent. But at the same time discharges of organic chlorine compounds were down by 90 per cent, biological oxygen demand by 80 per cent and suspended solids discharges, chemical oxygen demand and phosphorus discharges by 50 per cent. Sulphur emissions dropped by 85 per cent in the 1990s and emissions of reduced sulphur compounds causing odour problems by 80 per cent. By contrast nitrogen oxide emissions remained unchanged throughout the 1990s.

Continued efforts to raise the standards of environmental protection in the forest industry call for good control of the entire production process. The key concern in the development of production processes in the pulp and paper industry is to minimise raw material consumption: wood, water, chemicals and pigments. In 2000, the forest industry used a total of 70 million solid cubic metres of wood, of which 57 million solid cubic metres were of domestic origin, and 13 million solid cubic metres were imported. Recyclable fibre makes up five percent of the paper and board industry's fibre raw material. Imported timber for the Finnish forest industry is covered by ISO quality and environment certification.

In 2000 the forest industry used a total of 26.3 terawatt hours (TWh) of electricity, representing 61 per cent of industrial electricity consumption and 33 per cent of the whole country's consumption. The forest industry itself generated 11.1 TWh of the electricity and some 15.2 TWh was imported. Fuel consumption in the forest industry amounted to 263 petajoule, or 64 per cent of total industrial fuel consumption. The most important fuel is wood, which is used in the form of bark, wood chips and black liquor in the pulp industry. Wood accounts for over 70 per cent of total fuel consumption by forest industry power plants. The forest industry is the country's largest consumer of biomass fuel.

Forest industry companies have been actively involved in the energy conservation conventions agreed upon by the Ministry of Trade and Industry and the confederation of Finnish industry and employers. According to the first annual report published in 2000, the coverage of electricity was 88 per cent in 1999 and the coverage of fuels was 86 per cent. In other industries the coverage elec-

Figure 15. Pulp and paper industry production and load on the rivers and lakes (1990 =100)



tricity averaged 72 per cent and the coverage of fuel use was 82 percent. The saving effect from the measures of the conventions was 1.3 TWh for heating and fuel, and 0.2 TWh for electricity.

Environmental investments by the pulp and paper industry in 2000 amounted to ten per cent of their total investments, which is a slight improvement on the figure recorded one year previously. Most of the environmental investments in 2000 went towards the reduction of water use. Water recycling is better than before and also efforts are being made to better control water use in the production of paper and board.

Recycled paper and board are important raw materials for the paper industry. The use of recycled materials has increased very rapidly all over the world, and it is expected that by 2010 recycled fibre will account for around half of the raw materials used in paper production. Under a decision in principle made by the Government in 1998, the recovery and utilisation of recycled paper shall be intensified, so that in 2000, at least 70 per cent of the volume of paper products sold in Finland will be re-used primarily as recycled material, with the target for 2005 set at a minimum of 75 per cent. In 2000, a total of 734,000 tonnes of recycled paper was recovered, representing 67 per cent of the total end consumption of paper and board in Finland. In the whole world the recovery rate is 40 per cent. Some waste paper was imported for the production of recycled fibre. This was used primarily in the production of newsprint, different types of board and tissue.

Chemical industry

Chemicals are an important branch of industrial production in Finland in terms of both end products intended for consumers and, particularly, intermediate products supplied to other branches. However, even small quantities of many of the hazardous substances used and processed in the chemical industry may have serious environmental impacts, which underlines the need for reliable and comprehensive environmental protection. The bulk of the investments by the chemical industry in environmental protection still consists of conventional external measures aimed at purifying emissions, whereas investments in process technology remains at a low level. Nonetheless the industry has succeeded in reducing some of its discharges into water and air emissions, and the volume of waste has been declining since 1994.

Figure 16. Pulp and paper industry production and emissions into the atmosphere (1990=100)

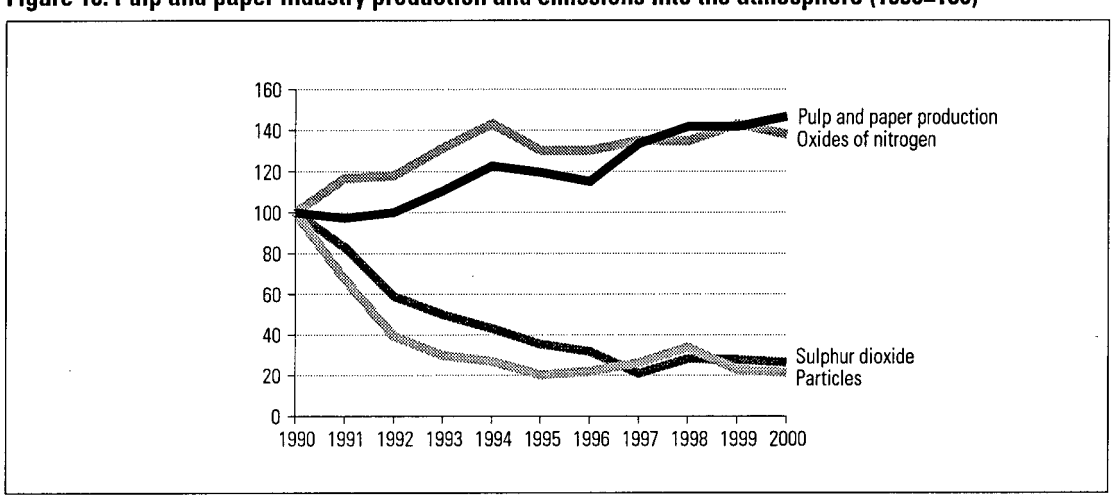
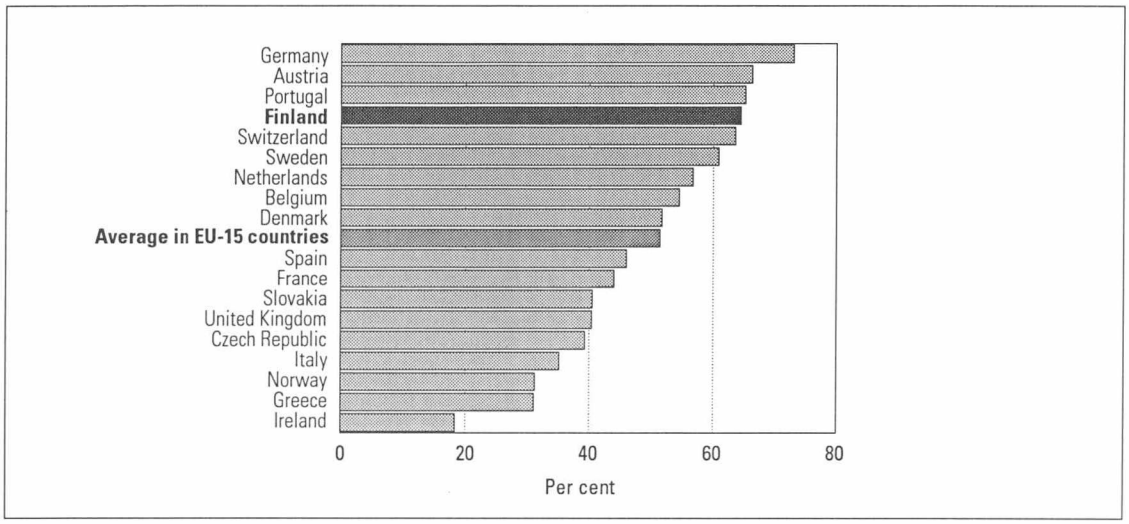


Figure 17. Recovery of waste paper in different countries 1999



20. Emissions from the chemical industry (tonnes)

	1995	1996	1997	1998	1999	2000
Sulphate	99 578	78 317	72 807	66 265	61 742	48 529
Phos-phorus	19	22	21	15	13	14
Nitrogen	449	485	481	427	382	440
Mercury	24	13	12	12	7	8
Cadmium	4	4	4	0	1	0
Lead	1 250	1 106	413	7	5	3

The chemical industry has taken voluntary steps to raise the standards of its environmental protection and industrial safety in the context of the international Responsible Care programme. In 2000 the programme covered approximately 80 per cent of Finland's chemical industry production and 25,000 employees. Of those companies committed to the Responsible Care programme, 80 per cent possessed some quality management or environmental management system. Of these systems, 55 per cent were in compliance with the ISO 9000 standard, 31 per cent compliant to the 14001 standard, three per cent with the EMAS, and nine per cent with the BS 8800 system.

Those companies taking part in the Responsible Care programme invested FIM 333 million (which was 35 per cent more than in 1999) in improving aspects in the environment, health and safety. Operating expenses also increased by 17 per cent to FIM 579 million. The increase in expenses shows not only the serious attitude of the chemical industry towards the subject but also the tightening of the demands that are placed on the matter. Companies direct around 10 per cent of their investments to this cause. For inputs in production, energy use increased by three per cent and if proportioned to the quantity of production the increase was two per cent.

The most noteworthy emissions reductions under the Responsible Care programme were made at the beginning of the 1990s. In 2000 numerous emissions levels were stable from a few years before. Annual variations are the result of changes in company and branch structure as well as the market situation. The chemical industry's release of emissions into the atmosphere continued to decrease, with the exception of evaporable hydrocarbons. Nitrogen compound emissions fell by ten per cent from last year's levels to 7,300 tonnes in 2000 and sulphur com-

pound emissions fell to 14,200 tonnes, and if proportioned with the quantity of production this signifies a decrease of 14 per cent in comparison with the previous year. Carbon dioxide emissions in proportion to the quantity of production decreased by two per cent, totalling 4.5 million tonnes in 2000, less than eight per cent of the whole country's emissions.

In water discharges sulphate and heavy metal discharges decreased, whereas nitrogen and phosphorus discharges and oxygen use increased. A partial reason for the increases is the improved discharge monitoring and analysis technology, which in some cases has been able to produce more accurate information about the discharges than before. The amount of hazardous waste fell by ten per cent in comparison with last year, to 123,000 tonnes. Exploitable waste amounts increased by four per cent in comparison with last year, to 167,000 tonnes. The amount of waste for disposal grew by 66 per cent to 483 tonnes. The increase was mostly due to changes in the definition of what waste is, the increased number of land areas in need of cleaning and certain structural changes in companies.

21. Emissions from oil refining (tonnes)

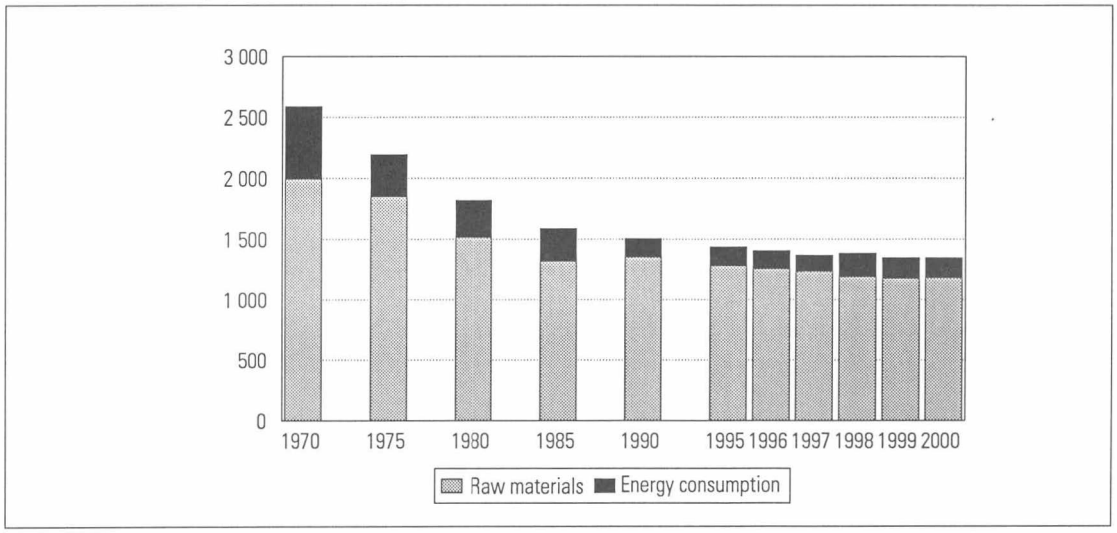
	1995	1997	1999	2000
Evaporable hydrocarbons	..	4 745	4 873	4 748
Nitrogen oxides	2 287	2 985	3 053	2 877
Sulphur dioxide	4 536	3 069	3 188	3 266
Oil spills to waters	7	5	4	5

.. = data not available.

Metallurgical and electronics industries

Extensive recycling of metals reduces the need for extracting virgin ores, as metals are almost entirely recyclable. Measured in terms of volume the most recycled material in the world is steel: each year the volume of recycled steel exceeds the figure for all other materials put together. In 2000 some 400 million tonnes of scrap were used to produce 847 million tonnes of steel in the world, i.e. almost half of it was made from recycled material. It has also been shown that, as a rule, steel production based on recycling is environmentally friendlier than production based on virgin natural resources. For in-

Figure 18. Carbon dioxide characteristic emissions from metal production (kilograms of carbon dioxide per tonne of metal produced)



22. Emissions from metal production

	1995	1996	1997	1998	1999	2000
Production volume	**100.0**	**105.8**	**111.6**	**117.7**	**122.3**	**128.1**
Emissions into the atmosphere (thousand tonnes)						
Sulphur dioxide	8.1	8.1	7.5	7.6	8.1	7.8
Nitrogen oxides	3.2	3.1	3.5	3.5	4.1	4.1
Discharges into water (tonnes)						
Nitrogen	420.6	449.3	421.6	526.0	490.0	520.5
Chromium	3.5	2.3	3.9	4.2	5.8	3.0
Nickel	12.4	6.0	10.3	6.8	9.3	7.2
Copper	8.2	8.7	8.9	6.8	7.1	9.7
Zinc	10.7	9.9	9.4	6.9	7.6	7.3

stance, the manufacture of steel from scrap iron requires some 58 per cent less energy per unit than does the use of virgin raw materials. Recycling also helps to reduce energy consumption in the production of aluminium, which loses none of its properties in recycling. The smelting of recycled aluminium only takes five per cent of the energy that is needed to produce the same amount of aluminium from bauxite.

Since the manufacture of metals requires a large amount of energy, emissions into the atmosphere are the main source of pollution in this sector. The Finnish smelting industry has worked on improving its production processes and in this way significantly raised the efficiency of its raw materials and energy use and reduced its emissions. Half of the world's copper and 30 per cent of its nickel are produced by the Finnish flash smelting method, which has a low external energy demand and which effectively recovers sulphurous gases.

Investments in environmentally acceptable process technology in the metalworking industry exceeded the costs arising from the purchase of traditional emission purification technologies for the first time in 1996. The majority of the investments aimed at combating air pollution in the industry concern the recovery of emitted particles and dust. Water protection investments involve reducing wastewater loads by developing production processes and purification methods. The aims of wastewater management investments have been the reduction of the amount of waste and increased recycling. In the smelting industry the development of environmental protection has focused on the introduction of environmental management systems and related life-cycle analyses. The electrical and electronics industry has aimed at reducing the use of CFC compounds and at improving the recovery and utilisation of scrap.

Waste management

In 1997 approximately 130 million tonnes of waste and waste-like materials were produced in Finland. The degree of usefulness of waste in the whole national economy was 38 – 40 per cent, i.e. around 50 million tonnes. Without the forestry industry's felling waste and the leftover dirt from ground and water construction, which are not in all cases counted as dirt, the waste accumulation was 85 million tonnes. Around 500 kilos of urban waste were collected per year per person, while the respective figure in the EU varies between 300 and 600 kilos. There were 327 operational waste dumps in Finland in 1997. The number of dumps out of operation was 1514.

About 95 per cent of all waste is generated in production, chiefly in industry, agriculture and construction. Industrial waste consists of production, mining, energy and water supply waste. The volume of construction waste is magnified particularly by the large volumes of earth moved during construction. Agricultural waste consists entirely of manure, 90 per cent of which is recycled.

Industrial waste in 1997 amounted to 16 million tonnes, compared to 15.4 million tonnes

23. Finland's waste accumulation in 1997 (thousand tonnes)

	Accumulation	Recycled
Municipal solid waste	2 510	36%
Household waste	980	..
Sewage sludge	136	61%
Hazardous waste	485	..
Industrial waste	18 400	61%
Energy and water supply waste	1 350	65%
Mineral excavation waste	29 600	..
Agricultural waste	25 500	78%
Building and demolition waste	1 690	..

.. = not available.

24. Size of the environment industry in Finland by activity 1998

	FIM million	Per cent
Manufacturing, energy supply	8 381	40.3
Water supply, waste-water management	4 303	20.8
Waste management	2 103	10.2
Central government	1 586	7.7
Wholesale of waste and scrap	1 307	6.3
Recycling	239	1.1
Other activities	2 798	13.6
Total	**20 717**	**100.0**

in 1992. These figures include not only solid waste but also waste waters, emulsions and sludge. The biggest producers of waste are the pulp and paper industry, the mechanical forest industry and the metallurgical and chemical industries. More than one-third of industrial waste consists of waste wood and bark from the pulp and paper industry, although this is nowadays increasingly utilised in manufacturing processes and in energy production. In 1997, 64 per cent of industrial waste was utilised; or 4.5 million tonnes of industrial waste were re-used as material input, 5.4 million tonnes were used in energy generation, and 4.1 million tonnes of industrial waste were taken to landfill sites.

In an attempt to improve and intensify waste recycling, Finland has adopted the principle of producer responsibility, which says that the manufacturer or the importer is to take an active role in organising the eventual disposal and treatment of the waste products. The principle has already been applied to used car tyres, waste paper and packaging materials. During Finland's presidency of the EU, Member States reached agreement on the application of the producer responsibility principle to the disposal of scrap vehicles. The directive proposal was endorsed by the EU Parliament and Council of Ministers in July 2000. According to the new directive car manufacturers will be required to cover all or a substantial part of the costs incurred from the recovery of scrap vehicles so that as from the beginning of 2001, manufacturers will be responsible for new vehicles sold from that date onwards. In practice, the costs are included in the prices of the new cars. As from the beginning of 2007, manufacturers will also have responsibility for vehicles that came onto the market before 2001.

5 Energy supplies

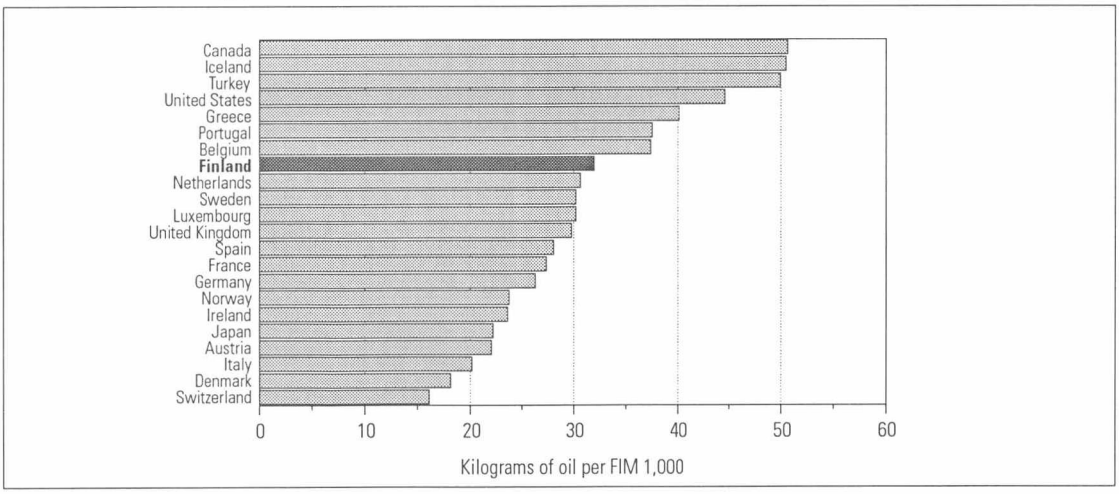
Energy production

Finland's energy consumption in 2000 totalled 30.8 Mtoe. Oil accounted for 28 per cent of energy consumption, coal for 11 per cent, natural gas for 11 per cent, nuclear power for 18 per cent and peat for 5 per cent. The share of domestic energy sources was 29 per cent and 20 per cent originated from wood. Finland has a high level of per capita energy consumption, which is due to its northern location and continuous need for heating in the winter, the dominant role of heavy industry in its economic structure and long distances in what is a sparsely populated country. Finland's energy consumption in proportion to GDP has been on the decline since 1993. The Finnish electricity markets were opened to competition for small consumers in 1998.

Electricity consumption amounted to 79.1 billion TWh in 2000, up by 1.7 per cent on the figure one year previously. Nuclear power was used to generate 22 TWh of electricity (27 per cent of total electricity consumption), hydroelectric power accounted for 14.4 TWh (18 per cent). Close on one-third or 31 per cent of the electricity was generated in combined heat and power production. Net imports of electricity amounted to 15 per cent or 11.9 TWh. Industry and construction accounted for 54.9 per cent of the electricity demand or 43.4 billion TWh, households and agriculture for 24 per cent and services and the public sector for 17.4 per cent. Household and agriculture electricity consumption fell 1.7 per cent from the previous year.

According to Finland's climate strategy Finland's electricity consumption in 2010 would be about 90 TWh without additional measures. However, with proper savings and management processes, as prescribed by the climate strategy, electricity consumption can be reduced by a few terawatt-hours by 2010. Even with such savings measures electricity consumption will continue to grow slowly and amount to over 90 TWh in 2015. Electricity consumption will increase in industry, in households and services. Industry consumption will be higher especially due to higher production volumes in the forest industry. In households, smaller families, a

Figure 19. Total energy consumption in selected countries by GDP unit 1998



25. Total energy consumption 2000

	Petajoules (PJ)	%
Industry	507	50
Heating	211	21
Transport	168	17
Others	119	12
Total	**1 005**	**100**

greater use of home appliances and an increasingly sparse population density contribute to a higher consumption.

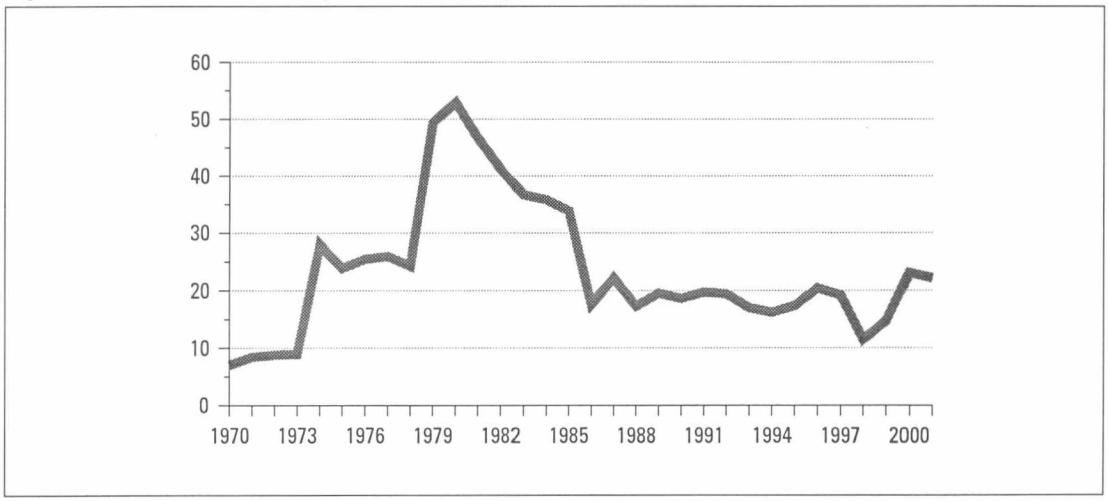
Use of fossil fuels

Much of the environmental damage caused by energy production is due to the use of fossil fuels. The adverse environmental impacts resulting from the accelerating use of fossil fuels are considerable, and in many places they are by now seriously jeopardising the renewal and tolerance of the natural environment. In the light of what we know today there is no threat of fossil energy resources being depleted over the next few decades. Given the known fossil fuel reserves, it is estimated that the world's oil resources will last for the next 40 years, those of natural gas for 55 years and those of coal for 200 years.

In recent years the world market prices have been rising as a result of a declining supply and rising demand. The Organisation of Oil Producing Countries (OPEC) has cut back production in order to raise prices. In the late 1990s the supply still greatly exceeded demand and in 1998 the real price of crude oil fell, being at its lowest below USD 10 a barrel. The last time the price was this low was in 1973 ahead of the first oil crisis. In 1999 world production of oil totalled 3.45 billion tonnes.

Oil consumption in Finland peaked in the 1970s at between 10 and 12 million tonnes a year. Consumption figures declined sharply in the 1980s and during the 1990s annual consumption of oil dropped to less than nine million tonnes. The consumption of petrol and lubricants fell by four per cent in 2000, whereas the use of other oil products increased.

Figure 20. Trend in real world price of oil (USD per barrel)



26. 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	8.7	5.7	3.9
1999	8.7	5.6	3.8
2000*)	8.3	5.8	4.0

– = not in use. *) = preliminary data.

Greenhouse gases

One of the most serious environmental problems caused by fossil fuel use is the development of so-called greenhouse gases and the warming of the atmosphere. An agreement on reducing greenhouse gas emissions was reached in Kyoto, Japan, in December 1997, while the EU Member States' Environment Ministers reached agreement on an internal division of burdens in Luxembourg in June 1998. At the Luxembourg meeting Finland committed itself to reducing its greenhouse gas emissions to the 1990 level by 2008–2012. The Kyoto Protocol identifies emission target levels for six gases: carbon dioxide, methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbon (HFC), perfluorocarbon (PFC) and sulphur hexafluoride (SF_6). At unit level the greenhouse effects resulting from other gases are much greater than those from carbon dioxide: for instance, the effects of methane are 20 times greater, those of nitrous oxide over 300 times greater and those of the three other gases 1,000 times greater.

In 2000 the carbon dioxide emissions from Finland's energy production totalled 54 million tonnes, or nearly three million tonnes less than one year previously The decrease was due to reductions in the use of oil and peat, which in turn was partly the result of higher oil prices. Carbon dioxide emissions attained the 1990 level already in 1999, the former year being the Kyoto benchmark year and Finland's goal for 2008–2012. Measures to reduce greenhouse gas emissions have been delineated in a national climate strategy report submitted to Parliament in March 2001. According to the national climate strategy, Finland's greenhouse gas emissions will grow from approximately 77.1 million carbon dioxide equivalent tonnes in the benchmark year 1990 by 20 percent to approximately 90 million

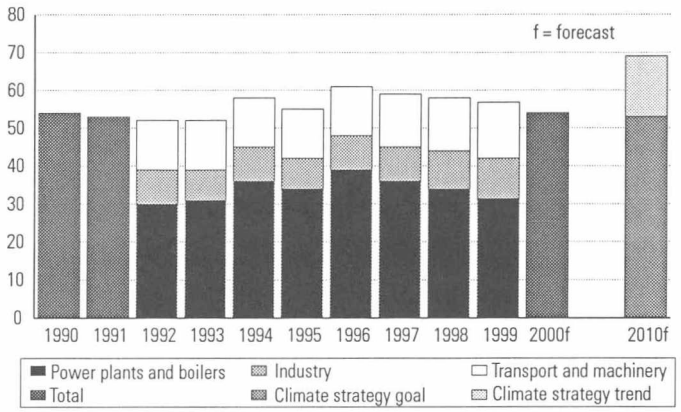
27. Greenhouse gas emissions in the EU countries (million equivalent tonnes of carbon dioxide) and division of burdens by 2008–2012

	Emissions 1998 million tonnes	Change in 1990–99	Target for division of burdens 2008–2012
Luxembourg	6	– 43%	– 28%
Germany	1 022	– 19%	– 21%
Denmark	76	– 5%	– 21%
Austria	80	+ 3%	– 13%
Belgium	145	+ 3%	– 7.5%
Netherlands	230	+ 6%	– 6%
UK	663	– 14%	– 12.5%
Italy	540	+ 4%	– 6.5%
France	551	0%	0%
Finland	**76**	**– 1%**	**0%**
Sweden	71	+ 2%	+ 4%
Ireland	64	+ 22%	+ 13%
Spain	370	+ 23%	+ 15%
Greece	120	+ 17%	+ 25%
Portugal	74	+ 22%	+ 27%
Total	**4 046**	**– 4%**	**– 8%**

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

	1990	1995	1996	1997	1998	1999
Carbon dioxide (CO_2)	62.4	62.6	68.1	66.9	64.5	64.2
Methane (CH_4)	6.1	4.6	4.5	4.3	4.1	3.9
Nitrous oxide (N_2O)	8.4	7.8	7.8	8.1	7.9	7.7
Others (SF_6, HFC_5, PFC_5)	0.1	0.0	0.1	0.2	0.3	0.4
Total	**77.1**	**75.2**	**80.5**	**79.4**	**76.8**	**76.2**

Figure 21. Carbon dioxide emissions from fossil fuels and peat (million tonnes)



tonnes in 2010, unless no further emissions reducing measures than those already agreed upon are taken. The biggest challenge is growth in electricity consumption.

Air pollution and acid deposition

Acidification affects the soil and water in those areas of Finland that are the most sensitive and that receive the biggest load. The major sources of acid deposition are emissions of sulphur dioxide and oxides of nitrogen, largely from long-range transport and somewhat less from energy production and transport. In 2000 Finland's sulphur dioxide emissions totalled 84,600 tonnes, 86 per cent less than in 1980. This reduction is the result of changes in the structure of energy production, a decrease in the use of heavy fuel oil, a fall in the sulphur content of fuel as well as improvements in process technology. Finland's sulphur dioxide emissions in proportion to GDP are about one-third smaller than is the average figure for the European OECD countries. Electricity and heat generation account for 28 per cent of the emissions, industry for 37 per cent. Some 17 per cent of the sulphur dioxide deposition occurring in Finland comes from domestic sources, while 54 per cent of its own emissions are deposited outside the country's borders. Finland reached the targets set down for 2000 in the second sulphur protocol signed in Oslo as early as 1994.

In 2000 Finland's total emissions of oxides of nitrogen were around 237,000 tonnes, over 19 per cent less than in 1980. Close on

29. Origin of acid deposition in Finland 1998 (per cent)

	Sulphur	Nitrogen
Finland	17	29
Western Europe	13	23
Russia	29	9
Baltic states	7	4
Other Eastern Europe	17	7
Others (background deposition)	16	27
Total	**100**	**100**

30. Long-range transport of Finnish emissions in 1998 (per cent)

	Sulphur	Nitrogen
Finland	46	25
Western Europe	9	7
Russia	16	14
Baltic states	3	2
Other Eastern Europe	1	2
Others (background deposition and seas)	25	49
Total	**100**	**100**

two-thirds or 64 per cent of these emissions were caused by traffic, while energy generation accounted for 25 per cent. Measured against the country's GDP, these emissions are comparatively high in Finland, about 70 per cent higher than in European OECD countries on average. In 1998, 29 per cent of the deposition of oxides of nitrogen came from domestic sources, while 75 per cent of Finnish emissions drift across the borders and are deposited in other countries. Finland has achieved the targets set out in the Sofia Protocol, according to which emissions were to be halted at the 1987 level by 1994. The European Union is currently negotiating a directive on the reduction of emissions from large-scale combustion plants. The directive takes account of the BAT requirements and imposes new threshold values for new gas turbines.

Acid deposition has caused damage to a number of fish populations in Finland, and evidence of damage has been observed in some 2000 lakes in southern and central Finland. There have, however, been some signs of lakes' recovery during the past few years as a result of reduced airborne loads. The sulphate concentrations in the lakes of southern and central Finland are on the decrease and their resistance to acidification has improved significantly during the past ten years. In spite of these favourable trends critical loads were still being exceeded in certain parts of Finland in 2000. Improvements have also been recorded elsewhere in Europe, where acid deposition has decreased by 30–40 per cent since the 1980s. The recovery process in North America has been slower, and the situation there is similar to that experienced in Scandinavia in the 1980s.

In the 1970s and 1980s groundwater pH values showed a slight tendency to decrease in many places around Finland. At the same time the buffer capacity of well water has been reduced. At least in the near future groundwater acidification cannot be expected to pose any major threat to the wellbeing of the country's forests. The situation may well change in the long term unless deposition levels can be reduced below the critical loads in the whole country

Atmospheric ozone

Along with climate change and acidification, one of the main global threats to the environment is presented by ozone depletion in the upper atmosphere and the formation of ozone in the lower atmosphere. Causing increased ultraviolet radiation that is detrimen-

Figure 22. Finland's sulphur emissions and reduction targets (thousand tonnes of sulphur dioxide)

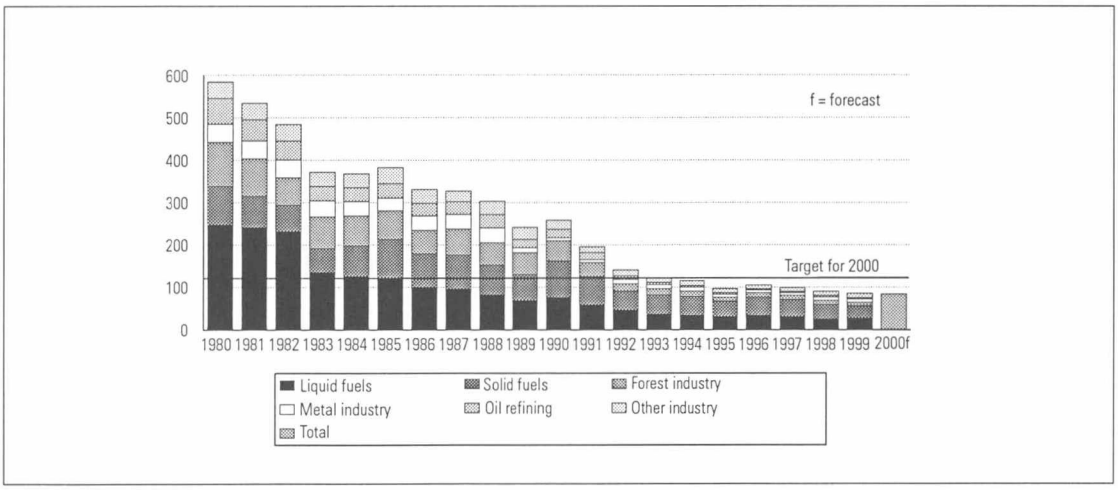
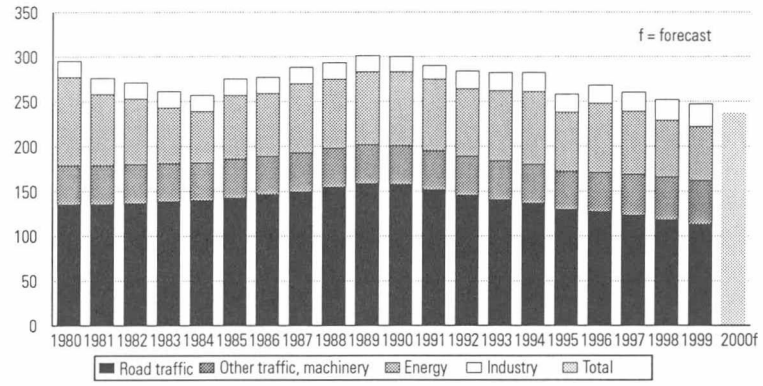


Figure 23. Finland's nitrogen oxides emissions (thousand tonnes)



NB.
Emission calculation methods have changed and therefore the figures for 1992 - 1999 cannot directly be compared with earlier data.

tal to humans as well as to the flora and fauna, ozone depletion in the upper atmosphere is expected to gain momentum during the early years of the new millennium, especially over northern regions. In spring 2000 the situation in the northern polar region was much worse than during the two previous years. According to measurements by the Meteorological Institute ozone depletion above Finland reached 35 per cent and locally as much as 60 per cent in March 2000. This, according to the Meteorological Institute, was due to the cold conditions in the stratosphere which favour the same kind of ozone depletion chemistry seen over Antarctica.

Finland currently has stricter legislation than many other EU countries to restrict the use of substances that contribute to ozone depletion. In 1998 the EU Council of Environment Ministers took a decision to further tighten restrictions on the manufacture and use of ozone-depleting substances. For instance, additional restrictions were imposed on methyl bromide and HFCF compounds. The use of methyl bromide will be phased out in the European Union by 2005, and the production of HCFC compounds will be frozen at the current level by 2008 and discontinued by the end of 2025. As a result of this decision the EU exceeds almost all the requirements set out in the Montreal Protocol.

The high ozone contents in the lower atmosphere have adverse effects on vegetation and human health. Ozone is formed in the reaction of certain emissions from transport and industry, such as nitrogen oxides and carbon monoxide, with particles in the atmosphere. Experts believe that nitrogen oxide and volatile hydrocarbon emissions from road traffic are the main culprits behind ozone build-up in Western Europe today. In Finland the volume of nitrogen oxides in particular is crucially important to ozone formation. The formation of ozone is by nature a non-linear process and largely depends on the meteorological conditions and background concentrations in the north hemisphere. For this reason it is not always easy to establish clear links of causation between emissions and concentrations.

It is estimated that during the growing season of crops, critical ozone exposure times are exceeded almost every year in Finland. Critical exposure levels for forests are exceeded in southern and central Finland, es-

pecially during hot, sunny summers. The health threshold identified in the EU ozone directive is repeatedly exceeded every year over large areas of Finland. The only way that the ozone content in the lower atmosphere can be significantly reduced is through a marked reduction in emissions of nitrogen oxides and volatile hydrocarbons throughout the northern hemisphere.

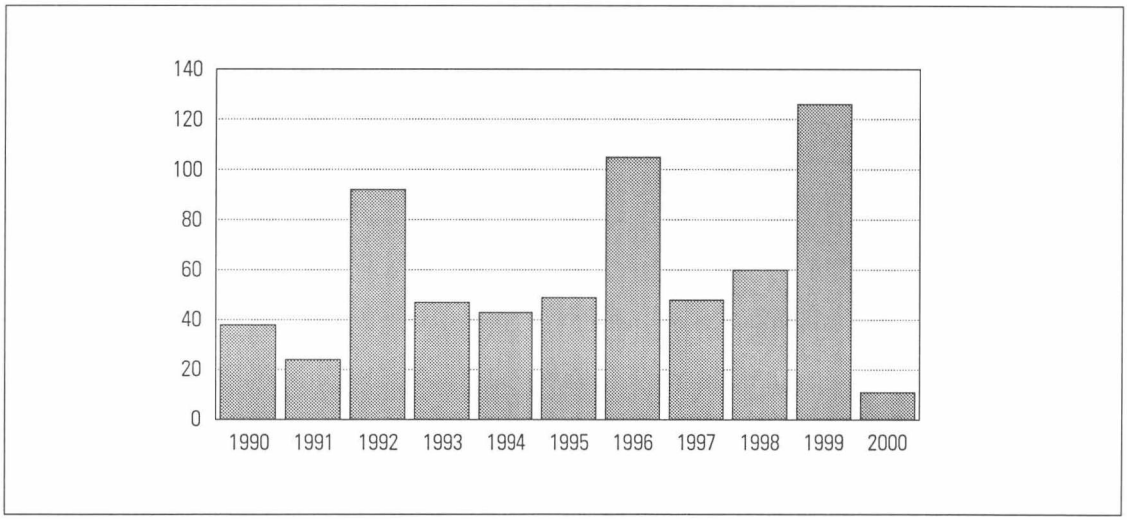
Sustainable energy supply

The promotion of renewable energy sources and increased efficiency in energy use are key conditions for sustainable development. The European Union promotes the use of renewable energy sources, solar energy, wind power, biomass and waste, geothermal energy and small-scale hydroelectric schemes and related trade in equipment and technology through the ALTENER III research programme. The EU's SAVE programmes are aimed at promoting the conservation of energy. ALTENER III was launched in January 2000 as part of a framework energy programme. The budget for ALTENER research programmes in 1998–2002 totals EUR 77 million. The European Commission aims to increase the combined production of electricity and heat and to double the proportion of renewable energy sources from the current level of 6 per cent by 2010.

Between 1998 and 2010, the EU will also be working to promote the introduction of renewable energy sources by a major campaign to boost investments, in which the aim is to build one million solar panel systems capable of generating 1KWh of electricity, 10,000 MW of wind power capacity, 10,000 MW of biomass capacity and 100 model communities relying exclusively on renewable energy. All in all it is estimated that the achievement of the target of 12 per cent by 2010 will require investments totalling around EUR 165 billion.

The commercial utilisation of wind and solar energy began in the 1980s and has since then expanded very rapidly. The costs of generating wind energy have dropped by as much as 30–40 per cent since the early 1990s. In Denmark and the United Kingdom production costs are already less than FIM 0.2/kWh, while in Finland the production costs of wind-powered electricity are approximately FIM 0.25/kWh in the best sta-

Figure 24. Excessive ozone content recorded in the lower atmosphere at certain observation stations (days/year)



tions. The joint body for research centres working on renewable energy under the auspices of the EU expects production costs to fall to the same level as in condensing power plants by 2005. The technology that is needed for the large-scale exploitation of solar energy is already available, although some of it is still at the laboratory stage. For the time being solar energy is only applicable in special locations, such as for the provision of electricity to summer cottages. However, for solar heat, business applications are already becoming available on the market.

The Finnish programme for the promotion of renewable energy sources initiated in 1999 aims to increase the use of renewable energy sources by 50 percent by 2010. The majority or 90 per cent of the increase would come from bioenergy, mainly from wood, four per cent from heat pumps, three per cent from hydropower, and less than 0.5 per cent from solar energy. The target would imply an increase of 5–6 percentage points in the use of renewable energy sources as a proportion of total energy consumption compared to 1995. Biofuels emit less harmful greenhouse gases and sulphur into the air than fossil fuels.

Finland has both the know-how and the wind conditions to be able to achieve a rapid increase in the use of wind energy over the next few years. In 2001 capacity stood at 38 MW. In 2000 Finland produced 76.6 GWh of energy by wind power, which is 0.1 percent of Finland's energy consumption. The goal is that Finland's wind power capacity would reach 500 MW by 2010. The construction of more wind power has been hampered by the low price of electricity.

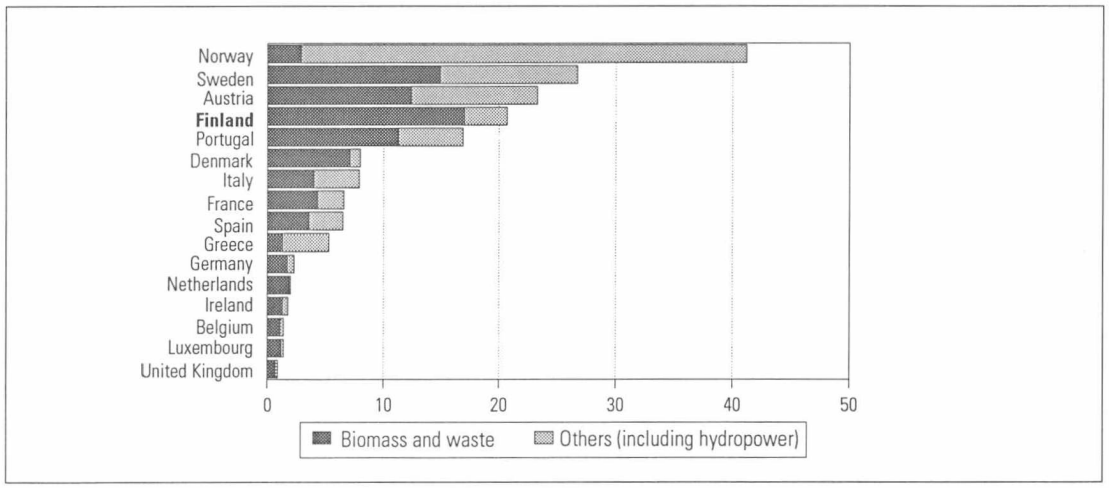
The country also has a high standard of know-how in the field of solar energy. Current applications of solar energy are mainly in the

31. World annual wind energy construction starts in 1990–2004 (MW per year)

1990	200
1991	240
1992	338
1993	480
1994	730
1995	1 290
1996	1 292
1997	1 566
1998	2 597
1999	3 922
2000	4 885
2001*)	5 825
2002*)	6 095
2003*)	7 600
2004*)	9 175

*) = prediction.

Figure 25. Renewable energy sources as a proportion of total energy consumption in 1997 (per cent)



provision of electricity for summer cottages and remote regions. A total of 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 experimental solar power stations have been connected to the electricity network. Electricity companies are also offering consumers the option of purchasing 'green electricity' generated by means of old hydropower, wind and solar energy.

Although Finland's energy supply system relies largely on conventional forms of energy, it is nevertheless highly efficient, particularly on account of the co-generation of heat and electricity. In 2000, 31 per cent of all electricity in the country was generated in combination with heat. Industry accounted for 12 billion TWh of this, community district heating for 13 billion TWh. These co-generating plants generated a total of 21 billion TWh of district heating. All in all the consumption of district heating in 2000 amounted to 26.9 billion TWh. Some 44 per cent of the population live in housing connected to a district heating system: in Helsinki the figure is 93 per cent of the population, in Tampere 71 per cent, in Lahti 90 per cent and in Oulu 81 per cent. The mean price of district heating in 2000 was FIM 0.204 per kWh.

Energy taxes

As well as levying taxes on transport fuel, the Finnish energy taxation system focuses heavily on the end product, i.e. electricity. Electricity tax is divided into a lower and higher bracket. The lower applies to industry and market gardeners using hothouses, the higher tax is applied to households, the service sector, agriculture and the public sector. In contrast to the situation in electricity generation, the tax on fuels used to produce heat is levied according to its carbon content. The tax is FIM 102 per carbon dioxide tonne.

The surtax on carbon dioxide based sources was increased by 24 per cent in 1998, as was also done with the electricity surtax payable by industrial companies and private consumers. The higher electricity taxation has increased support for electricity produced with renewable sources. The tax benefit of wind power was increased from FIM 0.025 to FIM 0.041 per kWh.

A Ministry of Finance working group set up to identify and resolve problems in the existing energy taxation system and to draft the necessary changes in legislation and guidelines completed its report in May 2001. The proposals of the report include changes to the taxation of combined heat and power, the

32. Finland's energy tax revenue for 2000 (FIM million)

	Basic tax	Surtax	Maintenance support fee	Total
Petrol	7 286	572	96	7 954
Diesel	3 229	573	45	3 847
Light fuel oil	267	662	52	981
Heavy fuel oil	–	265	16	281
Coal	–	296	8	304
Peat	–	80	0	80
Natural gas	–	48	2	50
Total	**10 782**	**2 496**	**219**	**13 497**

33. Changes to energy taxes in Finland

	1.1.1997	1.1.1998	1.9.1998
Petrol (p/litre)	308.3	328.3	328.3
Diesel (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/tonne)	169.0	198.6	246.0
Peat (FIM//MWh)	4.2	4.9	9.0
Natural gas (p/m^3)	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

progressive electricity tax system and various definitions. The report also points out that European Commission approval on energy taxation related matters has usually taken too long and the necessary permits have only been temporary. For energy taxation to fulfil the requirements of clarity, legality and predictability, it should be known what kinds of subsidy systems the Commission approves of when formulating energy taxation legislation. In practice, a decision, on the national level, on the intended subsidy measures should be available in good time so that the necessary support can be sought from the Commission and that the decision would be made before the content of national legislation is finally decided.

6 Transport

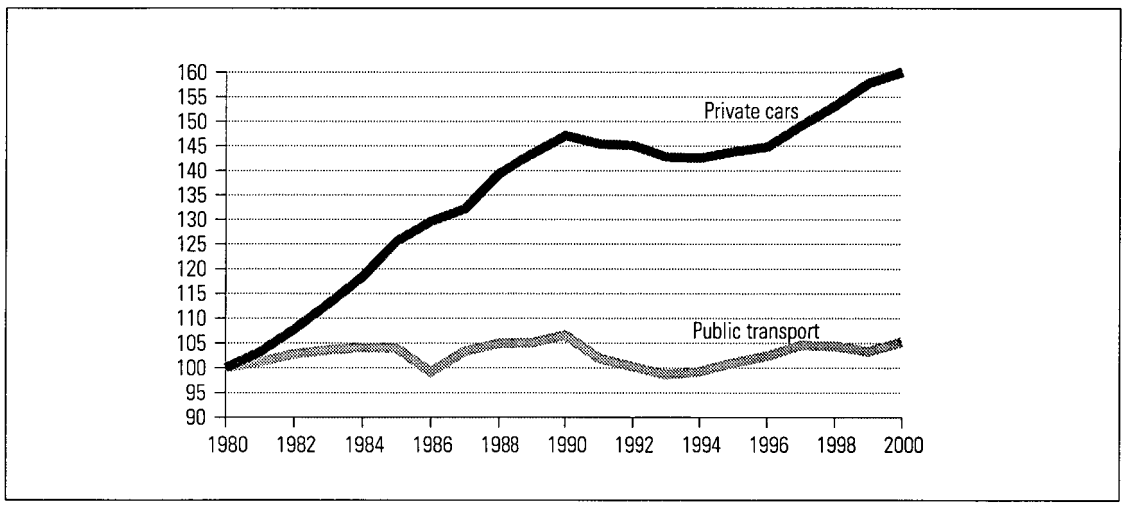
Trends in traffic volumes

The annual distance travelled per head of population in Finland is one of the highest in the European Union: on average Finnish people travel 14,500 km a year, while the average for the EU countries is around 13,000 km. In 1989-1999 the daily distance travelled in Finland was around 45 km compared to no more than 10 km in 1980. The number of trips has remained unchanged since the 1970s: every day people make around three trips within Finland.

The growth of transport is seen most clearly in road traffic. In 2000, Finland's road traffic continued to increase. The number of cars on the main roads increased by 2.3 per cent and the distance travelled by 1.5 per cent. The total distance travelled by road traffic in 2000 was 46.7 million kilometres, of which private cars accounted for about two-thirds or 38.5 million kilometres. In 2000, the railways' passenger traffic increased by about three per cent and the number of passengers at Finnish airports increased by 5.5 per cent. Water transport was 16 million passengers in 2000, the same as in the previous year.

Most of Finland's exports and imports are conveyed by sea. In 2000, imports and exports by sea increased from the previous year's 77.5 million tonnes to 80.6 million tonnes. The domestic road transport's freight increased by over one per cent from 411.0 to 415.5 million tonnes in 2000. Measured in tonne-kilometres, road transport's freight increased by 3.9 per cent. More freight is transported in Finland per capita and per GDP unit than anywhere else in Europe. The annual tonne-kilometre figure for Finland is 7,200, whereas the corresponding figure for the EU countries is 4,200. Sparse population and a long distance from the markets increase goods transport. However, Finland's population density has hardly any effect on passenger traffic. It is predicted that by 2010, passenger traffic will increase by 15 per cent and freight transport by 27 per cent.

Figure 26. Trends in the use of public transport and private cars (1980=100)



Environmental impact

Transport has the following environmental effects:

- greenhouse gas emissions,
- other exhaust gas emissions detrimental to the environment or human health: oxides of nitrogen, sulphur dioxide, hydrocarbons, carbon monoxide and particles,
- noise,
- impacts on waterways, the soil, natural resources and biodiversity,
- impacts on the social environment.

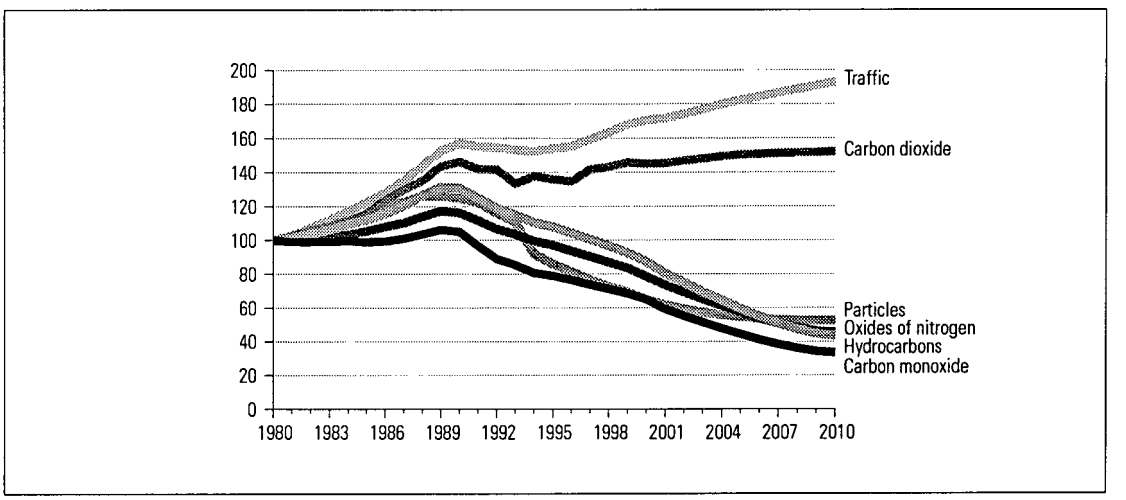
Considerable efforts have been invested in reducing the adverse environmental impacts of transport. The Government's transport-related sustainable development obligations are defined in the Ministry of Transport and Communications environment programme revised in September 1999. This programme lays the foundation for the environment system within the Ministry's administrative sector. The environmental system closely integrates environmental issues with the planning, development, implementation and follow-up of the transport sector's operations. Institutes and corporations under the Ministry of Transport and Communications will complement this umbrella programme with their own programmes and environment systems. The new environmental programme's follow-up report came out in the summer of 2000, providing evidence for the first time of target attainment in the light of selected environment indicators. Annual follow-up has been continued also in 2001, when an independent evaluation of the viability of the environmental system was completed. The integration of transport and environment has been continued also on the EU level by strategic planning as well as moulding the TERM-indicators to better support the programme level goals and procedures.

Road vehicle emission limits were tightened quite considerably in the 1990s, which led to the introduction of new, cleaner fuel qualities as well as vehicles equipped with catalytic converters or improved engines. New, stricter EU fuel quality requirements will be phased in during 2000 and 2005. Indeed,

34. Traffic emissions as a percentage of total emissions in Finland in 2000 (per cent)

Carbon dioxide	24
Oxides of nitrogen	61
Hydrocarbons	30
Carbon monoxide	53
Sulphur dioxide	20

Figure 27. Trends in emissions from road traffic (1980=100)



lead and sulphur emissions from petrol engines and sulphur emissions from diesel engines have been almost entirely eliminated through fuel changes. The introduction of catalytic converters has in turn reduced emissions of nitrogen oxides, hydrocarbons, carbon monoxide and particles. Vehicles equipped with catalytic converters accounted for almost 50 per cent of total passenger traffic. It is expected that all petrol cars will be fitted with catalytic converters by 2010.

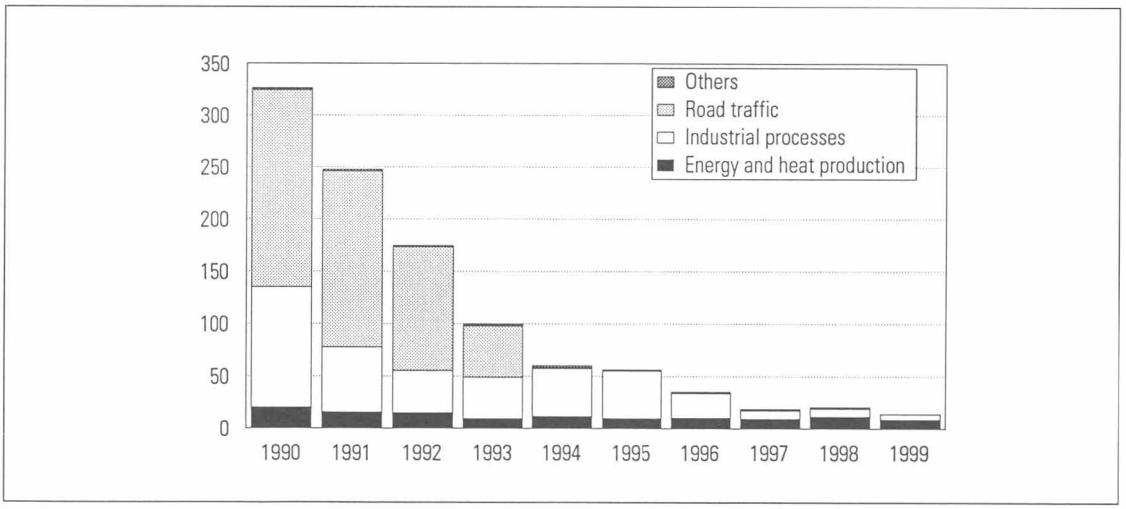
Emission limits will be further tightened over the next few years. In 2000 Finland adopted a revised emission directive concerning heavy vehicles which brought in a 30 per cent reduction in exhaust gas emissions from heavy goods vehicles and buses. In 2006, emissions from new cars will be further reduced by 30 per cent and particle emissions by 80 per cent. A 40 per cent reduction in oxides of nitrogen emissions will enter into force in 2009. Earlier decisions will see stricter emission limits brought in for passenger cars and light commercial vehicles in 2001 and 2006. The tightening of motorcycle emission limits has been agreed to take effect in 2003 and 2005. In practice, stricter limits mean the introduction of catalytic converters for the largest motorcycles.

However, not all the environmental problems caused by transport can be resolved by means of technology alone. The reduction of carbon dioxide emissions, noise and problems related to land use are broader and more complex issues that are harder to resolve than the more 'traditional' environment problems: a major challenge indeed for transport policy in the 21st century.

The proposal for a national climate strategy presented to Parliament by the Council of State in March 2001, incorporates a wide and diverse range of actions to be implemented in the transport sector. With the help of these it is estimated that the 1990 emission levels may be reached by 2010. The working groups aim both at reducing the transport needs (with the most important plan being to condense and integrate the urban structure) and effecting the modal split. Attention has also been paid to goods transport, international transport, driving habits and solutions provided by information technology.

In the 21st century, special attention should be paid to air quality and noise abatement in urban areas. Improvements in fuel quality and engine technologies mean that air quality norms are nowadays exceeded less often,

Figure 28. Trend in total emissions of lead in Finland (tonnes)



although the limits for particles and oxides of nitrogen are still sometimes exceeded. Another major problem with regard to air quality in urban areas is ozone. Most of the ozone in Finland originates from Central Europe. Ozone has adverse effects on both the flora and human health. The problems of noise from traffic will continue to increase with the ever-increasing number of people and vehicles in cities and towns. In the future urban and community planning will need to play a more prominent role in tackling the noise problem. Attempts will be made to prevent environmental damage caused by transport land usage by developing the assessment of environmental effects (YVA) prior to project planning. In all, over half the realised and pending assessments of environmental effects are targeted at transport projects.

Of environmental impacts caused by road traffic, the salt used on Finnish roads in winter, amounting to 81,500 tonnes in 2000, is a major challenge. The objective is to decrease the use of salt to about 70,000 tonnes by 2003. About half the major groundwater areas have roads that must be salted in winter. In a survey concerning the risks of road salt on the quality of groundwater, the chloride content level was defined for 600 groundwater areas. The results indicate that in 290 areas further examination should be started, the quality of groundwater should be monitored more effectively and salting should be reduced. In addition, the limit set on household water for prevention of corrosion in water pipe materials was exceeded in 131 areas.

Emissions from air traffic are continuing to increase. Air traffic within Europe increased by 40 per cent between 1993 and 1997, air travel to destinations outside the EU area by almost the same amount. It is predicted that over the next few years air traffic in Europe will continue to increase by 6-8 per cent a year, which according to a EU survey will lead to a 3-4 per cent annual increase in carbon dioxide emissions. The growth of air traffic is effectively cancelling out the reductions in emissions achieved through the improved fuel efficiency of modern aircraft engines. A communication by the European Commission in December 1999 aims to encourage greater environmental efforts in the air traffic sector. The measures will be aimed at boosting the environmental efforts within the International Civil Aviation Organization (ICAO) and to establish uniform and comprehensive procedures for the treatment of environmental issues related to air traffic in the Member States.

On the railways, work is continuing to reduce the environmental impact of rail traffic by means of electrification. Railway noise is being reduced by grinding the rails. Shipping is becoming responsible for an increasing proportion of total emissions: for instance, over 95 per cent of all sulphur emissions in the transport sector can be

35. Material flows in road maintenance (thousand tonnes)

	1997	1998	1999	2000
Construction				
Aggregates from outside	6 051	7 703	5 466	3 368
Surfacing materials	1 082	722	..	..
Road network maintenance				
Salt	120	102	103	82
Grit	650	610	560	570
Waste collected	11	10	13	12

.. = data not available.

36. Emissions from transport in 2000 (thousand tonnes)

	Carbon monoxide	Hydrocarbons	Nitrogen dioxide	Sulphur dioxide	Carbon dioxide
Road traffic	250.8	41.0	106.5	0.2	11 075.7
Rail transport	0.6	0.2	3.6	0.2	240.0
Water transport	27.8	10.3	71.7	19.2	3 155.4
Air traffic	3.4	0.5	3.5	0.3	1 141.3
Total	**282.6**	**52.0**	**185.3**	**20.0**	**15 612.4**

traced to this source. In international shipping the sulphur content of fuels must not exceed 4.5 per cent, the limit set for the Baltic Sea is 1.5 per cent.

Transport costs and taxation

The pricing of traffic through various kinds of taxes and fees is an important means of steering consumption in an environmentally friendlier direction. In Finland environmental taxes and fees are applied to road traffic, rail transport and in part to water transport. There are basically three types of road traffic tax, i.e. taxes are levied on acquisition, ownership and use. One way to increase the popularity of new cars with a low fuel consumption might be to introduce tax incentives that would encourage consumers to buy certain types of vehicles. In 2000 more than FIM 7.5 billion was spent on the maintenance and development of transport routes: FIM 3.1 billion on roads and FIM one billion on development projects. Almost FIM 2.4 billion was used on railway maintenance: FIM 1.9 billion on basic maintenance and FIM 486 million on development investments. FIM 954 million was used for the maintenance and development of waterways.

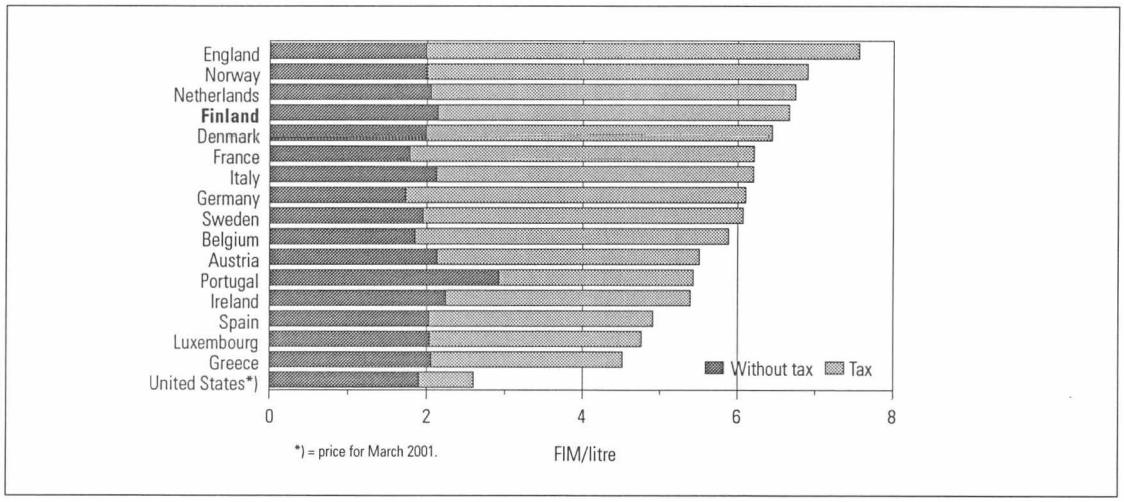
The basis for economic steering in the EU is the marginal social cost charging principle, in which transport expenses dependent on the distance covered are incorporated into transport fees. The various transport taxes and fees are an important tool in directing consumer habits in a more environmentally friendly direction. Taxes targeted at road traffic are the automobile or motorcycle tax levied on acquisition, the annual vehicle license tax and diesel engine vehicle tax and the fuel tax. The fuel tax on road traffic is partly based on environmental effects. Economic steering has also been applied to rail

37. Special taxes levied on road traffic (FIM million)

	1998	1999	2000	2001	2002
	A	A	A	B	BP
Vehicle licence tax	1 198	1 245	1 306	1 345	1 408
Motor vehicle tax	1 042	1 101	1 074	1 190	1 242
Excise duty/VAT on motor vehicle tax	1 157	1 345	1 385	1 166	1 160
Motor vehicle tax	5 259	6 115	6 295	5 300	5 271
Excise duty/VAT on fuel tax	2 537	2 575	2 537	2 506	2 574
Fuel tax	11 534	11 705	11 532	11 390	11 700
Total	**22 727**	**24 086**	**24 129**	**22 897**	**23 355**

A = Final accounts. B = Budget. BP = Budget proposal.

Figure 29. Retail prices of motor fuel (95E) on 15 July 2001 (FIM per litre)



traffic in Finland. The rail fee, renewed in 2000, is based on the marginal social cost charging principle and takes into account the external costs caused by traffic volume.

The tax on fuel is the main source of revenue from the special taxes levied on road traffic: taxes currently make up around 70 per cent of the price of unleaded petrol in Finland. This is the eighth highest proportion in the EU countries after England, Norway, Germany, France, Denmark, the Netherlands, Sweden Belgium and Ireland. The tax on diesel is slightly lower than the average for EU countries. Fuel taxes are graded on environmental grounds. As a result, reformulated, oxygenated petrol and sulphur-free diesel have in practice taken over from older fuel qualities.

7 Towards sustainable development

In Finland the use of State, municipal and industrial financing on environmental protection is nowadays estimated at over FIM 10 billion per year. In financial terms, even more significant are environment-related taxes and payments, amounting to about FIM 24 billion. Active environmental policy, in the form of traditional government intervention and also partly in the form of economic steering, has played a key role in reducing environmental damage in Finland in the past two decades. Now, in the beginning of the new millennium, Finland's environmental policy faces new challenges. Emphasis, in addition to governmental intervention, is now on the provision of environmental information, the establishment of voluntary agreements with companies and the use of environmental standards. Local environmental concerns are now being replaced by those with global repercussions – these include reductions in greenhouse gas emissions and other wastes as well as sustaining biodiversity. The environment will be burdened especially by predicted growth in the use of natural resources, transport and energy. Without farsighted and preventive environmental policy, rapid economic growth in the future may lead, once again, to increases in environmental damage.

The European Council meeting in Gothenburg accepted the EU's strategy for sustainable development. It closely incorporates policies of economic, social as well as ecological sustainability. The strategy represents the Union's contribution to the 10-year follow-up to the UN's Rio process at the World Summit on Sustainable Development (WSSD) in 2002. Furthermore, it is the EU's aim that the Kyoto Protocol shall be ratified and that it shall take effect in 2002. The agreement that was reached in Bonn in July 2001 concerning those issues that were left open at the Kyoto conference was a significant step toward the ratification of the Protocol. The Kyoto Protocol will not come into force until the industrial countries that have ratified it together account for at least 55 per cent of the industrial countries' carbon dioxide emissions levels of 1990. However, the United States' decision not to ratify the protocol has jeopardised the possibility that the Protocol will come into force. According to the policies agreed on by the European Council of the European Union, the most important goals of the EU are: increasing ecoefficiency so that the current over-utilisation of natural and environmental resources will be reversed by 2015, integrating environment and poverty eradication, making globalisation work for sustainable development and enhancing good governance and participation on all levels. The first point also covers the safeguarding and the protection of natural resources and the carrying capacity of eco-systems, which are important for economic and social development. According to these guidelines the EU should take a leading role in these policies.

One of the most important tasks that lies ahead in the near future, both in Finland and internationally, is to draw an overall picture of the state of the environment and the potential threats. It is problematic that due to contradictory development trends in many environmental matters, it is difficult to form a full and clear general picture of the true state of the environment. The follow-up meeting to the Rio Development and Environment Conference in 2002 will be aiming to draw such an overall picture of the results achieved within the framework of sustainable development and the state of the environment. Work is currently under way to develop the tools and methods needed for this analysis. An agreement on the UN's sustainable development indicators should be reached during 2001. Finland was involved in testing these indicators in 1996-1999. In addition, the UN, the World Bank, the OECD and Eurostat, the EU's statistical agency, will be publishing revised guidelines for the calculation of an environmentally adjusted green GDP during 2001.

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

Agreement	Objectives	Implementation
Climate change UN Framework Agreement on Climate Change, Rio de Janeiro, 1992. Kyoto Protocol on Climate Change, 1997.	To stabilise greenhouse gas concentrations in the atmosphere at a safe level. The aim is to reduce greenhouse gas emissions by at least 5 per cent from the 1990 level by 2008–2012. The target varies from country to country. For the EU countries the aim is a reduction of 8 per cent. Finland is to stabilise its emissions at the 1990 level.	The Protocol has been signed by 84 countries and ratified by 34 developing countries. The EU aims for the agreement to come into force in 2002. Finland's emissions were at the 1990 level in 2000. Emissions will increase without new measures, however. Finland's national climate programme, aimed at meeting the emission requirements, was formulated in the spring of 2001.
Substances depleting the ozone layer The Vienna Convention for the Protection of the Ozone Layer, 1985. Montreal Protocol, 1987.	To stop the use of substances causing depletion of the ozone layer in the upper atmosphere.	The production, consumption, use, import and export of substances causing depletion of the ozone layer has been restricted by EU regulation 2037/2000 and by decision of the Council of State (262/1998).
General agreement on long-distance transport of air pollution across national boundaries: ECE. 1979.		
Sulphur emissions Oslo Sulphur Reduction Protocol, 1994.	To ensure in the long run that sulphur deposition does not exceed the critical load for each area. Finland is committed to cutting down its sulphur emissions by 80 per cent from the 1980 level by 2000.	Finland's emissions in 2000 were already 86 per cent lower than in 1980 and they have been further reduced.
Nitrogen oxide emissions Sofia Protocol on the Control of Nitrogen Oxide Emissions and their Transboundary Fluxes, 1988.	Finland has committed itself to freezing its emissions of oxides of nitrogen to the 1987 level by the end of 1994.	Finland's emissions have decreased approximately 19 per cent from the 1980 level. The renewal of the fleet of cars continues to reduce emissions.
Heavy metals Århus Protocol, 1998.	To reduce emissions of mercury, cadmium and lead into the atmosphere below the 1990 level.	The Protocol has not yet entered into force. It has been signed by 26 countries and ratified by nine, Finland included.
Non-degradable organic compounds (POP) Århus Protocol, 1998.	To restrict or discontinue the use of non-degradable organic compounds (for example pesticides).	The Protocol has not yet entered into force. It has been signed by 26 countries and ratified by six.
Gothenburg Protocol to abate acidification, eutrophication and ground-level ozone, 1999.	To cut emissions of sulphur dioxide, nitrogen oxides, volatile organic compounds (VOC) and ammonia for 2010. Finland's emission ceilings as from 2009 are 116,000 tonnes of sulphur, 170,000 tonnes of nitrogen oxide, 130,000 tonnes of VOC and 31,000 tonnes of ammonia.	The Protocol has not yet entered into force. It has been signed by 31 countries. Finland signed the protocol in December 1999.
Biological diversity Agreement on Biological Diversity, 1992.	To protect the diversity of global ecosystems, animal and plant species and their genes, to establish a pattern for their sustainable use and to achieve an equitable division of the benefits gained from the use of biological natural resources.	The safety of importing genetically modified organisms in terms of both biological diversity and human health. The first follow-up report of the Finnish national action programme on biological diversity was completed in 2000.

Agreement	Objectives	Implementation
Cartagena Biosafety Protocol, 2000.		The Cartagena Protocol has not yet entered into force. It has been signed by 104 countries, Finland included, and ratified by three.
Protection of the Baltic Sea Helcom Recommendations and Ministerial Statements, 1988 and 1998.	To prevent and stop the pollution of the Baltic Sea and promote its ecological recovery and balance.	The targets will be implemented through the "Aims of Waterway Protection 2005" programme accepted by the Council of State and the "Plan of operation for waterway protection until 2005" programme accepted by the Ministry of the Environment and through EU regulations. Will be implemented through national permits and bilateral and multilateral co-operation, especially in the neighbouring areas. The new Agreement took effect on 17.01.2000.
Baltic Environmental Programme, 1992.	To eliminate the Baltic Sea's worst local point sources and nonpoint source inputs.	
Helsinki Agreement on the protection of marine environment of the Baltic Sea, 1992.	To reduce emissions of nutrients, heavy metals and non-degradable substances into the Baltic Sea by 50 per cent from the 1987 level by 2005.	
Hazardous waste Basel Agreement on the Transboundary Transport of Hazardous Waste and Supervision of its Handling, 1989. Protocol on liability and compensation for damage, 1999.	Environmental viewpoints to be considered in transboundary transport of hazardous waste. The production of waste to be limited and attempts made to utilise and process waste as close as possible to its place of origin.	The protocol on liability and compensation for damage was signed in December 2000. All EU countries abide by the export prohibition of hazardous waste from industrial countries to developing countries.
Persistent organic pollutants Stockholm Agreement on persistent organic pollutants (POPs), 2000.	To halt production and use of ten pesticides and industrial chemicals.	The Agreement was signed by 23 countries in May 2001.
Trade in hazardous chemicals Rotterdam Agreement on Prior Consent for Certain Chemical Substances and Dangerous Pesticides in International Trade (PIC), 1998.	According to the Agreement, the export of five dangerous chemicals and 22 pesticides is allowed only with the prior consent of the importing state. The importing state may also refuse to accept the chemicals.	The Agreement has not yet entered into force, but the PIC system is adhered to on a voluntary basis. The Agreement has been signed by 80 countries, and ratified by 14.
Flora and Fauna General Agreement (CITES) and Protocols on international trade of flora and fauna, 1973.	To regulate the international trade of endangered species and their products.	The Agreement will be implemented through corresponding EU regulations.
Access to information and participation ECE Århus Convention on Access to Information, Public Participation in Decisionmaking and Access to Justice in Environmental Matters, 1998.	To guarantee the public participation and supply of information concerning environmental matters, as well as the right of appeal and the right to the institution of proceedings.	The Convention has not yet entered into force. It has been signed by 40 countries, and ratified by 11. The ratification preparations are in motion in Finland. Finnish legislation mostly fulfils the requirements of the Convention.
Environmental impact as-sessment ECE Espoo Convention on Environmental Impact Assessment in a Transboundary Context, 1991.	To assess the environmental effects, as well as prevent and limit the harm caused by projects that cause significant transboundary environmental damage, before making decisions related to them.	The Espoo Convention came into force in 1997. At the beginning of 2001, it had been ratified by 35 countries and the EU. Finland has applied the Convention to seven projects and has twice been the recipient.

Statistical appendix

1. World´s carbon dioxide emissions from fossil fuels (millions of tonnes)

	Total	Industrialised countries	Developing countries	Other countries
1900	1 942	..	..	..
1901	1 999	..	..	..
1902	2 046	..	..	..
1903	2 244	..	..	..
1904	2 270	..	..	..
1905	2 392	..	..	..
1906	2 575	..	..	..
1907	2 853	..	..	..
1908	2 725	..	..	..
1909	2 845	..	..	..
1910	2 978	..	..	..
1911	3 041	..	..	..
1912	3 205	..	..	..
1913	3 437	..	..	..
1914	3 102	..	..	..
1915	3 074	..	..	..
1916	3 311	..	..	..
1917	3 498	..	..	..
1918	3 448	..	..	..
1919	3 067	..	..	..
1920	3 548	..	..	..
1921	3 064	..	..	..
1922	3 295	..	..	..
1923	3 720	..	..	..
1924	3 694	..	..	..
1925	3 724	..	..	..
1926	3 722	..	..	..
1927	4 061	..	..	..
1928	4 033	..	..	..
1929	4 336	..	..	..
1930	3 987	..	..	..
1931	3 582	..	..	..
1932	3 233	..	..	..
1933	3 400	..	..	..
1934	3 687	..	..	..
1935	3 817	..	..	..
1936	4 242	..	..	..
1937	4 537	..	..	..
1938	4 297	..	..	..
1939	4 562	..	..	..
1940	4 811	..	..	..
1941	4 947	..	..	..
1942	4 937	..	..	..
1943	5 047	..	..	..
1944	5 003	..	..	..
1945	4 453	..	..	..
1946	4 701	..	..	..
1947	5 260	..	..	..
1948	5 615	..	..	..
1949	5 438	..	..	..
1950	5 953	4 344	522	1 088
1951	6 457	4 621	599	1 236
1952	6 553	4 573	655	1 325
1953	6 708	4 658	670	1 380
1954	6 778	4 621	747	1 410
1955	7 433	5 002	851	1 580
1956	7 929	5 276	925	1 728
1957	8 251	5 295	1 006	1 950
1958	8 458	5 150	1 302	2 005
1959	8 924	5 269	1 547	2 109
1960	9 324	5 532	1 661	2 131
1961	9 368	5 654	1 476	2 239
1962	9 738	5 913	1 432	2 394
1963	10 268	6 275	1 480	2 512
1964	10 848	6 545	1 565	2 738
1965	11 352	6 767	1 709	2 875
1966	11 921	7 030	1 835	3 056
1967	12 336	7 289	1 835	3 212
1968	12 954	7 681	2 002	3 271
1969	13 746	8 140	2 239	3 367
1970	14 748	8 384	2 531	3 833
1971	15 329	8 495	2 797	4 037
1972	15 932	8 839	2 938	4 155
1973	16 791	9 276	3 164	4 351
1974	16 817	9 006	3 256	4 555
1975	16 717	8 662	3 445	4 610
1976	17 675	9 195	3 715	4 766
1977	18 167	9 176	4 000	4 991
1978	18 315	9 343	4 285	4 688
1979	19 347	9 590	4 481	5 276
1980	19 088	9 331	4 433	5 324
1981	18 441	9 054	4 447	4 940
1982	18 304	8 673	4 669	4 962
1983	18 252	8 610	4 832	4 810
1984	18 863	8 839	5 054	4 969
1985	19 503	8 973	5 376	5 154
1986	20 176	9 017	5 624	5 535
1987	20 628	9 143	5 894	5 591
1988	21 419	9 431	6 238	5 750
1989	21 800	9 587	6 479	5 735
1990	22 000	9 542	6 704	5 754
1991	22 278	9 472	7 485	5 321
1992	21 934	9 483	7 374	5 076
1993	21 815	9 557	7 674	4 584
1994	22 326	9 694	8 192	4 440
1995	22 984	9 824	8 614	4 547
1996	23 369	10 201	8 980	4 188
1997	23 658	10 305	9 339	4 015
1998	23 610	10 316	9 350	3 944
1999	24 106	10 563	9 670	3 873
2000*)	24 604	10 811	9 991	3 802
2001*)	25 101	11 059	10 311	3 731
2002*)	25 599	11 307	10 632	3 660
2003*)	26 096	11 555	10 952	3 589
2004*)	26 592	11 802	11 272	3 518
2005*)	27 090	12 050	11 593	3 447
2006*)	27 586	12 298	11 913	3 375
2007*)	27 586	12 546	12 234	3 304
2008*)	28 084	12 793	12 554	3 233
2009*)	29 078	13 041	12 875	3 162
2010*)	29 575	13 289	13 195	3 091
2011*)	30 228	13 390	13 675	3 163
2012*)	30 881	13 491	14 154	3 236
2013*)	31 534	13 592	14 634	3 308
2014*)	32 186	13 693	15 113	3 380
2015*)	32 840	13 794	15 593	3 453
2016*)	33 491	13 894	16 072	3 525
2017*)	34 144	13 995	16 552	3 597
2018*)	34 796	14 096	17 031	3 669
2019*)	35 450	14 197	17 511	3 742
2020*)	36 102	14 298	17 990	3 814

.. = data not available. *) = forecast.
Source : Worldwatch Institute (1900–1999) and OED/World Energy Outlook 2000 (2000–2020).

2. Environmental sustainability index (ESI) of certain countries in 2001

Finland	**80.5**	Japan	60.6	Egypt	46.5
Norway	78.2	Lithuania	60.3	Turkey	46.3
Canada	78.1	Slovenia	59.9	Mexico	45.3
Sweden	77.1	Spain	59.5	Albania	44.2
Switzerland	74.6	Costa Rica	58.8	Belgium	44.1
New Zealand	71.3	Estonia	57.7	Romania	44.1
Australia	70.7	Brazil	57.4	Kenya	43.9
Austria	67.8	Czech Republic	57.2	Indonesia	42.6
Iceland	67.3	Bolivia	56.9	Uzbekistan	41.6
Denmark	67.0	Chile	56.6	Kazakhstan	41.6
United States	66.1	Latvia	56.3	India	40.9
The Netherlands	66.0	Russia	56.2	South Korea	40.3
France	65.8	Italy	54.3	Macedonia	39.2
Uruguay	64.8	Greece	53.1	Algeria	38.9
United Kingdom	64.1	Zimbabwe	52.0	Iran	38.4
Germany	64.2	South Africa	51.3	Sudan	37.7
Ireland	64.0	Malaysia	49.7	China	37.6
Slovak Republic	63.2	Israel	49.5	Ukraine	36.8
Argentina	62.5	Belarus	48.0	Nigeria	31.8
Portugal	61.4	Poland	47.6	Ethiopia	31.2
Hungary	61.0	Bulgaria	47.5	Saudi Arabia	29.8
				Haiti	24.7

Source: World Economic Forum. An Initiative of the Global Leaders of Tomorrow Environment Task Force. 2001 Environmental Sustainability Index. Davos, Switzerland. January 2001. p. 12.

3. Trends in real GDP and consumption of energy and materials in Finland

	GDP at 1995 prices, FIM billion	Consumption of materials, millions of tonnes	Total consumption of energy, (Mtoe 1,000)
1980	430.1	163.0	22 606
1981	439.3	157.7	22 404
1982	453.0	163.6	22 005
1983	465.5	179.0	22 463
1984	481.4	180.6	23 369
1985	496.3	187.8	24 946
1986	508.7	183.0	24 748
1987	530.1	194.3	26 218
1988	555.2	194.4	26 517
1989	583.8	203.2	26 679
1990	584.0	196.7	27 220
1991	547.4	176.5	26 775
1992	529.2	173.6	26 436
1993	523.2	167.4	27 149
1994	543.8	180.1	29 014
1995	564.6	178.2	28 478
1996	587.2	176.7	29 766
1997	624.1	185.9	30 587
1998	657.4	193.6	31 056
1999	684.8	199.0	31 288
2000	722.0	200.5	30 778

Source: Statistics Finland, National accounts and Studies 229; Ministry of Trade and Industry: Energy Reviews.

4. Trends in real GDP and atmospheric emissions in Finland

	GDP at 1995 prices, FIM billion	Carbon dioxide emissions, millions of tonnes	Sulphur dioxide emissions, thousands of tonnes	Emissions of oxides of nitrogen, thousands of tonnes
1980	430.1	54	584	295
1981	439.3	45	534	276
1982	453.0	43	484	271
1983	465.5	43	372	262
1984	481.4	44	368	258
1985	496.5	50	383	275
1986	508.7	49	331	278
1987	530.1	52	327	288
1988	555.2	52	303	293
1989	583.8	52	242	301
1990	584.0	54	258	300
1991	547.4	53	195	290
1992	529.2	52	141	284
1993	523.2	52	122	282
1994	543.8	58	115	282
1995	564.6	55	97	258
1996	587.2	61	105	268
1997	624.1	60	100	260
1998	657.4	57	96	252
1999	684.8	57	85	247
2000	723.9*)	54*)	84e	237e

*) = preliminary data. e = prediction.
Source: Statistics Finland.

5. 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	76.9	94.9	75.7	113.6
2001*)	60.6	72.7	46.7	95.6

*) = I–II/01.
Source: United Nations, United Nations Conference on Trade and Development – UNCTAD, Monthly Commodity Price Bulletins.

6. Mining of ores and industrial minerals and quarrying of limestone 1980–2000 (millions of tonnes)

	Ores	Limestone	Industrial minerals		Ores	Limestone	Industrial minerals
1980	10.5	3.1	3.1	1991	5.5	5.3	7.2
1981	9.9	5.0	3.5	1992	4.7	4.4	8.0
1982	9.7	5.5	5.1	1993	4.9	4.1	8.7
1983	9.0	6.0	6.0	1994	4.6	3.9	9.2
1984	9.5	5.6	7.1	1995	3.2	3.4	9.3
1985	8.4	5.8	7.2	1996	3.4	3.4	9.3
1986	6.9	5.0	7.2	1997	3.5	3.7	9.9
1987	6.1	5.0	7.9	1998	3.2	4.0	10.0
1988	6.1	5.4	8.3	1999	3.1	3.9	10.4
1989	5.5	5.5	8.6	2000	3.3	3.8	10.2
1990	5.5	5.7	8.3				

Source: Mining Industry Association.

7. Forest increment and total drain 1953–2000 (million solid cubic metres)

	Increment	Total drain		Increment	Total drain		Increment	Total drain
1953	53.8	44.5	1970	58.3	58.7	1987	75.6	54.1
1954	53.8	50.7	1971	58.3	55.0	1988	75.6	57.1
1955	51.8	56.4	1972	58.3	54.8	1989	75.6	58.7
1956	51.8	52.4	1973	58.3	55.0	1990	75.3	55.1
1957	51.8	52.7	1974	58.3	52.0	1991	75.3	44.7
1958	51.8	53.1	1975	67.0	40.7	1992	75.3	51.0
1959	51.8	53.9	1976	67.0	40.7	1993	75.3	53.8
1960	54.8	60.4	1977	67.0	43.0	1994	75.3	61.7
1961	54.8	63.4	1978	67.0	47.4	1995	75.8	63.6
1962	54.8	58.7	1979	67.0	57.2	1996	75.8	59.0
1963	54.8	57.5	1980	72.0	59.7	1997	75.8	65.8
1964	54.8	58.0	1981	72.0	56.0	1998	75.8	69.4
1965	57.0	55.9	1982	72.0	48.5	1999	75.8	69.4
1966	57.0	54.3	1983	72.0	49.3	2000*)	75.8	70.0
1967	57.0	54.4	1984	72.0	52.3			
1968	57.0	54.1	1985	75.6	55.2			
1969	57.0	57.5	1986	75.6	49.6			

*) = preliminary data.
Source: Finnish Forest Research Institute, Inventory of the Finnish Forests.

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

Year of fertilisation 1 July – 30 June	Nitrogen	Phosphorus
1979/80	83.3	27.9
1980/81	82.4	27.8
1981/82	78.7	26.8
1982/83	91.4	29.9
1983/84	90.7	30.9
1984/85	88.9	30.8
1985/86	90.0	30.2
1986/87	94.4	31.0
1987/88	98.2	32.0
1988/89	100.3	29.7
1989/90	111.5	30.7
1991/91	109.4	26.3
1991/92	92.8	19.9
1992/93	94.3	19.4
1993/94	94.1	19.0
1994/95	101.6	20.0
1995/96	92.3	16.1
1996/97	86.0	11.8
1997/98	85.9	12.3
1998/99	81.0	11.6
1999/00	84.2	10.4

Source: Kemira Agro.

9. Use of pesticides in agriculture 1980–2000 (thousands of kilograms of active ingredient)

	Weed killers	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	733.9	264.5	998.4
1998	843.9	320.3	1 164.2
1999	790.2	349.9	1 040.1
2000	862.4	284.9	1 147.3

Source: Plant Production Inspection Centre.

10. Sources of water loading and natural runoff (tonnes)

	Phosphorus	Nitrogen
Agriculture	2 900	39 900
Households	670	14 930
Industry	250	3 960
Depositions from air	270	17 100
Others	570	6 580
Natural runoff	2 700	70 000
Total	**7 360**	**152 470**

Source: Finnish Environment Institute.

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

	Industry	Fish farming	Households
1985	836	518	134
1986	751	511	145
1987	840	479	170
1988	885	454	210
1989	832	436	250
1990	699	458	250
1991	578	296	245
1992	501	279	219
1993	414	242	188
1994	379	274	167
1995	357	245	154
1996	297	247	153
1997	266	234	140
1998	262	262	128
1999	250	260	121
2000	231	245	123

Source: Finnish Environment Institute, Pollution Prevention Unit.

12. Implementation rates of nature conservation programmes, 1.1.2001 (hectares of land area)

	Target	Implemented	%	Unimplemented	%
National parks and nature reserves	883 030	871 200	99.9	5 000	0.1
Protection programme for ancient forests	346 100	11 030	98.6	4 900	1.4
Mire protection programme	613 760	418 160	92.0	49 000	8.0
Herb-rich woodland protection programme	6 570	4 040	69.6	2 000	30.4
Shore protection programme	142 140	90 840	66.2	48 000	33.8
Natura 2000, new areas	78 370	47 600	63.0	29 000	37.0
Bird sanctuary protection programme	66 740	11 940	19.8	53 000	80.2

Implemented = area is already protected or area has been acquired by the state but no actual protection decision has been made yet.
Unimplemented = programme covers private land not yet under state ownership.
Source: Ministry of the Environment, Land Use Department.

13. Forests and forest conservation in selected European countries

	Forest area (1 000 ha)	Proportion of forest of total land area (%)	Strictly protected forests (ha)	Strictly protected forests (% forest area)	All protected forests (ha)	All protected forests (% forest area)
Finland	23 000	76	1 530 000	6.6	2 440 000	10.6
Sweden	28 000	69	576 163	2.5	832 370	3.7
Albania	1 048	38	14 500	1.38	164 111	15.7
Norway	11 950	37	148 000	1.23	199 500	1.7
Denmark	445	11	6 085	1.14	92 000	20.7
Russia (Eur.)	132 341	39	1 726 000	1.3	3 995 600	3.0
Belgium	665	41	1 260	1.0	5 000	3.7
Bulgaria	3 357	30	..	1.0	335 000	10.0
Ireland	570	8	5 736	1.0	5 736	1.0
Greece	6 513	49	142 000	1.0	951 700	14.6
Czech Republic	2 637	33	25 000	0.95	175 000	6.6
Slovenia	1 110	54	10 420	0.93	71 000	6.4
The Netherlands	334	10	3 028	0.9	18 500	5.5
Slovakia	1 920	42	15 428	0.8	270 000	14.0
Italy	8 675	29	62 053	0.72	560 409	6.7
United Kingdom	2 305	10	10 000	0.4	128 700	5.1
Romania	6 370	27	..	0.35	527 000	8.3
Spain	12 511	25	32 644	0.26	3 000 000	24.0
Germany	10 700	30	24 976	0.24	400 000	4.0
Austria	3 924	47	8 062	0.2	49 000	1.2
Hungary	1 748	19	3 665	0.2	370 422	21.2
Bosnia	2 589	51	3 125	0.12	25 506	1.0
Croatia	2 485	44	2 856	0.11	181 405	7.3
France	15 156	28	14 000	0.09	180 000	1.2
Portugal	3 306	37	2 827	0.08	560 409	6.3
Switzerland	1 186	29	1 018	0.08	13 529	1.1
Poland	8 726	28	3 687	0.04	183 246	2.1

.. = data nor available.
Source: Parviainen, J., Kassioumis K., Bucking, W., Hochbichler, Päivinen, R., Little D. (2000), EU/COST E 4: Forest Reserve Research Network Project. Final Report.

14. Different types of residences and holiday homes

	Houses	Row houses	Apartments	Others	Holiday homes
1980	774 215	125 990	765 585	115 981	251 744
1995	898 016	290 885	928 378	63 655	416 236
1996	903 585	295 095	941 299	58 812	423 318
1997	908 719	298 793	953 760	59 919	429 384
1998	915 579	303 296	967 818	60 513	434 782
1999	922 624	307 608	979 569	63 109	444 023
2000	..	..	..	..	450 600

Source: Statistics Finland. .. = data not available.

15. Pulp and paper industry production 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	1 144	233
1999	12 947 000	6 977 000	205 267	1 127	225
2000	13 509 000	7 101 000	199 769	990	202

Source: Forest Industry Association, Yearbooks on Environmental Protection.

16. Pulp and paper industry production and emissions to the atmosphere (tonnes per year)

	Paper and board production	Pulp production	Sulphur dioxide	Oxides of nitrogen	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
1999	12 947 000	6 977 000	5 521	23 169	6 109
2000	13 509 000	7 101 000	5 178	22 351	5 809

Source: Forest Industry Association, Yearbooks on Environmental Protection.

17. Recovery of waste paper in certain countries 1999 (per cent)

	Recovery rate	Reclamation rate
Germany	73.1	61.0
Austria	66.4	43.2
Portugal	65.3	13.1
Finland	**64.6**	**5.4**
Switzerland	3.7	63.4
Sweden	60.9	18.2
The Netherlands	56.7	73.0
Belgium	54.5	34.2
Denmark	51.7	121.0
Average in EU 15 countries	51.4	45.7
Spain	46.0	81.4
France	44.0	55.0
Slovakia	40.5	41.3
United Kingdom	40.4	72.3
Czech Republic	39.3	42.2
Italy	35.2	49.1
Norway	31.3	45.5
Greece	31.1	100.6
Ireland	18.3	107.0

Source: CEPI. Annual statistics 1999.

19. Total energy consumption in selected countries by GDP in 1998

	Total energy consumption kilograms of oil/FIM 1,000
Canada	50.6
Iceland	50.5
Turkey	49.9
United States	44.6
Greece	40.1
Portugal	37.5
Belgium	37.4
Finland	**31.9**
The Netherlands	30.6
Sweden	30.2
Luxembourg	30.2
United Kingdom	29.8
Spain	28.0
France	27.3
Germany	26.3
Norway	23.7
Ireland	23.6
Japan	22.2
Austria	22.0
Italy	20.1
Denmark	18.1
Switzerland	16.1

Source: IEA/OECD; Energy Balances of OECD Countries 1997–1998.

18. Specific emissions of carbon dioxide from metal refining (kilograms of carbon dioxide per tonne metal produced)

	Raw materials	Energy use
1970	1 992	595
1975	1 848	347
1980	1 513	308
1985	1 319	268
1990	1 351	156
1991	1 399	149
1992	1 322	154
1993	1 383	136
1994	1 383	145
1995	1 281	155
1996	1 255	150
1997	1 235	132
1998	1 190	192
1999	1 176	169
2000	1 182	163

Source: Federation of Finnish Metal, Engineering and Electrotechnical Industries.

20. Trends in oil prices in real terms on the global market (USD per barrel)

	Current prices	Real (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	18.1	10.4
2000	28.2	23.1
2001*)	27.7	22.2

*) = I – II/01

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

NB. Concerns Crude Petroleum/Dubai, UK Brent and Alaska Average/W.Texas Average, spot, F.O.B.

21. Carbon dioxide emissions from fossil fuels and peat in Finland (millions of 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	53.9	..	..	..
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	59.8	36.4	9.8	13.6
1998	57.4	33.7	10.1	13.7
1999	56.8	31.4	10.6	14.8
2000e	54.0	..	..	..
2010e	53.0*)	69.0**)	..	..

e =prelimary data. *) = Climate strategy goal. **) Climate strategy trend.
.. = data not available.
Source: Statistics Finland and the Ministry of Trade and Industry.

22. Sulphur emissions in Finland (thousands of tonnes of sulphur dioxide)

	Liquid fuels	Solid fuels	Forest industry	Metall industry	Oil refining	Other industries	Total
1980	248	91	104	42	61	38	584
1981	241	74	89	42	50	38	534
1982	232	62	65	42	45	38	484
1983	135	57	75	38	34	33	372
1984	125	73	71	33	34	32	368
1985	122	91	68	30	34	38	383
1986	100	79	56	33	31	32	331
1987	96	80	62	34	30	25	327
1988	82	70	53	35	32	31	303
1989	68	62	52	11	20	29	242
1990	75	87	48	7	20	21	258
1991	58	67	33	7	17	13	195
1992	46	45	17	10	9	14	141
1993	36	46	15	9	5	11	122
1994	33	45	13	9	4	11	115
1995	30	37	9	7	4	10	97
1996	33	43	11	6	3	9	105
1997	30	41	10	6	3	9	99
1998	25	34	10	7	4	10	90
1999	26	30	8	8	3	10	85
2000e	..	..	..	..	..	..	84

.. = data not available. e = forecast.
Source: Ministry of the Environment, Environmental Protection Department and Statistics Finland.

23. Emissions of oxides of nitrogen in Finland (thousands of tonnes)

	Road traffic	Other traffic	Energy	Industry	Total
1980	136	43	98	18	295
1981	136	43	79	18	276
1982	137	43	73	18	271
1983	139	43	62	18	262
1984	140	43	57	18	258
1985	143	43	71	18	275
1986	147	43	70	18	278
1987	150	43	77	18	288
1988	155	43	77	18	293
1989	159	43	81	18	301
1990	158	43	82	17	300
1991	152	43	80	15	290
1992	146	43	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	70	21	260
1998	118	48	63	23	252
1999	113	49	60	25	247
2000e	..	..	..	..	237

. = data not available. e = preliminary data.
Source: Ministry of the Environment, Environmental Protection Department and Statistics Finland.

24. Excess of ozone in the lower atmosphere at certain observation stations (days per year)

	Utö	Virolahti	Ähtäri	Oulanka	Total
1990	9	8	11	10	38
1991	17	5	1	1	24
1992	29	21	27	15	92
1993	7	12	17	11	47
1994	14	10	13	6	43
1995	26	6	14	3	49
1996	29	44	19	13	105
1997	20	11	13	4	48
1998	19	13	19	9	60
1999	43	47	29	7	126
2000	3	2	5	1	11

Source: Finnish Environment Institute.

25. Renewable sources of energy as a percentage of total energy consumption in 1997 (per cent)

	Total	Biomass, waste	Others
Norway	41.2	2.9	38.3
Sweden	26.7	14.9	11.8
Austria	23.3	12.4	10.9
Finland	**20.7**	**17.0**	**3.7**
Portugal	16.9	11.3	5.6
Denmark	8.0	7.1	0.9
Italy	7.9	4.0	3.9
France	6.6	4.3	2.3
Spain	6.5	3.6	2.9
Greece	5.3	1.3	4.0
Germany	2.3	1.7	0.6
The Netherlands	2.0	1.9	0.1
Ireland	1.8	1.3	0.5
Belgium	1.4	1.1	0.3
Luxembourg	1.4	1.2	0.2
Great Britain	0.9	0.7	0.2

Source: EEA and Eurostat; Environmental Signals 2000. EEA. Environmental assessment report No 6. p. 20.

26. Trends in the use of public transport and private cars (millions of passenger kilometres)

	Total	Private cars	Motorcycles	Public Transport
1980	48 051	34 800	800	12 451
1981	49 300	35 900	800	12 600
1982	51 100	37 500	800	12 800
1983	53 000	39 300	800	12 900
1984	54 960	41 200	800	12 960
1985	57 445	43 700	800	12 945
1986	58 245	45 100	800	12 345
1987	59 669	46 000	800	12 869
1988	62 364	48 500	800	13 064
1989	63 779	49 900	800	13 079
1990	65 273	51 200	800	13 273
1991	64 196	50 600	900	12 696
1992	63 884	50 500	900	12 484
1993	62 882	49 700	900	12 282
1994	62 855	49 600	900	12 355
1995	63 540	50 060	900	12 580
1996	63 890	50 400	900	12 590
1997	65 820	51 900	900	13 020
1998	66 833	53 830	900	13 002
1999	68 662	54 900	900	12 862
2000	69 700	55 700	900	13 100

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

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

	Carbon dioxide	Hydro-carbons	Oxides of nitrogen	Particles	Carbon Monoxide
1980	7 645.4	47.0	135.7	9.3	386.2
1981	7 747.9	47.7	135.7	9.5	382.9
1982	7 930.4	48.8	137.3	9.8	382.7
1983	8 203.1	50.0	138.5	10.1	382.6
1984	8 453.6	51.4	140.4	10.4	384.3
1985	8 851.8	52.6	143.0	10.7	382.3
1986	9 459.7	54.3	146.6	11.2	383.7
1987	9 929.8	56.6	149.6	11.4	390.3
1988	10 334.6	59.5	154.7	11.7	400.0
1989	10 985.1	61.7	159.1	11.7	410.2
1990	11 179.0	61.4	157.6	11.6	405.4
1991	10 858.6	58.7	151.5	11.4	373.3
1992	10 834.7	55.8	144.6	10.8	343.6
1993	10 196.5	54.0	140.4	10.3	329.8
1994	10 535.9	51.9	135.0	8.5	311.4
1995	10 391.7	50.7	131.8	8.0	304.9
1996	10 300.8	49.0	127.0	7.6	295.5
1997	10 837.9	47.3	122.6	7.1	284.4
1998	10 952.7	45.5	117.9	6.7	274.8
1999	11 148.4	43.5	113.4	6.4	264.4
2000	11 075.7	41.0	106.5	6.0	250.8
2001*)	11 115.1	37.8	99.7	5.7	228.8
2002*)	11 228.7	35.3	93.9	5.5	212.9
2003*)	11 318.4	32.6	88.3	5.3	198.8
2004*)	11 424.2	30.4	83.0	5.2	184.7
2005*)	11 498.9	27.9	77.9	5.1	171.7
2006*)	11 518.1	25.8	73.0	5.0	159.0
2007*)	11 563.2	23.8	68.9	4.9	148.4
2008*)	11 580.0	22.2	65.2	4.9	139.6
2009*)	11 597.5	21.0	62.6	4.9	132.5
2010*)	11 627.1	20.4	61.6	4.9	129.4

*) = forecast.
Source: Technical Research Centre of Finland; LIISA Calculation Model.

28. Trends in total lead emissions in Finland (tonnes)

	Energy and heat production	Industrial processes	Road traffic	Others
1990	20.2	115.2	189.0	1.8
1991	15.6	62.3	168.0	1.5
1992	15.0	40.3	118.0	1.4
1993	9.1	39.7	49.0	1.9
1994	11.5	45.7	1.0	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
1998	11.3	7.9	0	1.1
1999	8.6	5.4	0	–

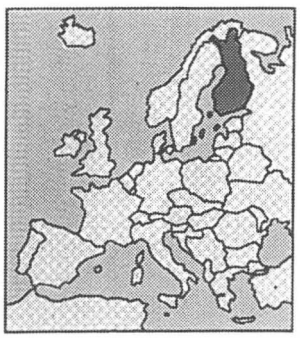
– = no emissions.
Source: Finnish Environment Institute.

29. Retail prices of motor fuel (95E) on 15 July 2000 (FIM per litre)

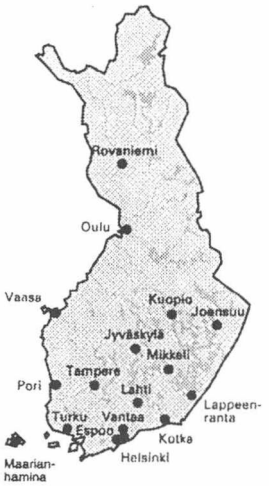
	Ex-refinery price	Pump price	Taxes	Proportion of taxes (per cent)
England	2.08	7.66	5.58	72.85
Norway	2.48	7.56	5.08	67.20
The Netherlands	2.37	7.12	4.75	66.71
Finland	**2.41**	**6.99**	**4.58**	**65.52**
Denmark	2.16	6.65	4.49	67.52
France	2.12	6.62	4.50	67.98
Italy	2.40	6.54	4.14	63.30
Germany	2.08	6.50	4.42	68.00
Sweden	2.18	6.32	4.14	65.51
Belgium	2.07	6.15	4.08	66.34
Austria	2.34	5.77	3.43	59.45
Portugal	2.92	5.43	2.51	46.22
Spain	2.30	5.23	2.93	56.02
Luxembourg	2.31	5.07	2.76	54.44
Ireland	1.91	4.99	3.08	61.72
Greece	2.37	4.87	2.50	51.33

Source:EU/Oil Petrolier and the Finnish Petroleum Association.

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. 77 per cent urban dwellers, with 1.0 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. 70 per cent of the population aged 25 to 64 have completed post-comprehensive education and 30 per cent have university degree or equivalent. 148 Internet connections per thousand inhabitants and 75 mobile phones for every 100 inhabitants.*

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, Norway 727 kilometres and 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 68 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 Ms Tarja Halonen since 1 March 2000. 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 2000 totalled FIM 785 billion (USD 112.2 billion), i.e. FIM 151,500 (USD 21,654) 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 in services, 15 in trade, 13 in financial services, 7 in transport and communications, 6 in agriculture and forestry and 6 in construction. Unemployment rate, calculated according to EU standards, was 7.8 per cent in August 2001.*

Foreign trade: *Main trading partners are Germany, Sweden, United Kingdom, USA and Russia. The value of imports totalled FIM 254 billion (USD 36 billion) and that of exports FIM 333 billion (USD 48 billion) in 2000. Of the imports 40.8 per cent were raw materials and 22.9 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

Finland's Natural Resources and the Environment 2001

Finland's Natural Resources and the Environment 2001 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 natural resources and environmental protection, industry, energy and transport. Finally, the publication contains a presentation of the principal agreements on the natural resources and the conservation of environment to which Finland is committed.

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