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Finland's Natural Resources and the Environment 2002

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Foreword

The 10-year follow-up meeting on sustainable development held in Johannesburg in August-September 2002 assessed the current state of affairs and the measures that had been fulfilled. The policy of sustainable development defined at the 1992 UN Conference on Environment and Development in Rio de Janeiro currently forms the basis of international environmental policy. However, the implementation of sustainable development has been slower, and has proven to be more difficult politically, than was perhaps envisaged in Rio de Janeiro. Numerous agreements and measures are now perceived to be insufficient in the face of ever-worsening problems. On the other hand, the political advances achieved can be viewed as significant progress towards sustainable development.

The European Union is possibly the most committed party to promoting sustainable development is the European Union. The EU's sustainable development strategy closely integrates ecological, social and economic sustainability, and the EU's sixth environmental programme integrates environmental challenges into other policy areas. Likewise, the Finnish Government programme for the 1999-2003 term of office systematically applies the principles of sustainable development, not only to the environment, but to all sectors of society. In order to fulfil the obligations to reduce greenhouse gas emissions set out in the Kyoto climate agreement, the Government approved a national climate strategy in March 2001. The Government programme requires the obligations to be fulfilled in ways that do not weaken economic or employment growth, and that support a continued decline in the public debt. In accordance with the Government's programme for sustainable development, the review "Finland's Natural Resources and the Environment" is published together with the Government budget proposal.

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; Carita Putkonen, Financial Counsellor at the Ministry of Finance; Timo Ritonummi, Senior Adviser at the Ministry of Trade and Industry; Marjaana Vainio-Mattila, Researcher at the Ministry of Agriculture and Forestry; Saara Jääskeläinen, 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 Jari Välimäki, Researcher, at the Finnish Environment Institute.

Helsinki, September 2002

Ministry of the Environment
Minister of the Environment
Jouni Backman

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Director General
Heli Jeskanen-Sundström

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1 The economy and the environment

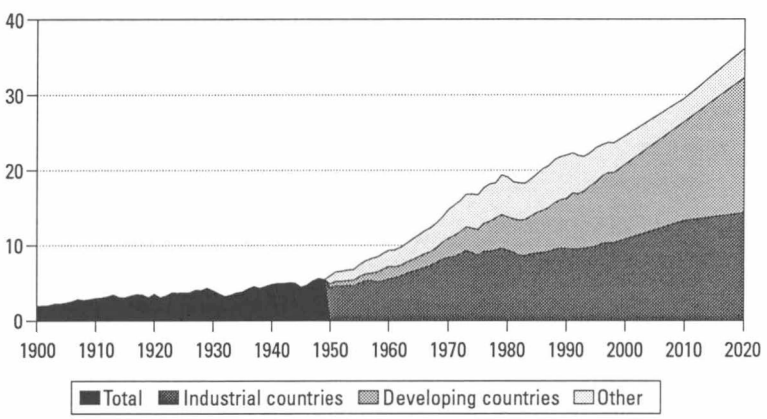
International environmental policy

The World Summit on Sustainable Development (WSSD) Agenda 21 ten-year follow-up was held in 26 August – 4 September 2002 in Johannesburg, South Africa. The principal issues of the summit were globalisation, poverty, production and consumption methods, environmental health, ecosystems and ecological management. One of the aims was to find a balance between ensuring the quality of the environment, strengthening the economy and improving social equality.

One of the biggest challenges for sustainable development is to prevent the acceleration of the greenhouse effect. At the UN Climate Summit in Kyoto in 1997 a global protocol was written to reduce greenhouse gas emissions. According to the protocol industrial countries must reduce their greenhouse gas emissions by an average of 5.2 per cent under 1990 levels by the end of the 2008–2012 period. The reduction for the United States is seven per cent, for the European Union countries eight per cent and for Japan it is six per cent. The Kyoto Protocol is a first step towards lowering the amounts of greenhouse gases to a safe level, although this will not yet have a significant effect in slowing down climate change. According to the Intergovernmental Panel on Climate Change (IPCC), the global reductions requirement is in the region of 50–90 per cent.

At the UN Climate Change Conference held in Bonn in July 2001 an agreement was reached on issues that were left open in the Kyoto Protocol, such as the implementation of the Kyoto flexible mechanisms, carbon sinks and the monitoring of the degree of compliance with the Climate Convention. The modalities of implementation of the Kyoto Protocol were accepted at the United Nations Framework Convention on Climate Change in Marrakech in October 2001. The European Union Council of the Environment decided in its meeting in March 2002 on the ratification of the Kyoto Protocol on behalf of the EU. The council accepted the ratification in April 2002 and all the member states' national ratifications were decided upon in June 2002. The long-term aim is that EU greenhouse gas emissions be reduced by 70

Figure 1. World carbon dioxide emissions from fossil fuels (billion tonnes)



NB. Figures for 2000–2020 are OECD estimates.

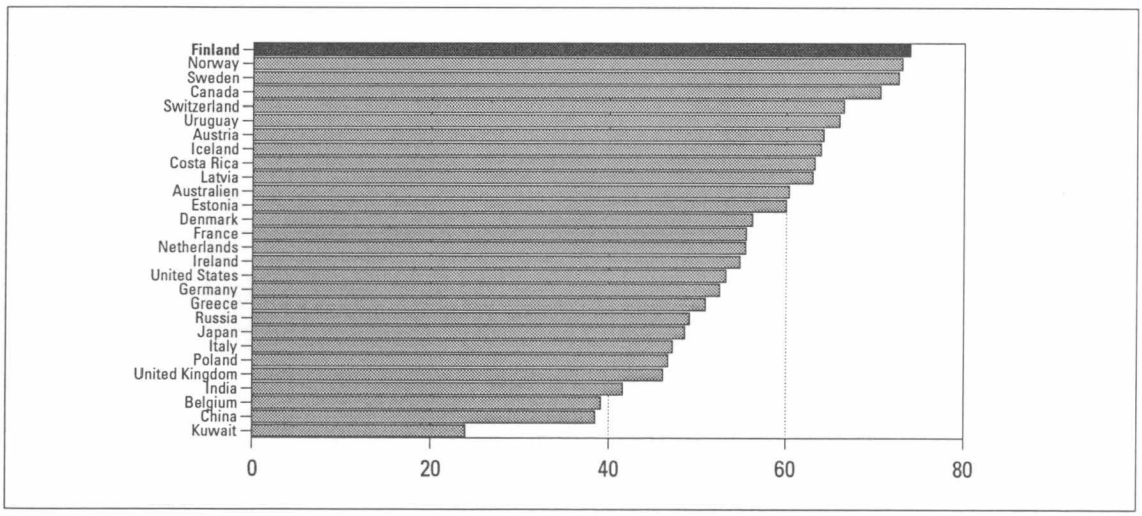
per cent compared to 1990 levels. Japan also ratified the Kyoto Protocol in June 2002. So far, 74 countries have ratified the protocol. The United States and Australia, on the other hand, have not entered the agreement, believing it to be against their economic interests.

According to a UN estimate the costs to industrial countries of implementing the Kyoto Protocol are between 0.1–1.1 per cent of GDP per year, if no limits are set on emissions trading. Without emissions trading the costs are twice as high. The European Commission's proposal concerning emissions trading inside the EU has been accepted. The idea of the system is to reduce greenhouse gas emissions as cheaply as possible and in an environmentally efficient way. According to the Commission's plan, emissions trading would be put into force and be obligatory already in 2005–2007, i.e. before the first binding period, 2008–2012.

The EU's sustainable development strategy was accepted at the European Council in Gothenburg in June 2001. The sustainable development strategy added an ecological dimension to the Lisbon long-term strategy, with which the European Union is to become the world's most competitive and dynamic information-based economy. The European Council will check at its annual spring meeting how the implementation and development of the sustainable development strategy has progressed. The European Commission's proposal for the Union's 6th environmental programme aims to elaborate 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. Concerning climate policy, the programme's primary goal is to ratify the Kyoto Protocol and to achieve reductions in emissions accordingly. Marketing mechanisms should play a greater role in environmental issues and scientific knowledge should be used more in decision-making. Consumer habits should also be directed in a more sustainable direction.

The Sixth Environmental Action Programme proposed by the EU Commission specifies that nature conservation and protecting biodiversity will be given more attention in agricultural and fishing policy, among others. The most important health-related environmental issues are the evaluation of the

Figure 2. Environmental sustainability index (ESI) for designated counties, 2002



EU chemical risk management system, reducing pesticide risks and improving air and water quality. With respect to the use of natural resources, emphasis is on sustainability and reducing waste. An important tool for attaining this goal is the Integrated Product Policy (IPP), the main features of which were presented by the European Commission in February 2001.

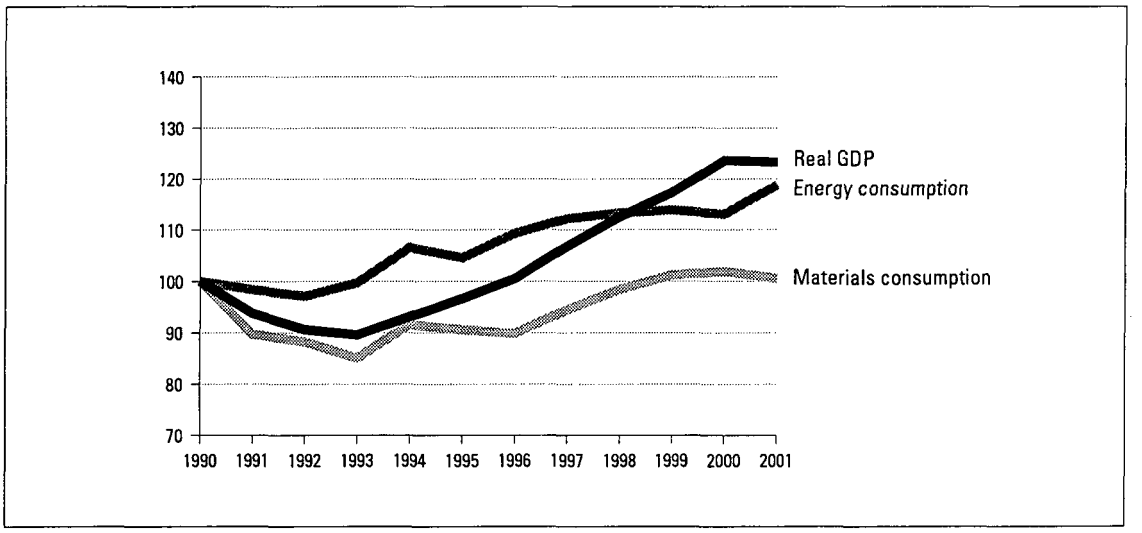
Sustainable development in Finland

Environmental protection is at a high level in Finland even by global standards. The World Economic Forum (WEF) acknowledged this in the Environmental Sustainability Index (ESI) in January 2002. According to the Index, Finland had made the most progress toward sustainable development. The Environmental Sustainability Index indicates how well a country has achieved environmental sustainability in comparison with other countries. Finland ranked highest in the quality of water and in private sector initiative. Other strong points were the level of science and technology, participation in international activities, air quality, environmental management and environmental health. Finland was poorly ranked in the indicators that measured consumption per capita. Finland's weaknesses were the size of the ecological footprint and the amounts of nuclear waste, greenhouse gases and the amount of transboundary pollutants released in other countries.

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, being one of the first countries to do so. Key objectives of the programme include slowing down 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 National Commission on Sustainable Development (FNCSD). It submits initiatives to the relevant authorities for drafting.

An overall estimate of the efficiency of the sustainable development programmes and of the necessity for supplementary action has been compiled in Finland for the Conference on Environment and Development in Johannesburg. The result of the evaluation, a national progress report, was submitted to the

Figure 3. Trends in real GDP and the consumption of energy and materials in Finland (1990=100)

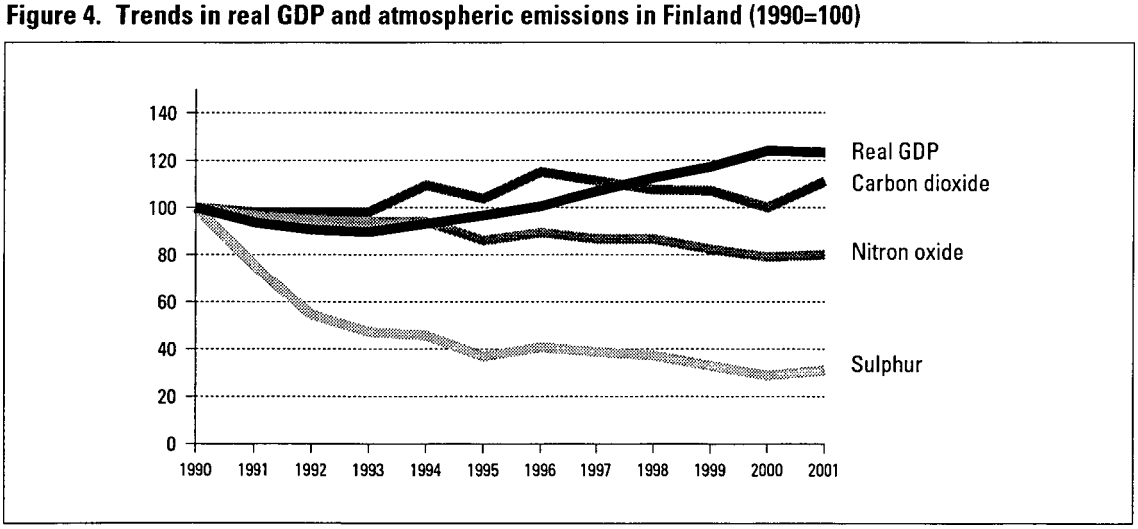


Rio +10 meeting (World Summit on Sustainable Development) in Johannesburg in August 2002. According to the Finnish National Commission on Sustainable Development there were three important themes for Finland at the Johannesburg conference: the sustainable use of natural resources, a sustainable information society, and a healthy and safe environment.

The Finnish 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 the Kyoto targets unless determined efforts are made 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. Actions are needed in both the production and the consumption of energy, transportation, construction, community planning, the control of agricultural and forest industry emissions as well as in waste management. To reach the Kyoto objectives, R&D activity, economic policy instruments and administrative guidance are needed.

The growth in electricity consumption and the closing down of old power plants demands the construction of new power plants. According to estimates, more efficient energy use and an increase in the use of renewable energy sources can cover half of the required reductions in greenhouse emissions. The climate strategy notes that the use of coal should not increase; a choice must be made between constructing new nuclear power capacities and replacing coal with natural gas. A government decision-in-principle made in May 2002 on the construction of additional nuclear power is an action compliant with the strategy and one which reduces the use of coal. Nevertheless, the possibilities for constructing co-generated heat and electricity plants should be explored as much as possible, with either natural gas or renewable energy sources as the primary source of fuel. In the national climate strategy it is estimated that the government's financing requirement and the annual financing requirement to be satisfied through the energy tax system will rise from its current level by a good EUR 50 million per year on average by 2010. The most significant expenditures would be in energy conservation and in the financing of renewable energy sources development.

Figure 4. Trends in real GDP and atmospheric emissions in Finland (1990=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 bring unity to the control and management of emissions. Special emphasis is on applying the best available technology (BAT) principle, on risk management and on the efficiency of energy use. A new Land Use and Building Act that supports 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 by a range of other measures, such as environmental taxes, environmental labelling schemes and voluntary agreements that have been put into use. 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 the GDP in Finland. The major source of government revenue from environmental taxes in all the countries is taxation on fossil fuels, particularly petrol and diesel. Environmental taxes as a proportion of total taxation increased to around 7 per cent in 1997 in OECD countries. The Ministry of the Environment estimates its environmental expenditures to total EUR 194 million in 2002, which is 0.6 per cent of the government expenditure. The proportion of these expenditures of the total government expenditure has remained stable over the last few years.

A government survey in February 2000 indicated that increases in environmental taxes helped to check carbon dioxide emissions in the 1990s: in 1998 emission volumes were a few million tonnes smaller than average.

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

	1999	2000	2001	2002	2003
	A	A	A	B	BP
Alcoholic beverage surtax*)	12	12	12	12	12
Soft Drink surtax*)	1	1	1	1	1
Pesticide fee	2	2	2	2	2
Energy taxes	2 651	2 596	2 652	2 665	2 900
Oil waste tax	3	3	3	3	3
Motor vehicle tax	1 028	1 059	922	887	900
Water protection tax	1	1	0	0	0
Oil pollution control fee	6	5	5	5	8
Vehicle licence tax	209	220	227	237	247
Diesel engine vehicle tax	185	181	208	209	218
Waste tax	34	33	31	34	47
Total	**4 133**	**4 113**	**3 982**	**4 055**	**4 338**

A = Final accounts. B = Budget. BP = Budget proposal. *) = packaging tax.

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.

Environmental protection in central government

In its sustainable development programme, the current government says that it will foster ecologically sustainable development by means of an 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 also when evaluating the total economic advantage of an offer.

The central administration plays a significant role in conducting and funding environmental research and development. Some of the funding bodies for environmental research are the Academy of Finland, the National Technology Agency (TEKES), as well as ministries operating in the environment, energy and natural resources sectors. It is es-

2. Government environmental expenditure (EUR million)

	1999	2000	2001	2002	2003
	A	A	A	B	BP
Environmental administration	86	92	98	102	105
Central government	*39*	*40*	*41*	*42*	*44*
Local government	*47*	*52*	*57*	*60*	*61*
Development co-operation	54	49	93	..	..
Co-operation with neighbouring regions	10	10	10	13	13
Nordic Environment Finance Corporation	1	1	1	1	1
Research and development	144	157	146	136	138
Environmental conservation and management[1]	*19*	*20*	*13*	*13*	*13*
Use and management of natural resources[2]	*30*	*29*	*27*	*27*	*27*
Universities)*	*42*	*44*	*52*	*55*	*56*
Development of environmental technology[3]	*49*	*59*	*48*	*35*	*35*
Other environmental research4)	*5*	*6*	*6*	6	*7*
Environmental NGOs	1	1	1	1	1
Environmental protection	54	38	37	41	49
Clean air and waste management	*12*	*10*	*10*	*12*	*8*
Water protection	*6*	*4*	*5*	*7*	*9*
Environmental management and decontamination	*36*	*24*	*23*	*23*	*32*
Nature conservation	78	79	58	58	46
Promotion of energy saving	3	3	3	3	3
Renewable energy investment support	20	20	17	25	25
Environmental protection of road traffic	20	20	22	22	20
Rail transport	17	17	17	17	40
Manure pit investment support	4	1	5	3	2
Environmental support for agriculture	270	276	282	298	306
Basic support	*233*	*250*	*248*	..	..
Special support	*35*	*25*	*32*	..	..
Others	*2*	*1*	*2*	..	..
Environmental support for forest management	4	4	4	4	4
Total	**766**	**769**	**794**	**725**	**753**

A = Final accounts. B = Budget. BP = Budget proposal.
.. = data not available. *) = estimate. **) = prediction. [1] Environmental Administration and the Academy of Finland.
[2] Agriculture and Foresty Administration. [3] Technical research. [4] Other administrative branches.

timated that these sources account for 33 per cent of university environmental research funding. Most university environmental research funding (56%) is self-financed, however. Environmental protection funds are primarily allocated to industry and local authorities for the purpose 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 most significant item economically in the government's environmental protection expenditure is environmental support for agriculture.

Development co-operation

Finland has declared, in the international sustainable development plan of action, Agenda 21, in the UN millennium declaration of development objectives, in international environmental agreements and in its own developing country policy aims, that it is committed to helping developing countries achieve environmentally sustainable development. This is achieved in practice by supporting the use of sustainable natural resources and by developing environmental protection in development co-operation with partner countries.

In Finnish development co-operation work, environmental problems are prevented by supporting the following: developing environmental legislation and management; the transfer of environmental protection technology; the protection and sustainable use of natural resources such as forest and water resources and the equitable division of the benefits obtainable from them; ecologically sustainable means of rural livelihood; environmental research, training and education; and citizens' possibilities for participation in and readiness for the developing environmental requirements of trading. The various forms of development co-operation strive to take into account the various requirements and possibilities of conservation and the sustainable use of natural resources by applying principles of evaluating environmental effects in both the strategic planning process and the preparation of development co-operation programmes.

According to the action plan approved by the Ministry for Foreign Affairs in February 2002, the most important points from the development co-operation perspective are the agreements concerning the prevention of climate change and desertification, agreements concerning the protection of biodiversity, and the activity of the UN Forest Forum (UNFF). Also important are the agreements for protecting the upper atmosphere's ozone layer and for regulating environmentally hazardous chemicals treatment. In 2001 an international agreement was signed concerning volatile organic compounds (VOC), from which new requirements will also follow for Finland's development co-operation work.

The fulfilment of environmental agreements has been supported by the Global Environment Facility (GEF) at around EUR 5 million per year. Around EUR 0.8 million per year has also been directed to a multilateral ozone fund that finances actions aimed at reducing the production and use of atmospheric ozone-depleting substances in developing countries.

Development co-operation work in the environmental field and export promotion are done to some extent with subsidized credit and industrial-economic-technological co-operation. This ensures that energy efficiency and sewage water treatment are developed. In addition to official inter-governmental co-operation, civic organizations' co-operation plans for the promotion of nature conservation in Finland and in developing countries are supported as is the activity of international environmental organizations.

3. Environmental aid in Finnish development co-operation work 1996–2001 (EUR million)

	1996	1997	1998	1999	2000	2001
Bilateral development co-operation work						
Environmental aid as main objective	17.0	23.4	26.2	31.0	21.6	38.8
Environmental aid as a significant side objective	20.3	22.0	20.9	17.7	24.7	53.1
Multilateral development co-operation work						
Support to GEF	4.9	5.6	2.5	4.3	1.4	0.0
Aid for the multilateral ozone fund	0.7	0.8	0.9	0.9	1.0	0.9
Total	**42.9**	**51.8**	**50.5**	**53.9**	**48.7**	**92.8**

A preliminary report on the development needs of developing countries and the possibilities for co-operation between the communities of Finland and in developing countries was published in 2001, after which a trial community co-operation programme was started at the beginning of 2002. The development of environmental co-operation between communities has an important role in the programme. A study on global environmental questions is supported by the Academy of Finland under the Integrated Global Change Research programme FIGARE, and the Finnish Biodiversity Research programme, FIBRE.

In addition to development co-operation work itself, sustainable development is promoted in the JI/CDM test programme aimed at preventing climate change. It is hoped that experience can be obtained for applying the procedures laid out in the Kyoto Protocol, the Clean Development Mechanism (CDM), and Joint Implementation (JI) in co-operation with developing countries and with transitional economy countries. Similar aims are behind participation in the Prototype Carbon Fund (PCF), in which Finland has invested USD 10n million. In April 2002 an energy seminar was held in El Salvador intended for all the Central American countries in the renewable energy and environmental technology sector. It is intended that intercommunication and co-operation with the region will continue.

Co-operation with neighbouring regions

Finland has advanced the improvement of the neighbouring countries' environment and the improvement of the state of the Baltic Sea since 1991. The Ministry of the Environment has backed environmental projects in northwestern Russia, Estonia, Latvia, Lithuania, and Poland. Finland has aimed to foster the ability of co-operating countries to solve environmental problems on their own as well as to prevent them before they occur. Areas of co-operation have included the development of environmental administration, water and air protection and waste management.

The Ministry of the Environment has, during 1991–2002, backed environmental conservation investments and technical aid projects in the countries near Finland to the tune of EUR 117 million. Co-operation with the Baltic States has been reflected in small and large joint ventures. Investments have been made in the large cities of the Baltic States with over 100,000 inhabitants for the treatment of wastewater. Thus, opportunities have been created for putting into force the recommendations made by the Helsinki Commission (HELCOM), an organization for protecting the Baltic Sea. Thanks to the countries' own efforts and international co-operation, a good base has been created for continuing the implementation of environmental legislation that is compliant with

EU regulations in middle-sized and small communities. At the same time, a transition can be made from protecting the water to other areas of environmental conservation. Achieving sustainable development and permanent environmental change presupposes not only investments, but also large-scale management development and training.

The changing of the working environment in co-operating countries has also renewed ways of working. In accordance with the new neighbouring area strategy compiled in 2001, the aim of the Ministry of the Environment's neighbouring area co-operation is to reduce and prevent the discharges originating from areas in Finland's proximity that are detrimental to Finland and the Baltic Sea. Included in the important aims are projects to reduce greenhouse gases and on joint realisation of the conservation of the nature's biodiversity and the sustainable use of forests in Finland's neighbouring areas. In those Baltic States applying for EU membership, the Ministry of the Environment is advancing the development of environmental management and the application of projects that back EU environmental legislation.

There is an attempt to intensify co-operation with the EU and international financial institutions for the purpose of directing resources to such co-operation that can create more environmental benefits than working alone could achieve. The aim is to get the co-operating countries, the EU and the international financial institutions to put more weight on environmental conservation in the areas neighbouring on Finland. In compliance with the new neighbouring area strategy, Finland's bilateral investment support will diminish in Estonia, Latvia and Lithuania. Ecoconversion arrangements with Poland end in 2002 after more than ten years of successful co-operation.

In Russia, Finland is continuing to back the project for the construction of a wastewater treatment plant in northwest St. Petersburg. After completion of the treatment plant most of St. Petersburg's sewage water will be properly treated. Substantial additional investments are still needed in order to treat all of the city's wastewater and to ensure that the inhabitants have clean drinking water. Finland has also made a financing decision toward completing the urgent work on the hazardous waste plant at Krasnyi Bor.

4. Finland's contribution to projects in neighbouring regions 1991–2002 (EUR million)

	Investment projects	Technical aid
Estonia	26	5
Latvia	12	1
Lithuania	8	2
Russia	21	11
Ukraine	1	0
Poland	17	0
Others*)	0	13
Total	**85**	**32**

*) financing to international financial institutions and co-operative projects in above countries.

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 local action plans for sustainable development. In Finland there are currently around 300 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 proposal for sustainable development indicators on the local level was presented in February 2000 in Hannover. The proposal aims to develop a more integrated system for the monitoring of sustainable development in European cities. Five Finnish cities and towns signed an agreement indicating their commitment: Helsinki, Tampere, Turku, Pori and Kouvola. In the environmental measurement system for municipalities developed by the Association of Finnish Local and Regional Authorities and the Turku School of Economics' Finland Futures Research Centre, the city of Lappeenranta rose to the top of the scale in September 2001. Pori and Raisio shared second place and Suomussalmi and Nummi-Pusula shared third place. Over the last few years, ecological footprint values have also been calculated according to the recommendations of the Association of Finnish Local and Regional Authorities.

The campaign started in 1997 for reducing greenhouse gas emissions in municipalities was continued and expanded in 2000. Amongst the municipalities in the campaign can be found some of Finland's largest cities. The campaign covers 41 municipalities representing over 45 per cent of the Finnish population. The campaign is a part of the International Council for Local Environmental Initiatives (ICLEI) "Cities for Climate Protection" project for reduction of greenhouse emissions in cities. Participating municipalities first formulate their greenhouse gas balance and greenhouse emissions forecast. The next stages involve the formulation and implementation of an emissions reduction plan.

The sustainable development future commitment process was started in the fall of 2001, its objective being the promotion of various working models worth pursuing from the sustainable development perspective. The principle is that in model municipalities for sustainable transportation, people walk, ride bicycles and use public transport. Jyväskylä, Kerava and Lempäälä are taking part in the sustainable transportation model municipalities plan.

Community waste disposal underwent major structural changes during the 1990s. The number of landfill sites has been reduced and their size increased. At the same time, waste recycling has increased and waste treatment intensified. By 2005 a large part of Finland's old landfill sites must close down, because they do not fulfil the European Union's strict new regulations. Landfill sites still in use at that time must be pools that are leak-proof at their base and completely isolated from their surroundings, so that landfill water and gases can be controlled. Moreover, dumping untreated waste will not be permitted from 2005 onwards. In 2005 no more than 30 per cent of waste materials may end up at landfills. The remaining 70 per cent will be utilized as secondary raw materials, energy, dirt or in landscaping. As a result of the tightened regulations the 160 currently operating landfills will be reduced to 60 or 70 and the costs of waste manage-

5. Environmental protection costs for local authorities (EUR million)

	1999	2000	2001*)
Waste management			
Investments	15	21	17
Operating costs	105	113	127
Water supply			
Waste water treatment			
Investments	36	39	43
Operating costs	105	109	114
Sewerage			
Investments	99	95	105
Operating costs	123	127	133
Energy Supply			
Clean air			
Investments	4	6	11
Operating costs	47	50	51
Yhteensä	**534**	**560**	**601**
Investments	154	161	176
Operating costs	380	399	425

*) = Preliminary data.

ment will grow an estimated 50 per cent to EUR 1.6 billion.

The biggest expense items for local authorities, joint municipal boards and municipal corporations are sewerage and wastewater treatment. Most of the costs arising from waste management, and sewerage and wastewater 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.

Environmental health

Many environmental problems clearly affect human health. The factors that globally damage health the most are related to air pollution, contamination of the waters and traffic accidents. According to an estimate by the WHO, air pollution causes around 100,000 early deaths in Europe alone. In Finland it has been estimated that the impurities of community air and especially particles cause 200–400 early deaths per year, 30,000 cases of worsening asthma symptoms, and 30,000–40,000 children's respiratory infections. Most of the problems are caused by fine particles. Estimating the number of health hazards and the economic impacts from a certain type of hazard is difficult, and the proposed figures vary a lot. In the future the greenhouse effect and the depletion of the ozone layer may be seriously hazardous to our health.

Environmental health is being promoted in many ways both internationally and on the national level. Three ministerial conferences have been held in conjunction with a process started by the WHO's European area office in 1989, resulting in most European countries having already established their own national environmental and health programmes. Finland's programme appeared in 1997 and local programmes have also been made.

Finland has an excellent environmental health record in the areas of household water supply, food hygiene and safety from radiation. By contrast, there remains room for improvement in indoor and outdoor air quality, noise reduction, accidents, and in containing the psychological and social health risks of the environment. Poor indoor air quality at the workplace causes around EUR 1.4 billion in expenses per year, of which sick leave makes up EUR 0.5 billion and allergies also make up EUR 0.5 billion. Significant expenses also result from drops in productivity, cigarette smoke, asbestos and radon. The main indoor air problems are dry and stuffy indoor air, humidity and mould damage as well as dust and dirt. The aim of the Indoor Air Year 2002 training and communication campaign is to make indoor air the central value of construction and building management.

In Finland suspended dust in the outdoor air is the most common cause for exceeding the levels set by air pollution control. The levels of medium fine particles have been reduced in many cities. Attempts have been made to limit this problem, e.g. by reducing street sanding in the winter, by improving the quality of the sand, and by stepping up street cleaning, especially during springtime. The expenses of health problems caused by street dust in Helsinki have been estimated to be between EUR 2.2 million and EUR 17.6 million. The costs of removing street dust are estimated at EUR 1.7 million per year. Estimating the economic impacts of health problems is difficult, and the proposed figures vary a lot. In the United States the expenses of health problems caused by motor traffic are estimated to be between USD 24–450 billion.

Despite extensive preventive measures, the amounts of the most dangerous particles,

those under 2.5 micrometers in diameter, have not been significantly reduced in Finland. These particles are so small that they can enter the air cells in the lungs and then intensify the symptoms of asthmatics and people suffering from lung and heart illnesses. Problems are also caused by carbon monoxide from traffic and oxides of nitrogen especially in the central areas of suburbs and alongside busy routes. Also the ozone levels measured in the lower atmosphere repeatedly exceed the WHO recommendations. Most of the lower atmospheric ozone measured in Finland comes from Central Europe. Particles may also be transported into our country in significant amounts. For example, high levels of small particles were measured in the Helsinki region in March 2002, probably coming from Central Europe.

The use of ozone layer-depleting substances such as CFC compounds has almost completely been ended in Finland. Even in the best-case scenario, though, it will still take decades before the ozone layer returns to normal. The thinning of the ozone layer increases harmful ultraviolet radiation on earth, which can in turn lead to an increased risk of skin cancer. Finns are especially susceptible to increased radiation because of their light skin.

Noise is becoming an ever-growing challenge to the quality of living. Around 20 per cent of Finns live in areas where traffic noise exceeds the harmful level of 55 decibels. Nuisance from road and air traffic is increasing. To control the problems of noise, technical improvements are needed, such as efficient soundproofing and noise barriers, as well as more diligent attention to the noise situation when zoning.

The good quality of foodstuffs is guaranteed in Finland by means of quality control at all stages of the production chain from the field to the store. Exposure to foreign substances and additives is very insignificant in Finnish foodstuffs, and permitted maximum levels are not exceeded unless the diet is extremely unbalanced. Exposure to dioxin compounds is 60 per cent attributable to fish, especially the Baltic herring – though with a well-balanced fishfood diet, health risks caused by dioxins and similar PCB compounds can be avoided. Exposure to dioxins has dropped over recent years and the average exposure is much less than the WHO recommended upper limit.

Finland has encouraging experiences with the systematic control of zoonotic diseases, i.e. diseases that humans can contract from animals, and with the monitoring of antibiotic resistance. much of the monitoring is on a self-monitoring basis. Finland is relatively well protected from animal disease because of efficient monitoring, self-sufficiency of farmers due to the country's northern location, and thus a relatively low level of im-

6. Finland's NMVOC (Non-methane Volatile Organic Compounds) discharges (tonnes)

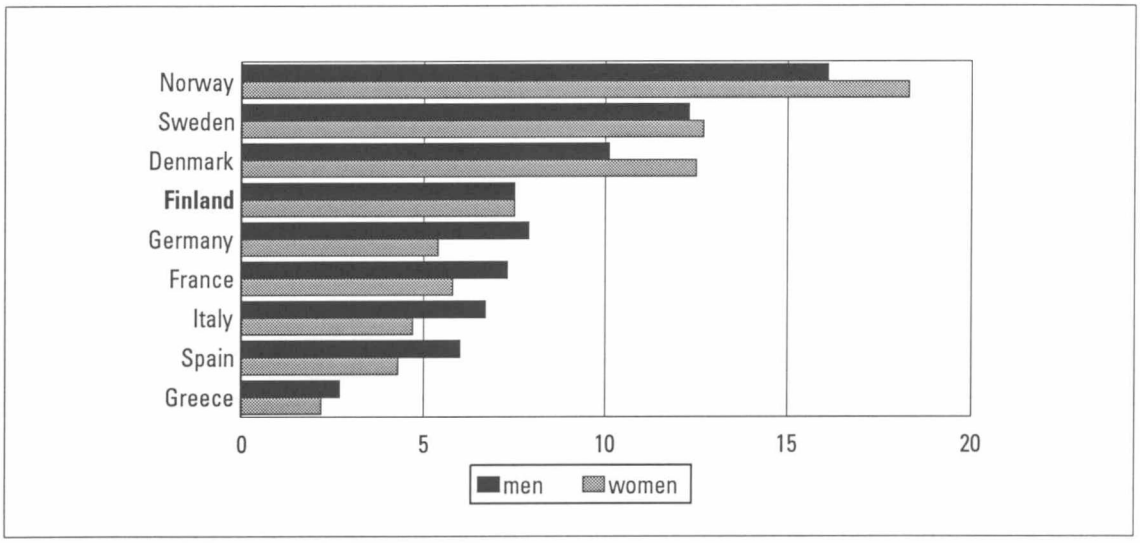
1990	218
1991	205
1992	198
1993	191
1994	189
1995	184
1996	179
1997	173
1998	169
1999	164
2000	160

7. Environmental health expenses in Finland, 1990–2000 (EUR million)

1990	101
1991	115
1992	120
1993	79
1994	87
1995	93
1996	89
1997	107
1998	107
1999	109
2000	105

ports of animal feed, animals and plants. Thanks to monitoring in 2001, one case of Bovine Spongiform Encephalitis (BSE) was identified. The reason for the outbreak is currently unclear. As a result of the positive identification, monitoring was further tightened. The number of cattle to be inspected per year will increase to around 130,000, while in 2001 the number was nearly 28,000. Worldwide, around 184,000 BSE cases were found by the end of 2001, of which over 181,000 were in the United Kingdom.

Figure 5. Incidence of melanoma in various countries (incidences per 100,000 inhabitants)



2 Natural resources

Sustainable use of natural resources

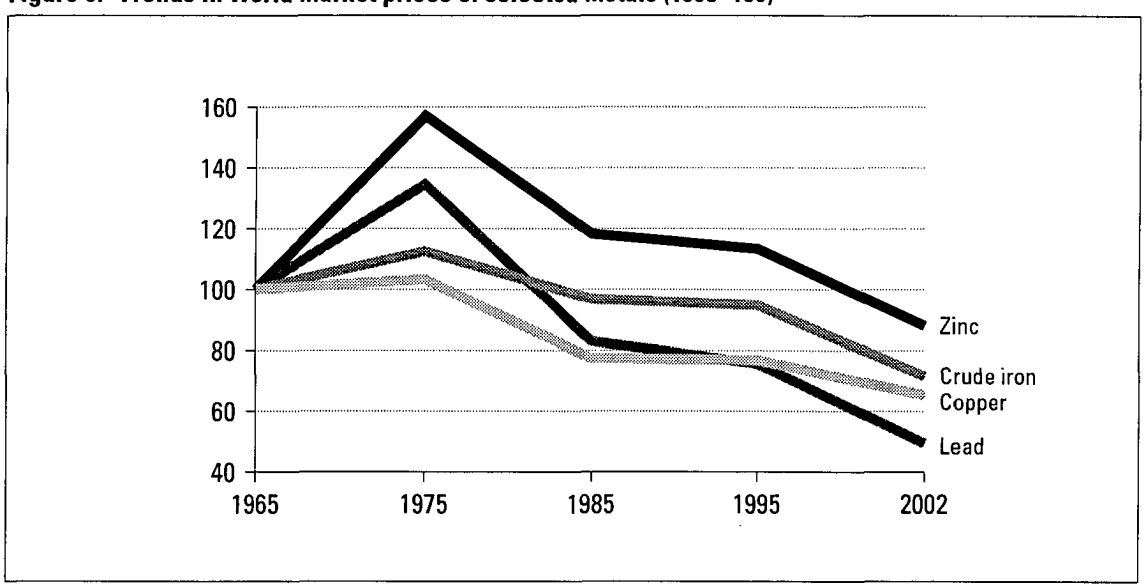
The continuing growth of the world population and rise in the standard of living are leading to increased material consumption. Especially the environmental damage caused by accelerating use of fossil fuels and natural resources is seriously jeopardising the renewal and tolerance of the natural environment. 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. The utilisation of most raw materials has steadily increased and their real prices have declined over the past 25 years. In the light of what we know today there is no threat of the non-renewable natural resources being depleted over the next few decades.

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 environmen-

8. The ecological footprint in different countries according to the WWF (hectares per inhabitant)

United Arab Emirates	15.99
United States	12.22
Kuwait	10.31
Denmark	9.88
Ireland	9.43
Australia	8.49
Finland	**8.45**
Canada	7.66
Sweden	7.53
France	7.27
Estonia	7.12
Germany	6.31
Norway	6.13
Japan	5.94
Russia	5.36
China	1.84
India	1.06

Figure 6. Trends in world market prices of selected metals (1965=100)



tal consequences that exceed the tolerance of the global ecosystem.

According to the Government's programme for sustainable development, efficiency in natural resource use will be advanced in Finland in both production and consumption. In 2001, a total of 198 million tonnes of primary materials were consumed in Finland. Of this, 120 million tonnes were non-renewable and 80 million tonnes renewable natural resources. Direct overall consumption of natural resource per GDP unit has declined steadily in the 1980s, 1990s and 2000s. In other words, greater economic wealth has been produced with fewer resources.

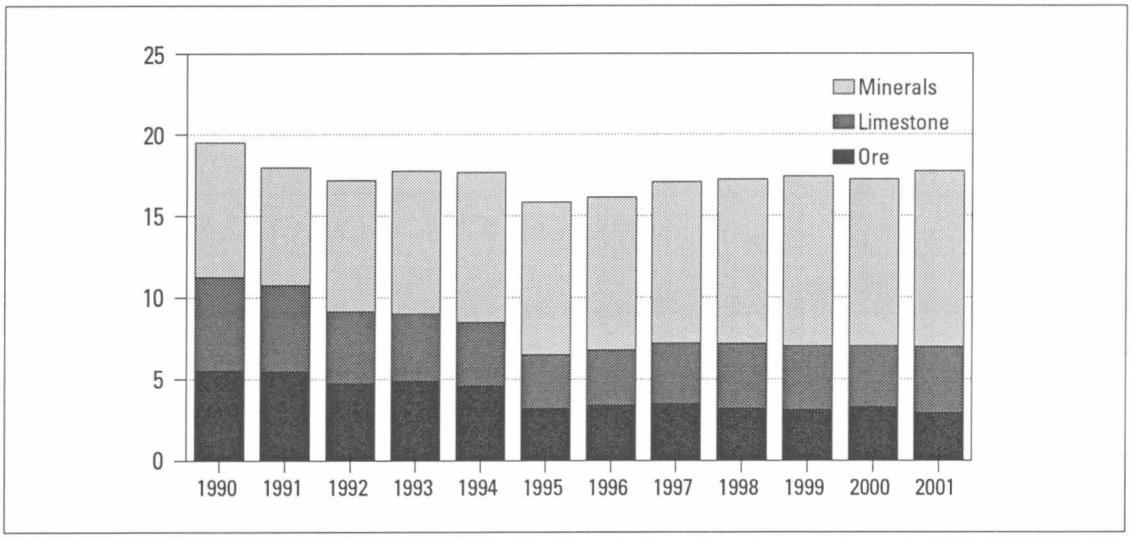
Ores and other extractable resources

Finland is self-sufficient in just one metallic mineral, chromium. 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.

The ore production in domestic mines declined quite considerably in the 1990s, while metal imports increased very sharply. In 2001 ore production in Finland amounted to 2.9 million tonnes, which was 0.4 million tonnes less than in the previous year. In 2001 the import of metallic minerals was 0.9 million tonnes, limestone production was 4.1 million tonnes and domestic industrial mineral production was 10.7 million tonnes. The most important ores 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

Figure 7. Mining of ores, industrial minerals and quarrying of limestone in Finland (million tonnes)



2001, 40 million tonnes of gravel and sand and 36 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 2001 the figure was 47 per cent.

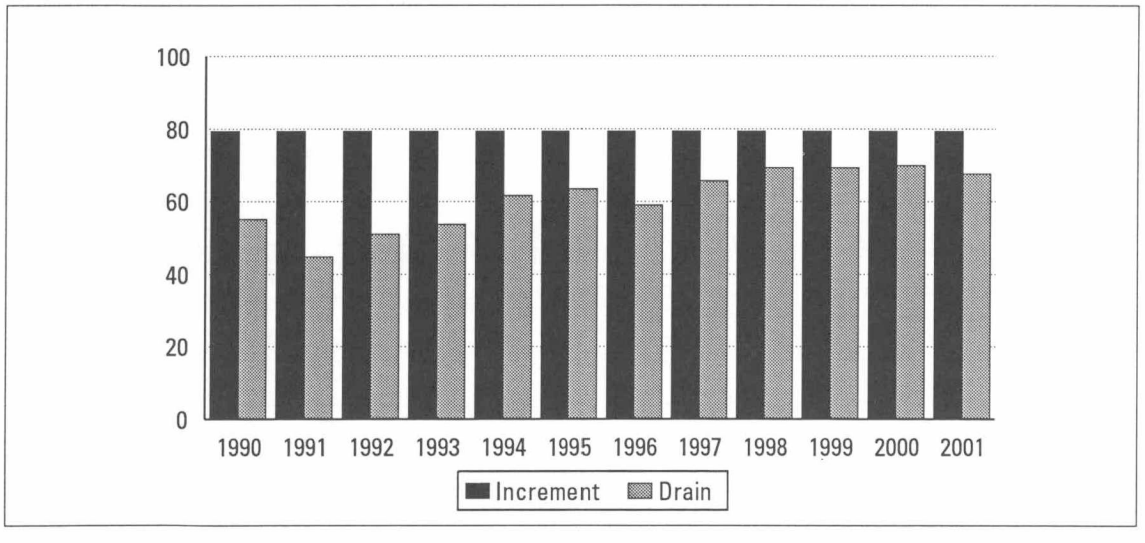
Forest resources

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 companies and 5 per cent by others. The total annual increment of 79.4 million cubic metres exceeds the total drain. In 2001, 58 million cubic metres were felled for industrial and other uses. Allowing for waste and natural losses, the total drain was 67.7 million cubic metres. Timber imports to Finland in 2001 were 15.4 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 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 was completed during the spring of 2002.

The way that Finland's commercial forests are managed is of key significance to preserving the biodiversity of Finnish nature.

Figure 8. Growing stock increment and drain (million solid cubic meters)



Intensive silviculture has had negative effects on the diversity of forests, especially regarding, for instance, the extent of old-growth forests and the amount of rotting wood. However, the new silviculture recommendations for private forests also take into account the requirements of biodiversity. An important way to promote the diversity of commercial forests is to preserve in their natural state the important natural habitats identified by the Forest Act, as well as other valuable nature areas as defined by silviculture recommendations and certification. If preserving important natural habitats in accordance with the Forest Act causes greater than minor losses to a private landowner, he may be entitled to environmental aid. From 1997 to the end of 2001, 460 thirty-year environmental aid agreements have been made, covering a total of 3,300 hectares. The support has become more sought after every year.

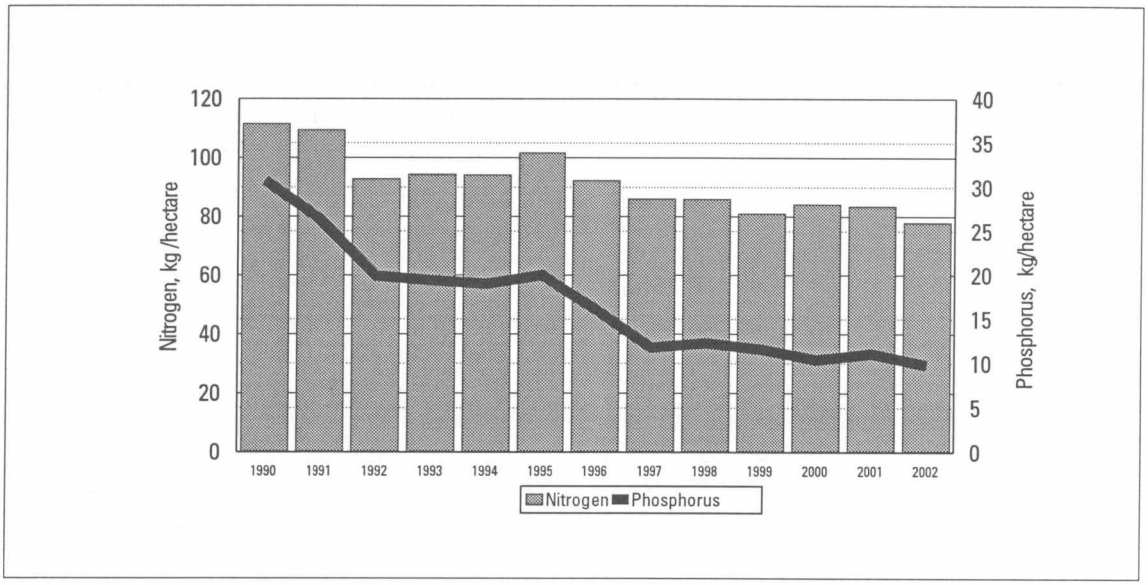
The estimated 60,000–90,000 hectares of private forests identified by the Forest Act are currently being surveyed. The great majority of the target areas can be preserved without paying compensations. Companies and the state have completed their survey of Forest Act targets. Finnish forest owners have 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, 65 per cent would preserve a valuable site in all cases and 15 per cent if it were small.

Certifications based on the Finnish Forest Certification System (FFCS) were started in summer 1999 and at the end of 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 forest, 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 brand was introduced in 2000.

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 2010 is based essentially on these target programmes.

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. 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, which reconciles the different uses of forests, 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 were completed in 2000.

Figure 9. Fertiliser use in agriculture



Cultivated resources

Some eight per cent of Finland's land area is in agricultural use. There is a total of some 2,216,900 hectares of farmland, i.e. fields and gardens, of which 1,984,500 hectares were under cultivation and 201,900 hectares were fallow in 2001. 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 is used for grazing. In 2001 there was a total of 75,384 farms with more than one hectare under cultivation. The majority of farms engage in productive activities entitled to agricultural subsidies and their mean cultivated area was 28 hectares. Since 1994, 30 per cent of active farms have ceased farming activities due to low profitability and an uncertain future. The mean cultivated area of farms has increased by 45 per cent since Finland joined the EU. According to estimates, the number of farms will continue to decline. In 2001 the total agricultural turnover in Finland was EUR 3.9 billion, of which subsidies accounted for 43 per cent or 1.7 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 from forestry, settlements in sparsely populated areas and holiday homes. Estimates by the Finnish Environment Institute indicate that 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 subsidy programme, implemented in 1995–1999, changed agricultural conventions in 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. The reduction in nitrate was only 4–15 per cent and the re-

9. Environmental subsidy for agriculture (EUR million)

	1999	2000	2001	2002	2003
	A	A	A	B	BP
1. Basic and additional procedures	233	250	248	..	..
2. Special subsidy	35	26	32	..	..
2.1 Organic production	*19*	*16*	*16*	..	..
2.2 Protective zones	*1*	*1*	*2*	..	..
2.3 Treatment of runoff	*10*	*4*	*6*	..	..
2.4 More efficient use of manure	*0*	*1*	*2*	..	..
2.5 Landscape managements and biodiversity	*4*	*3*	*6*	..	..
2.6 Farming in groundwater areas	*0*	*0*	*0*	..	..
2.7 Native breeds	*1*	*0*	*0*	..	..
3. Training and advisory services	2	1	2	..	..
4. Experimental projects	0	–	–	..	..
5. Other environmental management programmes	–	–	–	..	..
Total	**270**	**276**	**282**	**298**	**306**

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

duction in phosphorus from erosion was only 5–13 per cent.

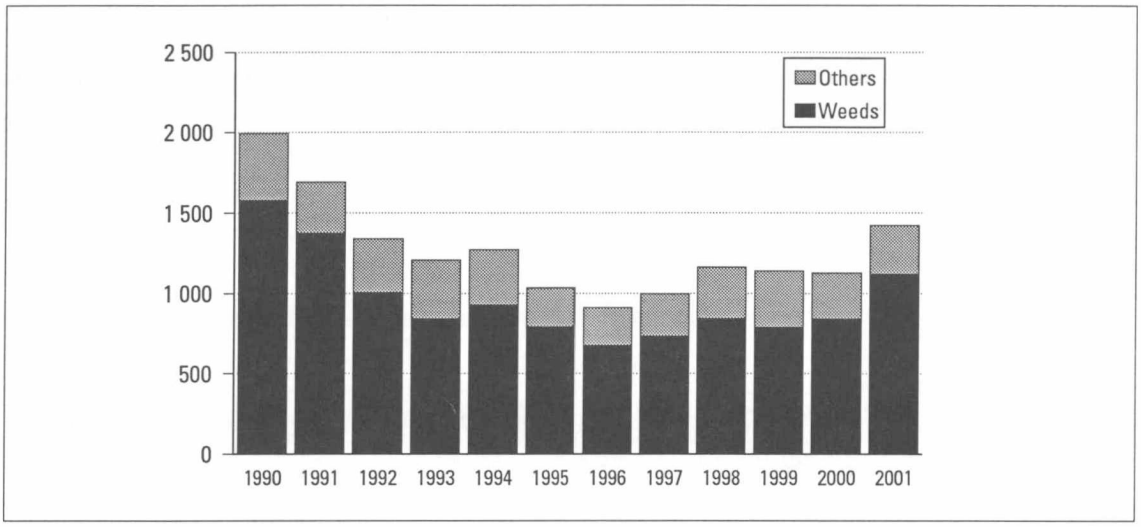
The nitrate regulation passed in 2000 is used to fulfil the European Council's directive on the protection of lakes and rivers against agriculturally caused nitrate pollution. The regulation includes directions for the storage, application and quantity of manure and the location and maintenance of livestock 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.

According to the Agenda 2000, a major reform of the European Union's agricultural policy adopted in 1999, a greater prominence is given to environmental considerations in the 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. The productivity of agriculture in Finland is clearly below the EU average because of the unfavourable climatic conditions. For this reason, subsidies have far more significance to Finnish agriculture when compared to the other EU countries. In 2001, fully or partly EU-financed subsidies were given out for a total of EUR 1.134 billion and in 2002 the amount will increase to EUR 1.164 billion. In 2001, national subsidies financed solely by Finland were given out for a total of EUR 572 million and in 2002 the amount will probably increase to EUR 588 million. A partial revision of the EU's agricultural policy is aimed for next in 2002–2003.

10. Organic farming and transition phase area in EU member states in 2000

	Hectares	Per cent of arable land
Austria	271 950	8.6
Italy	1 040 377	7.0
Finland	**147 423**	**6.8**
Sweden	171 682	6.3
Denmark	165 258	6.2
Germany	546 023	3.2
United Kingdom	547 323	2.9
Spain	380 838	1.5
Belgium	20 263	1.5
Netherlands	27 820	1.4
Portugal	50 002	1.3
France	370 000	1.3
Ireland	32 355	0.8
Luxemburg	1 030	0.8
Greece	24 800	0.7
Average for EU	**3 777 144**	**2.9**

Figure 10. Use of pesticides in agriculture (1 000 kg of active incredient)



In summer 2000 the European 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 EUR 286 million to EUR 235 million 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 remain unchanged. It is estimated that in the long term, the environmental subsidy to be provided to agriculture in 1995–2006 will reduce the phosphorus and nitrogen load on the waterways.

Organic farming is one of the recipients of agriculture's special environmental subsidy. The subsidy is used to promote organic farming. Organic farming methods imitate and make use of nature's own processes by means of diverse crop rotation. The use of artificial fertilisers and synthetically manufactured pesticides is not allowed on organic farms. The authorities inspect the operations of organic farms at least once during the growing season. In 2001 a total of 149,423 hectares were organically farmed in Finland.

Water resources

Finland has abundant surface and groundwater resources in proportion to its population and water consumption. There are an estimated 56,000 lakes of at least a hectare in size in Finland. According to the latest estimate the total length of shoreline is 214,896 kilometres for lakes, 53,510 kilometres for rivers and 46,198 kilometres for the sea. Inland waterways cover some 10 per cent of the country's total 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. Two to four per cent of the water suitable for water supply purposes is utilised yearly. The annual rate of usage for utilisable water is 15 per cent.

11. Water resource usage in European countries (billion cubic metres per year)

	Renewable water resources	Water usage	Intensity of water usage (%)
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	1500.0	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

Public waterworks serve almost 4.5 million Finns. Both surface and groundwater are used for producing household water. In sparsely populated areas water is mainly drawn from private wells. The daily per capita consumption of water supplied by the waterworks to households and industry is 243 litres, the figure for households alone is 150 litres. Some 0.7 million Finns rely on small water companies, co-operatives or their own wells. There are 1,320 monitored waterworks that serve over 50 people. The vast majority of these are small plants. Communities, industry and electricity production use an annual total of 2.5 billion cubic metres of sweet surface or groundwater produced by waterworks and industrial water catchments. About 3.5 million inhabitants use groundwater.

The central legal basis for protecting groundwater is in the prohibition on pollution in the Nature Conservation Act and in the groundwater protection requirements given under the European Commission's Water Framework Directive. The aim of the environmental authorities is to minimise the risk caused by the placing of chemical storage plants, garages, cattle sheds, fur farms and other facilities that could potentially cause pollution in groundwater areas. Around 200 conservation plans have been drafted for 500 groundwater areas. The monitoring of groundwater by municipalities, the central government's environmental administration and businesses in the vicinity of groundwater areas will be enhanced according to the requirements of the water framework directive.

Around 4.2 million inhabitants are serviced by a public sewerage system and there are a total of around 560 sewage treatment plants in population centres of over 50 inhabitants. All the treatment plants remove 94 per cent of the organic matter in waste water, and 93 per cent of the phosphorus. One of the great challenges for the near future is to decrease the amount of nitrogen in waste water. On a national level the removal rate of nitrogen had increased to 46 per cent in 2000. The total investments into the waterworks and sewage treatment plants in 2000 were EUR 244 million, of which EUR 105 million was used for waterworks, EUR 102 million for sewers and pump houses and EUR 37 million for treatment plants.

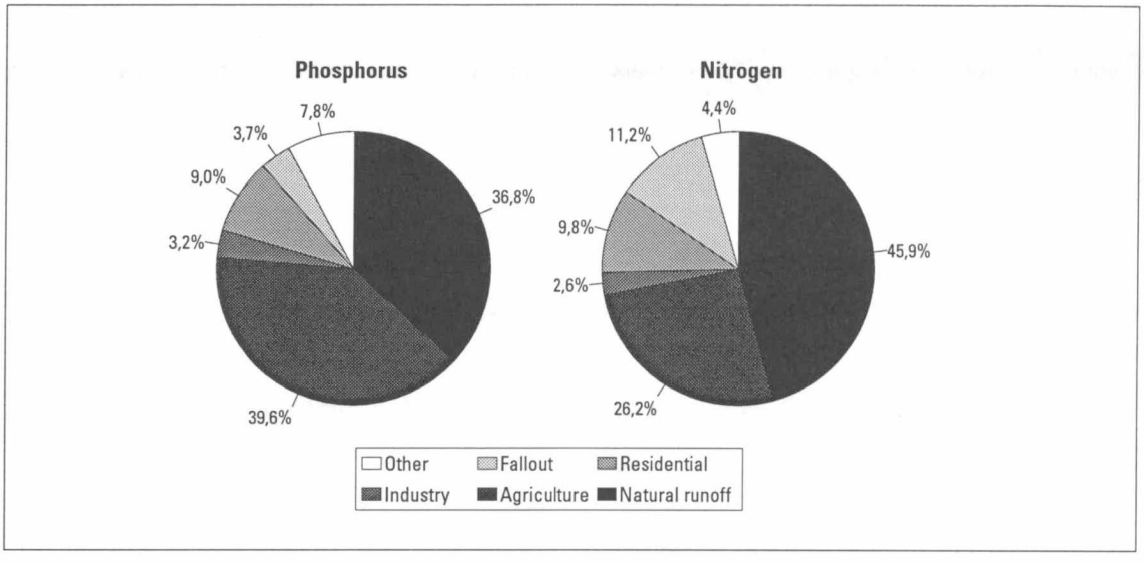
Approximately a million people are not served by public sewerage systems, mainly in sparsely populated areas. In addition to permanent housing, the majority of holiday homes, which are used by 1.5 million people, are located outside the sewerage system.

12. Water pumped by public waterworks (million cubic metres)

	1970	1980	1990	1999	2000*)
Groundwater	92	171	223	239	239
Surface water	201	218	201	167	167
Total	**293**	**389**	**424**	**405**	**406**

*) = estimate.

Figure 11. Sources of water pollution and natural runoff



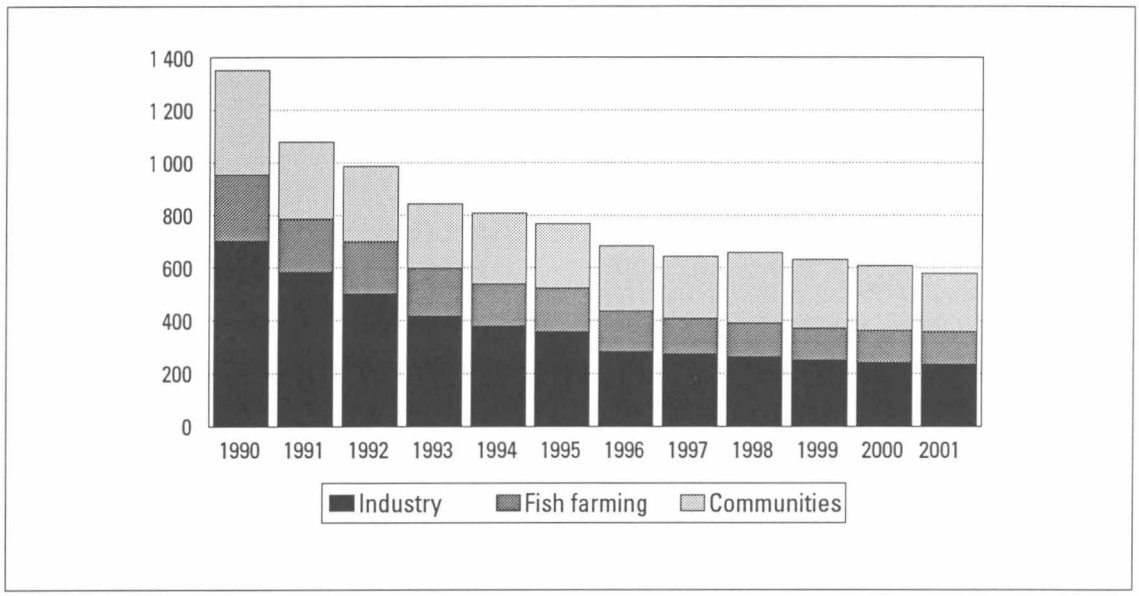
The target for the waste water originating from outside the sewerage system, either round-the-year or from holiday homes, is to reduce its environmental pollution levels by 2005 by reducing the biological oxygen demand by 60 per cent (to 3,800 tonnes per year) and of phosphorus levels by 30 per cent (to 300 tonnes).

The water quality of Finnish inland waterways is rather good by international comparison. The water quality of some 80 per cent of Finland's total lake area is classified as good or excellent. The water quality of the rivers is somewhat inferior to that of the lakes. The water quality of around 40 per cent of the total length of 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 most significant threat in this regard is eutrophication, which is steadily progressing in areas affected by nonpoint source pollution.

The Gulf of Finland is a shallow and vulnerable sea environment with 20 million people living within its catchment area in Finland, Russia and Estonia. About 75 per cent of the sweet water discharging into the Gulf of Finland comes from Lake Ladoga flowing down the river Neva. Consequently, the quality of the Neva's water, together with pollution from St. Petersburg, largely determines the state of the eastern Gulf of Finland. Domestic actions affect the coastal waters of the Gulf. The greatest polluters of the Gulf are agriculture, urban areas and the industry of the surrounding countries. According to the most current estimates, the annual load is 3,390 tonnes of phosphorus and 50,220 tonnes of nitrogen. The eutrophication levels in the Finnish coastal waters increase from the Gulf of Bothnia south to the Archipelago and 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.

The phosphorus content of the Gulf of Finland has increased from the beginning of the 1990s in spite of the incoming load decreasing by a third. Eutrophication and stratification together have resulted in oxygen defi-

Figure 12. Phosphorus discharge from industry, households and fish farming sources into waterways (tonnes)



ciency in the bottom zone of the sea. The Gulf has other environmental problems as well. Especially in the eastern reaches the heavy metal content of the seabed is high. In addition, the level of toxic organic chemicals in Baltic herrings and salmon continues to be high, although the level decreased in certain species of fish and in seals in recent years. Another problem is posed by non-native species, which are introduced to the Baltic Sea by ships. The increase in intentional and unintentional oil spills caused by ships also pollutes the Sea. In 2001, aerial surveillance over the Gulf of Finland registered 107 oil spills, 23 of which were in Finnish territorial waters.

Oil transports on the Gulf of Finland totalled over 40 million tonnes in 2000. The opening of new oil harbours by Russia and Estonia has increased the risk of oil spills in the eastern Gulf of Finland. Other kinds of shipping have greatly increased as well. In order to reduce the risks involved in oil and chemical transportation, the Ministry of Transport and Communications has created the Vessel Traffic Management and Information Service (VTMIS) for the Gulf of Finland together with Estonia and Russia. The service is meant to start up in 2004 and it will be used to connect the Vessel Traffic Systems (VTS) of the above countries. In addition, attempts will be made to implement the Automatic Identification System (AIS) and to enhance the capacity to combat oil and chemical spills.

The Baltic Marine Environment Protection Commission (HELCOM) has been working to prevent the contamination and pollution of the marine environment since 1980. During the 1990s the coastal states have increased their co-operation and many important projects have received international and EU funding. As part of HELCOM's Baltic Sea Joint Comprehensive Environmental Action Programme (JCP), 132 of the most significant sources of pollution, i.e. hot spots, were identified within the Baltic Sea's catchment area. Fifty of these are industrial plants with a significant effect on the environment. It is the responsibility of Finland to co-ordinate and evaluate the environmentally related actions of these industrial plants. By the summer of 2002, twenty-six names had been removed from the hot spot

list due to pollution reduction measures or the cessation of operations. To reach the goals set by the JCP, more measures will be needed, even though pollution has already decreased significantly. The reductions in the 1990s were due in particular to the environmental protection measures applied by the pulp and paper industries in the Nordic countries, the decrease in production by other industries and the increase in the efficiency of community waste water treatment in countries with transitional economies.

The goals in waterway protection for 2005 set pollution reduction targets so as to stop the deterioration of the surface layers of the Baltic Sea and inland waterways and to improve the condition of degenerated waterways. The aim is to reduce the pollutant loads caused by human activity, with the loads of nitrogen decreasing by 40 per cent and phosphorus by 45 per cent by 2005, compared to the levels of the early 1990s.

In April 2002 the Government decided on their policy for Finland's Baltic Sea environmental action programme and an action plan will be prepared for implementing it. The outlined policies will be implemented during the next 10–15 years. Domestic investment expenditure is estimated at EUR 300–370 million. In order to bring under control the agricultural nutrient load, it is proposed that the partly EU funded agricultural environmental subsidy is to be increased progressively from EUR 7.6 million to EUR 30.3 million in 2003–2006. The decision emphasises the importance that environmental investments in the vicinity of Finland have in improving the state of open sea areas of the Gulf of Finland. The first priority is to improve waste water treatment facilities and sewerage in the city of St. Petersburg and to increase oil recovery capacities in the Gulf of Finland. The international World Wide Fund for Nature gave the Finnish government recognition for its Baltic Sea conservation programme in the form of its highest award, the 'Gift to the Earth', which can be presented to a government, community or company for an act of environmental conservation. This was the first such award received by Finland. The WWF has presented 73 Gift to the Earth awards since 1962.

The Water Framework Directive that came into force in 2000 is to be used to renew the EU legislation on surface water and groundwater rather comprehensively. It both unifies existing EU water legislation and brings in fresh viewpoints. The deadline for member countries to make necessary legislative changes is 2003. The deadline for catchment area assessments is 2004; for starting follow-up programmes, 2006; for completing the action plan and catchment area management plan, 2009; for starting the action plan, 2012; and for reaching environmental goals, 2015. A key objective is to achieve an ecologically and chemically good state for surface water and a quantitatively and chemically good state for groundwater. In Finland the directive will cause changes to the Nature Conservation Act and to the Water Act. A new classification system based on water species and their environment will be needed to classify the state of surface waters and to replace the current system based primarily on the usability of water systems. The water framework directive requires numerous procedures, for example, water classification, monitoring, economic analyses, identifying environmental pressures and plans, and action plans for water conservation areas. These procedures are under development.

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 on endangered species in Finland completed in 2000, one in ten of the 15,000 or so studied species, or a total of 1,505 species, are currently endangered. There are 186 species that have become extinct and 1,060 species that 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 the maintenance of 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 1,762,000 hectares, i.e. 7.6 per cent of Finland's total forest and low-productivity forestland. Forests and low productivity forests that are strictly protected amount to around 1,665,000 hectares, or 7.2 per cent. Of the actual forest ground, 4.1% is protected, i.e. 834,300 hectares.

The nature conservation area network has been established in Finland by means of various conservation programmes. A financing package has been approved for the nature conservation programmes started in 1996. The aim is to complete all programmes by 2004, with funding extending to 2007 due to the staggering of payments. In 2001 nature conservation programmes were completed for a total of 24,410 hectares. The government acquired 18,350 hectares of area covered by approved nature conservation programmes and 6,060 hectares of privately protected forest were established. All in all, nature conservation areas have been established on 1.4 million hectares of government-owned and private property. An additional 1.4 million hectares of wilderness areas are protected by law.

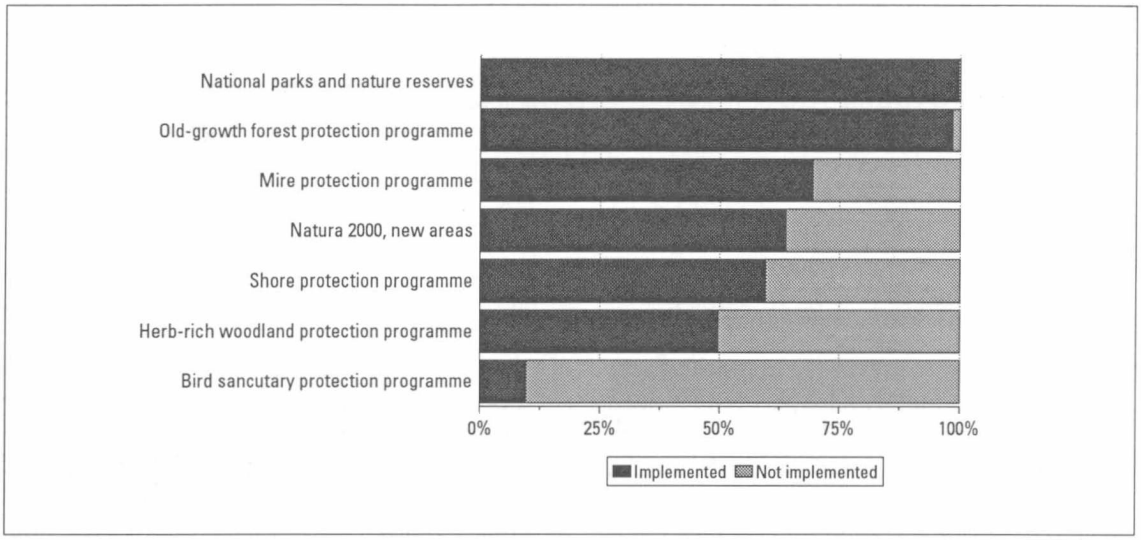
The conclusion of a group of specialists charting the conservation needs of the forests in southern Finland and East Bothnia in 2000 was that the current network of protected areas will not secure the survival of southern Finland's natural forest. In south-

14. The funding of conservation areas and conservation programmes (EUR million)

	1999	2000	2001	2002	2003
	A	A	A	B	BP
Purchase of land	45	36	27	24	18
Purchase of private land	*14*	*12*	*17*	*13*	*7*
Land exhanges	*9*	*7*	*5*	*5*	*5*
Income from sale of land	*22*	*17*	*5*	*6*	*6*
Management or conservation areas	15	14	17	17	17
Compensation payments	13	12	12	15	9
Protection of rapids	2	16	0	0	0
Life (Natura)	3	1	2	2	2
Total	**78**	**79**	**58**	**58**	**46**

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

Figure 13. Implementation of nature conservation programmes on private land, 1 Jan 2002



15. Nature conservation funding plan 2002–2007 (EUR million)

	2002	2003	2004	2005	2006	2007
Funds allocated	31	31	31	31	31	31
Interest	2	2	2	1	1	1
Land exhanges	10	10	10	–	–	–

– = not in use.

ern Finland, only 1.1 per cent of the forest has been fully protected while 1.8 per cent is less strictly protected. The conservation of southern Finland's forests is currently being prepared by the broadly-based METSO committee. It has suggested quantitative targets for the conservation of the region's forests and also determines the necessary conservation methods and required financing. 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.

In order to fulfil the European Commission's habitats and bird directives, attempts are being made to create a common network of areas to be protected, Natura 2000. In the Natura areas, conservation can be carried out in many ways depending on the need for protection of biotopes and species. Finland's proposal for the Natura areas was delivered to the European Commission in 1998. According to it, Finland's Natura network comprises 4.78 million hectares. The proposal contains 3.22 million hectares of government-owned land, of which 41,000 hectares were not previously under conservation. The revised proposal comprises 324,000 hectares of private land, of which 66,000 hectares have not been previously protected. Upon request from the European Commission, Finland completed its proposal with 264 new areas and broadened the boundaries of 33 already proposed Natura areas in May 2002. A final decision on the Natura 2000 network will be made by the European Commission.

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 programme's three-stage budget covering 2000–2004 is around EUR 640 million, of which 47 per cent is directed towards nature conservation (LIFE Nature) and around 47 per cent into new creative environmental technology projects (LIFE Environment). LIFE Nature is designed for the protection of the species and biotopes listed under the Commission's habitats directive and in particular for the implementation of the Natura 2000 network.

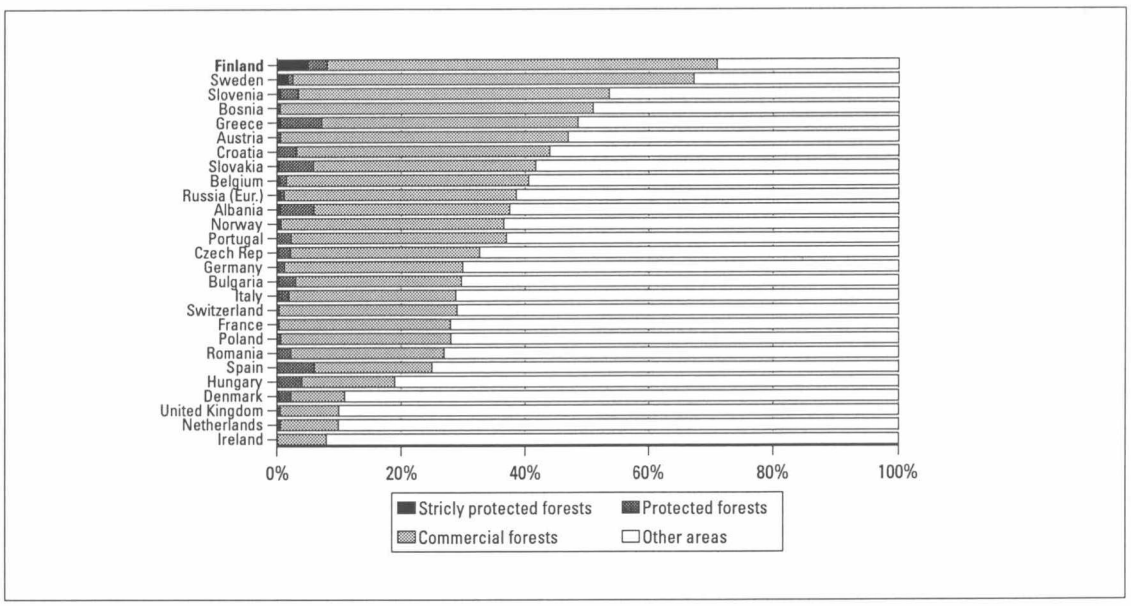
In 2002 the Commission allocated more than EUR 71 million to LIFE Nature projects. Six Finnish projects are receiving a total of over EUR 4.4 million. Between 1995 and 2000 Finland received EUR 27.4 million for 36 LIFE Nature projects. Between 1995 and 2001 Finland received EUR 12.5 million for 32 LIFE Environment projects. In 2002 the Commission granted eight Finnish LIFE Environment projects approximately EUR 3.8 million.

16. Natura barometer in the EU countries, 11 April 2002

	Number reserves	Total area (km²)	Proportion of forest and total land area (%)	Hectares per capita
Denmark	194	10 259	23.8	0.19
Spain	1 208	115 505	22.9	0.22
Greece	236	27 228	20.7	0.26
Portugal	94	16 502	17.9	0.12
Netherlands	76	7 330	17.7	0.05
Ireland*)	364	9 953	14.1	0.09
Finland	**1 381**	**47154**	**13.9**	**0.92**
Sweden	3 453	57 476	13.9	0.59
Italy	2 425	41 799	13.8	0.08
Luxemburg	38	352	13.6	0.09
Austria	130	8 915	10.6	0.12
United Kingdom*)	567	23 541	9.7	0.03
Germany*)	3 352	30 974	8.7	0.02
France*)	1 109	37 980	6.9	0.05
Belgium*)	274	1 788	5.9	0.01
Total	**14 901**	**436 756**	**13.7**	**0.10**

*) = Proposal for programme partly completed.

Figure 14. Forests and forest conservation in selected European countries (per cent of land area)



The built environment and zoning

The Land Use and Building Act and Decree, which came into force in 2000, are clearly supportive of sustainable development. The goal is to organise land use and building in areas in such a way 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 the prevention of environmental damage are among the general aims of the law. In addition, the law requires 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 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 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 co-ordinating measures targeted at different sectors. The quality of the environment may be affected and environmental damage prevented by zoning. In drafting zoning plans, the environmental effects of their implementation must be sufficiently studied.

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 suburbs is quickly emptying the countryside. Differentiation is also going on inside cities. 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. On the one hand, concentration of residences enhances the operational possibilities of public transport. On the other hand, the rise in living standards increases car use and holiday trips. Centralisation of services is a problem in the countryside and also in many residential areas. For example, grocery stores have undergone a considerable structural change in recent years, as many smaller shops have disappeared and new shops are larger and more centralised.

17. Population density and living structures in EU countries

	Population density 1999 habitants/km^2	Private houses in 1997 (%)	Single persons house holds 1999 (%)
Netherlands	384	71.0	32.0
Belgium	343	60.0	27.0
United Kingdom	245	..	28.0
Germany	230	45.6	35.0
Italy	191	..	23.0
Denmark	124	58.8	..
Portugal	109	98.3	16.0
France	108	56.2	30.5
Austria	96	66.1	28.5
Greece	80	67.4	22.5
Spain	78	37.6	13.0
Ireland	53	92.4	22.5
Sweden	20	45.7	..
Finland	**15**	**40.5**	**38.0**

.. = data not available.

The infrastructure of the built environment includes many buildings, structures, roads, streets, parks and various operations. In Finland, 71 per cent, or EUR 358 billion, of the national wealth is composed of buildings, transport facilities, networks and structures. In Finland there are around 2.6 million buildings with building permits. There are fewer than 2.5 million apartments and 450,000 holiday apartments. 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.

18. Different types of residences and holiday homes (1000s of residences)

	Houses	Row houses	Apartments	Others	Holiday homes
1980	774	126	766	116	252
1995	898	291	928	64	416
1996	904	295	941	59	423
1997	909	299	954	60	429
1998	916	303	968	61	435
1999	923	308	980	63	444

19. The constituents of Finland's national wealth in 1999

	EUR billion	per cent
Residental buildings	128	27.5
Other buildings	89	19.2
Machinery, equipment etc.	57	12.2
Land and water structures	52	11.2
Built-up land	54	11.7
Forest	49	10.5
Farmland	8	1.7
Other wealth	28	6.0
Total	**466**	**100.0**

4 Industry

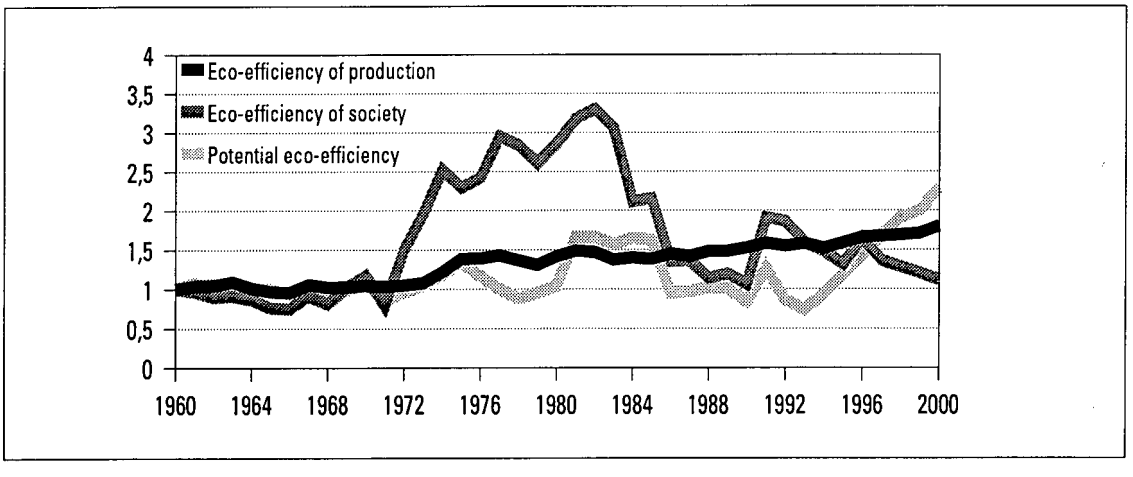
Progress in environmental protection

In the 1990s an increasing proportion of Finland's GDP was accounted for by industrial production; the corresponding shares of the service, construction and agriculture sectors were all on the decline. Growth was 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.

In the past few decades, the Finnish economy has shown a positive trend towards eco-efficiency but without further efforts Finland will probably not be able to achieve the Factor 4 and 10 environmental policy goals set by researchers and environmental organisations. The Factor 4 goal is to reduce the use of natural resources, raw materials and energy for each produced unit by a quarter from the current levels over a moderately long period, i.e. within the next 20 to 30 years. The Factor 10 goal is to reduce natural resource use to a tenth of the current levels over a longer time span, i.e. 30 to 50 years. Thus, the focus in eco-efficiency is that materials consumption affects the environmental load. The basic aim, therefore, is to reduce materials consumption to levels promoting sustainable development.

The eco-efficiency of production improved in Finland between 1960 and 2000 by almost half of the Factor goals. However, Finland's economy has the potential to achieve the Factor goals. Finland's problem is that the industry's potential for eco-efficiency does not convert into efficient national eco-efficiency. The industrial sector, notably the base metal industry, the pulp and paper industry, the mining industry and the transport industry made distinct improvements in eco-efficiency in 1975–2000. On the other hand, the eco-efficiencies of housing construction, civil engineering, agriculture and forestry have worsened, and especially in these sectors there is room for improvement.

Figure 15. Trends in Finland's eco-effiency



The industrial sector in Finland has invested significantly in environmental protection in recent years, and 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 to use the best available technology (BAT) in their processes and other functions. In Finland the requirement to use the best available technology is included in nature conservation legislation and in water, waste and sea conservation legislation. The Environmental Protection Act contains the main body of anti-pollution legislation. According to the Environmental Protection Act and Decree, any operation involving a risk of environmental damage must have an environmental permit.

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 discharges.

21. Environmental management systems applied in Europe 30 Jan 2002

	EMAS	ISO 14001
Germany	2 641	3 380
Austria	421	223
Sweden	202	2 070
Denmark	175	919
Spain	173	2 064
Italy	84	1 108
United Kingdom	78	2 500
Norway	78	235
Finland	**43**	**678**
France	35	1 092
Netherlands	25	942
Belgium	11	130
Ireland	9	200
Greece	4	66
Portugal	2	47
Luxemburg	1	9
Iceland	0	2
Liechtenstein	0	19
Total	**3 982**	**15 684**

20. Expenditure by industry on environmental protection (EUR million)

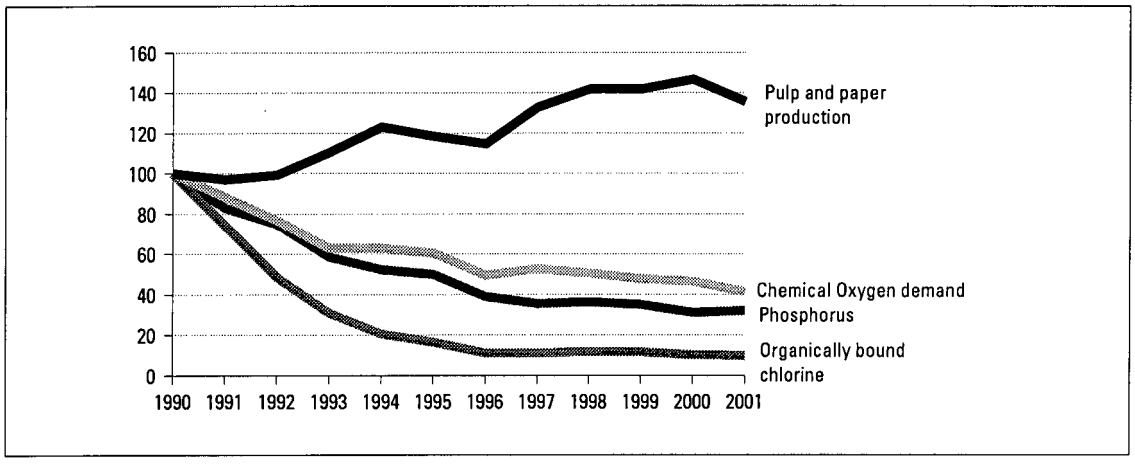
	1998	1999
Energy and water supply	39.6	43.9
Forest industry	196.4	167.0
Chemical and mineral industry	100.4	131.2
Metallurgical industry	123.1	102.0
Other industries	74.0	53.9
Total	**533.5**	**498.0**
of which		
Investments	187.5	140.3
Operating costs	346.0	357.7

The aim is, by 2005, to reduce phosphorus and nitrogen discharges by 50 per cent (from 1995) and biochemical oxygen demand by 45 per cent. The targets set for reductions in chromium, oil, nickel, copper and zinc discharges are 55–90 per cent. According to an interim estimate made in 2002 by the target programme, phosphorus discharges from industry were 35 per cent, biochemical oxygen demand 22 per cent and nitrogen emissions seven per cent lower in 2000 than in 1995. With the exception of copper, the other metal and oil discharges had dropped to the 2005 target level. According to the estimate, nitrogen discharges from the forest industry, and metallurgical industry discharges, should be reduced more vigorously.

The global ISO 14001 environment management system came into use in 1995. In spring 1996 the first companies registered in the voluntary environmental management and audit system (EMAS) for industrial companies operating within the EU. As the ISO proved to be clearly more popular in most EU countries, the usability of EMAS was improved with a revision in February 2001, meaning that EMAS system can be more easily used in all sectors. Moreover, the transfer from the ISO standards to EMAS has been made easier.

In many countries those companies that have registered in EMAS have been given relief

Figure 16. Pulp and paper industry production and load on the rivers and lakes (1990=100)



in permit and supervision procedures in the form of discounts on permit and supervision fees, reductions on the frequency of supervision visits, the replacement of environmental reporting with an EMAS report and priority given 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 clearer and more understandable as well as improving the compatibility with the ISO 9000 quality standard. The new standard is to be completed in 2004.

Forest industry

Finland accounts for five per cent of the world forest industry production and for 10 per cent of its exports. Ninety per cent of the 12.5 million tonnes of paper and board produced in Finland in 2001 was exported. The forest industry has been producing record quantities of paper and other wood products in recent years. In 2001, however, production in the forest industry dropped by 7.4 per cent

Figure 17. Pulp and paper industry production and emissions into the atmosphere (1990=100)

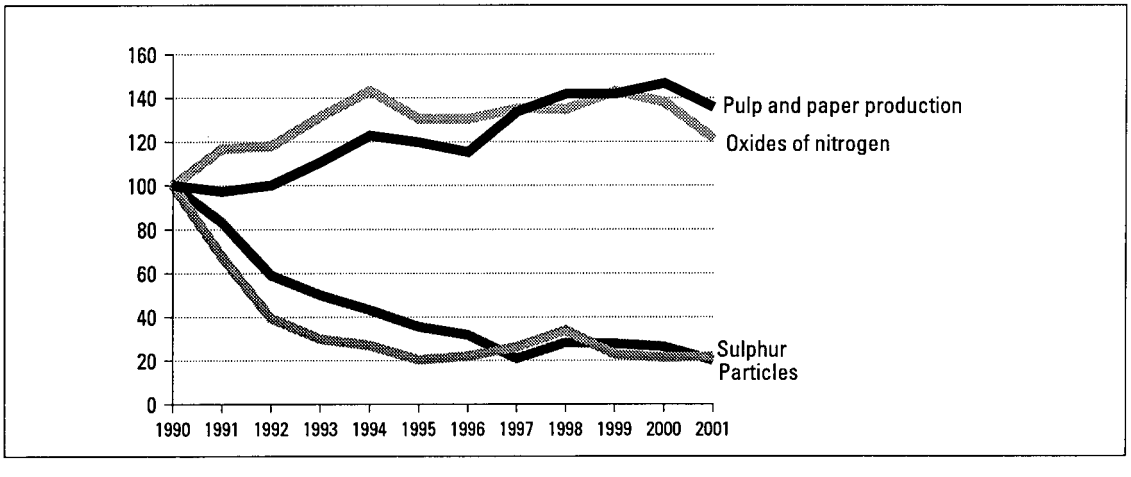
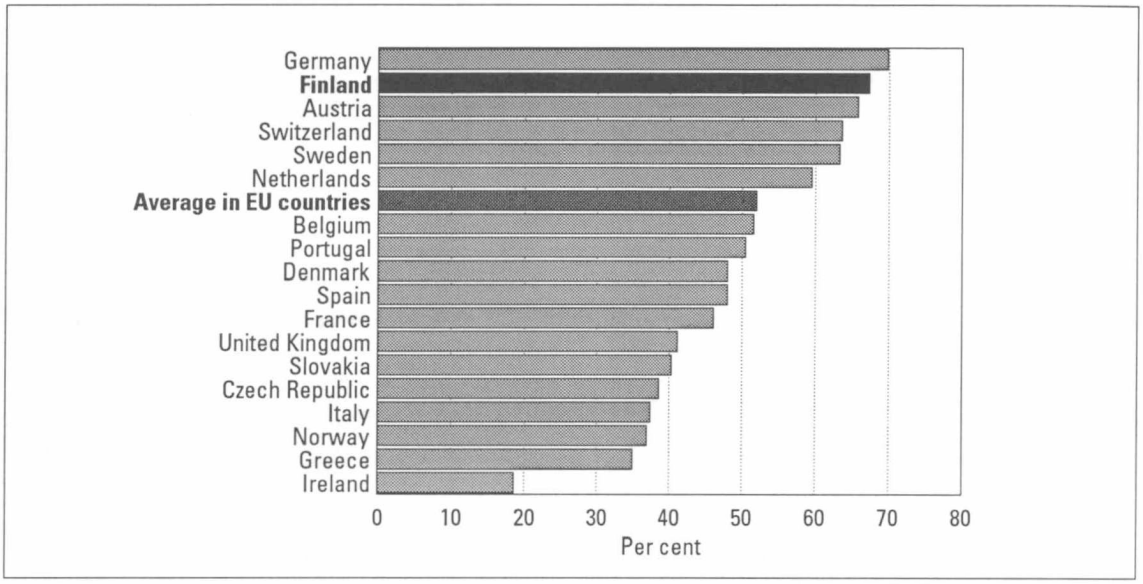


Figure 18. Recovery of waste paper in different countries 2000



on 2000. The paper industry's capacity utilisation in 2001 was 87 per cent on average.

Virtually all companies now have an environmental management system in place and they publish progress reports in connection with their annual reports. 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 improvements to the 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 68.5 million solid cubic metres of wood, of which 53.1 million solid cubic metres were of domestic origin, and 15.4 million solid cubic metres were imported. Imported timber for the Finnish forest industry is covered by ISO quality and environment certification.

In 2001 pulp and paper mills used 25.5 terawatt hours (TWh) of electricity, i.e. 59 per cent of industrial electricity consumption and 31 per cent of Finland's 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 largest consumer of biomass fuel.

Forest industry companies have been actively involved in the energy conservation agreements agreed upon by the Ministry of Trade and Industry and the Confederation of Finnish Industry and Employers. According to the annual report on industrial energy conservation agreements that was published in 2001, the coverage of the agreements at the end of 1999 was 97 percent concerning electricity use and 99 per cent concerning fuels. In other industries the coverage of the agreements averaged 77 per cent for electricity use and 92 per cent for fuel. The saving effect of the measures in the agreements was 0.5 TWh for heating and fuel, and over 0.26 TWh for electricity.

In 2000 the pulp and paper industries' environmental investments were EUR 96 million, i.e. 8 per cent of their total domestic investments which is a little less than in the previous year. Of the completed environmental in-

vestments the majority, 66 per cent, was directed in 2001 to water conservation, 16 per cent to waste disposal, 13 per cent to air pollution control and five per cent to other measures.

The use of recycled paper and board has increased 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. According to a policy decision of the Finnish Government in 1998, the recovery and utilisation of recycled paper will be intensified so that by 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 2001, 739,000 tonnes of paper and board were recycled in Finland, making up 74 per cent of all paper used. In the whole world the average recovery rate is around 40 per cent. Only around 10 per cent of the Finnish paper and board industry's production remains for domestic consumption, so the possibilities for increasing the share of recycled fibre are limited. In 2001, 83,290 tonnes of waste paper was brought into Finland to be used in the production of recycled fibre, and the Finnish paper and board industry used almost 713,000 tonnes of reclaimed paper as a raw material, so that reclaimed fibre accounted for 5.6 per cent of the paper and board industry's raw materials. This was used primarily in the production of different types of board, newsprint 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 consists of conventional external measures aimed at purifying emissions, whereas

22. The chemical industry's discharges into the waterways (tonnes)

	1995	1998	1999	2000	2001
Sulphate	99 578	66 265	61 742	62 529	64 550
Phosphorus	19	15	13	15	13
Nitrogen	449	427	382	461	459
Mercury *)	24	12	7	8	7
Cadmium *)	4	0	1	0	0
Lead *)	1 250	7	5	3	3

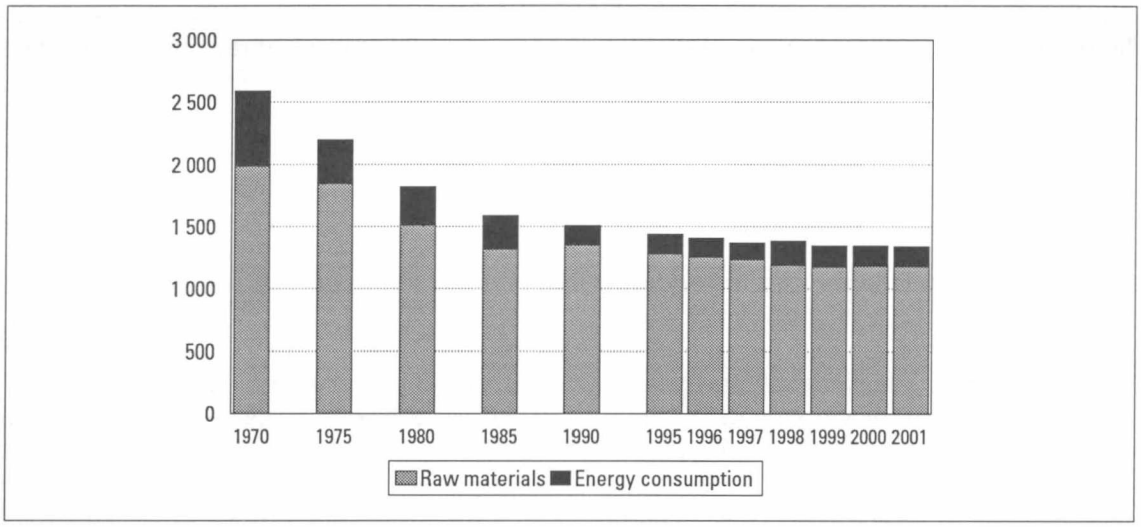
*) = kg.

23. Emissions and discharges from oil refining (tonnes)

	1995	1997	1999	2000	2001
Evaporable hydrocarbons	..	4 745	4 873	4 748	4 590
Oxides of nitrogen	2 287	2 985	3 053	2 877	2 915
Sulpuhur dioxide	4 536	3 069	3 188	3 266	3 383
Oil spills into water	7	5	4	5	9

.. = data not available.

Figure 19. Carbon dioxide characteristic emissions from metal production (kilograms of carbon dioxide per tonne of metal produced)



24. Emissions from metal production

	1995	1996	1997	1998	1999	2000	2001
Production volyme index	**100.0**	**105.8**	**111.6**	**117.7**	**122.3**	**128.1**	**128.6**
Emissions into the atmosphere (thousand tonnes)							
Sulphur dioxide	8.1	8.1	7.5	7.6	8.1	7.8	8.2
Nitrogen oxides	3.2	3.1	3.5	3.5	4.1	4.1	3.9
Discharges into water (tonnes)							
Nitrogen	420.6	449.3	421.6	526.0	490.0	520.5	320.9
Chromium	3.5	2.3	3.9	4.2	5.8	3.0	1.5
Nickel	12.4	6.0	10.3	6.8	9.3	7.2	5.6
Copper	8.2	8.7	8.9	6.8	7.1	9.7	7.9
Zinc	10.7	9.9	9.4	6.9	7.6	7.3	4.0

investments in process technology are at a low level. However, theNone industry has succeeded in reducing some of its discharges into water and air emissions, and the volume of waste has been declining since 1994.

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 2001 the programme covered more than 80 per cent of Finland's chemical industry production and 24,200 employees. Of those companies committed to the Responsible Care programme, 80 per cent possessed some quality management or environmental management system. Of the systems 47 per cent were ISO quality standard compliant, 34 per cent were ISO environmental standard compliant, three per cent were compliant with EMAS, and seven per cent with other systems.

Those companies taking part in the Responsible Care programme invested EUR 60 million (8 per cent more than in 2000) in improving environmental, health and safety matters. Operating costs in nature conservation fell by 4 per cent on the other hand, having been EUR 94 million in 2001. The energy consumption of factory inputs fell by 4

per cent, and in proportion to the quantity of production this increased by two per cent.

The most noteworthy emissions reductions under the Responsible Care programme were made at the beginning of the 1990s. In 2001 numerous emissions levels were stable from the previous year. Annual variations are the result of changes in company and branch structure as well as the market situation. The chemical industry's emissions into the atmosphere were slightly on the rise in 2001, with the exception of evaporable hydrocarbons, the emissions of which fell by four per cent. Nitrogen compound emissions rose by two per cent from the 2000 levels to 7,400 tonnes in 2001 and sulphur compound emissions rose to 14,400 tonnes. If proportioned to the quantity of production this signifies an increase of six per cent in comparison with 2000. Carbon dioxide emissions in proportion to the quantity of production remained at the 2000 levels having been 4.6 million tonnes in 2001.

Discharge monitoring and analysis technology has improved, which in some cases has been able to produce more accurate information about discharges than before. The amount of hazardous waste fell by 10 per cent in comparison with 2000, to 111,000 tonnes. Exploitable waste amounts increased by four per cent in comparison with 2000, to 160,000 tonnes. The amount of waste for disposal was 529,000 tonnes in 2001, which is around nine per cent more than in the previous year. The increase was due to changes in the definition of what waste is, the increased number of land areas in need of remedial action and certain structural changes in companies.

Metallurgical and electronics industries

The production of metal refining has grown steadily, having doubled over the last ten years. Simultaneously production in the electronics and electrical industry grew almost five-fold. Of the gross value of production in the metalworking and electronics industries in 2001, 47 per cent was from the electronics and electrical industry, 40 per cent from the machine and metalworking industry, and 13 per cent from metals refining. Most of the environmental effects in the metalworking industry arise from metals refining, where raw materials are being produced for use by other industries.

25. Finland's waste accumulation in 1999 (thousand tonnes)

	Accumulation	Recycled
Municipal solid waste	2 400	37%
Household waste	1 000	..
Sewage sludge	160	91%
Hazardous waste	638	13%
Industrial waste	19 000	64%
Energy supply waste	921	62%
Mineral excavation waste	29 600	..
Agricultural waste	20 000	94%
Building and demolition waste	1 200	..

.. = data not available.

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 2001 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. Recycling raw materials significantly reduces energy consumption when making metals. For instance, the manufacture of steel from scrap iron requires some 58 per cent less energy per unit than does the use of virgin raw materials. The recycling of aluminium also saves significant amounts of energy. The smelting of recycled aluminium only takes five per cent of the energy that is needed to produce the same amount of alu-

minium from bauxite. Also, metals do not lose their properties when recycled.

Since the manufacture of metals requires large amounts of energy, emissions into the atmosphere have the greatest environmental effect in this sector. The Finnish smelting industry has worked on improving its production processes and has thus significantly raised the efficiency of its raw materials and energy use and has 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.

The Kyoto protocol and carbon dioxide emissions are great challenges to metal refining. In the making of iron in a furnace and in the production of chrome iron, coal is an indispensable deoxidiser. The level of carbon dioxide emissions depends on the amount of raw material used. In Finland furnace efficiency is world-class, and carbon dioxides emissions per unit produced are among the world's lowest. Modern technology can do little to help reduce emissions.

Investments in environmentally acceptable process technology in the metalworking industry exceeded the costs arising from the purchase of traditional emission control technologies already 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 waste-w ater loads by developing production processes and treatment methods. The aims of waste-w ater management investments have been to reduce the volume of production by-products and to increase 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

Waste and waste-like materials, excluding the forest industry's felling waste and the surplus earth produced by the civil engineering industry, amounted in Finland to just under 83 million tonnes in 1999. Around 500 kilos of urban waste was collected per year per person, while the amount of urban waste in the EU varies between 300 and 650 kilos. There were 300 operational landfills in Finland in 2000. The number of landfills out of operation was 1,541.

About 95 per cent of all waste is generated in production, chiefly in industry, agriculture and construction. Industrial waste consists of production, mining and energy 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, 94 per cent of which is recycled.

Industrial waste in 1999 amounted to 19 million tonnes. This figure includes 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 1999, 64 per cent of industrial waste was utilised; 7.6 million tonnes were re-used as material input, 4.6 million tonnes were used in energy generation, and 4.7 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, where the manufacturer or the importer is to take an active role in organising the eventual disposal and treatment of 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 end-of-life vehicles. The directive proposal was endorsed by the European 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 bear the responsibility for vehicles that came onto the market before 2001. A directive for electrical and electronic waste, corresponding to the end-of-life vehicles directive, is under preparation in the EU.

5 Energy supplies

Energy production

In 2001 Finland's total energy consumption totalled 32.3 million oil equivalent tonnes. Of energy consumption, oil accounts for 26.6 per cent, coal for 12 per cent, natural gas for 11.3 per cent, nuclear power for 17.6 per cent and peat for 5.8 per cent. The share of domestic energy sources was 30 per cent while 20 per cent originated from wood. Finland has a high level of per capita energy consumption, which is due to the continuous need for heating, the dominant role of heavy industry in the economy and the need to travel long distances in what is a sparsely populated country.

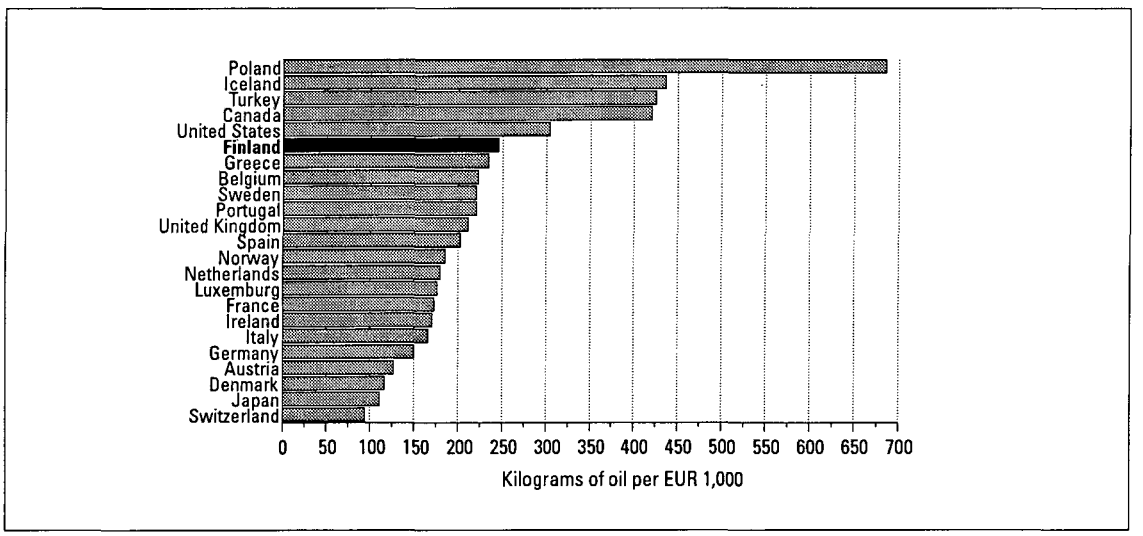
Electricity consumption amounted to 81.6 billion TWh, up by 3.1 per cent on 2000. Concerning production, nuclear power generated 21.9 TWh of electricity (31 per cent of total electricity consumption), hydroelectric power produced 13.3 TWh (19 per cent) and close on one-third or 36 per cent of the electricity was generated in combined heat and power production. Net imports of electricity amounted to 14.4 per cent or 11.8 TWh. Industry and construction accounted for 53 per cent of the electricity demand or 43.2 billion TWh.

In May 2002 Finland's parliament decided in principle to approve the building of a fifth nuclear power plant. In this connection, the parliament also required that quick measures be taken to limit the use of coal, to speed up the implementation of the country's energy-saving programme and regulations, as well as to promote the research, development and introduction of renewable energy sources. A progress report concerning these developments is to be submitted to the parliament during the course of the next electoral term. Finland's National Climate Strat-

26. Total energy consumption 2001

	Petajoules (PJ)	Per cent
Industry	514	49
Heating	236	23
Transport	170	16
Others	124	12
Total	**1 044**	**100**

Figure 20. Total energy consumption in selected countries by GDP unit 1999



egy estimates indicate that electricity consumption in 2010 will amount to 90 TWh without additional saving measures, and a few TWh less if the saving measures called for in the strategy are implemented. Nevertheless, even with the saving measures, electricity consumption will rise slightly to 90 TWh in 2015. It will rise in industry, households and the service sector. In industry, consumption will be fuelled mostly by higher forest industry output, while, in households, consumption will increase as a result of the trend toward smaller families, the increasing popularity for household appliances and the declining population density.

27. Total consumption of oil, coal and natural gas in Finland

	Oil, million tonnes	Coal, million tonnes	Natural gas, billion m³
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	8.4	5.8	4.0
2001*)	8.6	6.4	4.3

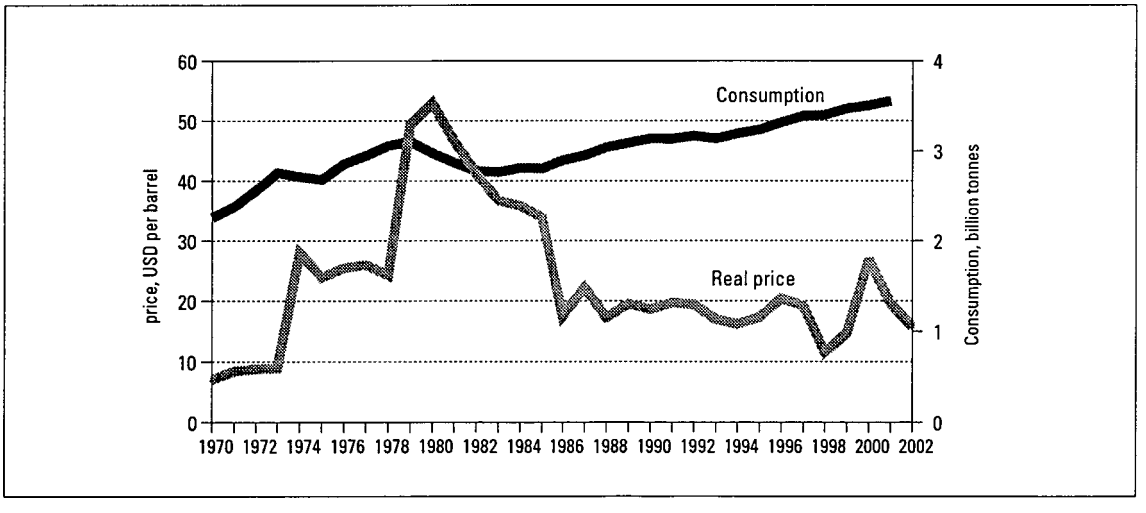
– = not in use. *) = preliminary data.

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 their accelerating use are considerable, and in many places they are by now seriously jeopardising the renewal and tolerance of the natural environment. Even so, in light of what we know today, there is no threat that fossil energy resources will be depleted over the next few decades. Given currently known fossil fuel reserves, 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 to raise prices. In the late 1990s, supply still greatly exceeded demand and in 1998 the real price of crude oil fell and, at its lowest, was below the price level of the first oil crisis of 1973. In 2001 global oil production totalled 3,594 million tonnes.

Figure 21. World oil consumption and real world market price



In Finland, oil consumption peaked in the 1970s at between 10 and 12 million tonnes a year. Consumption figures declined sharply in the 1980s, and during the 1990s the annual consumption of oil fell to less than nine million tonnes. In 2001, however, the consumption of fossil fuels increased, partly caused by a colder winter than average. The consumption of light fuel oil increased by two per cent and that of heavy fuel oil by just under six per cent. The consumption of petrol and diesel for vehicles also increased by one percent. The consumption of coal was up by 17 per cent and that of natural gas by nearly nine per cent.

Greenhouse gases

Among the most serious environmental problems caused by fossil fuels are greenhouse gases and global warming. The World Meteorological Organisation (WMO) and the United Nations Environment Programme (UNEP) established the Intergovernmental Panel on Climate Change (IPCC) in 1998 to produce scientific evaluations of climate change. These are utilised in international climate negotiations and in calculating the greenhouse gas emissions of different nations. The IPCC has produced three extensive reports on climate change in the years 1990, 1996 and 2001. The latest report indicates that global temperatures could rise by 1.4–5.8 degrees by 2100. The IPCC's tasks also include the development and formulation of guidelines on greenhouse gas inventories. In 2002, the organisation will develop guidelines for the calculation of sinks. Sinks, for example, soil and forests are important in the carbon, absorbing the carbon in the atmosphere.

The United Nations Framework Convention on Climate Change (UNFCCC), in force since 1994, binds its signatories to submit an annual inventory report of their anthropogenic greenhouse emissions for the previous two back. In Finland, these reports, and also the development of the inventory system, have been handled by a special greenhouse gas working group. The working group, established by the Ministry of Trade and Industry, compiles proposals on how to improve the continuous monitoring of greenhouse gases and their reporting. The group also submits proposals on what kind of public sector action should be undertaken in relation to the implementation of the Kyoto mechanisms, and proposals on how to improve the National Climate Strategy in this respect. The group's charter extends until the end of 2002.

Specific measures for the reduction of greenhouse emissions were agreed upon at the third session of the Conference of the Parties to the UNFCCC, in Kyoto in December 1997, and the joint EU burden was agreed in June 1998. Within the EU Burden Sharing Agreement, Finland is committed to reduce its greenhouse gas emissions to the 1990 level by 2008–2012. The Kyoto Protocol specifies reductions for six gases: carbon dioxide, methane (CH4), nitrous oxide (N2O), hydrofluorocarbon

28. EU greenhouse gas emissions (carbon dioxide equivalent tonnes) and targeted shares of burden

	Emissions 2000, million tonnes	Change 1990–2000	Targeted share of burden 2008–2012
Luxemburg	6	– 45%	– 28%
Germany	991	– 19%	– 21%
Denmark	69	– 2%	– 21%
Austria	80	+ 3%	– 13%
UK	649	– 13%	– 12,5%
Belgium	152	+ 6%	– 7,5%
Italy	543	+ 4%	– 6,5%
Netherlands	217	+ 3%	– 6%
France	542	– 2%	0%
Finland	**74**	**– 4%**	**0%**
Sweden	69	– 2%	+ 4%
Irelanti	66	+ 24%	+ 13%
Spain	386	+ 34%	+ 15%
Greece	130	+ 21%	+ 25%
Portugal	85	+ 30%	+ 27%
Total	**4 059**	**– 4%**	**– 8%**

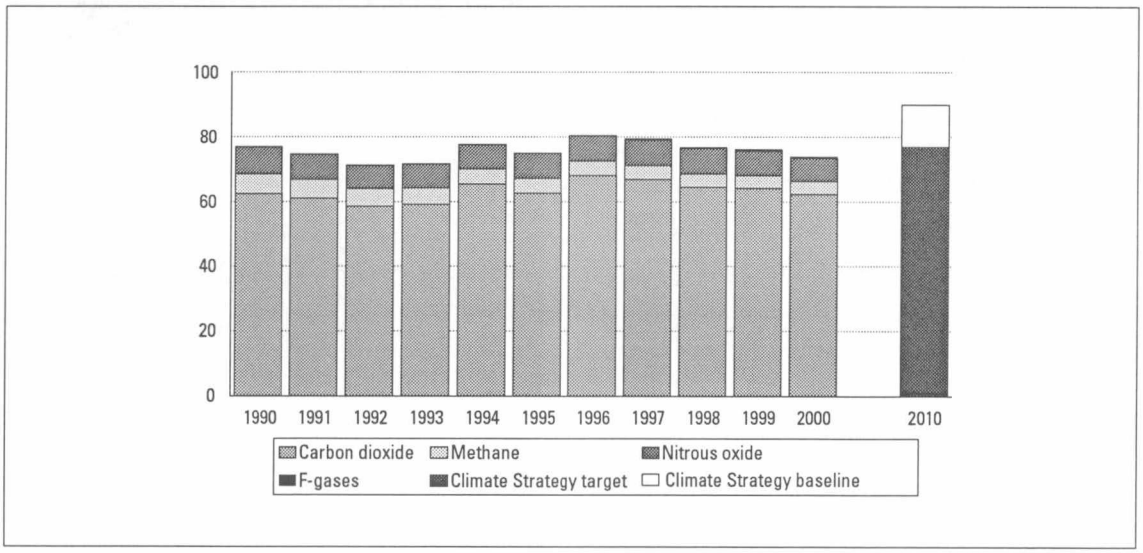
(HFC), perfluorocarbon (PFC) and sulphur hexafluoride (SF6). At unit level the other gases have much stronger effects than CO2: for instance, methane is 20 times, nitrous oxide more than 300 times and the three other gases 1,000 times more harmful over a hundred-year examination period.

In 2000, Finland's net greenhouse gas emissions were the equivalent of 74 million tonnes of carbon dioxide. This is 3 million less than in 1990, the Kyoto Protocol benchmark year, when emissions were 77 million carbon dioxide equivalent tonnes. The figures do not include carbon dioxide emissions from wood-based fuels, as these are considered to be reabsorbed by the forests. The figures will also become more exact in coming years with better computational rules and methods, and as a result it can be said that Finland's emissions are more or less at the 1990 level. The most significant greenhouse gas is carbon dioxide, which accounted for 84.2 per cent of the total in 2000. The major sources are energy and traffic, which accounted for 82 per cent of total emissions and nearly 94 per cent of carbon dioxide emissions. Finland's nitrous oxide emissions in 2000 amounted to 7.2 million carbon dioxide equivalent tonnes, or 9.7 per cent of Finland's total emissions. Nitrous oxide emissions have fallen by 1.24 million equivalent tonnes, i.e. 17.3 per cent, since 1990. These emissions arise from the agriculture, energy, industry and waste sectors. The N_2O emissions in 2000 of the agriculture sector, which is the most important of the aforementioned, were more than one million equivalent tonnes lower than in 1990. Finland's methane emissions in 2000 were about four million equivalent tonnes, 2.2 million less than in 1990. Methane's share in total greenhouse gas emissions also fell by eight per cent to 5.4 per cent, for the most part following changes in the waste handling sector. On the other hand, the F-gas emissions, i.e.

29. Finland's greenhouse gas emissions by sectors in 2000

	Million CO_2 equivalent tonnes	Per cent
Energy	47 626	64.4
Traffic	13 128	17.7
Agriculture	7 696	10.4
Industry	2 949	4.0
Waste	1 768	2.4
Others	792	1.1

Figure 22. Finland's greenhouse gas emissions (million equivalent carbon dioxide tonnes)



HFC_5, PFC and SF_6, have considerably increased. However, they only accounted for 0.7 per cent of all greenhouse emissions in 2000. These gases arise primarily in industry and energy production.

The National Climate Strategy report presented to the Finnish parliament in 2001 mapped out procedures for decreasing greenhouse gas emissions. According to the report, Finland's greenhouse gas emission will increase from the 1990 level of about 77 million carbon dioxide equivalent tonnes by 20 per cent to about 90 million tonnes in 2010, if no additional restrictive measures are put into effect to complement the ones already agreed on. The greatest challenge is posed by the increase 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 transboundary pollution and somewhat less from energy production and transport. In 2000 Finland's sulphur dioxide emissions totalled 74,100 tonnes, which means a reduction of 47 per cent from the 1990 level. 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 and improvements in process technology. Finland's sulphur dioxide emissions in proportion to GDP are about one-third less than is the average figure for the European OECD countries. Electricity and heat generation account for 58 per cent of the emissions, industry for 36 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. As early as 1994, Finland reached the targets set down for 2000 in the Oslo Protocol on Further Reduction of Sulphur Emissions.

In 2000 Finland's total emissions of oxides of nitrogen were around 235,900 tonnes, over 21 per cent less than in 1990. Close on two-thirds or 65 per cent of these emissions were caused by traffic, while energy generation accounted for 24 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 in 1998, 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.

Acid deposition has caused damage to a number of fish populations in Finland, and evi-

30. Origin 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 and seas)	16	27
Total	**100**	**100**

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

	Rikki	Typpi
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**

Figure 23. Finland's sulphur emissions and reduction targets (thousand tonnes of sulphur dioxide)

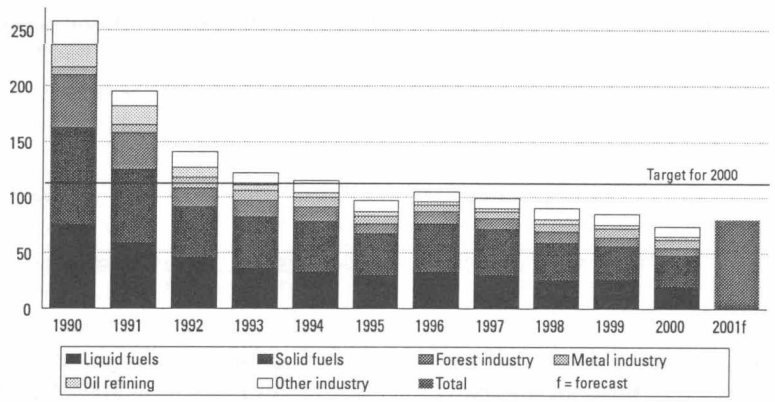
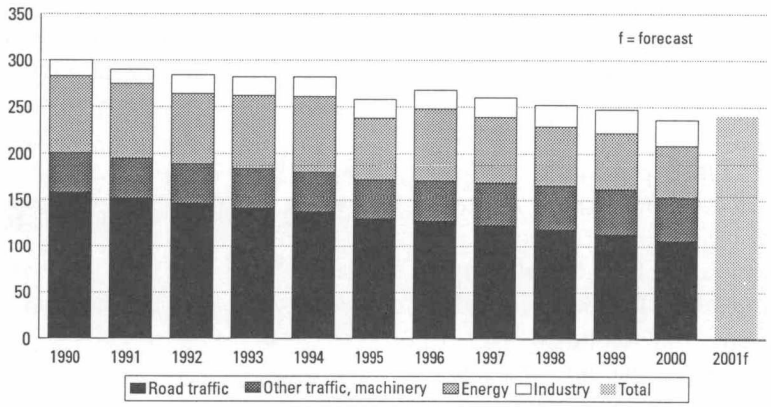


Figure 24. Finland's nitrogen oxides emissions (thousand tonnes)



NB. Emission calculation methods have changed and therefore the figures for 1992–2001 cannot directly ve compared with earlier data.

dence of damage has been observed in some 2000 lakes in southern and central Finland. There have, however, been some signs of 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. Additionally, resistance to acidification of the lakes has improved significantly during the past ten years. In spite of these favourable trends critical loads are still being exceeded in certain parts of Finland. 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 the Nordic Countries in the 1980s. At least in the near future, groundwater acidification cannot be expected to pose any major threat

32. Sulphur dioxide, nitrogen oxides and ammonia emissions of the EU countries in 1999 and the emission ceilings reported by the countries for 2010 (thousand tonnes)

	Sulphur dioxide (SO_2)		Nitrogen oxides NO_2		Ammonium (NH_3)	
	Emissions	Emission ceiling	Emissions	Emission ceiling	Emissions	Emission ceiling
Spain**)	1 498	746	1 194	847	517	353
United Kingdom	1 187	585	1 603	1 167	348	297
Germany	831	520	1 637	1 051	624	550
Italy	923	475	1 485	990	448	419
France	682	375	1 530	810	805	780
Greece*)	549	523	382	344	74	73
Belgium	186	99	292	176	103	74
Portugal*)	375	160	369	250	103	90
Ireland	157	42	119	65	127	116
Denmark	56	55	210	127	96	69
Netherlands	100	50	408	260	175	128
Finland	**87**	**110**	**247**	**170**	**35**	**31**
Sweden	63	67	261	148	55	57
Austria	42	39	171	103	70	66
Luxemburg	4	4	16	11	7	7
EU on average	**6 740**	**3 842**	**9 924**	**6 519**	**3 587**	**3 110**

*) = emissions data from 1998. **) = emissions data from 1996.

to the health 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 detrimental 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 the early spring of 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 high as 60 per cent.

Finland currently has stricter legislation than many other EU countries to restrict the use of substances that contribute to ozone depletion. In 1998 the European 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 concentration in the lower atmosphere has 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 level of ozone is high especially due to the long-range transport of emissions from Western Europe. The formation of ozone is by nature a non-linear process and largely depends on the meteorological conditions and background concentrations in the Northern Hemisphere. For this reason, it is not always easy to establish clear links of causation between emissions and concentrations.

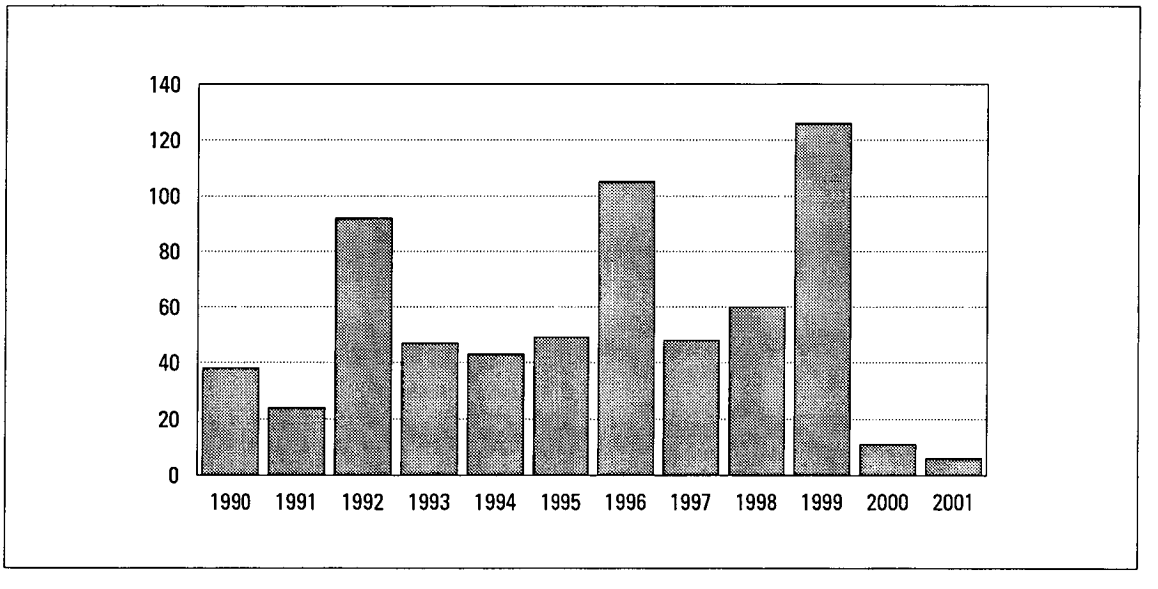
It is estimated that during the crop growing season, critical ozone exposure times are exceeded almost every year in Finland. Critical exposure levels for forests are exceeded in southern and central Finland, especially during hot, sunny summers. The health threshold identified in the EU ozone directive is repeatedly exceeded every year over large areas of Finland. The only way that the ozone level 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, such as solar energy, wind power, biomass and waste, geothermal energy and small-scale hydroelectric schemes, and related trade in equipment and technology through the ALTENER research programmes. The EU's SAVE programmes are aimed at promoting the conservation of energy. ALTENER III was launched in 2000 as part of a framework energy programme. The European Commission aims to increase combined heat and power production and to double the proportion of renewable energy sources from the current level of six per cent by 2010.

In a directive promoting the use of electricity produced by renewable energy sources, each member country has an individual indicative target for the percentage of renewable energy used of total electricity consumption by 2010. The indicative target for Finland is 31.5 per cent. To promote combined heat and power (CHP) production, the European Commission

Figure 25. Excessive ozone levels recorded in the lower atmosphere at certain observation stations (days per year)



has set a target for the whole EU to double the share of CHP by 2010. The forthcoming CHP directive and more accurate statistical methods may serve to specify this target.

In addition, between 1998 and 2010, the EU will also be working to promote the introduction of renewable energy sources through a major campaign to boost investments. The aim of the campaign is to build one million 1KW solar panel systems, 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 achieving the Commission's target of 12 per cent by 2010 will require investments of around EUR 165 billion.

33. Annual global new wind energy capacity (megawatts)

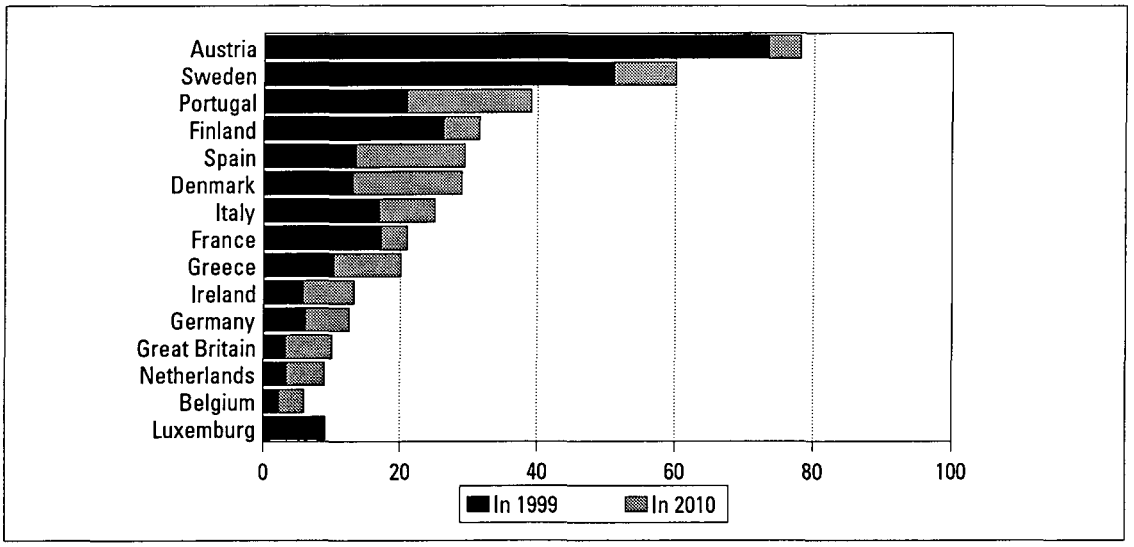
1990	200
1991	240
1992	338
1993	480
1994	730
1995	1 290
1996	1 292
1997	1 566
1998	2 597
1999	3 922
2000	4 885
2001*)	5 825
2002*)	6 095
2003*)	7 600
2004*)	9 175

*) = forecast.

The programme for the promotion of renewable energy sources initiated in 1999 aims to increase the use of renewable energy sources by 50 percent from the 1995 level by 2010. Most, or 90 per cent, of the increase would come from bioenergy, mainly from wood, four per cent from heat pumps, three 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.

Starting in 2003, the EU's sixth framework programme on energy research will focus on sustainable development and global change. A continuation programme on energy con-

Figure 26. Renewable energy sources as a proportion of electricity consumption in 1999 and target for 2010 (per cent)



34. Total consumption of forest chips in Finland in 2000 and 2001

	2000 GWh	2000 1000 k-m³	2001 GWh	2001 1000 k-m³
Heat and power production	600	790	1 853	960
Forest industry	*170*	*228*	*498*	*254*
Other producers of heat and power	*390*	*514*	*1263*	*654*
Heat entrepreneurs	*40*	*48*	*100*	*52*
Small real estates	110	142	763	381
Total	**710**	**932**	**2 616**	**1 342**

servation and the promotion of renewable energy is being prepared for 2003–2006.

One of the goals of the National Forest Programme's and the Ministry of Trade and Industry's Action Plan for Renewable Energy Sources is to increase wood fuel use. In 2000, solid wood fuel was used to produce 35 TWh of energy, 10 per cent of Finland's total energy consumption. An even greater source of energy was wood-derived waste liquor, which produced 40 TWh, 11 per cent of total energy consumption. Most solid fuels, 23 TWh, were used in heat and power plants. The most significant solid fuel is bark, with a share of about a third. Bark, like waste liquor, sawdust and forest chips, originates from, and is thus dependent on, the wood-processing industry. Wood pellets and briquettes are also chiefly made from industrial side products. Of the other wood fuels the most significant is burning short split billets. For the time being, converted chips are an uncommon, but an increasingly important wood fuel.

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 wind power capacity stood at 64 turbines and 38 megawatts. In 2001 Finland produced 69.9 GWh of energy by wind power, which is 9.1 per cent less than during 2000. The decrease was due to calm wind conditions at the beginning of the year. Wind power accounted for 0.1 per cent of Finland's electricity 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 solar energy applications are mainly for the 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 also 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 'eco-electricity' generated by means of old hydropower, biomass, 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 combined heat and power (CHP) production. In 2000, 31 per cent of all electricity in the country was co-generated 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 25.6 billion TWh. Some 46 per cent of the population live in housing connected to a district heating system.

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 two brackets. 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 EUR 17.16 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 from renewable sources.

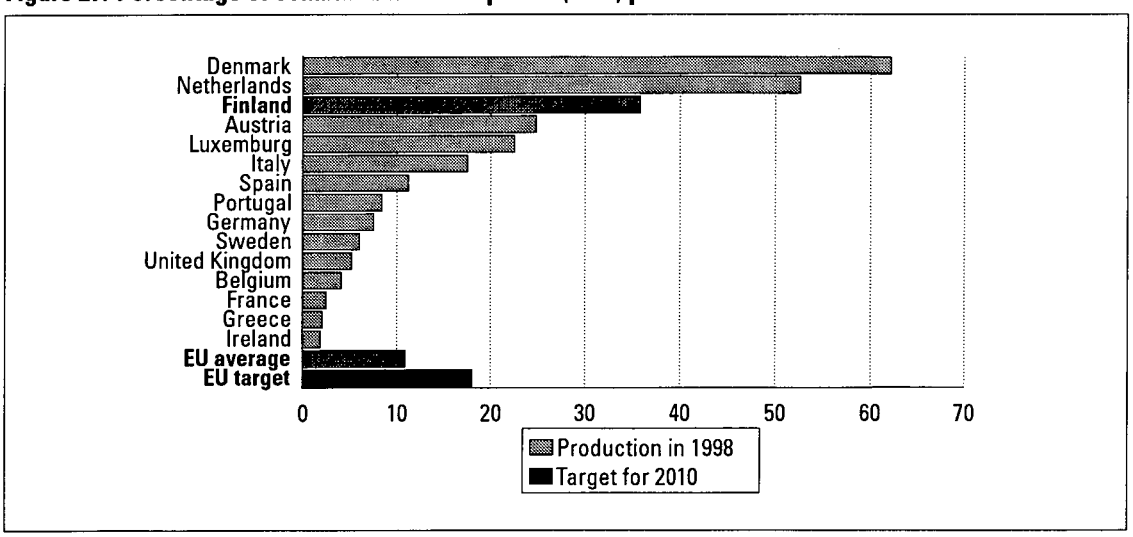
One of the central channelling procedures in the National Climate Strategy is energy taxation. The usability of the present energy taxation system in reducing emissions was evaluated in the report published in April 2002 by the Research Institute of the Finnish Economy and the Technical Research Centre of Finland. According to the report, the present energy taxation has a weak channelling effect due to its failure to comprehensively cover all sources of emissions, especially fuels used for electricity production.

According to the above-mentioned report, the use of energy taxation as a tool of energy and climate policy requires more extensive study. Certain proposals for directives concerning energy and climate policy, issued or being prepared by the European Commission, further highlight this need together with other aspects related to the supply and demand of energy. The most significant of these is the proposal for emissions trading, given in the autumn of 2001. Emissions trading overlaps partly with energy taxation. An investigation into the compatibility of energy taxation and other measures is being organised by the Ministry of Trade and Finance in the so-called Kyoto co-operation network.

35. Finland's energy tax revenue in 2001 (FIM million)

Petrol	1 337
Diesel	663
Light fuel oil	182
Heavy fuel oil	52
Coal	61
Peat	15
Electricity	397
Natural gas	11
Total	**2 749**

Figure 27. Percentage of combined heat and power (CHP) production in EU countries



There have been talks in the European Commission already from 1992 onwards about a proposal for a directive to update the taxation framework for energy, but no consensus has been reached on the matter. Finland has supported the achievement of a Europe-wide energy taxation directive. The objective of a cohesive taxation directive, with sufficiently high tax levels for products, is not only to fulfil our environmental responsibilities, but also to create a neutral competition environment between the member states.

6 Transport

Trends in traffic volumes

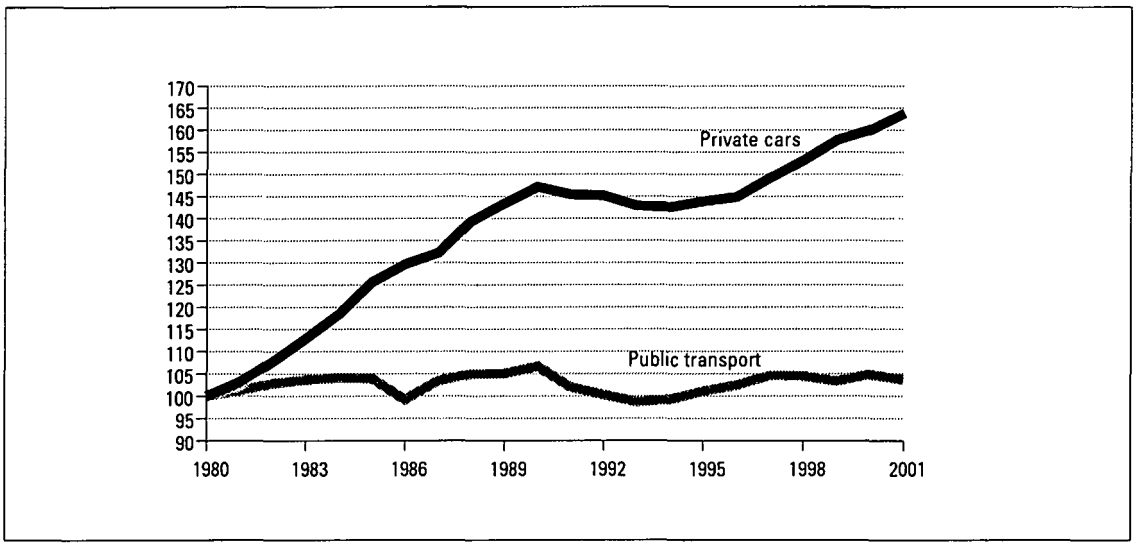
The annual distance travelled per head of population in Finland is one of the highest in the European Union: In Europe only Denmark and Italy have higher figures. The total distance travelled by road traffic in 2001 was around 47.7 million km, with private cars accounting for two-thirds. Passenger kilometres in road traffic totalled 64.5 billion, i.e. two per cent more than the previous year. Road freight transport, on the other hand, fell somewhat. Domestic road freight traffic in 2001 was around 372.8 million tonnes, which is around four per cent less than the previous year.

The slight growth in rail traffic continued in 2001. In rail freight transport the number of tonnes increased three per cent and the amount of passengers increased 0.5 per cent on the previous year. In freight transport international deliveries increased and domestic deliveries fell a little. Correspondingly, travel increased in local, short-distance trains but decreased in long-distance trains. Approximately 55 million passenger trips were made, and about 41.7 million tonnes of goods were transported.

There was an increase in the number of shipments by sea between Finland and foreign countries in 2001. Imports grew by 9.3 per cent on the previous year and exports grew by 0.3 per cent. All in all the amounts transported grew to a record 84.5 million tonnes, compared with 80.6 million tonnes in 2000. Passenger transport between Finland and foreign countries decreased by around 370,000 passengers, however, to 15.6 million.

The number of air traffic passengers in Finland fell by 0.2 per cent in 2001 compared to the previous year. International private flights decreased by 5.4 per cent and domestic traffic fell by 2.1 per cent. However, international scheduled traffic grew by 2.7 per cent.

Figure 28. Trends in the use of public transport and private cars (1980=100)



Environmental impact

Transport has the following environmental effects: greenhouse gas emissions (carbon dioxide, methane and nitrous oxide 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 ground and surface water, the soil, natural resources and/or biodiversity impacts on the social environment (e.g. on well-being)

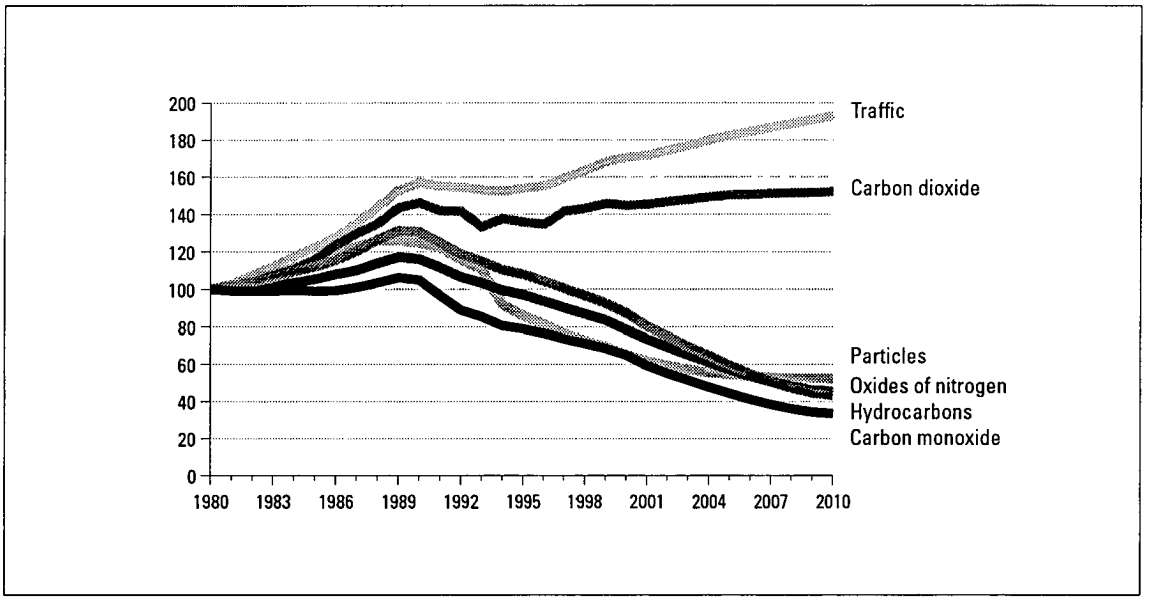
Finland is attempting to reduce the adverse environmental impacts of transport by means of an environmental programme revised in 1999 entitled Transportation policies with regard to environmental questions. The programme has been moulded into the structure of an ISO 14001-compliant environmental system, and it presents the aims, actions and timetables of environmental work in traffic and the responsible bodies for 1999–2004. Administrative sector institutions and companies will complement the programme with their own programmes. The implementation of the programmes will be monitored annually.

The carbon dioxide emissions of Finnish traffic totalled 16 million tonnes in 2001, i.e. around 23 per cent of all carbon dioxide emissions. This includes emissions from non-domestic air and water traffic, as well as flyovers in Finnish air space, whose emissions totalled four million tonnes in 2001. Road traffic was responsible for 90 per cent of domestic traffic emissions. Traffic accounted for around 15 per cent of methane emissions, just over 30 per cent of nitrous oxide emissions and around 10 per cent of HFC compound emissions. If no further actions are taken, traffic emissions are estimated to increase by a million carbon dioxide tonnes by 2020–2025.

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

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

Figure 29. Trends in emissions from road traffic (1980=100)

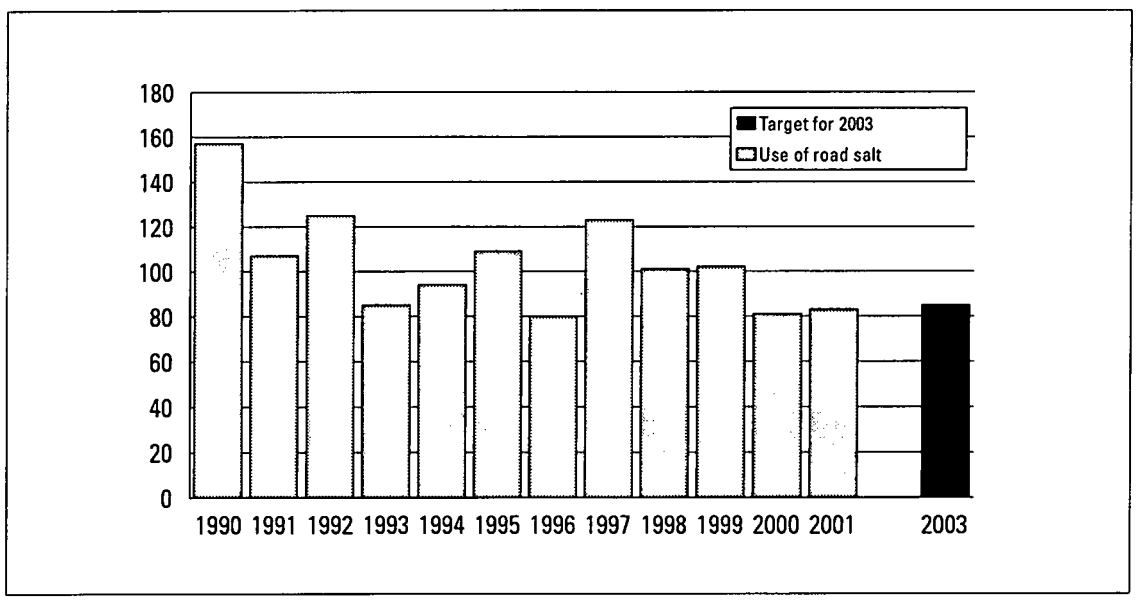


Attempts are being made to reduce greenhouse gas emissions by means of the climate strategy of the transportation sector, for example. The strategy is part of a national climate strategy, which was presented to parliament in a government report in the spring of 2001. The measures proposed in the strategy contain nine action groups, by which it is estimated that the emissions levels of 1990 can be reached by 2010. The measures aim to reduce the necessity of transportation (most importantly by condensing and integrating the social structure) and to affect the modal split. Attention has also been paid to goods transport, international transport, driving habits and solutions provided by information technology.

The aim is that technical improvements in the specific consumption of vehicles can be achieved through agreements made between the EU and the car industry. According to the agreements the average fuel consumption of private cars will decrease to 5–6 litres per 100 km and average carbon dioxide emissions to 140 grams per km by 2009. According to a study performed by the Finnish Vehicle Administration, average fuel consumption fell in Finland in new petrol-driven cars from 8.5 litres per 100 km in 1993 to 7.5 litres in 2000, and in diesel cars from 7.5 litres per 100 km in 1993 to under 6 litres in 2000. In Finland, cars first registered in 2000 or after produce an average of 174 grams of carbon dioxide on a one-kilometre journey. For petrol cars the figure is 178 grams and for diesel cars it is 155 grams. Petrol cars experienced a reduction of 8 per cent over the study period, while for diesel cars it was 23 per cent.

The transportation sector's environmental work will also pay special attention in the future to air quality in cities and to noise abatement. Thanks to improvements in fuel quality and engine technologies, air quality norms are exceeded less often nowadays, although the limits for particles and oxides of nitrogen are still sometimes exceeded. The total particle content of city air is at its highest in the springtime, when the sand spread on the roads during the winter rises into the air as dust because of traffic-caused air currents. Levels of oxides of nitrogen are at their highest in busy and poorly ventilated streets. Another major problem with regard

Figure 30. Use of road salt and desired level in 2003 (tonnes)



to air quality in urban areas is ozone, which is produced by emissions from traffic and industry, especially by oxides of nitrogen reacting with the substances in the atmosphere. Most of the lower atmospheric ozone in Finland originates from Central Europe.

There were 271,884 tonnes of traffic-caused carbon dioxide emissions in 2001, i.e. around 51 per cent of Finland's total carbon dioxide emissions. Hydrocarbon emissions from traffic amounted to 50,237 tonnes (30 per cent), particle emissions, 7,987 tonnes (15 per cent) and oxides of nitrogen emissions, 182,120 tonnes (60 per cent). Sulphur emissions from traffic totalled 19,670 tonnes, i.e. around 20 per cent of total sulphur dioxide emissions in Finland.

Motor vehicle emissions limits have been significantly tightened over the last few decades and these continue to be revised. In 2000 a change in the heavy vehicle emissions directive was put into force in Finland, by which current particle emissions will drop by 80 per cent compared to current levels by 2006 and nitrogen oxide emissions should fall by 40 per cent by 2009. Passenger car and light commercial vehicle emissions limits were tightened in 2001 and will tighten further in 2006 – while for motorcycles the limits will tighten in 2003 and 2005. The quality requirements of fuels have also been tightened in EU countries, most recently in 2000 and next in 2005.

The problems of noise from traffic will continue to increase with the ever-growing number of people and vehicles in cities and towns. A 1998 study concluded that around 980,000 Finns lived in areas with traffic noise at over 55 dBA. Of these, around 560,000 lived in street and planned road noise areas, around 35,000 in the proximity of a railway and around 65,000 in a flight traffic noise area. Up to now attempts have been made to solve the noise problem by technical improvements to vehicles and noise barriers, but, in the future, zoning and regulating the amounts of traffic in cities will need to play a more prominent role in tackling the problem.

The European Parliament and Council accepted an environmental noise directive in May 2002. In Finland a pilot project was started in 2001 by the Finnish Road Administration and the Ministry of Traffic and Communications in order to make a common noise database in the area of the Uusimaa road network and the Uusimaa Regional Environment Centre. The project will be expanded in the future to create a noise database for the whole country, covering all the sources of environmental noise.

In the traffic sector, the protection of groundwater and soil is taken into account already in the planning phase of projects. The environmental impact assessment (EIA) scheme is designed to prevent problems from taking shape. For existing road traffic routes a groundwater protection programme has been put into effect that primarily protects the most critical sites. There were 60 such sites at the turn of the millennium and around 145 km of road are in need of this protection. About 18 km of groundwater protection were built in 2001. Road salt use to prevent roads from freezing was reduced especially in groundwater areas. The target is to reduce salt use to around 85,000 tonnes by 2003. In 2001, 83,000 tonnes of salt were used. Alternative de-icing chemicals have been tested for use in both road and air traffic.

Natural resources use and waste generation have decreased somewhat in the traffic sector over the last ten years. Road policy is slowly undergoing a shift from the construction of new roads to the maintenance of existing ones. Furthermore, in road construction, the policy is to increasingly use earth recoverable from near the site itself, thereby decreasing the need to sort and bring in materials from elsewhere.

Transport costs and taxation

In the EU the basis for economic steering is the marginal social cost charging principle, in which transport expenses dependent on the distance covered are incorporated into transport fees. The pricing of traffic through various kinds of taxes and fees is an important means of steering consumption in an environmentally friendlier direction. Taxes targeted at road traffic include the automobile or motorcycle tax levied on acquisition, the annual vehicle license tax and motor vehicle tax, and the fuel tax. The fuel tax on road traffic is partly based on environmental effects, so the fuel tax for sulphur-free and lead-free fuel is lower. Moreover, the additional tax is based on the carbon content, being EUR 17.2 per tonne of carbon dioxide. Economic steering has also been applied to rail 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 fifth highest place in EU statistics, concerning the relative share of taxation in the price of fuel. The tax on diesel, however, is lower than the average for EU countries.

Just under EUR 1.3 billion of net appropriations in the state budget was used for the maintenance and development of traffic routes in 2001. A good EUR 0.5 billion was used for basic road maintenance and EUR 151 million for road development projects. EUR 387 million was used for rail maintenance, including EUR 320 million for basic rail maintenance and EUR 61 million for development investments. EUR 165 million was used for the upkeep of sea routes.

37. Material flows in road maitenance (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

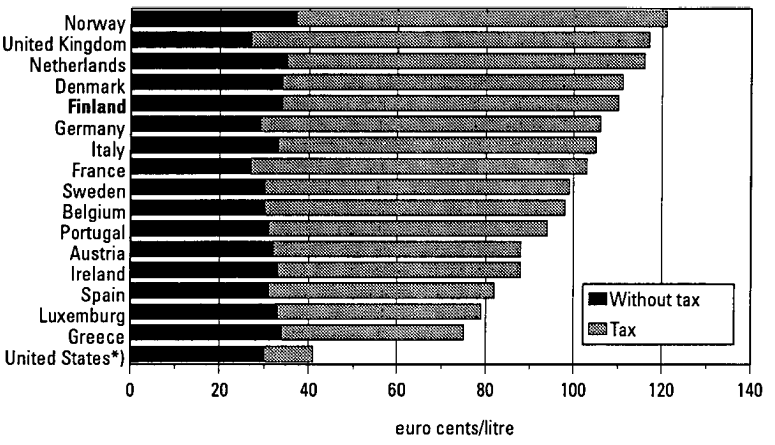
..= data not available.

38. Special taxes levied on road traffic (EUR million)

	1999 A	2000 A	2001 A	2002 B	2003 BP
Vehicle tax	209	220	226	237	247
Motor vehicle tax	185	181	200	209	218
VAT on motor car tax	226	233	196	195	198
Motor car tax	1 028	1 059	891	887	900
VAT on fuel tax	286	274	292	296	318
Fuel tax	1 969	1 939	1 960	1 971	2 180
Total	**3 903**	**3 906**	**3 805**	**3 795**	**4 061**

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

Figure 31. Retail prices of motor fuel (95E) on 15 August 2002



*) = price for March 2002.

7 Towards sustainable development

The ten-year journey towards sustainable development, which began with the UN Conference on the Environment and Development (UNCED) in Rio de Janeiro in June 1992, has proven to be a slow and politically complicated process. Basically, the slow progress and reluctance to co-operate are the result of a collision of economic interests between different countries. The United States has largely withdrawn from participating in the development of global environmental agreements and conservation, appealing to their economic interests. On the other hand, developing countries have become frustrated at the reluctance of western countries to give them the financing and support that was promised in Rio. The ideals and practice of sustainable development have been most diligently kept alive and advanced by the European Union over the last decade.

The EU's sustainable development strategy, which closely integrates the policies of economically, socially and ecologically sustainable development, was also the Community's contribution to the United Nations' ten-year follow-up to the Rio process, the World Summit on Sustainable Development (WSSD), held in August-September 2002. Additionally, the EU ratified the Kyoto protocol before the Johannesburg summit. From the EU point of view, the most important objectives of the WSSD meeting were to improve eco-efficiency so as to reverse the current over-utilisation of natural and environmental resources by 2015, to more closely integrate environmental conservation and the eradication of poverty, to make globalisation work for sustainable development, and to enhance good governance, participation and support on all levels. The first objective also included a concern to protect and secure the natural resources base and the carrying capacity of ecosystems, which are important for economic and social development. Accordingly, the EU should play a leading role in these policies.

Finland was able to significantly reduce much self-inflicted environmental damage in the 1980s and 1990s, due to environmental conservation based on active government intervention and also partly on economic steering. Now, at the beginning of the new millennium, Finland's environmental policy faces new challenges. The greatest emissions reductions have been made and, without a farsighted and preventive environmental policy, rapid economic growth in the future may lead, once again, to increases in environmental damage. The environment will be burdened especially by predicted growth in the use of natural resources, transport and energy. In addition to governmental intervention, emphasis is now on economic steering methods, the provision of environmental information, the establishment of voluntary agreements with companies and the use of environmental standards. Furthermore, local environmental concerns are now being replaced by those with global repercussions, such as reducing greenhouse gas emissions and other wastes, and sustaining biodiversity.

One of the most important tasks that lies ahead in the near future, both in Finland and internationally, is to draw up an overall picture of the state of the environment and the potential threats. The effects of global warming are already observable in the flora and fauna – coral reefs have suffered the most. Climate changes can also be seen in the shortening of European winters. Unfortunately, painting a clear general picture of the state of the environment is problematic, because many environmental matters exhibit contradictory development trends. The ten-year follow-up summit on sustainable development in Johannesburg strove to establish a general picture on the environment and on the results achieved within the framework of sustainable development. Work is currently under way to develop the tools and methods needed for this analysis.

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, 1997.	To stabilise greenhouse gas concentrations in the atmosphere at a safe level. In the Kyoto Protocol industrial countries committed themselves to reducing their greenhouse gas emissions altogether by 5% from the 1990 level by 2008–2012. Finland's share of the joint EU target is to keep emissions at the 1990 level during the 2008–2012 period.	The protocol has been signed by 84 parties including the EU. The EU and its member states brought their own ratification process to a conclusion on 31.5.2002. In 2000 Finland's emissions were at approximately the 1990 level.
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 Government (262/1998).
General agreement on long-distance transport of air pollution across national borders: (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 87% lower than in 1980.
Nitrogen oxide emissions Sofia Protocol on the Reduction of Nitrogen Oxide Emissions, 1988.	Finland committed itself to freezing its emissions of oxides of nitrogen to the 1987 level by the end of 1994.	Finland's emissions in 2000 were 18% lower than in 1987.
Reduction of heavy metals emissions Protocol, 1998.	To continue reducing emissions of mercury, lead and cadmium into the atmosphere below the 1990 level.	The Protocol has not yet entered into force. It has been signed by 35 countries and the EU, and ratified by 10 countries, including Finland.
Persistent organic compounds Protocol, 1998.	To restrict or discontinue the use of persistent organic compounds (e.g. pesticides).	The Protocol has not yet entered into force. It has been signed by 35 countries and the EU, and ratified by 9. Finland signed the Protocol in 1998.
The abatement of acidification, eutrophication and ground-level ozone Gothenburg Protocol, 1999.	To cut emissions of sulphur dioxide, oxides of nitrogen, ammonia and volatile organic compounds (VOC). Finland's emission ceilings as of 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 and ratified by 2.
VOC emissions Geneva Protocol, 1991.	To cut emissions of volatile hydrocarbons by 30% from the 1988 level by 1999.	Finland's emissions in 2000 were 27% lower than in 1988.
Wild fauna and flora General Agreement (CITES), 1973 and Protocols on international trade of fauna and flora.	To regulate the international trade of endangered species and their products.	The Agreement will be implemented through corresponding EU regulations.
Biological diversity • General Agreement on Biological Diversity, Rio de Janeiro, 1992. • Cartagena Biosafety Protocol, 2000.	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 Protocol aims to ensure the safety of importing genetically modified organisms in terms of both biological diversity and human health.	The 2nd follow-up report of the Finnish national action programme on biological diversity was completed in early 2002. The Cartegena Protocol has not yet entered into force. It has been signed by 110 countries (incl. Finland) and ratified by 19 countries. The preparation of Finland's ratification started in spring 2002.

AGREEMENT	OBJECTIVES	IMPLEMENTATION
Hazardous waste • Basel Agreement on the Transboundary Transport of Hazardous Waste and Supervision of its Handling, 1989. • Protocol on liability/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 close to its place of origin.	The protocol on liability and compensation for damage was signed in Dec. 2000. All EU countries prohibit the export of hazardous waste from industrial countries to developing countries. Finland has assisted developing countries in the management of hazardous waste disposal.
Persistent organic pollutants Stockholm Agreement on persistent organic pollutants (POPs), 2000.	To halt production and use of ten pesticides and industrial chemicals, to limit dioxin and furan emissions.	The Agreement has been signed by 151 countries and EU and ratified by 11. Finland's and the EU's ratifications are pending.
Trade in hazardous chemicals Rotterdam Agreement on Prior Consent for Certain Chemical Substances and Dangerous Pesticides in International Trade (PIC), 1998.	The export of dangerous chemicals and pesticides listed in the Agreement is allowed only with the prior consent of the importing state, which may also refuse to accept the chemicals. The Agreement applies to five industrial chemicals and 22 pesticides.	The Agreement has not yet entered into force, but the PIC-system is already adhered to voluntarily. The Agreement has been signed by 73 countries and ratified by 21. In Finland, ratification is pending. In Jan. 2002, the Commission made a proposal for a decision on EU ratification and a regulation concerning implementation.
Access to information and participation ECE Århus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters, 1998.	To guarantee public participation and the supply of information concerning environmental matters, as well as the right of appeal and the right to the institution of proceedings.	The convention entered into force on 30.10.2001. Finland's ratification is pending. Finnish legislation mostly fulfils the requirements of the Convention.
Environmental impact assessment 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 Convention came into force in 1997. By Aug. 2001, it was ratified by 37 states and the EU. Finland has applied the Convention to 7 projects and been the recipient 5 times.
Protection of the Baltic Sea Helsinki Agreement on the protection of the marine environment of the Baltic Sea, 1992.	To prevent and stop the pollution of the Baltic Sea and promote its ecological recovery and balance.	A revised Baltic Sea Agreement (1992) came into force on 17.1.2000. App. III and IV were revised in 1998 and 2001.
• Baltic Environmental Programme, 1992.	To eliminate the Baltic Sea's worst local point sources and nonpoint source inputs.	The Baltic will be protected in Finland through the "Aims of Waterway Protection 2005," the "Finnish Baltic Sea Protection Programme" and the "Plan of operation for waterway protection until 2005" accepted by the Environment Ministry. These measures are also observed in the Baltic area and in other international co-operation, and in granting permits.
• HELCOM Recommendations and Ministerial Statements, 1988 and 1998.	To reduce releases of nutrients, heavy metals and persistent or toxic organic substances into the Baltic Sea by 50 per cent from the 1987 level by 2005.	

List of Tables

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Statistical appendix

1. World's carbon dioxide emissions from fossil fuels (billion tonnes)

	Total	Industrialised contries	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	24 107	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*)	25 598	11 307	10 632	3 660
2003*)	26 095	11 555	10 952	3 589
2004*)	26 592	11 802	11 272	3 518
2005*)	27 089	12 050	11 593	3 447
2006*)	27 587	12 298	11 913	3 375
2007*)	28 084	12 546	12 234	3 304
2008*)	28 581	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*)	30 880	13 491	14 154	3 236
2013*)	31 533	13 592	14 634	3 308
2014*)	32 186	13 693	15 113	3 380
2015*)	32 839	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*)	34 797	14 096	17 031	3 669
2019*)	35 449	14 197	17 511	3 742

.. = data not available. *) = forecast.

Sources : Worldwatch Institute (1900–1999) and OED/World Energy Outlook 2000 (2000–2020).

2. Environmental sustainability index (ESI) of certain countries in 2002

Finland	**73.9**	Netherlands	55.4
Norway	73.0	Ireland	54.8
Sweden	72.6	United States	53.2
Canada	70.6	Germany	52.5
Switzerland	66.5	Greece	50.9
Uruguay	66.0	Russia	49.1
Austria	64.2	Japan	48.6
Iceland	63.9	Italy	47.2
Costa Rica	63.2	Poland	46.7
Latvia	63.0	United Kingdom	46.1
Australia	60.3	India	41.6
Estonia	60.0	Belgium	39.1
Denmark	56.2	China	38.5
France	55.5	Kuwait	23.9

Source: 2002 Environmental Sustainability Index. An Iniatiative of the Global Leaders of Tomorrow Environment Task Force. World Economic Forum.

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

	GDP at 1995 prices EUR billion	Consumption of materials, million tonnes	Total consumption of energy 1 000 Mtoe
1980	72.3	165.9	22 606
1981	73.9	160.9	22 404
1982	76.2	166.5	22 005
1983	78.3	181.3	22 463
1984	81.0	183.6	23 369
1985	83.5	190.9	24 946
1986	85.6	186.9	24 748
1987	89.2	194.2	26 218
1988	93.4	194.3	26 517
1989	98.2	203.1	26 679
1990	98.2	196.6	27 220
1991	92.1	176.3	26 775
1992	89.0	173.5	26 436
1993	88.0	167.2	27 149
1994	91.5	180.1	29 014
1995	95.0	178.2	28 478
1996	98.8	176.6	29 766
1997	105.0	185.9	30 587
1998	110.6	193.6	31 056
1999	115.2	199.0	31 705
2000	121.8	199.6	31 341
2001*)	123.2	197.8	32 330

*) = preliminary data.
Sources: Statistics Finland; National accounts and Research Reports 229; Ministry of Trade and Industry: Energy Reviews.

4. Trends in real GDP and atmiospheric emissions in Finland

	GDP at 1995 prices, EUR billion	Carbon dioxide emissions, million tonnes	Sulphur dioxide emissions, 1 000 tonnes	Emissions of oxides of nitrogen, 1 000 tonnes
1980	72.3	54	584	295
1981	73.9	45	534	276
1982	76.2	43	484	271
1983	78.3	43	372	262
1984	81.0	44	368	258
1985	83.5	50	383	275
1986	85.6	49	331	278
1987	89.2	52	327	288
1988	93.4	52	303	293
1989	98.2	52	242	301
1990	98.2	54	258	300
1991	92.1	53	195	290
1992	89.0	52	141	284
1993	88.0	52	122	282
1994	91.5	58	115	282
1995	95.0	55	97	258
1996	98.8	61	105	268
1997	105.0	60	100	260
1998	110.6	57	96	252
1999	115.2	57	85	247
2000	121.8	54	74	236
2001*)	123.2	60	80	240

*) = preliminary data.
Source: Statistics Finland.

5. Incidence of melanoma in various countries (incidences per 100,000 inhabitants)

	Men	Women
Norway	16.1	18.3
Sweden	12.3	12.7
Denmark	10.1	12.5
Germany	7.9	5.4
Finland	**7.5**	**7.5**
France	7.3	5.8
Italy	6.7	4.7
Spain	6.0	4.3
Greece	2.7	2.2

Source: Ferlay J., F. Bray, R. Sankila & D. Parkin (1999), EVCAN: Cancer Incidence, Mortality and Prevalence in the European Union. IARC Cancer Base No. 4. IARC Press, Lyon.

6. 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	113.4
2002*)	65.3	71.5	49.4	88.1

*) = I–II/02.
Sources: United Nations, United Nations Conference on Trade and Development – UNCTAD, Monthly Commodity Price Bulletins.

7. Mining of ores and industrial minerals and quarrying of limestone in 1980–2001 (million 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	2001	2.9	4.1	10.7

Source: Mining Industry Association.

8. Forest increment and total drain in 1953–2001 (million solid cubic metres)

	Increment	Total Drain		Increment	Total Drain		Increment	Total Drain
1953	53.8	44.5	1971	58.3	55.0	1989	75.6	58.7
1954	53.8	50.7	1972	58.3	54.8	1990	79.4	55.1
1955	51.8	56.4	1973	58.3	55.0	1991	79.4	44.7
1956	51.8	52.4	1974	58.3	52.0	1992	79.4	51.0
1957	51.8	52.7	1975	67.0	40.7	1993	79.4	53.8
1958	51.8	53.1	1976	67.0	40.7	1994	79.4	61.7
1959	51.8	53.9	1977	67.0	43.0	1995	79.4	63.6
1960	54.8	60.4	1978	67.0	47.4	1996	79.4	59.0
1961	54.8	63.4	1979	67.0	57.2	1997	79.4	65.8
1962	54.8	58.7	1980	72.0	59.7	1998	79.4	69.4
1963	54.8	57.5	1981	72.0	56.0	1999	79.4	69.4
1964	54.8	58.0	1982	72.0	48.5	2000	79.4	70.0
1965	57.0	55.9	1983	72.0	49.3	2001	79.4	67.7
1966	57.0	54.3	1984	72.0	52.3			
1967	57.0	54.4	1985	75.6	55.2			
1968	57.0	54.1	1986	75.6	49.6			
1969	57.0	57.5	1987	75.6	54.1			
1970	58.3	58.7	1988	75.6	57.1			

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

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

Year of fertilisation 1 July – 30 June	Nitrogen	Phosphorus	Year of fertilisation 1 July – 30 June	Nitrogen	Phosphorus
1979/80	83.3	27.9	1991/92	92.8	19.9
1980/81	82.4	27.8	1992/93	94.3	19.4
1981/82	78.7	26.8	1993/94	94.1	19.0
1982/83	91.4	29.9	1994/95	101.6	20.0
1983/84	90.7	30.9	1995/96	92.3	16.1
1984/85	88.9	30.8	1996/97	86.0	11.8
1985/86	90.0	30.2	1997/98	85.9	12.3
1986/87	94.4	31.0	1998/99	81.0	11.6
1987/88	98.2	32.0	1999/00	84.2	10.4
1988/89	100.3	29.7	2000/01	83.5	11.1
1989/90	111.5	30.7	2001/02	77.5	9.9
1991/91	109.4	26.3			

Source: Kemira Agro.

10. Use of pesticides in agriculture in 1980–2001 (thousand 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
2001	1120.1	303.1	1423.2

Source: Plant Production Inspection Centre.

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

	Phosphorus	Nitrogen
Agriculture	2 600	39 500
Households	575	14 641
Industry	234	3 778
Depositions from air	390	16 000
Others	560	6 485
Natural runoff	2 700	70 000
Total	**7 059**	**150 404**

Source: Finnish Environment Institute.

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

	Industry	Households	Fish farming
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	268	128
1999	250	259	122
2000	231	249	125
2001	234	220	120

Source: Finnish Environment Institute, Pollution Prevention Unit.

13. Implementation rates of nature conservation programmes, 1 Jan. 2002 (hectares of land area)

	Target	Implemented	%	Unimplemented	%
National parks and nature reserves	972 830	961 000	99	11 830	1
Protection programme for ancient forests	347 200	341 670	98	5 530	2
Mire protection programme	637 960	442 960	69	195 600	31
Natura 2000, new areas	78 370	50 000	64	28 370	36
Shore protection programme	141 340	84 200	60	57 140	40
Herb-rich woodland protection programme	6 640	3 300	50	3 340	50
Bird sanctuary protection programme	66 140	7 200	11	58 940	89

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

14. Forests and forest conservation in selected European countries

	Forest area (1 000 ha)	Propotion of forest of total land area %	Strictly protected forests (ha)	Strictly protected forests (% of forest area)	All protected forests (ha)	All protected forests (% of 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
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 not available.
Source: Parviainen J. – Kassioumis K. – Bucking W. – Hochbichler E. – Päivinen R. – Little D. (2000), EU/COST E 4: Forest Reserve Research Network project. Final Report.

15. Trend in Finland's eco-efficiency (1960=1.0)

	Eco-efficiency of production	Eco-efficiency of society	Potential eco-efficiency		Eco-efficiency of production	Eco-efficiency of society	Potential eco-efficiency
1960	1.0	1.0	1.0	1981	1.5	3.2	1.7
1961	1.0	1.0	1.1	1982	1.5	3.3	1.7
1962	1.0	0.9	1.1	1983	1.4	3.1	1.6
1963	1.1	0.9	1.1	1984	1.4	2.1	1.6
1964	1.0	0.9	1.0	1985	1.4	2.2	1.6
1965	1.0	0.8	1.0	1986	1.4	1.4	1.0
1966	1.0	0.7	0.9	1987	1.4	1.4	1.0
1967	1.1	0.9	1.0	1988	1.5	1.1	1.0
1968	1.0	0.8	0.9	1989	1.5	1.2	1.0
1969	1.0	1.0	1.0	1990	1.5	1.1	0.8
1970	1.0	1.2	1.1	1991	1.6	1.9	1.3
1971	1.0	0.8	0.9	1992	1.5	1.9	0.9
1972	1.1	1.5	1.0	1993	1.6	1.6	0.7
1973	1.1	2.0	1.0	1994	1.5	1.5	0.9
1974	1.2	2.5	1.2	1995	1.6	1.3	1.2
1975	1.4	2.3	1.3	1996	1.7	1.6	1.4
1976	1.4	2.4	1.2	1997	1.7	1.4	1.7
1977	1.4	3.0	1.0	1998	1.7	1.3	1.9
1978	1.4	2.8	0.9	1999	1.7	1.2	2.0
1979	1.3	2.6	0.9	2000	1.8	1.1	2.3
1980	1.4	2.9	1.0				

Source: Hoffrén, J. (2001): Measuring the Eco-efficiency of Welfare Generation in a National Economy. The Case of Finland. Statistics Finland. Research Reports 233. Helsinki. pp. 184, 195.

16. Pulp and paper industry production and load on 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
2001	12 503 000	6 548 000	178 246	949	206

Source: Forest Industry Association; Yearbooks on Environmental Protection.

17. 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
2001	12 503 000	6 548 000	5 279	19 656	4 433

Source: Forest Industry Association; Yearbooks on Environmental Protection.

18. Recovery of waste paper in certain countries in 2000 (per cent)

	Recovery Rate		Recovery Rate
Germany	74.3	Spain	54.6
Finland	**71.3**	France	47.1
Austria	65.2	United Kingdom	44.2
Switzerland	69.3	Slovakia	38.8
Sweden	65.0	Czech Republic	42.9
Netherlands	63.5	Italy	43.6
Average in EU 15 countries	**55.3**	Norway	65.9
Belgium	51.2	Greece	30.5
Portugal	44.0	Ireland	27.3
Denmark	45.4		

Source: CEPI. Annual statistics 2001.

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

	Raw materials	Energy used
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
2001	1 180	160

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

20. Total energy consumption in selected countries by GDP in 1999

	Total energy consumption kilograms of oil/EUR 1 000
Poland	685.3
Iceland	436.5
Turkey	425.0
Canada	420.4
United States	304.1
Finland	**245.3**
Greece	233.8
Belgium	222.3
Sweden	220.0
Portugal	220.0
United Kingdom	210.8
Spain	202.7
Norway	185.4
Netherland	179.7
Luxemburg	176.2
France	172.8
Ireland	170.5
Italy	165.9
Germany	149.7
Austria	126.7
Denmark	116.3
Japan	110.6
Switzerland	94.4

Source: IEA/OECD; Energy Balances of OECD Countries 1998–1999.

21. Trends in world oil consumption and in oil prices in real terms on the global market (USD per barrel)

	Current prices	Real (1996) prices	Billion tonnes
1970	2.1	7.0	2 254
1971	2.6	8.4	2 377
1972	2.8	8.8	2 556
1973	3.1	8.9	2 754
1974	11.2	27.9	2 710
1975	10.6	23.9	2 678
1976	11.8	25.5	2 852
1977	12.8	26.0	2 944
1978	12.9	24.3	3 055
1979	29.2	49.4	3 103
1980	35.5	52.9	2 972
1981	34.1	46.6	2 868
1982	31.4	41.2	2 776
1983	28.4	36.7	2 761
1984	28.3	35.8	2 809
1985	27.0	33.8	2 801
1986	13.8	17.5	2 893
1987	17.8	22.2	2 949
1988	14.2	17.3	3 039
1989	16.9	19.5	3 088
1990	17.6	19.6	3 136
1991	18.3	19.7	3 134
1992	18.2	19.4	3 165
1993	16.1	17.0	3 135
1994	15.5	16.2	3 192
1995	16.9	17.4	3 235
1996	20.4	20.4	3 316
1997	19.2	19.2	3 388
1998	13.1	11.5	3 398
1999	18.1	14.7	3 469
2000	28.2	26.8	3 504
2001	24.5	19.6	3 554
2002*)	19.6	15.7	..

*) = I–II/02. .. = data not available.

Sources: 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.

22. Finland's greenhouse gas emissions (million equivalent tonnes of carbon dioxide)

	Carbon dioxide	Methane	Nitrous oxide	F-gases	Climate strategy target	Climate strategy trend
1990	62.4	6.1	8.4	0.1	–	–
1991	61.0	5.8	7.9	0.1	–	–
1992	58.6	5.4	7.3	0.0	–	–
1993	59.2	5.0	7.5	0.0	–	–
1994	65.4	4.7	7.6	0.0	–	–
1995	62.6	4.6	7.8	0.0	–	–
1996	68.1	4.5	7.8	0.1	–	–
1997	66.9	4.3	8.1	0.2	–	–
1998	64.5	4.1	7.9	0.3	–	–
1999	64.2	3.9	7.7	0.4	–	–
2000	62.3	4.0	7.2	0.5	–	–
2010	–	–	–	–	77.0	90.0

– = not in use.
Sources: Statistics Finland and Ministry of Trade and Industry.

23. Sulphur emissions in Finland (thousand tonnes of sulphur dioxide)

	Liquid fuels	Solid fuels	Forest industry	Metal 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	382
1986	100	79	56	33	31	32	331
1987	96	80	62	34	30	25	328
1988	82	70	53	35	32	31	303
1989	68	62	52	11	20	29	244
1990	75	87	48	7	20	21	260
1991	58	67	33	7	17	13	194
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	89
1999	26	30	8	8	3	10	85
2000	20	28	7	7	3	9	76
2001*)	..	..	..	..	..	..	80

.. = data not available. *) = preliminary data.
Sources: Ministry of the Environment; Environment Protection Department and Statistical Finland.

24. Emissions of oxides of nitrogen in Finland (thousand tonnes)

	Road traffic	Other traffic	Energy	Industry	Total
1980	136	43	98	18	295
1981	136	43	79	18	276
1982	137	43	73	18	271
1983	139	42	62	18	261
1984	140	42	57	18	257
1985	143	43	71	18	275
1986	147	42	70	18	277
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	42	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
2000	106	47	56	27	236
2001*)	..	..	..	..	240

.. = data not available. *) = preliminary data.
Source: Ministry of Environment; Environment Protection Department and Statistics Finland.

25. 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
2001	6	5	0	2	13

Source: Finnish Meteorological Institute.

26. Combined heat and power production (CHP) as a percentage of electricity generation in EU countries

	Production in 1998	Goal for 2010
Denmark	62.2	
Netherlands	52.6	
Finland	**35.8**	
Austria	24.8	
Luxemburg	22.5	
Italy	17.5	
Spain	11.2	
Portugal	8.4	
Germany	7.5	
Sweden	6.0	
United Kingdom	5.2	
Belgium	4.1	
France	2.5	
Greece	2.1	
Ireland	1.9	
Average for EU	**10.9**	**18.0**

Source: European Union

27. Renewable sources of energy as a percentage of total energy consumption in 1999 and goal for 2010 (per cent)

	1999	2010
Austria	73.5	78.1
Sweden	51.0	60.0
Portugal	20.9	39.0
Finland	**26.3**	**31.5**
Spain	13.5	29.4
Denmark	13.1	29.0
Italia	16.9	25.0
Ranska	17.2	21.0
Kreikka	10.3	20.1
Irlanti	5.8	13.2
Saksa	6.1	12.5
Iso-Britannia	3.2	10.0
Alankomaat	3.4	9.0
Belgia	2.3	6.0
Luxemburg	9.1	5.7

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

28. Trends in the use of public transport and private cars (million 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
2001	70 400	57 000	900	12 900

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

29. Trends in emissions from road traffic (thousand tonnes)

	Carbon dioxide	Hydrocarbons	Oxides of nitrogen	Particles	Carbon monoxides
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.

30. Use of de-icing salt and goal level for 2003 (tonnes)

	Use of de-icing salt
1990	157
1991	107
1992	125
1993	85
1994	94
1995	109
1996	80
1997	120
1998	102
1999	103
2000	82
2001	83
2003	85*)

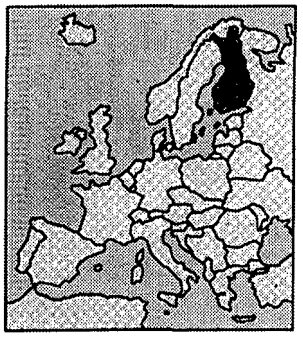
*) = goal.
Source: Finnish Road Administration.

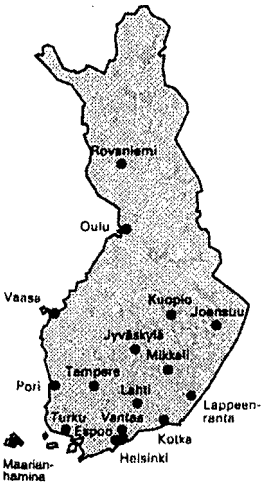
31. Retail prices of motor fuel (95E) on 15 August 2002 (cent per litre)

	Ex-refinery price	Pump price	Taxes	Propotion of tax, %
Norway	37	121	84	69.4
United Kingdom	27	117	90	77.2
Netherlands	35	116	81	70.1
Denmark	34	111	77	69.6
Finland	**34**	**109**	**76**	**69.3**
Germany	29	106	77	72.9
Italy	33	105	72	68.2
France	27	103	76	73.4
Sweden	30	99	69	69.3
Belgium	30	98	68	69.1
Portugal	31	94	63	67.0
Ireland	33	88	55	62.9
Austria	32	88	56	63.8
Spain	31	82	51	61.9
Luxemburg	33	79	46	57.8
Greece	34	76	41	54.4

Sources: 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 0.3 per cent. Average household size is 2.3 persons. 77 per cent urban dwellers, with 1.0 million living in the capital city of Helsinki and its surrounds. 92 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 31 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 72 per cent of the country while 7 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 2001 totalled EUR 136 billion (USD 133 billion), i.e. EUR 26,210 (USD 25,633) 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 8.1 per cent in August 2002.*

Foreign trade: *Main trading partners are Germany, Sweden, United Kingdom, USA and Russia. The value of imports totalled EUR 36 billion (USD 35 billion) and that of exports eur 48 billion (USD 47 billion) in 2001. Of the imports 39,3 per cent were raw materials and 24.6 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 2002

Finland's Natural Resources and the Environment 2002 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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