



YMPÄRISTÖMINISTERIÖ
MILJÖMINISTERIET
MINISTRY OF THE ENVIRONMENT

SVT

*Ympäristö ja luonnonvarat 2005:3C
Miljö och naturresurser
Environment and Natural Resources*



Tilastokeskus
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Finland's Natural Resources and the Environment 2005





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Foreword

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. In September 2002, in Johannesburg, South Africa, then the state of affairs and the degree to which measures had been implemented were assessed at the 10-year follow-up meeting on sustainable development (World Summit on Sustainable Development). The European Union (EU) has taken a leading role in promoting sustainability. 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. The European Union has also started preparing a new environmental strategy.

Finland has committed itself to implementing the Johannesburg Plan of Implementation on a national level. The time scale of the Johannesburg Plan of Implementation is long – around 15 years. This review, *Finland's Natural Resources and the Environment*, reports yearly on the national implementation. The Finnish Government Programme is inclined towards economical, social and ecological sustainability, which means the balanced dovetailing of production activity, economic growth and environmental considerations. This review concentrates on commitments that concern the environment and the maintenance of the carrying capacity of ecosystems. The main current environmental challenges in Finland relate to the promotion of sustainable consumption and production. Review is especially needed of the waste policy which lags behind to the pace of development in society. Generation of waste can be prevented through measures that promote sustainable consumption and production. In this respect economic and environmental interests are congruous, for raw materials also have their price.

Finland's Natural Resources and the Environment 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 Päivi Valkama, Budget Secretary at the Ministry of Finance, Carita Putkonen, Financial Counsellor at the Ministry of Finance, Mirja Kosonen, Senior Adviser at the Ministry of Trade and Industry, Veikko Marttila, Senior Adviser at the Ministry of Agriculture and Forestry, Risto Saari, Senior Adviser at the Ministry of Transport and Communications, Jarmo Muurman, Senior Adviser at the Ministry of the Environment, and Juha-Pekka Majjala, Senior Adviser 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 Stella From, Senior Planning Officer at the Finnish Environment Institute.

Helsinki, September 2005

Ministry of the Environment

Minister of the Environment
Jan-Erik Enestam

Statistics Finland

Director General
Heli Jeskanen-Sundström

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1 Environmental policy

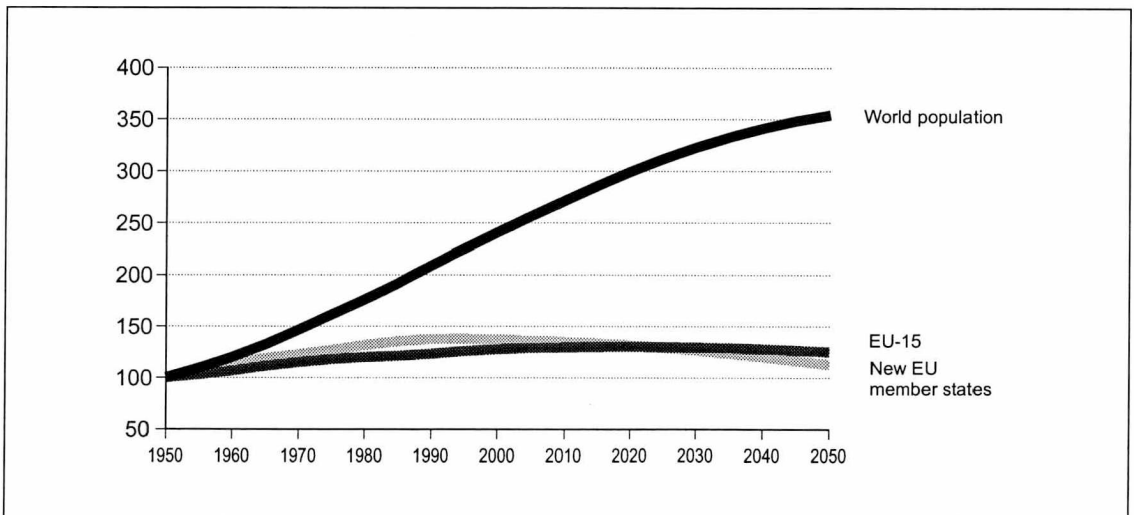
International environmental policy

The increase in environmental problems is a result of the growing world population and reigning production and consumption trends. According to estimates by the United Nations, the world population was 6.2 billion in 2002, and that figure is increasing by 200,000 people every day, or 74 million every year. Population growth has slowed though, and according to an estimate by the Population Research Institute of the United States, world mortality will exceed the birth rate by 2050. By this time the world's population will have reached 8.9 billion, according to UN estimates. A point of great concern is how natural resources will be sufficient for all the people of the world given current production and consumption trends.

The World Summit on Sustainable Development (WSSD) was held in 2002 in Johannesburg, South Africa. New sustainability

objectives were agreed upon, and Agenda 21 of the Rio de Janeiro Environment and Development Conference was accelerated. The principal issues of the summit were globalisation, poverty, production and consumption methods, environmental health, ecosystems and environmental management. One of the aims was to find a balance between ensuring the quality of the environment, strengthening the global economy and increasing social equality. During the first stage of the Johannesburg Plan of Implementation in the twelfth and thirteenth sessions of the UN Commission on Sustainable Development (2004–2005), emphasis was placed on improving people's access to water, and on developing sanitation and human settlements in the poorest countries. These objectives also form part of the United Nations Millennium Development Goals. The themes of the fourteenth and fifteenth sessions of the UN Commission on Sustainable Development (CSD) are climate change, air quality, industrial development and renewable energy.

Figure 1. Population trend globally, in the EU15 member states and in the new EU member states (1950=100)



Progress in sustainable development has been slower than anticipated, and there have proved to be many political hurdles in the process. 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 so far can be viewed as significant progress towards sustainable development.

One of the main concerns of 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 for the reduction of greenhouse gas emissions. The Kyoto Protocol entered into force on 16 February 2005, at which time it had been ratified by 141 countries, representing 61.6 per cent of the carbon dioxide emissions of industrialised countries.

1. Population growth in different countries

	Birth rate (children/ woman)	Predicted population changes in 2004-2050 (per cent)
Angola	6.80	+ 206
Nigeria	5.70	+ 124
India	3.06	+ 50
Brazil	2.18	+ 24
United States	2.02	+ 43
France	1.89	+ 7
Finland	1.75	- 8
Sweden	1.73	+ 18
Australia	1.73	+ 31
China	1.70	+ 11
Belgium	1.62	+ 5
Canada	1.50	+ 16
Estonia	1.41	- 23
Russia	1.39	- 17
Germany	1.30	- 9
Italy	1.29	- 10
Spain	1.26	- 3
Bulgaria	1.23	- 38

Parties to the Protocol include the European union (EU) member states, Japan, Canada and Russia. The United States and Australia, on the other hand, have left themselves outside the Protocol. In March 2005, a European Council meeting reacted positively to a suggestion by the Ministers of the Environment of member states to cut greenhouse gas emissions by 15–30 per cent by 2020, compared with 1990 levels. However, the target agreed by the Ministers of the Environment to cut emissions by 60–80 per cent by 2050 did not receive support in the European Council. A view shared by many EU countries is that the EU should not commit itself to new cuts unless the United States also commits to them.

The main decision of the thirteenth session of the UN Commission on Sustainable Development (CSD-13) was to include water, sanitation and human settlement issues in national strategies for poverty and development. With regard to water issues, CSD-13 hastened the drawing up of management and efficiency plans for integrated water resources by 2005, agreed upon in Johannesburg, and also hastened the financial support for their preparation and the development of facilities. Finland had a central role as the leading country of the EU's preparations for the human settlements theme. Decisions concerning human settlements include the integrated planning perspective, the promotion of a sustainable infrastructure, and a mention that slum-dwellers and their organisations participate in the planning, decision-making and implementation processes, and in the strengthening of local administration. The position of the UN human settlements programme, Habitat, strengthened, and the organisation was deemed a central actor in the monitoring and implementation of the objectives of CSD-13.

EU environmental policy

The EU strategy for sustainable development contains objectives and measures to tackle the challenges of climate change, traffic congestion, threats to public health and the depletion of natural resources. The EU's sixth Environment Action Programme will promote sustainable development and contribute to the implementation of a European sustainable development strategy. The key challenges are climate change, health, environment and quality of life, nature and biodiversity, the sustainable use of natural resources, and waste management. Concerning the use of natural resources, the emphasis is on sustainability and waste reduction. In addition, steps are being taken to guide the consumption habits of citizens in more sustainable directions, with measures such as integrated product policy aimed at improving the ecological sustainability of products and encouraging consumers to make environmentally responsible choices. Sustainable development policy in the EU is currently being updated, and the renewed strategy should be completed during 2006. In addition, a strategy for the sustainable use of natural resources, a strategy for the protection of the marine environment, and a strategy for soil protection are under preparation in the EU.

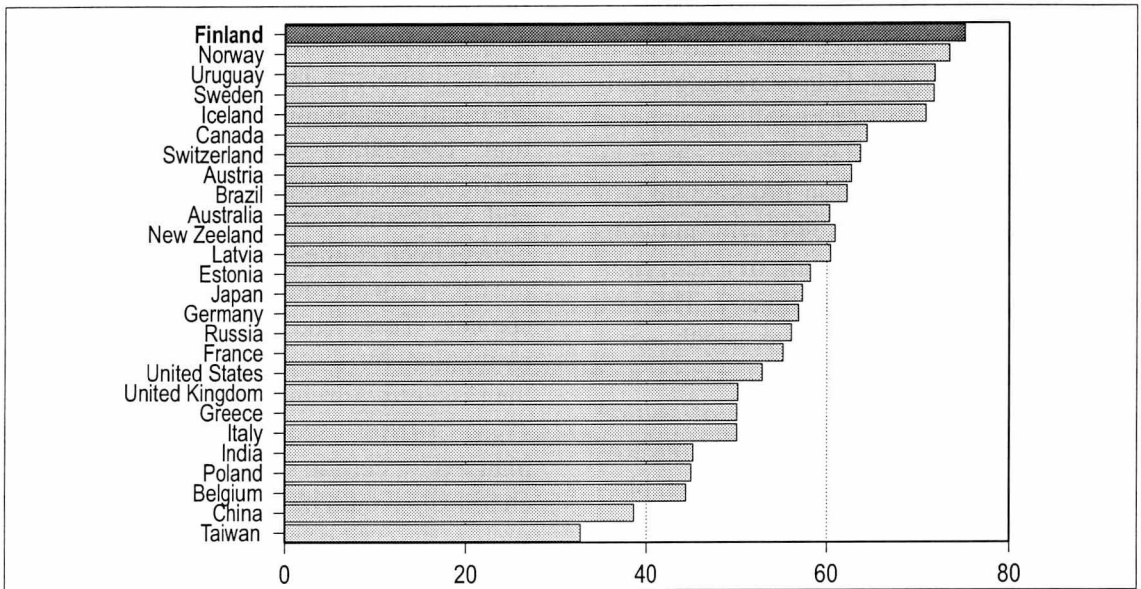
A great challenge for EU environmental policy is to raise the level of environmental protection in the ten new Central and Eastern European member states to the level of the rest of the EU. An estimated EUR 140 billion must be invested in environmental protection by the new member states in the next ten years, i.e. 2–3 per cent of their gross national product, in order for them to achieve the 1997 level of the old member states.

The chemicals legislation under preparation in the EU aims for chemical use to be safe throughout the production chain, and for products to be safe for the consumer and the environment. The central element of the chemicals legislation, REACH (Registration Evaluation and Authorisation of Chemicals), includes the wide-scale testing and registration of all chemicals that have not yet been studied, with the testing schedule drawn up according to quantities of substances. This would be followed by an evaluation by the authorities, who would then issue requirements for further testing. Tight permit requirements are being planned for certain substances. End users of chemicals would have new responsibilities, such as assessing the risks of their own activity, and obtaining relevant information and passing it on. The proposal is intended to improve human health and the level of environmental protection. It is estimated that 4,500 deaths would be avoided every year in the EU with the new legislation. According to the estimate, the new procedure would cause additional work and expenditure for the chemicals industry. The REACH obligations are due to be put into effect in 2006. The EU Chemicals Authority, which will monitor the implementation of the new regulations, is planned to be situated in Finland.

Sustainable development in Finland

According to the World Economic Forum (WEF) Environmental Sustainability Index (ESI), Finland made the most progress globally towards sustainable development in 2001, 2002 and 2005. The index indicates how well a country is achieving environmental sustainability in comparison with other countries. According to the comparison, Finland's strengths are the initia-

Figure 2. Environmental sustainability index for designated countries (ESI 2005)



tive shown by its society and private sector regarding environmental issues, and its promotion of environmental health. Other strengths in which Finland fared slightly worse, but still performed well when compared to other countries, were the state of the environment, the reduction of environmental problems and international co-operation. Compared with other countries, Finland's most notable weaknesses were the indicators measuring consumption per capita. According to the report, Finland equals the United States in terms of competitiveness, but scores much higher in terms of environmental sustainability.

The Finnish sustainable development programme was approved in 1998, and its re-evaluation will be started during 2005. Finland's current Government programme also aims to further the practical implementation of the actions decided on at the Johannesburg summit. The goal is increased efficiency in the use of materials and energy at all stages of the product life

cycle. As part of this aim, the Government has organised the drawing up of a national programme for advancing sustainable consumption and production. The broadly-based KULTU committee established by the Government completed a proposal for a national sustainable consumption and production programme in June 2005. In the proposal, the additional objectives and environmental policy measures that are required for Finland to become an eco-efficient society were analysed.

Environmental policy instrument

Government intervention in the realm of sustainable development has been stepped up in recent years. The current legislation on environmental protection came into force in 2000, updating and harmonising previously existing legislation and authorisation procedures. The Environmental Protection Act aims to bring uniformity to the process of restricting and

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

	2002	2003	2004	2005	2006
	A	A	A	B	BP
Alcoholic beverage surtax *)	20	20	20	–	–
Soft drink surtax *)	2	2	2	–	–
Beverage container tax	–	–	–	13	13
Pesticide fee	2	2	2	2	2
Energy taxes	2 756	2 900	2 901	3 010	2 979
Oil waste tax	4	3	3	3	3
Motor car tax	1 023	1 207	1 235	1 200	1 300
Oil pollution control fee	6	9	9	9	9
Vehicle tax	446	473	642	536	560
Waste tax	32	41	42	53	62
Total	4 291	4 657	4 857	4 826	4 928

A = Final accounts. B = Budget. BP = Budget Proposal. – = not in use. *) = packaging tax.

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

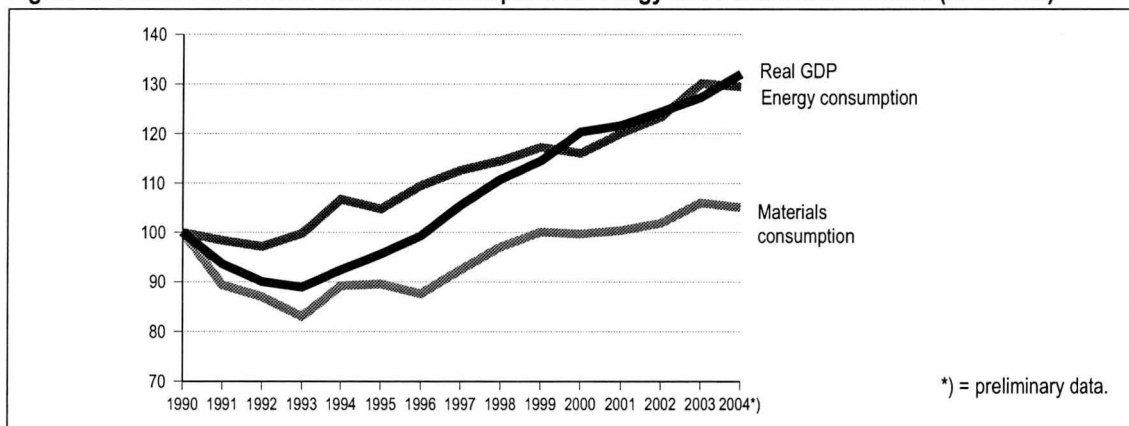
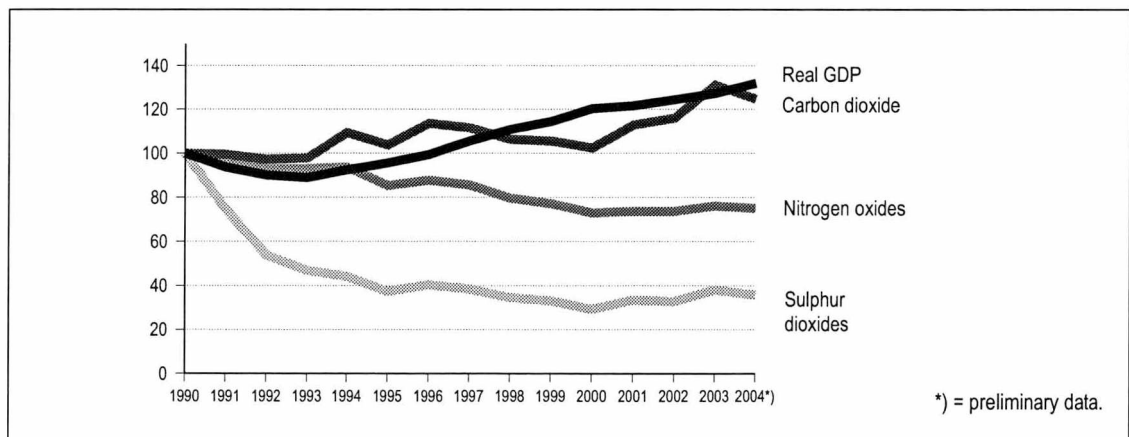


Figure 4. Trends in real GDP and atmospheric emissions in Finland (1990=100)



managing emissions. Special emphasis is placed on applying the best available technology (BAT), risk management, and efficient energy use. A new Land Use and Building Act supporting sustainable development came into force at the beginning of 2000 and was reviewed at the beginning of 2001. Its key objectives include creating preconditions for a favourable living environment, increasing the

sustainable development of communities, and increasing citizen participation and influence at a grassroots level. These laws have been complemented by a range of other measures, including environmental taxes, environmental labelling schemes and voluntary agreements.

According to the Government programme, ecologically sustainable development will

3. Government environmental expenditure (EUR million)

	2002	2003	2004	2005	2006
	A	A	A	B	BP
Environmental administration	101	108	111	114	115
<i>Central administration</i>	42	46	47	48	48
<i>Regional administration</i>	59	62	64	66	67
Development co-operation	116	107	119	119*)	119**)
Co-operation with neighbouring areas	13	10	10	10	8
Nordic Environment Finance Corporation	1	1	1	1	1
Research and development	175	176	187	192	198
<i>Environmental protection and management¹⁾</i>	17	17	17	18	18
<i>Use and management of natural resources²⁾</i>	40	38	40	42	45
<i>Universities*)</i>	57	56	60	60	60
<i>Development of environmental technology³⁾</i>	45	49	51	54	57
<i>Other environmental research⁴⁾</i>	16	16	19	18	18
Environmental NGOs	1	1	1	1	2
Environmental protection	40	54	63	53	44
<i>Clean air and waste management</i>	11	8	19	15	8
<i>Water protection</i>	6	8	9	10	9
<i>Environmental management and decontamination</i>	23	38	35	28	27
Nature conservation	59	58	69	70	67
Promotion of energy saving	6	7	10	10	9
Promotion of renewable energy	28	27	24	24	24
Energy repairs for dwellings	–	15	17	17	17
Environmental protection of road traffic*)	26	20	26	27	16
Manure pit investment support	2	2	3	3	3
Agri-environmental support	284	288	294	322	265
<i>Basic support</i>	252	254	255	..	..
<i>Special support</i>	31	34	38	..	..
<i>Others</i>	1	0	1	..	..
Environmental support for forest management	4	4	6	6	7
Total	857	878	941	969	895

A = Final accounts. B = Budget. BP = Budget proposal. – = not in use. .. = data not available. *) = estimate. **) = forecast.

1) = Environmental Administration and the Academy of Finland. 2) = Agriculture and Forestry Administration.

3) = Technical research.

4) = Other administrative branches.

be fostered through an environmentally responsible purchasing policy. The public sector is indeed a major purchaser of industrial investment and consumer goods. Public sector purchasing can take environmental perspectives into account especially in determining the objective of the purchase, in evaluating the overall economic benefit of tenders, and in the terms and conditions of the purchasing agreement. The idea is that local and central government organisations involved in environmentally responsible purchasing projects will learn from each other in developing best practices.

Funding for environmental protection paid through the Government budget that is not part of the environmental administration's operational expenditure is mostly directed at the environmental protection activities of industry and municipalities. Nature conservation appropriations are used to acquire and manage nature conservation areas. As a sponsor of environmental research and development, the Government has an important role through various ministries, the Academy of Finland, and the National Technology Agency of Finland (TEKES). The Government also plays its part in carrying out the different EU programmes. The importance of agri-environmental support, which is

partly financed by the EU, will be increasing further in the forthcoming programming period.

Finland is committed to helping developing countries attain environmentally sustainable development. This is achieved in practice by supporting the use of sustainable natural resources and by promoting environmental protection in development co-operation with partner countries. Some of the ways in which Finland's development co-operation work aims to prevent environmental problems include providing support for the development of environmental legislation and management, transferring environmental protection

5. Finland's contribution to environmental protection in neighbouring areas 1991-2005 (EUR million)

	Investment projects	Technical assistance
Estonia	31	6
Latvia	12	23
Lithuania	8	3
Russia	36	14
Ukraine	1	0
Poland	16	0
Others*)	0	9
Total	104	35

*) = contributions to international financial institutions and co-operation projects in above countries.

4. Environmental aid in Finnish development co-operation in 2002-2005

	2002	2003	2004	2005*)
Bilateral development co-operation				
Environmental aid as primary objective	27	25	30	30
Environmental aid as a significant secondary target	85	74	80	80
Multilateral development co-operation				
Support to the GEF	3	7	8	8
Support to the multilateral ozone fund	1	1	1	1
Total	116	107	119	119

*) = preliminary data.

technology, promoting the sustainable use of natural resources and equitable division of the benefits obtainable from them, ecologically sustainable ways of making a living from the land and environmental research, training and education, giving citizens opportunities to participate, and preparing for the growing environmental requirements of trading.

As stated in Finland's neighbouring area strategy and plan of action, the ability of countries to solve their environmental problems on their own and to prevent them from occurring has been developed through co-operation work. Finland's environmental co-operation work with northwestern Russia, Estonia, Latvia, Lithuania and Poland began in 1991. The main objective of the co-operation is to achieve reductions in those emissions from neighbouring areas that have an impact on Finnish areas and especially the

Baltic Sea. Even though the Baltic states are now members of the EU, Finland has continued technical aid co-operation with these countries through the transition period until 2006. The eco-conversion co-operation work with Poland will end in the autumn of 2005. In the co-operation work with northwestern Russia, activity has focused on the treatment of wastewater in the St. Petersburg region. Finland has helped fund the building of the southwestern wastewater treatment plant in St. Petersburg with a total of EUR 10 million. The total cost of the project is almost EUR 190 million. The wastewater of 715,000 inhabitants will be treated in the new St. Petersburg treatment plant. Once the treatment plant is completed, there will be nitrogen load reductions of 1,800 tonnes and phosphorus load reductions of 260 tonnes per year. The construction of the treatment plant will be completed in September 2005.

In Finland, the administrative tasks of environmental protection relating to permits and monitoring are mostly the responsibility of municipalities. There are over 30,000 establishments with environmental permits in Finland. The activity of 80–85 per cent of these belongs to the scope of monitoring by municipalities. The biggest environmental expense items for municipalities, joint municipal boards and municipal corporations are sewerage and wastewater treatment. Most of the costs arising from waste management, sewerage and wastewater treatment are covered by the fees collected from users, but some of the money for investments in these projects comes from Government funding. Expenditure on environmental management is financed using municipalities' own funding and through Government support.

6. Environmental protection by municipalities (EUR million)

	2002	2003	2004*)
Waste management			
Investments	19	21	26
Operating costs	126	129	125
Waste water treatment			
Investments	40	46	42
Operating costs	121	125	126
Sewerage			
Investments	97	111	102
Operating costs	141	147	147
Environmental management			
Investments	7	6	4
Operating costs	58	58	57
Total	609	643	629
Investments	163	184	174
Operating costs	446	459	455

*) = preliminary data.

Ecological tax reform

In addition to using administrative means, environmental protection strives to make more use of economic instruments. The development of an environment-related tax in particular is high on the agenda. The impacts on the economy and employment caused by administrative instruments for environmental protection are often worse than those caused by tax instruments. According to the Government programme, the taxation structure will be reformed to promote sustainable development. The ecological tax reform will reduce the use of non-renewable natural resources and will reduce environmental damage. It will also promote recycling and the eco-efficiency of products, their use and energy consumption. There have been ecological tax reforms in other countries in recent years, most recently in Sweden. Ecological tax reform refers to the introduction of a new environment-related tax or the de-

velopment of existing taxes to support environmental policy aims. The reduction of income taxes is often a simultaneous objective. The reform strives for a double benefit, meaning that as the state of the environment improves, the economy also benefits and unemployment decreases. Inflation and unemployment decrease.

Ecological tax reform has usually meant increasing the taxation of energy and transport, as the majority of revenue from environment-based taxes is accumulated from energy and transport taxes. In Denmark, in particular, the reform has also included the introduction of new environment-related taxes. The overall effect of these taxes on tax revenue is insignificant. When the taxes are effective in terms of environmental targets, their tax base and tax revenue also diminish constantly, which is why they cannot replace the reduction of income taxation.

The name "ecological tax reform" has not been used for tax reforms carried out in Finland, even though the focus of taxation has been shifted towards environment-based taxes for some time in the same way as in countries that have undergone an ecological tax reform. Consequently, the revenue from environment-based taxes in relation to GDP is higher in Finland than on average in the EU. According to a report compiled by the Ministry of Finance in October 2004, the implementation of the ecological tax reform, included in the Government programme, must begin with environmental targets and requirements. The tax instrument may be one central policy instrument that can reduce the conflict between economic and ecological sustainability. The ecological tax reform would not constitute a very significant employment policy instrument in Finland,

7. Percentage of environmental taxes in the EU15 countries in 2002

	Percentage of GDP	Percentage of Government tax revenue
Denmark	4.8	9.9
Netherlands	3.6	9.2
Portugal	3.2	8.8
Finland	3.1	6.8
Sweden	3.0	5.9
Italy	2.9	7.0
Luxembourg	2.9	7.0
UK	2.8	7.7
Greece	2.6	7.2
Germany	2.6	6.4
Austria	2.6	5.9
Ireland	2.3	8.1
Belgium	2.3	5.0
Spain	2.2	6.0
France	2.0	4.5
EU15	2.8	6.5

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

	2002	2003	2004	2005	2006
	A	A	A	B	BP
Vehicle tax	237	243	642	536	560
Motor vehicle tax	209	230	–	–	–
Motor car tax	1 023	1 207	1 235	1 200	1 300
VAT on motor car tax	163	192	196	191	207
Fuel tax	1 971	2 183	2 159	2 173	2 205
VAT on fuel tax	209	218	215	217	220
Total	3 812	4 273	4 447	4 317	4 492

A = Final accounts.

B = Budget.

BP = Budget proposal.

-- = not in use.

however. When striving towards precisely defined environmental targets, the creation of environment-based taxes can be an effective solution.

The most important environment-based taxes in Finland are energy taxes and fuel and motor vehicle taxes associated with transport. In Finland, the pricing of traffic through various taxes and fees is an important means of steering consumption in a more environmentally friendly direction. Energy taxation aims to moderate the use and production of energy and generate tax revenue for the Government. To help reach these goals, the excise duty on energy products is divided into a basic tax and a surtax. The basic tax is a fiscal tax, and is levied on liquid fuels such as petrol, diesel, and light fuel oil. The surtax is levied according to carbon content, and it currently stands at EUR 18.05 per carbon dioxide tonne. The surtax is levied on the liquid fuels mentioned above and on heavy fuel oil, coal, fuel peat, natural gas and electricity. Wood and heat are not taxed. Fuel taxation supports reaching the reduction targets of fossil fuel use, while still keeping in mind the particular traffic conditions in Finland. For energy and fuel taxation, this involves keeping the tax base as broad as possible.

The development of energy taxation is linked to emissions allowance trading and the aims of the climate strategy. As the first measure arising from the emissions trading scheme, the Government has proposed the discontinuation of the taxation of peat and its tax subsidies in order to preserve its competitiveness.

Taxes targeted at road traffic include the motor car tax levied on acquisition of automobiles and motorcycles, the annual vehicle license tax and motor vehicle tax, and the fuel tax. As the fuel tax on road traffic is partly based on environmental impacts, the levy on sulphur-free and lead-free fuel is lower. Moreover, the surtax is based on the carbon content, being EUR 17.2 per tonne of carbon dioxide. Financial instruments have 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 external costs caused by traffic volume. In 2003, EUR 45 million was collected in rail fees. The tax on fuel is the main source of revenue from the special taxes levied on road traffic. Taxes currently make up 71 per cent of the price of unleaded petrol in Finland, and 58 per cent of the price of diesel.

2 Global environmental challenges

Climate change

One of the main concerns of sustainable development is to prevent the acceleration of the greenhouse effect. The Intergovernmental Panel on Climate Change (IPCC) estimates that, as a result of global warming, the average global temperature could rise by 1.4–5.8 degrees Celsius by 2100. At the UN Climate Summit in Kyoto in 1997 a global protocol was written for the reduction of greenhouse gas emissions. According to the Protocol, industrial countries must reduce their greenhouse gas emissions by an average of 5.2 per cent from 1990 levels during 2008–2012. According to the IPCC, the emissions reduction requirement in the long term is in the order of 50–90 per cent worldwide, for atmospheric carbon dioxide content to be kept at no more than double pre-industrial levels. In the IPCC calculations, the carbon dioxide content in the atmosphere will rise by more than 50 per cent by 2050, from 365 ppm (parts per million) to at least 550 ppm.

As part of the Finsken project, the Finnish Meteorological Institute has produced a series of scenarios for the future climate in Finland and the composition of the atmosphere. The projections based on models estimate that the Finnish climate will become warmer and rain volumes will increase in all the possible scenarios. The exposure of forests to low-level ozone will exceed the critical level in southernmost Finland in all the scenarios. The situation looks the least promising under the studied scenarios that aim for economic growth – in other words, scenarios in which energy production relies mostly on fossil fuels. According to these scenarios, the average

temperature in Finland will rise by 6–7 degrees Celsius halfway through the century, and the ozone exposure of forests will also reach critical levels in northern Finland. In the low emissions scenarios, in which environmental values are given priority rather than economic development, or in which economic growth is achieved with the help of new, environmentally friendly technology, the ozone exposure of forests will begin to decrease halfway through the century. The increase in pollution from traffic and energy production that causes ozone to form in the lower atmosphere will be so immense globally that the measures for reducing air pollution agreed upon in Europe will not suffice to prevent increases in ozone levels.

In its extensive expert report published in November 2004, the Arctic Council estimated that climate change has an aggravated effect on the Arctic region. Over the last few decades, the average temperature of the Arctic region has risen at nearly double the rate of the average global temperature. Changes that have already taken place are observable as the melting of the Arctic region's ice sheets, sea ice and permafrost, coastal erosion, and changes in the habitats and populations of species. Young people in the Arctic today are exposed to 30 per cent more ultraviolet radiation during their lives than any other previous generation, and are thus more prone to skin cancer, cataracts and immune system disorders. Indigenous peoples are threatened by profound economic and cultural changes. Moreover, people, buildings and other infrastructure are more frequently susceptible to the effects of storms and melting frost.

In 2003 Finland's net greenhouse gas emissions were the equivalent of 85.6 million tonnes of carbon dioxide, while in 1990, the Kyoto Protocol benchmark year, the emissions were the equivalent of 70.5 million tonnes of carbon dioxide. Carbon dioxide is the major greenhouse gas, accounting for 85 per cent of the total. The main source of carbon dioxide is fuel use for the production of electricity and heat, and fuel consumption in transport. These account for 78 per cent of total greenhouse gas emissions and 89 per cent of carbon dioxide emissions. In 2004, Finnish carbon dioxide emissions from fossil fuels and peat decreased by five per cent on previous years to 67 million tonnes, while in 1990, the corresponding emissions totalled 53.7 million tonnes. The reduction in emissions was a result of the reduced burning of coal, peat and natural gas, while hydroelectric

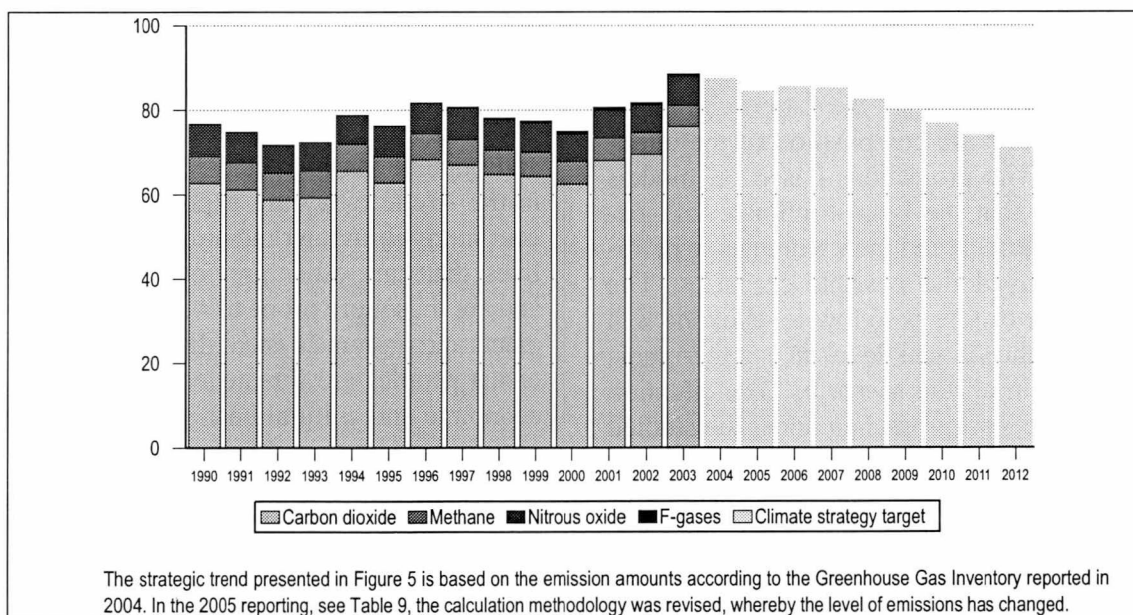
9. Finland's greenhouse gas emissions by sectors and sources in 2003 (million carbon dioxide equivalent tonnes)

Energy	73.04
<i>Energy production</i>	36.70
<i>Industry and construction</i>	14.10
<i>Road traffic</i>	13.60
<i>House heating, etc.*)</i>	6.50
<i>Evaporative emissions, etc.</i>	2.10
Industrial processes	3.45
Solvents, etc.	0.04
Emissions from agriculture	5.42
Waste	2.73
Other	0.83
Total emissions	85.58

*) = Households and services.

production increased compared with the previous year

Figure 5. Finland's greenhouse gas emissions for 1990–2003 and climate strategy target to 2012 (million carbon dioxide equivalent tonnes)



The strategic trend presented in Figure 5 is based on the emission amounts according to the Greenhouse Gas Inventory reported in 2004. In the 2005 reporting, see Table 9, the calculation methodology was revised, whereby the level of emissions has changed.

EU climate change policy

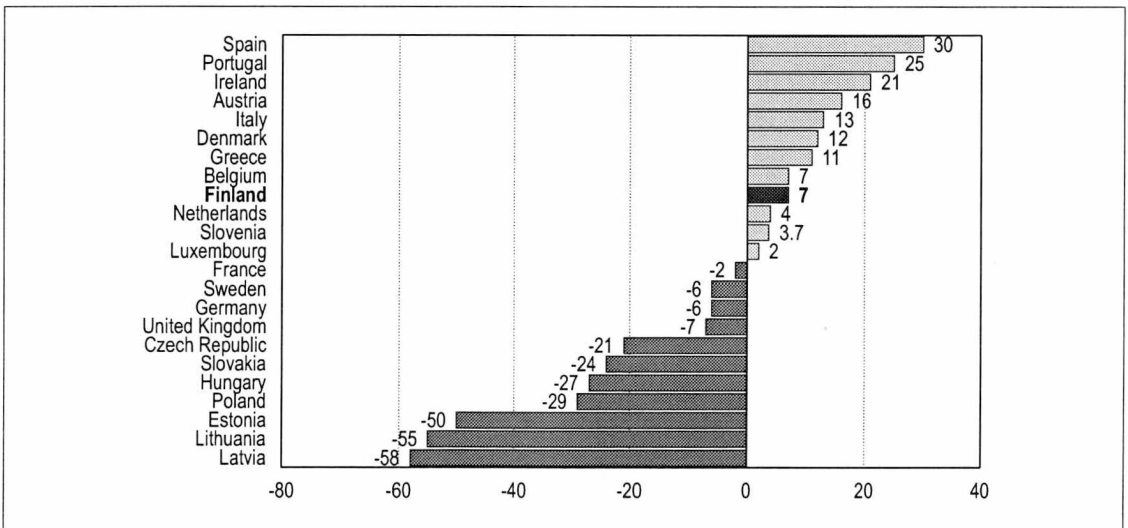
The EU has set a long-term guiding goal for climate policy: that the world temperature should not rise by more than two degrees compared with pre-industrial times. Indeed, some of the EU member states will voluntarily reduce their emissions by more than the agreed amount. Sweden will cut its emissions by four per cent from 1990 levels by 2012, even though the EU burden sharing would permit emissions in Sweden to increase by four per cent. In its energy strategy, the United Kingdom has also voluntarily committed itself to achieving reductions of 20 per cent by 2010, instead of the 12.5 per cent required by the EU burden sharing. The German goal is a reduction of 25 per cent by 2005, when according to burden sharing its target is to reduce greenhouse gas emissions by 21 per cent by 2012. Furthermore, the United Kingdom and Sweden have expressed their intention to strive for emissions reductions of 60 per cent by 2050.

10. Greenhouse gas emissions in EU15 countries (carbon dioxide equivalents) and burden sharing

	Emissions in 2003 (million tonnes)	Change 1990–2003	Burden-sharing target 2008–2012
Luxemburg	11.3	- 11.5%	- 28.0%
Germany	1 017.5	- 18.5%	- 21.0%
Denmark	74.0	+ 6.3%	- 21.0%
Austria	91.6	- 16.6%	- 13.0%
United Kingdom	651.1	- 13.3%	- 12.5%
Belgium	147.7	+ 0.6%	- 7.5%
Italy	569.8	+ 11.6%	- 6.5%
Netherlands	214.8	+ 0.8%	- 6.0%
France	557.2	- 1.9%	+ 0.0%
Finland	85.6	+ 21.5%	+ 0.0%
Sweden	70.6	- 2.4%	+ 4.0%
Ireland	67.6	+ 25.2%	+ 13.0%
Spain	402.3	+ 40.6%	+ 15.0%
Greece	137.6	+ 23.2%	+ 25.0%
Portugal	81.2	+ 36.7%	+ 27.0%
Total	4 179.6	- 1.7%	- 8.0%

The requirements set for the EU by the Kyoto Protocol in 1997 were distributed among the 15 old EU member states in the EU Burden Sharing Agreement in 1998.

Figure 6. EU member states in relation to Kyoto target levels in 2002 (per cent)



The Agreement was ratified in 2002. The EU member states have made national implementation strategies to meet the requirements of the Kyoto Protocol. Some of the countries will buy a significant amount of their required emissions reductions from other countries within the framework of the Kyoto Protocol's flexible mechanisms. According to a Commission follow-up report, emissions in the EU in 2002 stood at 2.9 per cent below their 1990 level, which is still 1.9 per cent above the Kyoto target level.

EU emissions trading

Emissions trading began in the EU at the beginning of 2005. It is regarded as an essential instrument for achieving greenhouse gas reduction targets. The trading system for carbon dioxide emissions allowances is aimed at reducing greenhouse gas emissions as cheaply as possible, and in an environmentally efficient way. Emissions trading takes place with each member state allocating the emissions allowances site by site to installations covered by the emissions trading scheme, after which the emissions allowances can be traded within the Community. Those for whom it is more cost-effective to reduce emissions can sell their allowances to those for whom the reductions would be more costly. At least 95 per cent of the emissions allowances for the initial period 2005–2007 are allocated to installations free of charge. For the period 2008 to 2012, member states must allocate 90 per cent of the allowances free of charge. Member states must elaborate national allocation plans containing details of the total amount of emissions rights the state will grant during the period specified in the Directive, and how it will allocate the emissions rights to different installations.

In 2004 and 2005, the price of a carbon dioxide tonne has varied between EUR 5.9 and EUR 21.

The EU-wide emissions trading scheme has a considerable effect on Finnish climate policy. Within the EU burden-sharing agreement, Finland is committed to cutting its greenhouse gas emissions to the 1990 level by 2008–2012. Since the cost of reducing emissions is comparatively high in Finland, Finnish companies would primarily be purchasers of emissions allowances. In August 2004, the Finnish Government approved a proposal for the Finnish National Allocation Plan, which was delivered to the European Commission for approval. The Commission accepted the Finnish Allocation Plan in October 2004. The Finnish Government made a decision regarding the granting of emissions allowances on 21 December 2004. The total emissions allowance for Finland is 136.5 million tonnes of carbon dioxide, which is around three per cent less than the estimated carbon dioxide emissions. The figure includes 2.5 million carbon dioxide tonnes reserved for new participants. Emissions allowances were allocated to installations, establishment by establishment, free of charge. There were 530 establishments within the scope of the emissions trading system, belonging to 147 installations. The companies taking part in emissions trading produce around half of Finland's greenhouse gas emissions, and 59 per cent of Finland's carbon dioxide emissions.

Finland's climate policy

The National Climate Strategy is currently being re-evaluated and will be put as a report before the Government and Parliament in the autumn of 2005. According to

the Climate Strategy, Finland's greenhouse gas emissions will rise above the Kyoto target level unless determined and effective efforts to restrict emissions are made. Action is needed in the areas of energy production and consumption, road traffic, construction, community planning, the control of emissions from agriculture and forestry, and waste management. The Finnish National Climate Policy is being implemented through wide-scale co-operation.

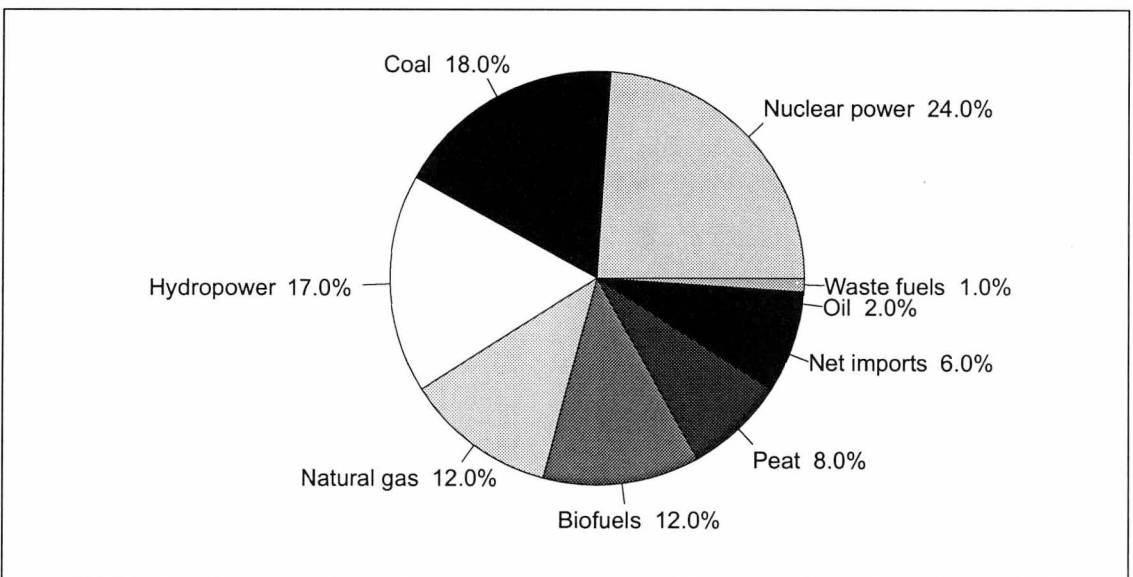
The UN Framework Convention on Climate Change requires signatories to monitor their greenhouse gas emissions closely. It binds its signatories to submit an annual inventory report on their anthropogenic greenhouse emissions for the last but one year. The European Commission also compiles an inventory covering the EU member states. In Finland, a greenhouse gas emissions inventory establishment as required by the Kyoto Protocol, was established at Statistics Finland in 2004.

A JI/CDM test programme led by the Ministry for Foreign Affairs was started in 1999 to gain experience with the project-based Kyoto mechanisms – Joint Implementation (JI) and the Clean Development Mechanism (CDM) – which aim to reduce greenhouse gases. The test programme has a total of EUR 20 million in appropriations for its operations. Some EUR 11 million has been invested in the World Bank's Prototype Carbon Fund (PCF) and the Baltic Sea Region Energy Co-operation Testing Ground Facility (TGF). The rest is used in bilateral JI and CDM projects and in the administration of the programme. According to current estimates, the projects that are presently under

11. End-use of energy by sector in 2004

	Petajoules (PJ)	Per cent
Industry	568	50
Heating	239	21
Transport	182	16
Other	140	12
Total	1 129	100

Figure 7. Breakdown of electricity production by energy sources in 2004 (per cent)



way will produce around 2.2 million carbon dioxide tonnes in Kyoto-compliant emissions reductions. One Joint Implementation project compliant with the Kyoto Protocol is the Pakri wind farm in Paldiski, Estonia, which was officially opened in June 2005. The project will reduce Estonia's greenhouse gases by around 50,000 tonnes per year by reducing oil shale-based electricity production. The wind farm comprises eight turbines with a combined energy production capacity of 18.4 megawatts. The Finnish Government will purchase around half a million tonnes of emission reductions from the project between 2004 and 2012, for a price of EUR 5.8 per tonne of carbon dioxide. The total value of the transaction is approximately EUR 2.5 million. Finland can then utilise the emission reductions to meet its Kyoto emission reduction target.

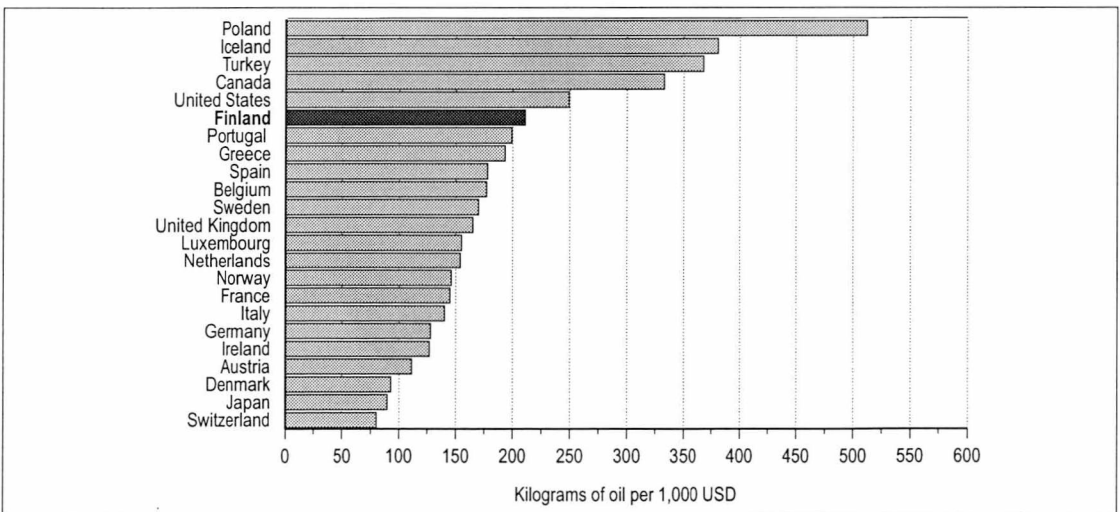
Sustainable development and energy

In 2004 Finland's total energy consumption was estimated to 35 million oil equivalent tonnes, which is a reduction of 0.5

per cent on the previous year. With much more rainfall in 2004 than in the dry previous year, the amount of electricity produced by hydropower increased by 56 per cent of total energy consumption. The share of fossil fuels was 51 per cent, 30 per cent originated from domestic energy sources, and 20 per cent from wood. Industry is the largest consumer of energy in Finland, accounting for half of energy end-use. Of final energy consumption, 21 per cent went into the heating of buildings, and 16 per cent went into road traffic. Finland has a high level of per capita energy consumption, due to the considerable need for heating, the dominant role of heavy industry in the economy, and the long distances in what is a sparsely populated country. Energy intensiveness dropped in Finland in 2004 as the GDP rose at a higher rate than energy consumption.

Electricity consumption in Finland amounted to 86.8 TWh in 2004, up by nearly two per cent from 2003. The increase in electricity consumption was caused by industry, which increased its electricity consumption by four per cent.

Figure 8. Total energy consumption in selected countries by GDP unit in 2002



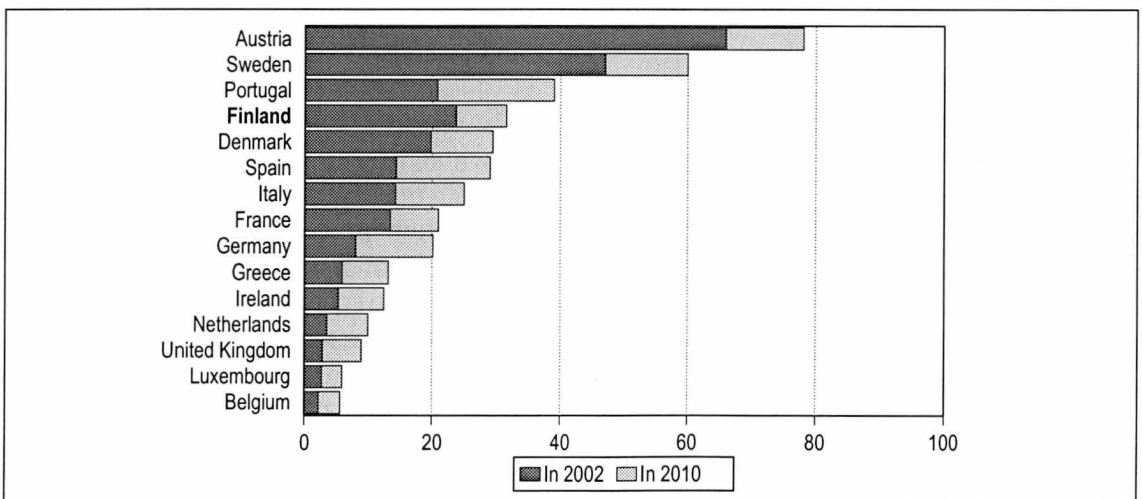
The forest industry consumed five per cent more electricity in 2004 than in the previous year, the chemicals industry four per cent more, and the metallurgical industry two per cent more. The electricity consumption of households, agriculture and services remained on par with the previous year.

In 2002 the Finnish Parliament decided in principle to approve the building of a fifth nuclear power plant. In connection with this, 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, and to promote the research, development and introduction of renewable energy sources. A report will be presented to Parliament concerning these actions.

The promotion of renewable energy sources and increased efficiency in energy use are key conditions for sustainable development and fighting climate change. The International Conference for Renewable Energies, held in Bonn in June 2004, concluded that the importance of renewable energy sources

and energy-efficiency will increase, and that in the future, they will constitute the most important sources of energy and will be widely available. A renewal of EU funding programmes is being planned, with the aim of focusing more on innovation, competitiveness and providing risk capital for small and medium-sized enterprises (SMEs). The Competitiveness and Innovation framework Programme (CIP) for 2007–2013 also includes the current long-term programme for the energy sector, the Intelligent Energy - Europe programme (2003–2006). The new programme is expected to expand the renewable energy sources (ALTENER) field of the programme, as well as the field concerned with improving energy efficiency (SAVE). The part of the programme devoted to energy saving in transport (STEER) also continues to be a primary area of focus. In the EU's Sixth Framework Programme for Research and Technical Development started in 2003, energy research focuses on the topic of sustainable development and global change. In the EU's Seventh Framework Programme approved in April 2005, the environment, including climate change,

Figure 9. Renewable energy sources as a proportion of electricity consumption in 2002, and the target for 2010 (per cent)



forms one of the thematic domains. In the proposal for a framework programme, EUR 2.552 billion is dedicated to environmental research between 2007–2013.

The European Commission aims to double the percentage of renewable energy sources in use from the earlier figure of six per cent by 2010. In the directive promoting the use of electricity produced from renewable energy sources, each member state is given an individual indicative target for the percentage of total energy consumption to be produced from renewable energy sources by 2010. The indicative target for Finland is 31.5 per cent. To promote combined heat and power (CHP) production, the European Commission has set a target for the whole of the EU to double the share of CHP by 2010. To achieve this target (among others), a directive for promoting combined heat and power production was drafted, which came into force in February 2004.

12. EU wind-power capacity December 31, 2004, and increase during 2004 (megawatts)

	Capacity	Increase
Germany	16 649	2 054
Spain	8 263	2 064
Denmark	3 083	7
Italy	1 261	357
Netherlands	1 081	199
United Kingdom	889	253
Austria	607	192
Greece	587	61
Portugal	585	274
Sweden	478	50
France	386	138
Ireland	339	148
Belgium	106	28
Finland	82	30
Poland	55	0
EU total	34 725	5 411

In Finland, the Action Plan for Renewable Energy Sources is being implemented as a part of the National Climate Strategy, which aims to increase the use of renewable energy sources by 30 per cent from 2001 levels by 2010. Most of the increase, nearly 90 per cent, would come from bioenergy – mainly from wood. The goal for wind power in the action plan is to increase its use to 16 times the amount used in 2001 by 2010. The target for 2025 is to increase the use of renewable energy by 60 per cent compared with the situation at the beginning of the this decade.

One of the aims of the National Forest Programme and the Action Plan for Renewable Energy Sources is to increase wood fuel use. In 2003, 13.4 million solid cubic metres of wood fuel was used in heat and power plants to produce over 25 TWh of energy, representing six per cent of Finland’s total energy consumption. An even greater source of energy was wood-derived waste liquor. Of the other wood fuels, the most significant is the burning of firewood. The most significant solid fuel is bark, accounting for 65 per cent of the total. Bark, like sawdust, wood chips and forest industry residues, originates from, and is thus dependent on, the wood-processing industry. Wood-based fuels accounted for around 20 per cent of Finland’s energy consumption in 2004.

The world’s wind-power capacity has grown swiftly in recent years. In Europe, 73 TWh of energy are produced every year using wind power, which is almost the equivalent of the overall electricity consumption of Finland. The use of wind-power increased by 20 per cent in the EU countries in 2004. Despite abundant potential, most of the EU member states are still at a low level of wind-power production. So far the construction of more

wind power sites has been hampered by the low price of electricity. At the end of 2004, Finland had 82 megawatts of wind power capacity in 92 plants. The goal is to increase Finland's wind-power capacity to 500 megawatts (MW) by 2010. The EU's wind power capacity was 34,725 megawatts at the end of 2004, the United States' 6,750, and the rest of the world's 6,437 megawatts.

Finland has a high standard of know-how in the field of solar energy. Current solar energy applications are mainly to provide electricity to holiday homes and remote regions. A total of some 30,000 solar panel units have been sold to generate electricity for holiday homes. Solar energy is used to light 1,500 shipping beacons, and four experimental solar power stations have been connected to the electricity network.

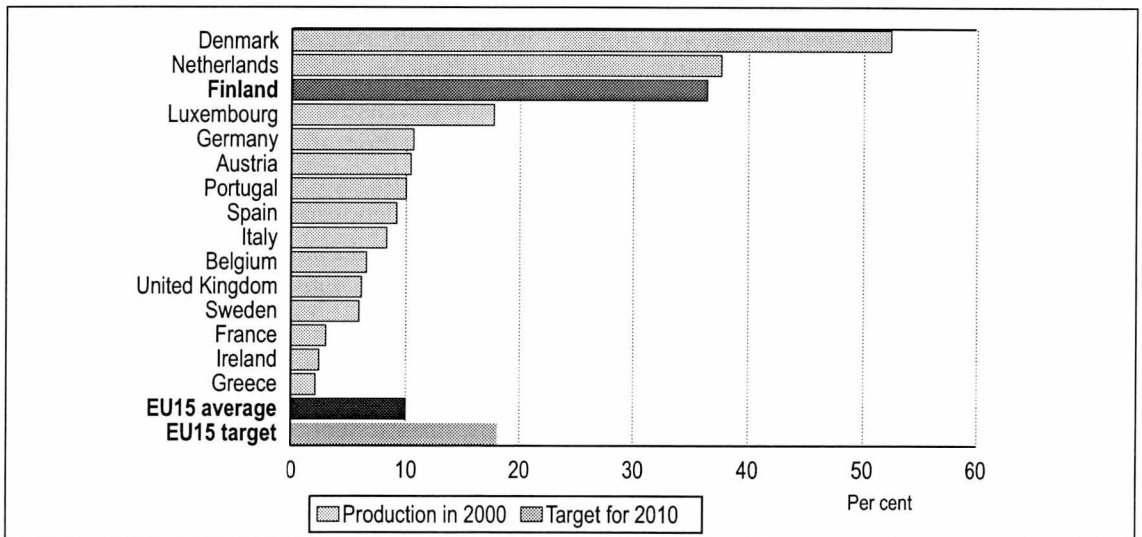
Fuel peat accounts for six per cent of Finland's total energy requirement. The main arguments for supporting fuel peat use are that it is indigenous, the certainty of the availability of energy, and the employ-

ment perspective, particularly in northern and eastern Finland. Peat is suitable for use as a fuel, particularly when combined with wood, and is classified as a slowly renewing biomass fuel. However, emissions arising from the burning of peat fall under the category of fossil-fuel greenhouse gas emissions. A total of around 2.2 million oil-equivalent tonnes of peat were burnt in 2004, and there has been a definite rising trend since the 1980s. According to the National Climate Strategy, the aim is for peat use to remain at the current level in terms of quantity, in the production of combined heat and power and in the production of heat alone.

Improving energy efficiency

Finland's energy supply system relies largely on conventional forms of energy. It is highly efficient, particularly on account of the combined heat and power (CHP) production. Around half of the output goes into industry, and half into the needs of communities. Co-generation uses just two-thirds of the amount of fuel required in the separate

Figure 10. Percentage of electricity produced in combined heat and power production in total electricity production in EU15 member states in 2000



generation of power and heat. In 2003, 75 per cent of district heating and 34 per cent of all electricity was produced through combined heat and power production. All in all, the consumption of district heating in 2003 amounted to 29.9 TWh. Some 46 per cent of the population live in housing connected to a district heating system. In the largest cities the figure is around 90 per cent.

New measures for promoting energy saving and energy efficiency are part of an energy-savings-programme implemented under the National Climate Strategy. It is estimated that the new measures included in the programme will reduce total energy consumption by 4–5 per cent by 2010, which corresponds to a reduction of 1.5 million tonnes of oil compared to the situation in which the new energy-saving measures are not implemented. Carbon dioxide emissions will also decrease by around 4–5 million tonnes in 2010 compared with the alternative.

Points of emphasis in the energy-savings-programme include developing and commercialising energy-efficient technology, developing financial instruments, increasing the efficiency of normative guidance use, implementing energy saving agreements and further developing energy review and energy analysis activities. The effectiveness of the actions will be increased through information, education and motivation. Motiva, an advocacy unit that operates in the form of a company and is funded primarily by the Ministry of Trade and Industry, has a central role in promoting these actions.

The energy performance certificates and inspections of boilers and central air conditioning systems required by the directive on the energy efficiency of buildings will be in full use by 2009. Across the EU, require-

ments for the energy efficiency of products compliant with the recently drafted directive on the eco-design of energy-using products will be set out, and a directive concerning energy end-use efficiency and energy efficiency, which is under preparation, will provide a framework for energy-saving measures in public corporations and energy companies, among others.

The carbon dioxide emissions of the transport sector depend on traffic volumes and on the specific fuel consumption of the vehicles. In 2004, a total of nearly 51 billion kilometres was travelled by car on the roads in Finland. The distance travelled has increased by 2–3 per cent per year since the recession years at the beginning of the 1990s. Train traffic, boat traffic and international air traffic have also been on the rise in recent years.

In 2004, the average fuel consumption in new petrol-driven cars was 7.8 litres and carbon dioxide emissions were around 182 grams per 100 km. For diesel cars, the corresponding figures were 6.3 litres and 168 grams, respectively. The aim is for technical improvements to be achieved in the specific consumption of the vehicle fleet through agreements made between the EU and the automotive industry and through consumer information. According to the agreements, the average fuel consumption of private cars should decrease to 5–6 litres per 100 km and average carbon dioxide emissions to 140 grams per 100 km by 2009. According to a directive on consumer information, information on the fuel consumption and carbon dioxide emission rate of new private cars for sale must be provided to buyers at the place of sale and in advertisements. In a contradictory trend to that seen in most other EU member states, specific fuel consumption figures have been rising in Finland in the 21st century, especially for vehicles running on diesel.

3 Environmental impacts of the economy

Control of environmental protection

The European Union and the ISO (International Organisation for Standardisation) have created operating models for the systematic management and development of the environmental issues of companies and other organisations. The EMAS (Eco-Management and Audit Scheme), based on an EU regulation, and the ISO 14001 environmental management systems standard are in use in Finland. The new ISO 14001 standard was approved in November 2004. There were 941 ISO-certified organisations in Finland at the end of April 2005. The requirements of the ISO 14001:1996 standard, included in the EMAS regulation, were adjusted to conform with the new standard in the summer of 2005.

It is possible to join EMAS in all the EU countries, as well as in Norway, Iceland and Liechtenstein. There is also an increasing interest in EMAS in countries not currently in its scope of application. Of the candidate countries seeking EU membership, Romania has made a “quasi-registration” of one organisation in EMAS. There are also 13 organisations on a list of organisations fulfilling the EMAS requirements upheld by the European Commission in countries such as Switzerland, China and Korea.

In EMAS, openness and the need to inform stakeholders are given special attention. Organisations registered under EMAS regularly publish an environmental report on their activity, which has been confirmed by a third party. In Finland, the fee

13. ISO 14001 and EMAS environmental management systems in use in Europe

	ISO 14001 ^{*)}	EMAS organisations ^{**)}	EMAS sites ^{**)}
United Kingdom	5460	62	63
Spain	4860	466	599
Germany	4320	1605	2049
Italy	4318	298	371
Sweden	3404	99	114
France	2344	20	20
Netherlands	1162	25	29
Czech Republic	950	18	20
Finland	888	40	48
Hungary	780	1	1
Denmark	711	125	268
Poland	555	0	0
Austria	500	258	344
Belgium	366	33	179
Norway	350	28	28
Portugal	313	27	30
Slovenia	247	1	1
Ireland	218	8	8
Slovakia	169	2	2
Estonia	100	0	0
Romania	96	1	1
Greece	90	6	6
Lithuania	72	0	0
Luxembourg	39	1	1
Liechtenstein	22	0	0
Cyprus	21	0	0
Latvia	20	0	0
Malta	4	1	1
Iceland	3	0	0
Total	32382	3125	4183

^{*)} = on 1 October 2004. ^{**)} = on 30 April 2005.

for processing an environmental permit can be reduced if, for example, an environmental management system shortens the processing time. Environmental management systems can be used as proof that environmental requirements in tender offers of public contracts will be met.

Finland's industrial sector has invested more and more in environmental protection in recent years, with the emphasis starting to shift to the various dimensions of social responsibility. The European Commission's Integrated Pollution Prevention and Control (IPPC) Directive underlines the responsibility of companies to employ the best available technology (BAT) in their processes and other functions. In Finland, the BAT requirement has been included in the Environmental Protection Act and in legislation dealing with water protection, waste disposal and marine protection. The Act contains the major elements of legislation tackling environmental pollution. The Environmental Protection Act and Decree require environmental permits to be acquired for any operation that carries the risk of environmental pollution.

The water protection programme, which extends to 2005, and the related action plan oblige the industrial sector to reduce its discharges considerably. By 2005, the aim is to cut phosphorus and nitrogen discharges by 50 per cent compared to 1995, and chemical oxygen demand by 45 per cent. Targets of a 55–90 per cent reduction in chromium, oil, nickel, copper and zinc discharges have also been established. In 2003 the consumption of chemical oxygen by industry reduced by 27 per cent, the phosphorus discharge load decreased by 36 per cent, and the nitrogen discharge load decreased by 18 per cent when compared with 1995. The biological oxygen consumption of the pulp and paper industry decreased by 48 per cent between 1995 and 2003, the phosphorus discharge load decreased by 36 per cent, and the nitrogen discharge load decreased by 18 per cent. The pulp and paper industry accounts for 87 per cent of total industrial biological

oxygen consumption, almost 90 per cent of the phosphorus discharge load, and 73 per cent of the nitrogen discharge load.

In Finland, industry has been actively involved in an agreement made between the Ministry of Trade and Industry and the Confederation of Finnish Industries (EK) to promote energy savings in industry. The agreement is in force until the end of 2005. Over 90 per cent of the energy used in the forest industry and metal refining falls under the agreement. By the end of 2003, the annual energy savings derived from measures reported within the scope of the agreement totalled 3.4 TWh for heat and fuels, and 0.6 TWh for electricity.

Energy production

Energy production causes the emission of many air pollutants, with serious environmental impacts. The most significant of these emissions are sulphur dioxides and nitrogen oxides. Many international agreements were signed in the 1980s and 1990s to cut these emissions. As a result of these agreements, sulphur emissions in Europe decreased by 60 per cent between 1980 and 2000. Emissions of nitrogen oxides have also decreased significantly since the 1980s.

In 2003 Finland's sulphur dioxide emissions totalled 93,000 tonnes, according to estimates, which meant a reduction of 64 per cent from the 1990 level. This reduction was the result of changes in the structure of energy production, reduced fuel oil use, decreased sulphur content in fuel, and improvements in process technology. Finland's sulphur dioxide emissions in proportion to GDP are about one-third less than the average in European OECD countries. Electricity and heat generation ac-

Figure 11. Finland's sulphur dioxide emissions and target level for 2010 (thousand tonnes)

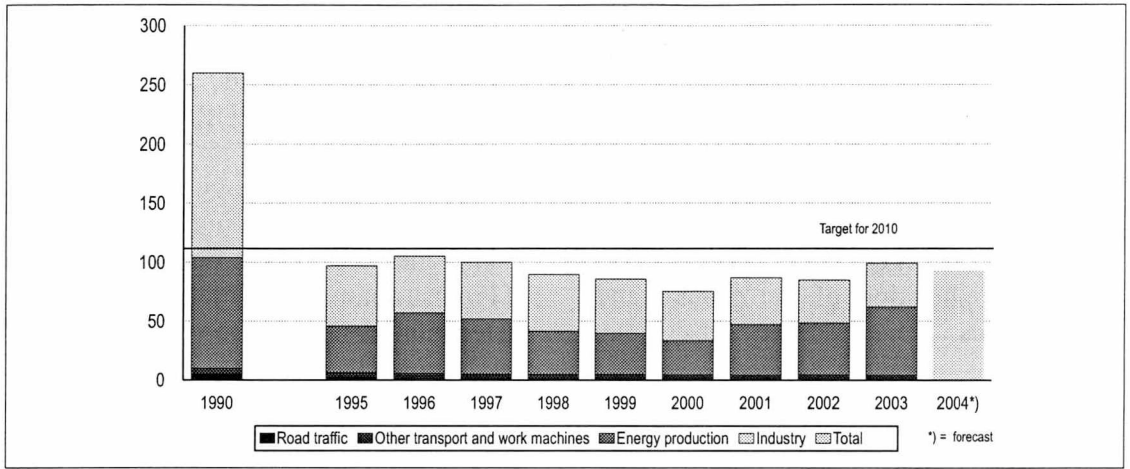
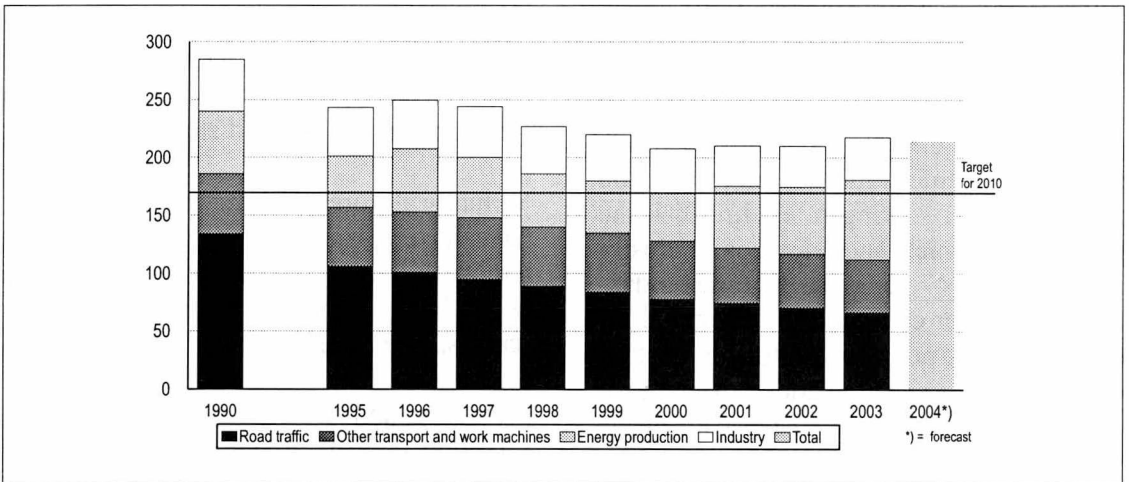


Figure 12. Finland's nitrogen oxides emissions and reduction target for 2010 (thousand tonnes)



count for 59 per cent of emissions, and industry for 37 per cent.

According to estimates, in 2003 there were around 214,000 tonnes of nitrogen oxide emissions in Finland – almost 25 per cent less than in 1990. Almost 52 per cent of these emissions were caused by domestic traffic. Energy generation accounted for 32 per cent of nitrogen emissions. Measured against the country's GDP, nitrogen oxide emissions are comparatively high in Fin-

land, about 70 per cent higher than the average in European OECD countries.

Sulphur dioxide and nitrogen oxide emissions are converted into acids in the atmosphere through various chemical processes and then deposited on the ground are either as particle-like compounds or absorbed by moisture in the air or in rainwater. Acid deposition has many consequences for the soil or the watercourses if the critical load of the ecosystem is exceeded. As a result

of emissions decreases, sulphur deposition in particular has decreased both in Finland and elsewhere in Europe. At Finnish gauging stations, sulphur deposits have decreased by 50–60 per cent since 1985, and nitrogen deposits by 20–40 per cent. However, acidification still affects the soil and water in those areas of Finland that are the most sensitive and under the greatest pollutant load. Nitrogen oxide emissions also cause eutrophication of the ground and watercourses.

Environmental protection in industry

In the 1990s an increasing proportion of Finland's GDP was accounted for by industrial production; the corresponding shares of the service, construction and agricultural sectors were all in decline. Growth was fastest in the electronics industry, which showed a sevenfold increase in production in the wake of soaring sales. In 2004, the metal, electronics and electrical industry accounted for 47 per cent, the forest industry for 15.6 per cent, and the chemical industry for 9.3 per cent of total industrial output in terms of value added. Metal production accounted for 12.7 per cent of the value of Finnish exports in 2004, machinery and equipment production accounted for 11.6 per cent, the electronics industry for 24.7 per cent, the forest industry for 19.5 per cent, and the chemicals industry for nine per cent.

Finnish industry invested a total of EUR 208.5 million in environmental protection in 2001. Water protection accounted for around 41 per cent of this, and air protection for 35 per cent. The pulp and paper industry invests the most in environmental protection, with investments totalling EUR 95

million in 2001. The metal production sector invested the next-largest amount in environmental protection in 2001 – slightly more than EUR 20 million. The operating costs from environmental protection measures in 2001 totalled EUR 415 million.

Environmental technology net sales were around EUR 2.1 billion in Finland in 2003. Taking into account the foreign operations of Finnish companies, Finnish environmental technology net sales rose to around EUR 3.4 billion. The industry provides 9,000 jobs in Finland, and 2,600 abroad. Exports still make up a significant proportion of net sales in environmental technology – totalling nearly half of domestic net sales. Furthermore, one in five companies in the sector also has foreign operations. The Finnish environmental technology sector, including foreign operations, is in the same size category as iron and steel production.

Virtually all forest industry companies now have an environmental management system in place and publish environmental reports in conjunction with their annual reports. The forest industry's continued efforts to raise the standards of environmental protection and to minimise discharges call for good control of the entire production process. The key concern in improving production processes in the pulp and paper industry is to minimise raw material consumption: wood, water, chemicals and pigments. In 2004, the forest industry used a total of 75 million solid cubic metres of wood, of which 57.6 million were of domestic origin and 17.4 million were imported. Wood consumption for the previous year was at a similar level. Imported timber for the Finnish forest industry is covered by ISO quality and environmental certification. The most important fuel was wood, used in the form of bark, wood chips and

Figure 13. Pulp and paper industry production and effluent load on the rivers and lakes (1990 =100)

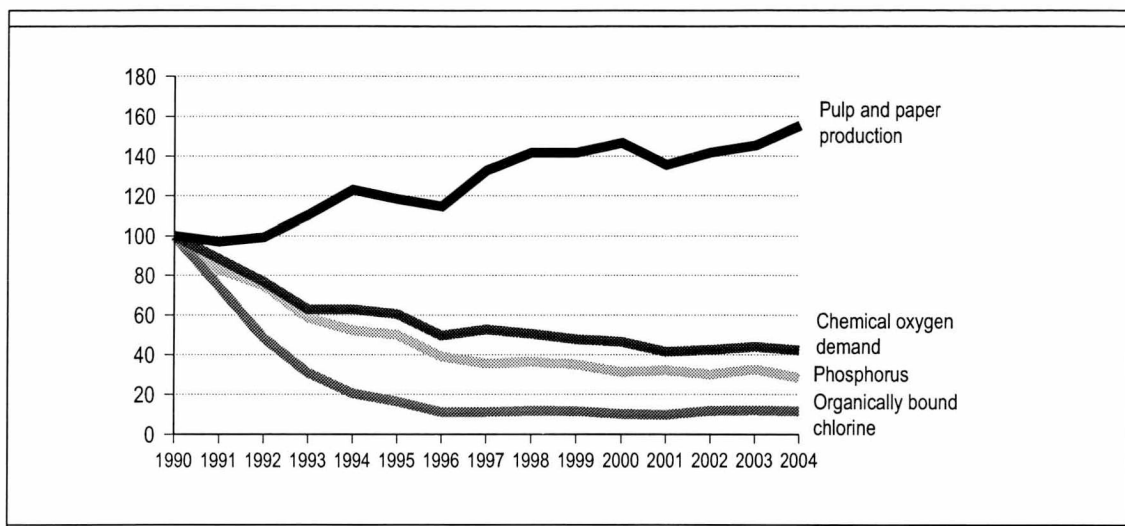
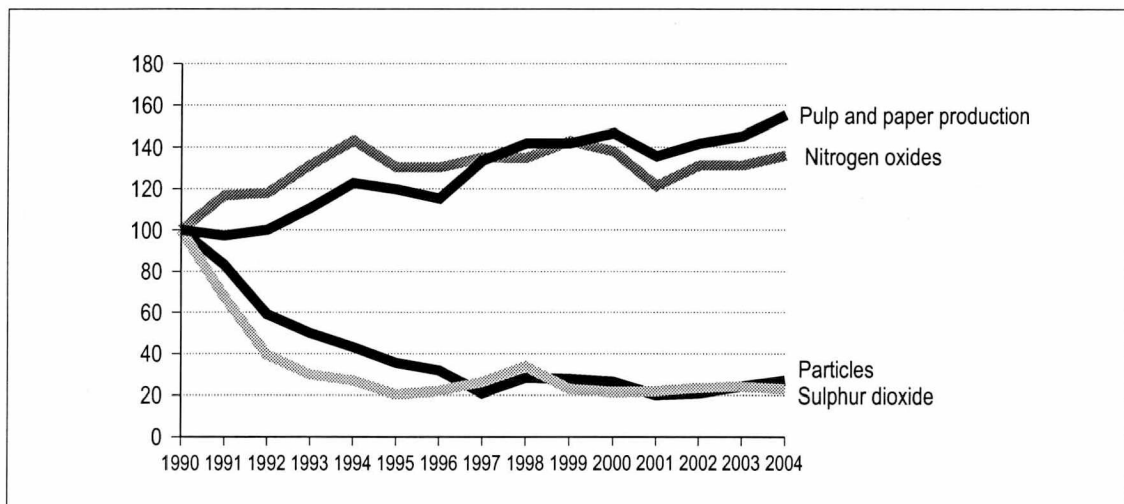


Figure 14. Pulp and paper industry production and emissions into the atmosphere (1990=100)

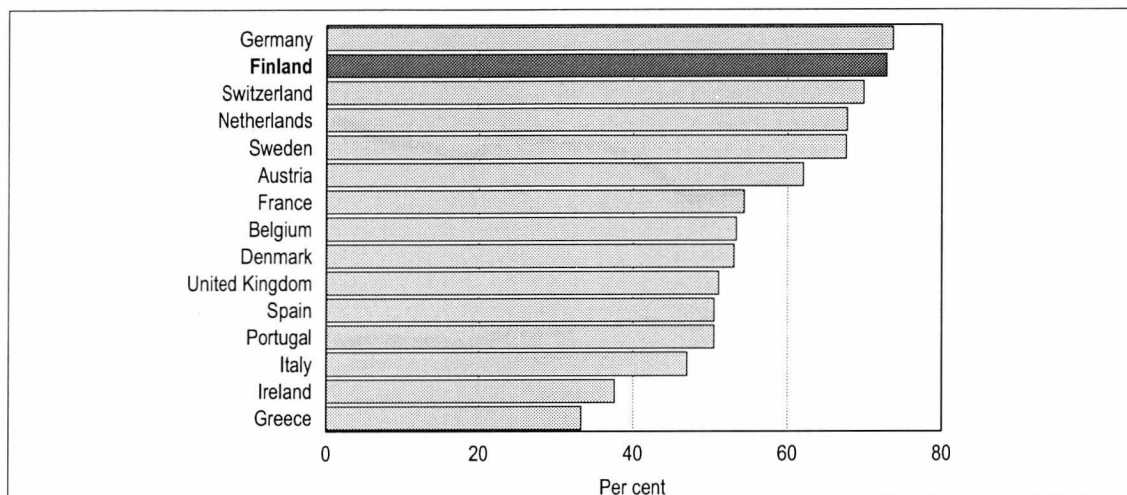


black liquor in the pulp industry. The forest industry is the largest consumer of biomass fuel in Finland.

Finland accounts for five per cent of the world's forest industry production and 10 per cent of its exports. Of the 11.2 million tonnes of paper produced in Finland in 2004, more than 90 per cent was exported, and of the 2.9 million tonnes of board pro-

duced, more than 80 per cent was exported. In recent years the forest industry has been producing record quantities of paper and other wood products. In 2004, forest industry production increased by over six per cent from the previous year. The paper industry's average capacity utilisation in 2004 was 93 per cent. In the same year, the pulp and paper industry's environmental investments totalled EUR

Figure 15. Recovery of waste paper in the EU15 countries in 2003



76 million, representing a 55 per cent increase on the previous year. Of implemented environmental investments, 25 per cent were directed towards water protection, 33 per cent towards air protection, three per cent towards waste management, and 39 per cent towards other measures. The forest industry's operating costs for environmental protection in 2004 totalled around EUR 100 million.

The use of recycled paper and board has increased substantially all over the world, and it is expected that by 2010 recycled fibre will account for around half the raw material used in paper production. According to a 1998 decision in principle by the Finnish Government, the aim by 2005 is for at least 75 per cent of the volume of paper products sold in Finland to be reused primarily as recycled material. In 2004, 796,400 tonnes of paper and board were recovered in Finland, which represents 71 per cent of all paper used. The average global recovery rate of waste paper stands at around 40 per cent.

Since only approximately 10 per cent of Finnish paper and board industry produc-

tion is consumed domestically, the potential for increasing the share of recycled fibre is limited. All in all, Finnish industry used 740,000 tonnes of recovered paper as raw material in 2004. Of this 97 per cent was used by the paper and board industry, while the rest was used by companies producing heat insulation solutions. Recovered fibre accounted for five per cent of the raw material used in the pulp and paper industry. Recovered paper was used mainly in the production of various boards, newsprint and tissue.

Chemicals are an important branch of industrial production in Finland both in terms of end products intended for consumers and especially 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, underlining the need for reliable and comprehensive environmental protection. Most investments in environmental protection made by the chemical industry consist of conventional external measures to reduce emissions, whereas investments

in process technology are less significant. Nevertheless, the chemical industry has managed to significantly reduce certain emissions into the water and air. The amount of waste has also been decreasing since 1994.

The chemical industry has taken voluntary steps to raise the standard of its environmental protection and industrial safety in the context of the international Responsible Care programme. In 2004 the programme covered more than 80 per cent of production in the Finnish chemical industry, i.e. nearly 20,000 employees. The companies involved in the programme reported that the investments in their environmental, health, and safety systems totalled EUR 74 million in 2004, which represents an increase of 30 per cent on the previous year. The costs were mainly derived from water protection, waste management and air pollution control. The operating costs of environmental, health and safety measures were EUR 99.6 million in 2004.

The most noteworthy emissions reductions under the Responsible Care programme were made in the early 1990s. Acidifying emissions into the air have decreased by more than 80 per cent since 1988, and volatile organic compound emissions have decreased by more than 60 per cent in the same period. Greenhouse gas emissions have increased by around six per cent from the 1999 level. According to water discharge indices, water discharges that cause eutrophication have decreased by over 40 per cent, and potentially ecotoxic discharges have decreased by nearly 80 per cent.

Metal refining production has been growing steadily, doubling over the past ten years. In the same period, production in the electronics and electrical industry has grown almost fivefold. Of total sales in the metal and electronics industries in 2003, 45 per cent were from the electronics and electrical industry, 42 per cent were from the machine and metalworking industry, and 13 per cent were from metals refining. Most environmental impacts in the metallurgical industry arise

14. Chemical industry effluents emitted into the watercourses

	1999	2000	2001	2002	2003	2004
Production volume (1999=100)	100.0	107.8	109.0	107.7	108.5	109.7
Sulphate*)	61 742	62 529	64 586	64 440	77 550	91 499
Phosphorus*)	13	15	13	11	11	13
Nitrogen*)	391	461	465	438	326	363
Mercury**)	7	8	7	5	7	11
Cadmium**)	1	0	0	0	2	17
Lead**)	5	3	3	4	2	4

*) = 1000 kgs. **) = kg.

15. Emissions and discharges from oil refining (tonnes)

	1999	2000	2001	2002	2003	2004
Production volume (1999=100)	100.0	96.4	89.8	99.2	99.7	103.4
Volatile hydrocarbons	4 913	4 748	4 590	4 085	4 379	3 956
Nitrogen oxides	3 053	2 877	2 915	3 203	3 179	3 209
Sulphur dioxide	3 918	3 266	3 383	3 199	3 340	3 373
Oil spills into water	4	5	9	3	2	9

16. Emissions and discharges from metal refining

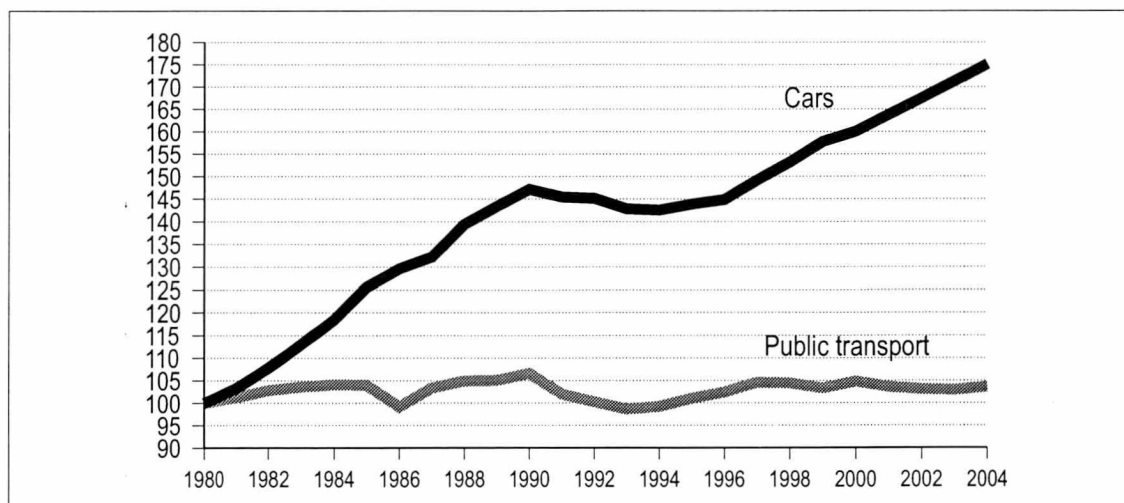
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Production volume (1995=100)	100.0	104.2	110.4	116.9	120.8	126.9	123.9	125.8	128.6	132.2
Atmospheric emissions (thousand tonnes)										
Sulphur dioxide	8.1	8.1	7.5	7.6	8.1	7.8	8.4	7.6	8.4	7.9
Nitrogen oxides	3.2	3.1	3.5	3.5	4.1	4.1	4.0	4.0	4.7	4.3
Discharges into water (tonnes)										
Nitrogen	420.6	449.3	421.6	526.0	490.0	520.5	351.4	307.5	399.3	340.0
Chromium	3.5	2.3	3.9	4.2	5.8	3.0	1.4	1.1	1.1	1.2
Nickel	12.4	6.0	10.3	6.8	9.3	7.2	5.6	3.8	3.4	1.8
Copper	8.2	8.7	8.9	6.8	7.1	9.7	7.9	3.3	6.0	2.4
Zinc	10.7	9.9	9.4	6.9	7.6	7.3	4.0	3.2	2.6	3.7

from metals refining, where raw materials are produced for use by other industries. The extensive recycling of metals reduces the demand 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 that of all other materials combined. Recycling raw materials significantly reduces energy consumption when making metals. Furthermore, metals do not lose their properties when recycled.

Environmental protection in transport

In the EU countries, passenger transport has increased by 1.7 per cent in recent years and freight transport has increased by 2.4 per cent. Passenger transport has been exhibiting a similar trend in Finland, but freighting decreased in 2002-2003 by 2.2 per cent. In all the EU countries, the increase has mainly been the result of an increase in road traffic. Traffic volumes have many direct impacts on the state of the environment. Problems of noise, for

Figure 16. Trends in use of public transport and cars (1980=100)



example, are exasperated when traffic volumes increase. Finland is attempting to reduce the environmental impact of road traffic through the use of an ISO 14001 compliant environmental system. In 2004, the Ministry of Transport and Communications prepared its third environmental programme, "Transport policies in environmental issues until 2010." The programme defines the main methods of operation for environmental work in all forms of transport. Administrative institutions and companies will complement the programme with their own programmes. The implementation of the programmes will be monitored annually.

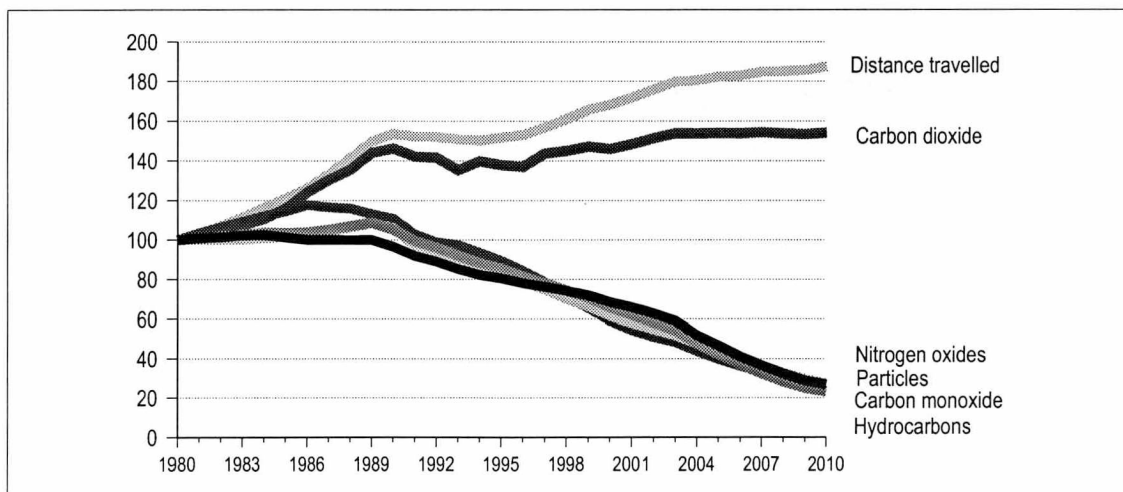
Motor vehicle emissions limits have been significantly tightened over the last few decades and continue to be revised. At the beginning of 2005 the new EURO4 emissions norms for private cars and vans entered into force, as a result of which particle emissions per car will reduce by half compared with the EURO3 norm. Other exhaust emissions (CO, HC, NOx) per car will also be reduced. The EURO4 emissions norms for heavy vehicles (lorries and buses) will enter into force in October 2005. Along with the new norm, the particle emissions per heavy vehicle will

decrease by 80 per cent, and other emissions will decrease by one-third.

In a directive on the sulphur content of fuels in EU road traffic, a schedule was made for lowering the sulphur content of fuels in stages to less than 10 ppm by 2009. Finland changed to fuels with less than 10 ppm in September 2004. The change was influenced by an amendment to the taxation of fuel which entered into force on 1 October 2004, which meant that it was no longer profitable for petrol stations to keep the more heavily taxed 50 ppm fuel in stock after September.

The use of biofuels in transport has not progressed because in Finland it is regarded as more cost-efficient to promote the use of biofuels in industry and energy production. With its current actions Finland will probably not attain the goal of the biofuels directive that more than 5.75 per cent of transport fuels on the market should be biofuels. In addition to emissions from vehicles, the maintenance of traffic routes is also a burden on nature. For reasons of traffic safety, a significant quantity of deicing agents are used in the traffic sector. In 2004, 88,000 tonnes of

Figure 17. Trends in emissions from road traffic and projection to 2010 (1980=100)



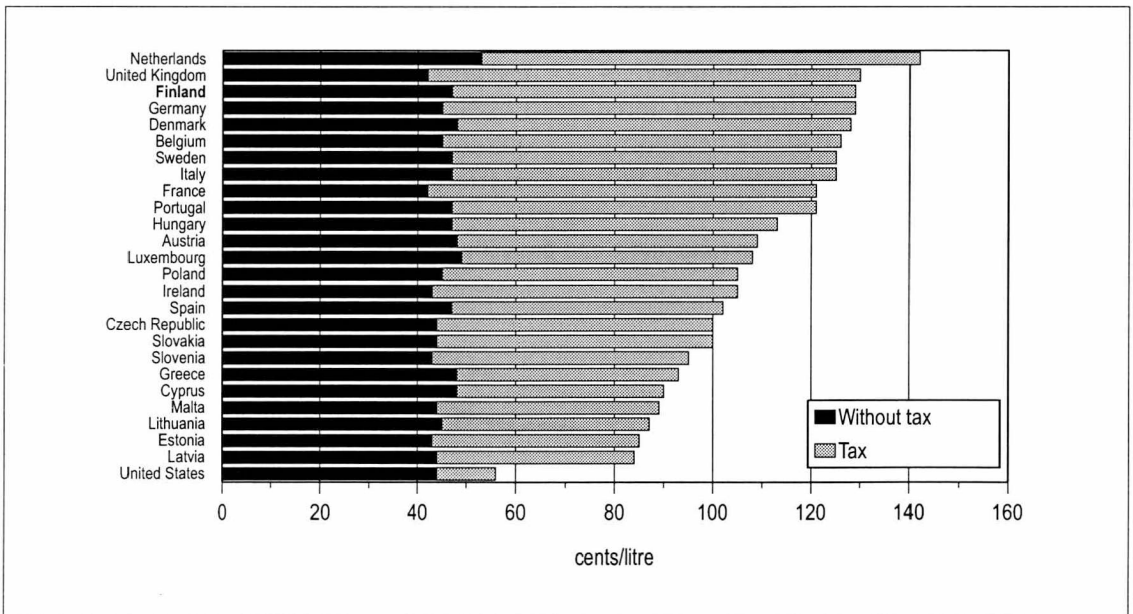
salt were used in the deicing of roads. In airports during the winter season of 2003–2004, just under 3,000 tonnes of deicing agents were used, mainly sodium acetates and potassium acetates, as well as 3,600 cubic metres of deicing and anti-icing agents for aeroplanes. Salt use is being minimised especially in groundwater areas. When planning new routes, planners try to designing them in groundwater areas. Furthermore, a groundwater protection programme is being implemented for existing roads, under which it is planned that the sites requiring urgent protection are protected by 2010. This involves the establishment of around 15 kilometres of protective zones each year. Implementation of the programme has been hampered in recent years by a lack of resources. In 2004, for example, no groundwater protection work was carried out.

Over the last decade, the use of natural resources and waste generation have decreased somewhat in the traffic sector. In road construction, the policy is increasingly to use soil material recoverable from near the site itself, thereby decreasing the amount of soil material transported to and from the construction site.

17. Material flows in road maintenance (thousand tonnes)

	2001	2002	2003	2004
Construction				
Aggregates from outside	3670	2860	1620	2170
Road network maintenance				
Deicing salt	77	100	81	99
Spring maintenance and dust control agents	28	29	26	21
Grit	460	710	520	720
Waste collected	11	11	9	7

Figure 18. Retail prices of motor fuel (95E) on 15 August 2005



Environmental health

Many environmental problems clearly affect human health. The greatest global health risks are related to air pollution, dangerous chemicals, the contamination of water and food, noise, and traffic accidents. Air pollution causes the majority of environment-related diseases in Europe. The most significant health effects of indoor air include lung cancer caused by radon, the health effects caused by passive smoking, and allergic symptoms caused by mould resulting from water damage in flats. Work time worth EUR 85–250 million is lost each year in Finland as a result of symptoms caused by poor-quality indoor air.

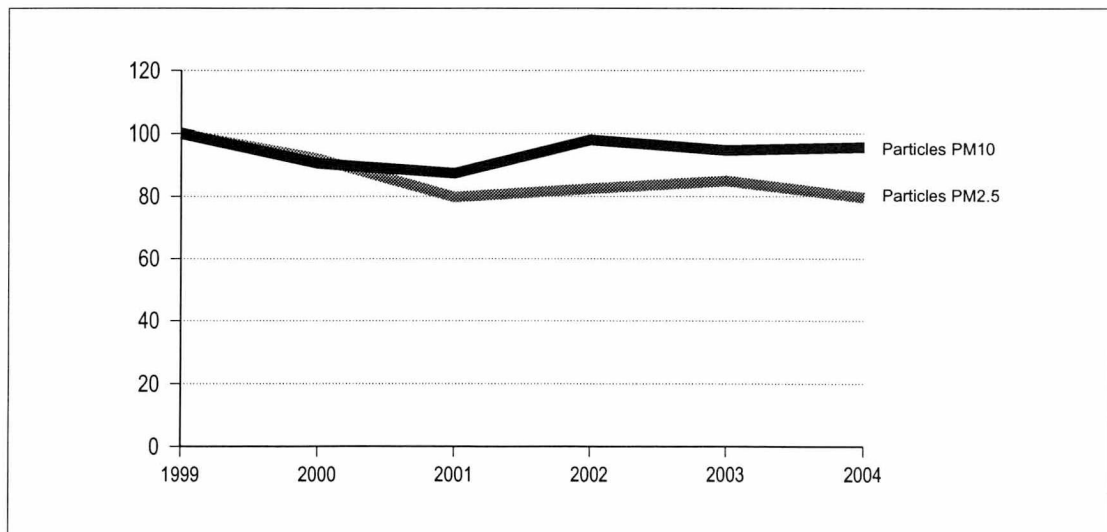
Impurities in the outdoor air are also significant health hazards to vulnerable groups of people. These include people with respiratory and cardiac diseases, elderly people and children. It is estimated that, impurities in community air, especially particles, cause the aggravation of asthma symptoms in around 30,000 people each year in Finland, and airway infections in 30,000–40,000 children. According to the most recent estimates, as many as 1,000

people die prematurely every year in Finland because of impurities in the air.

Measures for controlling the effects of impurities in outdoor air include reducing street gritting in winter, improving grit quality, replacing the grit with salt agents, and improving street cleaning, especially in the spring. Despite preventive measures, the quantity of the most dangerous particles, those under 2.5 micrometres (PM 2.5) in diameter, has not been significantly reduced. These particles are so small that they can enter the air sacks in the lungs and then intensify the symptoms of asthmatics and people suffering from lung and heart illnesses. According to estimates by the EU's CAFE programme (Clean Air For Europe), PM 2.5 particles alone cause 350,000 premature deaths in Europe. Problems are also caused by carbon monoxide from traffic and nitrogen oxides, especially in the centres of built-up areas and alongside busy traffic routes.

In addition to air pollution, environmental noise is also a notable environmental health hazard in Finland. Nearly a million Finns live in areas where the average noise level

Figure 19. Urban air particle concentrations in the largest cities (1999=100)



during the day exceeds the recommended noise limit for outdoor noise (55 dB). These areas are almost exclusively traffic noise areas. Noise diminishes the quality of the living environment and makes it less inviting, and it is harmful to many people's health and well-being and affects their ability to function. Noise has certain immediate effects on people. These include various physiological effects, such as a connection to cardiac and

coronary diseases. Noise also affects communication and sleep, and may cause stress. A proposal for a national noise abatement programme was completed in 2004. The objective of the programme is to pay special attention in planning and placement of noise abatement measures to preventing new noisy areas from forming, implementing noise abatement measures in the noisiest areas, and preserving quiet areas.

4 Non-renewable natural resources

Sustainable use of natural resources

The growth of the world's population and the improvement in standards of living are inevitably increasing consumption. In particular, environmental impacts from the accelerating use of fossil fuels and natural resources are jeopardising the renewal and tolerance of the natural environment. Indeed, one of the greatest challenges for sustainable development is to change existing production and consumption patterns 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 30 years. In the light of current knowledge, there is no threat of non-renewable natural resources and fossil fuels being exhausted over the next few decades.

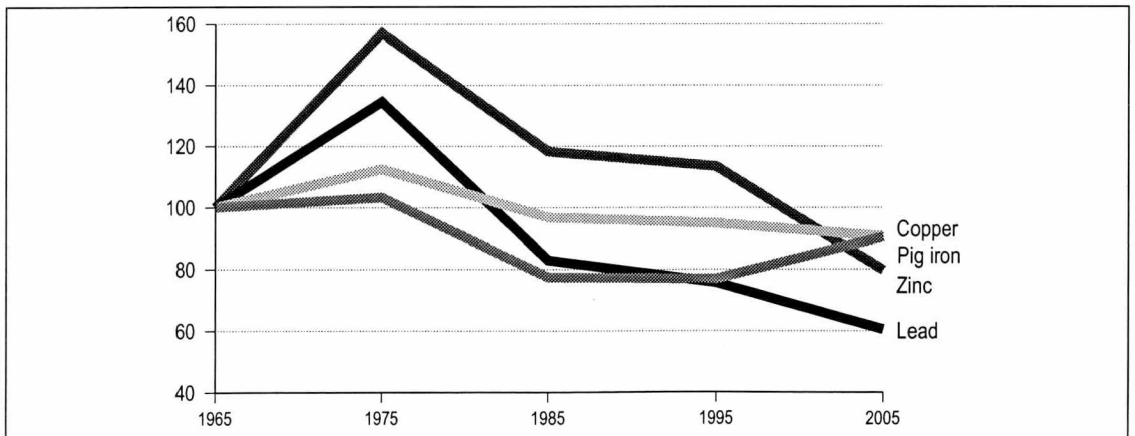
According to the Government's sustainable development programme, the sustainable use of natural resources requires that non-renewable natural resources are used sparingly and efficiently and that they are

replaced with renewable natural resources whenever possible. The objective is to ensure that, if non-renewable natural resources are used in economic activity, they are used in the most efficient way. The aim

18. Ecological footprint in selected countries in 2001 according to WWF (hectares per inhabitant)

United Arab Emirates	9.9
United States	9.5
Kuwait	9.5
Australia	7.7
Sweden	7.0
Finland	7.0
Estonia	6.9
Denmark	6.4
Canada	6.4
Norway	6.2
Ireland	6.2
France	5.8
Germany	4.8
Russia	4.4
Japan	4.3
Italy	3.8
Brazil	2.2
Costa Rica	2.1
China	1.5
India	0.8

Figure 20. Trends in real world market prices of selected metals (1965=100)



is therefore to reduce the amount of waste generated, and to reuse and recycle materials. Finland's ecological footprint is large due to the substantial use of raw material by the forest industry and the conversion of nuclear energy into fossil fuels in calculating the ecological footprint.

The Government programme aims to ensure that Finland's competitiveness is based on production and consumption that fulfil the conditions of ecologically sustainable development. In 2004, over 221 million tonnes of primary materials were consumed in Finland. Of this, 145 million tonnes were non-renewable natural resources and 76 million tonnes were renewable. Direct overall consumption of natural resources per GDP unit has declined steadily in the 1980s, 1990s and 2000s. In other words, greater economic wealth has been produced with fewer resources.

Use of fossil fuels

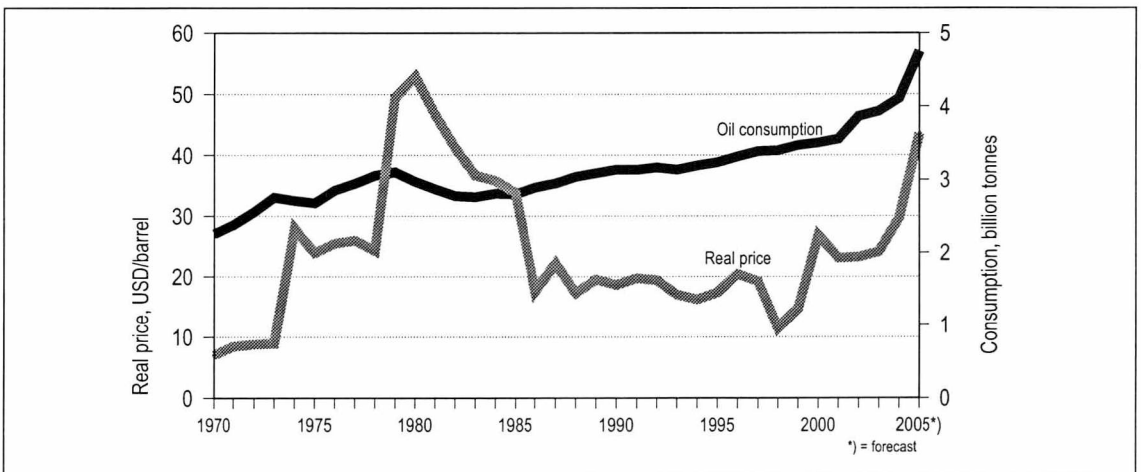
Much of the environmental damage caused by energy production is caused by the use of fossil fuels. The environmental impacts

resulting from their use are considerable, and in many places they are now jeopardising the renewal and tolerance of nature. Given the 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 of oil have been rising as a result of declining supply and rising demand. In the late 1990s, when supply still greatly exceeded demand, the real price of crude oil fell. At its lowest point, in 1998, it was in real terms below the price level preceding the first oil crisis in 1973. In 2003 global oil consumption was 4,109 million tonnes.

In Finland, oil consumption peaked in the 1970s at 10–12 million tonnes a year. Oil consumption declined sharply in the 1980s, and during the 1990s fell to less than nine million tonnes. In 2001, however, the consumption of oil products increased. During 2003–2005 the consumption of fossil fuels has continued to rise in Finland. In 2004 petrol consumption increased by nearly two per cent and diesel fuel by over four per cent. The con-

Figure 21. World oil consumption and real world market price



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

	Oil, million tonnes	Coal, million tonnes	Natural gas, 1000 million m ³
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
2000	8.4	5.8	4.0
2001	8.6	6.6	4.3
2002	8.7	7.3	4.2
2003	8.9	9.6	4.7
2004*)	8.9	8.6	4.6

– = not in use.

*) = preliminary data.

Consumption of light fuel oil decreased by eight per cent, while that of heavy fuel oil increased by five per cent and that of coal by 10.6 per cent.

Ores and other land-extractable resources

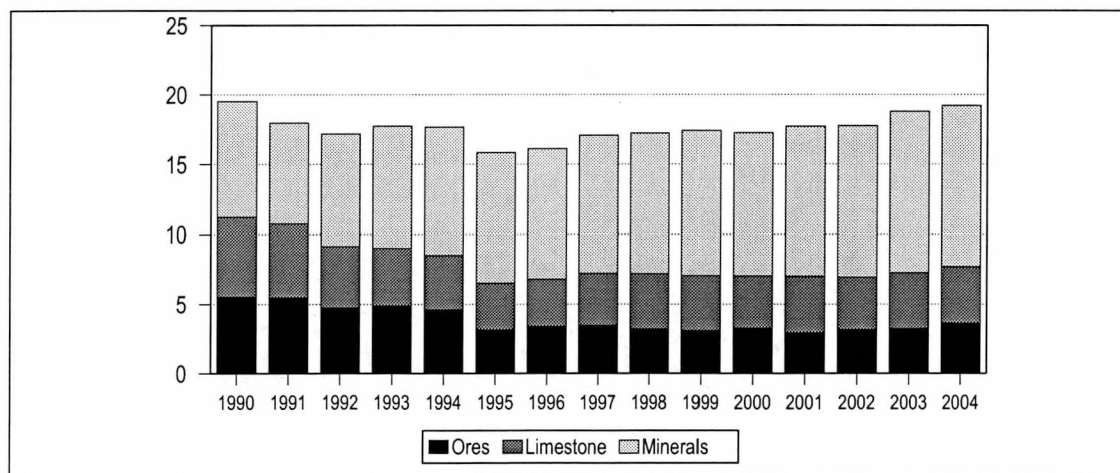
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Ore production in domestic mines declined considerably in the 1990s, while ore imports increased sharply. In 2004 ore production amounted to 3.6 million tonnes, up by nearly 400,000 tonnes from the previous year, and 5.9 million tonnes of metallic minerals were imported. Also in 2004, 4.1 million tonnes of limestone and 11.5 million tonnes of domestic industrial minerals were produced. The most important ores are chromium, zinc, nickel, copper and gold, while the most important industrial minerals in addition to limestone are granite and talc.

The consumption of gravel and rock materials 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

Figure 22. Mining of ores and industrial minerals and quarrying of limestone in Finland in 1990–2004 (million tonnes)



building sector. In 2004, 31 million tonnes of gravel and sand and 42 million tonnes of rock materials were extracted. In recent years the use of natural rock as a substitute for gravel has sharply increased as gravel resources near residential areas are becoming depleted. In addition, the civil engineering industry is attempting to replace the use of virgin natural resources with materials that are a by-product of industrial production.

Waste management

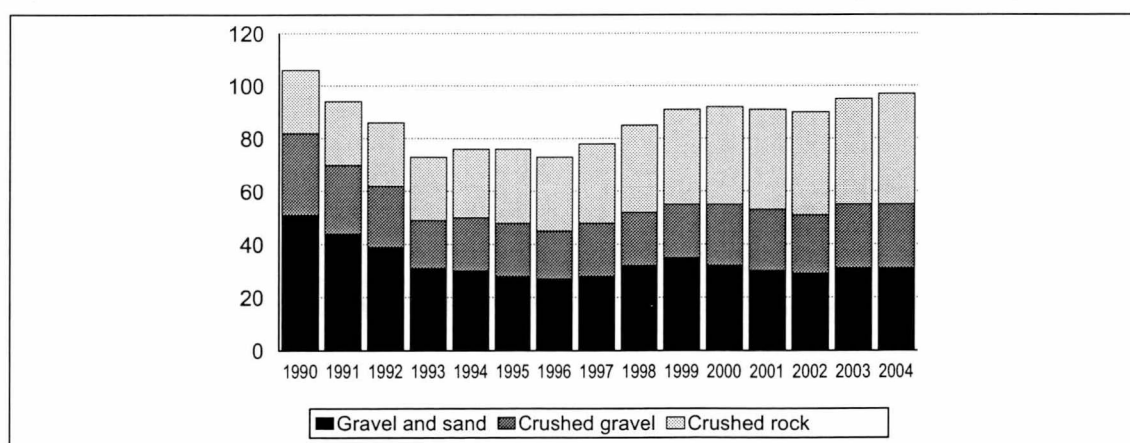
The total waste generated in Finland in 2003 exceeded 119 million tonnes. Less municipal waste was taken to landfill sites in 2003 than at any time since the mid-1990s, due to a decreasing trend that had continued for some years. On the other hand, there was no increase in municipal waste recycling. The measures taken to achieve municipal waste reduction targets seem to have been successful, even though consumption has constantly grown. municipal waste has been reduced slightly by the use of refillable and reusable return and refill packages, for example. Over 2.3 million tonnes of municipal waste was generated in 2003, of which less than half was

produced in households. The municipal waste taken to landfill sites totalled over 1.5 million tonnes. Almost 12 million tonnes of industrial waste was generated in 2003, of which 60 per cent was recycled.

To improve the efficiency of waste recycling, Finland has adopted the principle of producer responsibility, in which the manufacturer or importer must play an active role in organising the disposal and treatment of waste products. This principle has already been applied to used car tyres, waste paper and packaging waste. Regulations on producer responsibility for the disposal of end-of-life vehicles and electrical and electronic waste entered into force on 1 September 2004.

The National Waste Plan, based on the Waste Act and the EU's Waste Directive, presents the current status of the waste sector and sets targets for the development of the sector up to the end of 2005. The Government approved the revised Waste Plan in August 2002. The National Biological Waste Strategy was completed at the end of 2004. Its objective is to reduce the amount of biodegradable waste being

Figure 23. Consumption of land extractable resources in Finland in 1990–2004 (million tonnes)



taken to landfills and to prevent the climate-warming methane emissions that are formed in landfills.

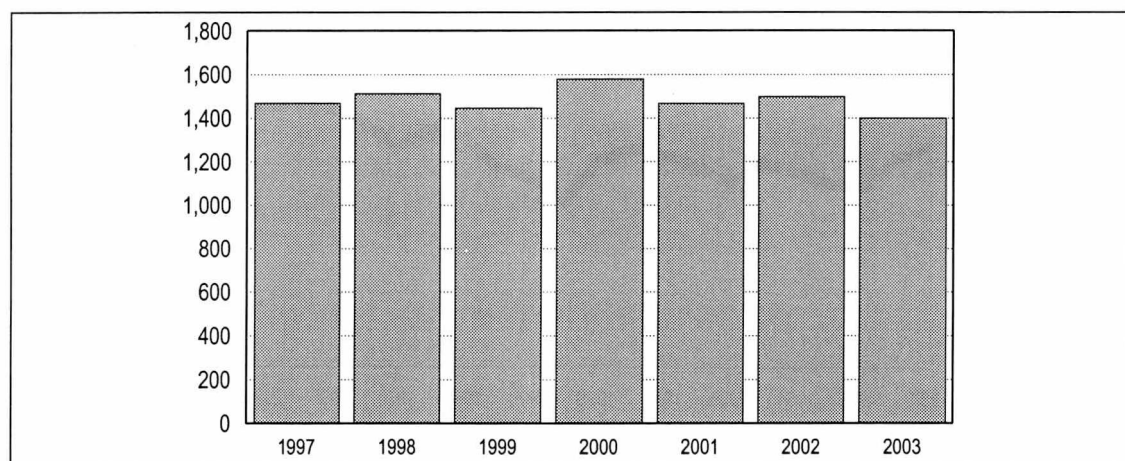
Finland had 184 operational landfill sites in 2004, of which 148 were for ordinary waste. The trend has been to concentrate municipal landfill operations into a smaller number of larger sites. At the same time, more waste is being recycled and the waste is being treated more effectively. By January 2005, there were 180 municipal waste recycling and treatment plants. By 2007 many of Finland's old landfill sites will have to be closed down, because they do not fulfil regulations concerning liner requirements. After then, the landfill sites in use will be lined and sealed well enough to control the leakage of any liquids and gases produced. The target of the National Waste Plan was that by 2005 a maximum of 30 per cent of waste material would end up at landfills. The remaining 70 per cent would be utilised as secondary raw materials, energy, soil or in landscaping. As a result of the tightened requirements, only 60–70 landfill sites receiving mixed waste would be operating in 2005 and the costs of waste management would grow to an estimated EUR 1.6 billion.

In Finland, 300,000 tonnes of urban waste is incinerated, by co-incineration in ten plants and in one special incineration plant. This is around 10 per cent of urban waste. In addition, there are two plants in Finland specialising in the incineration of hazardous waste. The EU directive on waste incineration was brought into force in Finland by a government decree in May 2003. The decree clarifies and standardises the requirements for waste incineration.

20. Total waste generated in Finland in 2003 (thousand tonnes)

	Waste generated	Waste recycled
Agricultural waste	21 300	99%
Forestry waste	22 950	6%
Mineral excavation waste	25 000	24%
Industrial waste	11 953	60%
Power generation waste	1 488	51%
Construction waste	34 120	27%
Urban waste	2 325	37%
<i>Household waste</i>	981	40%
<i>Other solid urban waste</i>	1 344	36%
Sludge from waste water treatment	150	65%
Total	119 286	39%

Figure 24. Municipal waste delivered to landfill sites (1000 tonnes)



5 Renewable natural resources

Changeover to renewable natural resources

Sustainable development requires that non-renewable natural resources be used less and that renewable natural resources be used more. This changeover is implied by the following three rules of Economist Herman Daly.

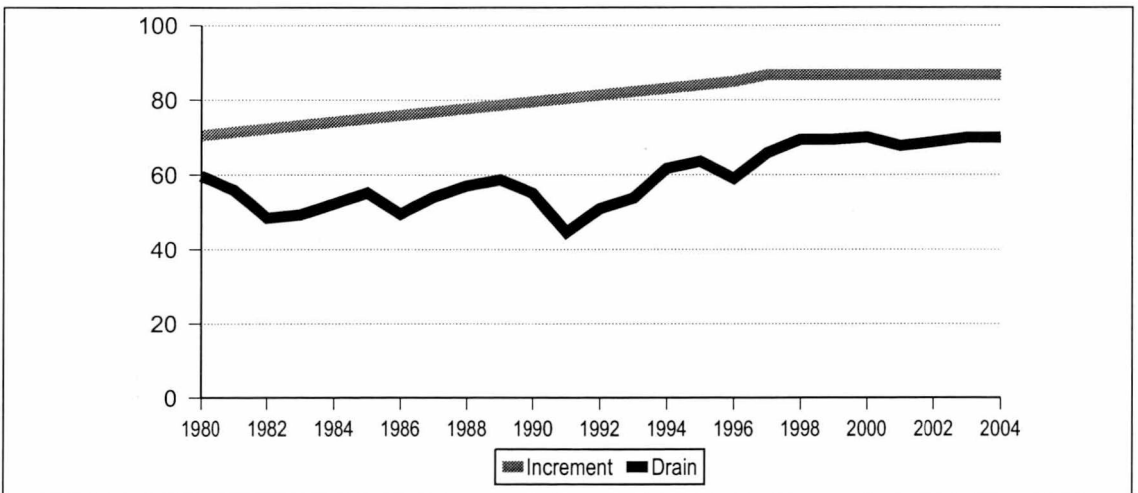
1. Renewable resources cannot be used faster than they regenerate.
2. Non-renewable resources cannot be used faster than renewable resources can be substituted for these.
3. Pollutants and waste may not be emitted and produced at greater rates than they can be processed by the environment.

According to these rules, a sustainable economic system is only possible if renewable natural resources are used in ways that do not jeopardise their ability to regenerate.

Forest resources

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 (i.e. productive forest) amounts to 20 million hectares. Altogether 53 per cent of forestry land is in private ownership, 34 per cent is owned by the state, eight per cent by companies and five per cent by others. The figure for state-owned forestry land also includes areas reserved for conservation. The total volume of growing stock is over two billion cubic metres. Of this, 68 per cent is owned privately, 18 per cent by the state, nine per cent by companies and five per cent by others. The total annual increment of 81 million cubic metres exceeds the total drain. In 2004, 62.7 million cubic metres were felled. Allowing for waste and natural losses, the total drain of Finland's forests was 70 million cubic metres. Timber imports to Finland in 2004 totalled 17.4 mil-

Figure 25. Growing stock increment and total drain (million solid cubic metres)



lion solid cubic metres, of which 83 per cent came from Russia. The total usage of raw timber in Finland in 2004 was 80.9 million cubic metres.

The purpose of the National Forest Programme 2010 is to develop the management, use and protection of the forests, so that economic, ecological, social and cultural sustainability is taken into account in their exploitation. The goal stated in the Forest Programme is to gradually 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 will fix the total volume of growing stock at its current level.

The way that the commercial forests are managed is of key significance to preserving biodiversity in Finnish nature. Intensive silviculture has had negative effects on the diversity of forests, for instance regarding the reduction in the total area of old-growth forests and the amount of rotting wood. However, the new silviculture recommendations for private forests also include biodiversity considerations. An important way to support the diversity of commercial forests is to preserve in their natural state the key natural habitats identified in the Forest Act, as well as other valuable nature sites as defined by silviculture recommendations and certification. Environmental support for forest management is paid to private landowners for losses caused by preservation of important natural habitats. Demand for this support has grown year by year.

In autumn 2002, the Government approved an action plan for the protection of the forests of southern Finland, the western part of Oulu province, and southwest-

ern Lapland. It was named the Forest Biodiversity Programme in Southern Finland (METSO). The programme contains many experimental conservation methods, largely based on volunteerism. These include the trading of natural assets, bidding competitions and co-operation networks for forest biodiversity. Networks are formed around certain core areas that are important for biodiversity. They include national parks, government camping areas and local recreation areas. The available appropriations were used to sign 38 natural asset trading contracts for 10 years. The total area of these sites is 228 hectares. The trial, which started in the late winter of 2004, has stirred widespread interest among forest owners.

In Finland 21.9 million hectares are certified by the FFCS (Finnish Forest Certification System), which is part of the PEFC (Pan European Forest Certification) system. The FFCS contains requirements that are in accordance with laws and international agreements for the management and use of forests, certification of the origin of wood, and the execution of external auditing. The nationally implemented "Survey of Habitats of Special Importance under the Forest Act" (METE project) was completed in spring 2004. The survey found 95,000 especially important natural habitats, as defined in the Forest Act, having an area of about 60,000 hectares. Based on the quality assessment of the survey, it is estimated that, on average, 80 per cent of such key natural habitats were found.

The statutory regional target programmes for forestry aim to reconcile the objectives set for the different uses of commercial forests. Prepared jointly with forest owners and various stakeholders, the programmes provide an overall picture of the state of for-

estry in each district administered by forestry centres, any development needs 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. Revision of the regional target programmes for forestry started in 2004.

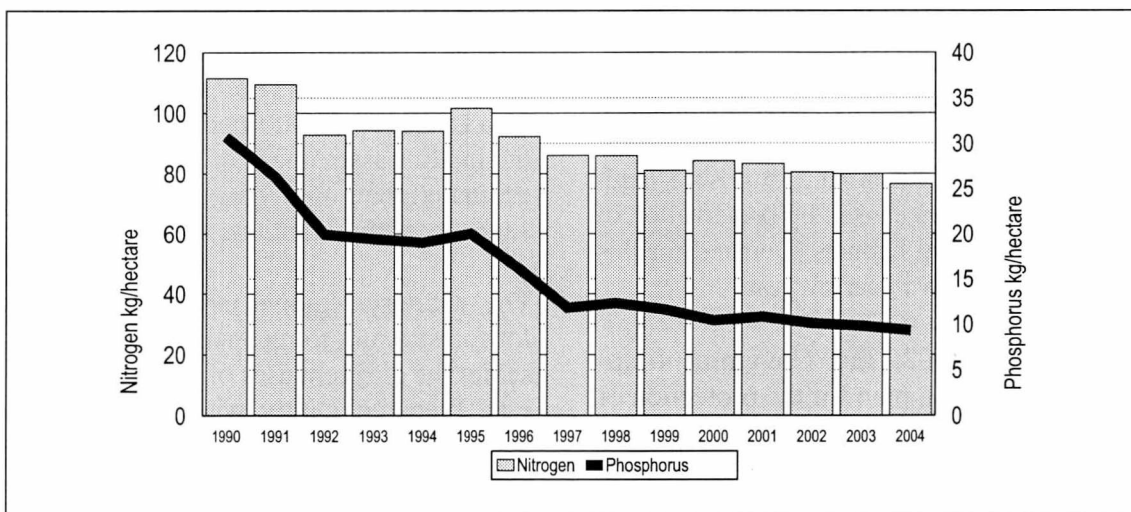
In recent years, Metsähallitus, the government body responsible for administering state forests, has made greater allowances for social and environmental considerations by working closely with stakeholders and local residents to draw up natural resource plans for areas covering 0.5 to 2 million hectares. The plans provide the framework for landscape ecological planning, which treats large forest areas of 40,000–100,000 hectares as single entities. Regional landscape ecological planning, which reconciles the different uses of forests, is aimed at securing biodiversity and the diverse utilisation of commercial forests. For example, rotting wood is left in forests and buffer

zones are established. Valuable forest sites are left intact and, where necessary, ecological corridors are established to connect these areas.

Cultivated resources

Eight per cent of Finland's land area is in agricultural use. The country has 2,218,997 hectares of farmland, i.e. fields and gardens, of which 2,023,068 hectares were being cultivated and 195,922 hectares were lying fallow in 2004. Agricultural production in Finland is primarily based 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 2004, there were 71,465 farms in Finland with more than one hectare under cultivation, which is 2,249 farms fewer than in 2003. The number of farms is estimated to be decreasing further. The average field area of farms was 31.4 hectares, i.e. 0.9 hectares more than in the previous year. Of all farms 21.5 per cent had less than 10 hectares of fields, while three per cent had more than 100 hectares of fields. The majority of farms

Figure 26. Fertiliser use in agriculture



have production that is eligible for agricultural support. Thirty-two per cent of farms supplement agriculture and forestry with other business activity. During Finland's EU membership the average field area of farms has grown by 45 per cent. In 2004, the total agricultural turnover was EUR 4 billion, and fully or partly EU-funded subsidies of EUR 1.237 billion were given out. National agricultural subsidies funded by Finland totalled EUR 589 million.

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 pollution include natural leaching, forestry, sparse settlements and holiday homes. An estimated 60 per cent of the total phosphorus load and about 50 per cent of the nitrogen load caused by human activity can be traced to agriculture. The impacts of agriculture on eutrophication are most clearly visible in coastal areas and in small rivers. The first EU environmental support programme in

use, in 1995–1999, was expected to reduce the amount of total phosphorus originating from agriculture and ending up in the watercourses by 40 per cent, and total nitrogen by 30 per cent. However, the actual reduction in nitrogen was estimated to be only 4–15 per cent and that of phosphorus 5–13 per cent.

The use of pesticides has increased in Finland in recent years, due mainly to the growing popularity of direct sowing. Moreover, the use of low volume substances is being replaced by the use of pesticides that must be applied in greater volumes. The cultivated area has also increased at the expense of grassed areas.

The EU directive designed to protect watercourses against agricultural nitrate pollution was put into force in Finland by a Government Decree on nitrates in 2000. The Decree regulates the storage, application and quantity of manure and the location and maintenance of livestock shelters and exercise areas. It also contains regulations concerning the size of manure storage

22. Agri-environmental support (EUR million)

	2002	2003	2004	2005	2006
	A	A	A	B	BP
1. Basic and additional measures	252	254	255	..	..
2. Special support	31	34	38	..	..
2.1 Organic production	17	17	17	..	..
2.2 Buffer zones	2	2	3	..	..
2.3 Treatment of runoff	4	4	4	..	..
2.4 More efficient use of manure	3	3	4	..	..
2.5 Landscape management and biodiversity	5	7	9	..	..
2.6 Cultivation in groundwater areas	0	0	0	..	..
2.7 Native breeds	0	1	1	..	..
3. Training and advisory services	1	0	1	..	..
4. Experimental projects	–	–	–	..	..
5. Other environmental management programmes	–	–	–	..	..
Total	284	288	294	322	265

A = Final accounts.

B = Budget.

BP = Budget proposal.

– = Not in use.

.. = data not available.

facilities, periods when manure may not be spread on the land, and the maximum nitrogen content of manure and fertilisers.

EU agricultural policy was revised in 2003. As a result, issues related to foodstuffs safety, the environment, and animal health and wellbeing have been highlighted. The horizontal plan for the development of rural areas accepted by the European Commission in 2000 also includes an agri-environmental support scheme for the 2000–2006 period. In Finland 93 per cent of farmers are committed to the scheme and it covers 98 per cent of arable land. The scheme takes more account of the differences between individual farms with respect to environmental management.

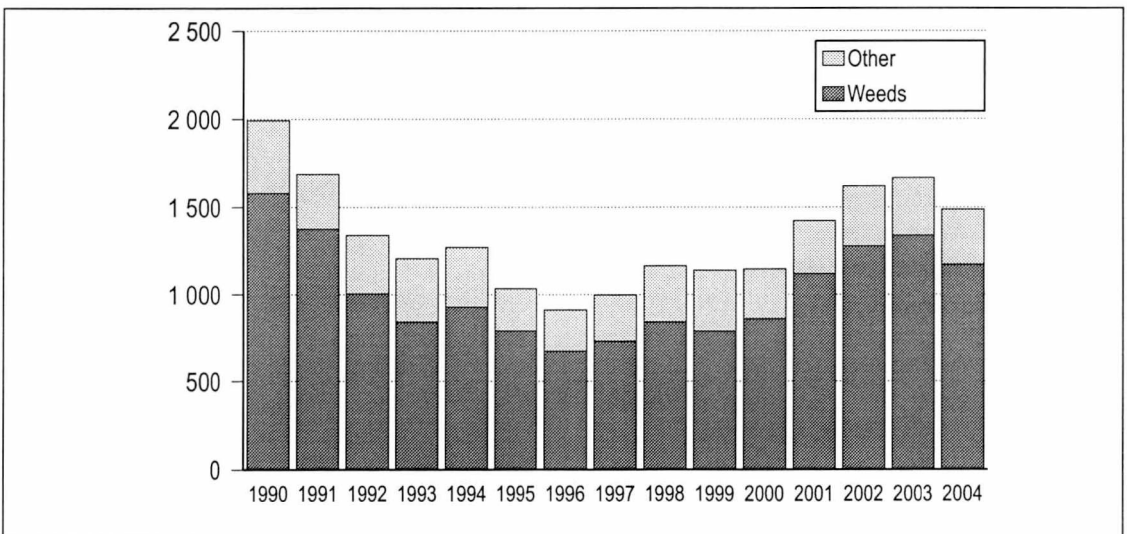
Organic farming is one of the areas of agriculture that has benefited from the agri-environmental support. A key feature of organic farming is the utilisation of nature's own processes by means of diverse crop rotation. The use of artificial fertilisers and synthetically manufactured pesticides is forbidden. The authorities inspect

the operations of organic farms at least once during the growing season. In 2004, a total of 142,054 hectares were organically farmed in Finland.

21. Organic farming and transition-phase field area in EU15 member states in 2003

	Hectares	Per cent of arable land
Austria	297 000	11,6
Italy	1 168 212	8,0
Finland	156 692	7,0
Denmark	178 360	6,7
Sweden	187 000	6,1
United Kingdom	724 523	4,2
Germany	696 978	4,1
Spain	665 055	2,3
Netherlands	42 610	2,2
Portugal	85 912	2,2
Luxembourg	2 004	2,0
France	509 000	1,7
Belgium	20 241	1,5
Greece	28 944	0,9
Ireland	29 850	0,7
EU15	4 792 381	3,5

Figure 27. Use of pesticides in agriculture (1000 kg of active ingredient)



Water resources

Finland has abundant water resources in relation to its population and water consumption. On the basis of the Water Poverty Index (WPI), developed by the World Water Council and the UK-based Centre for Ecology and Hydrology, Finland is the world's richest country in terms of water – ahead of 147 other countries in the study. The index is compiled on the basis of water resources, access to them, use of water, capacity to manage resources and environmental impacts. Finland's inland watercourses cover some 10 per cent of its total area, i.e. 33,500 square kilometres, and territorial waters extend over 36,000 square kilometres. There are an estimated 56,000 lakes in Finland of at least one hectare in size. With respect to ground water resources, about 4–6 million cubic metres a day is available for water supply. Two to four per cent of the total yield of Finland's water resources is used annually for water supply.

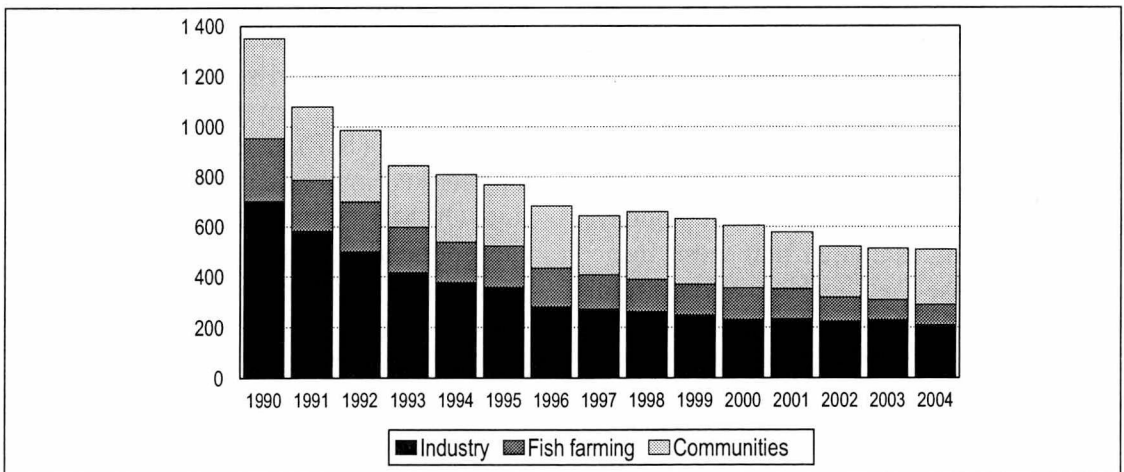
The use and management of water resources and areas is regulated in Finland by

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

	Renewable water resources	Water usage	Intensity of water usage (%)
Belgium	18	9	75
Spain	112	35	32
Italy	191	42	22
Denmark	6	1	21
Greece	74	9	12
United Kingdom	147	12	8
Switzerland	54	2	2
Russia	4507	77	2
Finland	110	2	2
Sweden	174	20	2
Norway	382	2	1
Estonia	13	0.2	1

the Water Act. Activities and structures affecting watercourses or groundwater require a permit under the Water Act. Surface water and groundwater are primarily protected by the provisions of the Environmental Protection Act. The Water Supply Act covers water supply and water utilities. As an EU member, Finland is also bound by the EU's water sector regulations. The EU's Water Framework Directive has mostly en-

Figure 28. Finland's phosphorus discharge into watercourses from industry, communities and fish farming sources (tonnes)



tered into force through the Act on Organising River Basin Management. Decrees elaborating the law are under preparation. The above-mentioned national laws have also been revised to correspond with the Directive. The main aim of the new water management planning system is to ensure a good chemical and ecological state of surface waters and a good quantitative and chemical state of ground waters by 2015.

The water mains networks of public waterworks serve approximately 90 per cent of Finns. About 40 per cent of household water derives from surface water and about 60 per cent from groundwater and artificial groundwater. The daily per capita supply of water from the waterworks to households and industry is about 240 litres, of which about 150 litres is estimated to be used by households. In sparsely populated areas water is mainly drawn from private wells. Some 0.6 million Finns rely on small water companies, co-operatives or their own wells.

The sewerage networks of the public waterworks serve about 81 per cent of the population and there are some 560 sewage treatment plants in built areas of over 50 inhabitants. The treatment plants remove 96 per cent of the organic matter in wastewater, about 94 per cent of the phosphorus, and about 47 per cent of the nitrogen. One of the great challenges for the near future is to decrease the nitrogen content of wastewater. The wastewater of properties not connected to the public waterworks must be treated adequately. The requirements concern both permanent and holiday dwellings. It is estimated that these measures will cause the phosphorus load from sparsely populated areas to drop to less than half of its present level, and the total phosphorus load caused by humans to decrease by 6–7 percent in the next 10–15 years.

Even though urban and industrial wastewater is treated adequately nowadays, surface water quality is still threatened by eutrophication. Many of Finland's originally nutrient-poor watercourses have become eutrophic and support the blooming of algae, for example. Diffuse pollution is still a major source of water pollution, and this has not been reduced to the same extent as point source pollution. Sources of diffuse pollution include agriculture and forestry and sparsely populated areas beyond centralised sewerage systems. According to a general usability classification of surface water, made with data from 2000–2003, 80 per cent of Finland's classified lake areas and 73 per cent of its sea areas were graded as excellent or good. The water of 43 per cent of the total length of classified rivers was graded as excellent or good. These rivers are mainly in northern Finland. The water quality of rivers was worse than that of lakes, because developed areas and agriculture are concentrated near them.

The Convention on the Protection of the Marine Environment of the Baltic Sea came into force at the beginning of 2000. The task of the Baltic Marine Environment Protection Commission (HELCOM) is to constantly monitor the Convention's implementation and make recommendations on actions to promote the Convention's purpose. HELCOM's Baltic Sea Joint Comprehensive Environmental Action Programme (JCP), approved in 1992, is another key instrument for marine protection. Of the 132 major sources of pollution (hot spots) identified in the Programme, 55 have so far been crossed off the list. The Baltic Sea gained PSSA (Particularly Sensitive Sea Area) status in April 2004.

The amount of oil transported in the Gulf of Finland has increased by almost 160 per cent since 2000. In 2004 some 112 million tonnes of oil were transported, and this amount is forecast to rise to some 190 million tonnes by 2010. The sharp increase is due mainly to increased Russian oil production and the introduction of new ports on the Russian side of the Gulf of Finland.

Other natural resources

There are 61 species of fish in Finland. In terms of quantity, the important fish species for recreational fishing are perch, pike, roach, whitefish, pike-perch, vendace, bream, trout, and rainbow trout. The total catch of recreational fishermen in 2003 was 38.5 million kilograms, of which 73 per cent were caught in inland waters. The total value of the recreational fishing catch was EUR 47.5 million. The most important catches for professional fishing are the Baltic herring, whitefish, sprat, pike-perch, cod and salmon. The financially most significant catch in inland waters was vendace. In 2003, the value of the professional fishing catch was EUR 26.2 million.

Reindeer husbandry forms a quantitatively very small part of agriculture and the national economy. However, reindeer herding has great economic, ecological and cultural significance in the northern reindeer herding areas. The reindeer population density by lichen grazing area is the smallest in the northern regions, although by summer grazing area and by total land area, the density is greater than in the southern reindeer herding districts. The highest permitted number of live reindeer in all reindeer herd-

ing districts for 2000–2010 is 203,700. In recent years, reindeer populations have been reduced to the required level.

Finland's total annual berry harvest varies between 600 and 1100 million kilos. Of this amount, an average 40 million kilos are collected, of which 30 million kilos are used by households. The economically most important berries are lingonberries, blueberries and cloud berries. Otherwise the only berries of commercial importance are cranberries and buckthorn berries. More than half of all Finns of working age pick berries and over 40 per cent pick mushrooms.

In Finland, hunting rights belong to land-owners. The number of registered hunters is 300,000. The most common game animals are deer and elk, hares, raccoon dog, mink, waterfowl and grouses. The management of hunting to ensure sustainability is based on the voluntary monitoring of game species by hunters.

24. Values of products from nature in 2003 (EUR million)

Game catch	76.0
Elk	57.0
Other game	19.0
Fish catch	73.7
Reindeer herding	10.6
Berries*)	7.5
Christmas trees	7.0
Mushrooms*)	4.3
Lichen**)	1.6

*) = Amount entering into trade. **) = Value of exports.

6 Nature conservation and the built environment

Nature conservation

One of the aims of nature conservation is to preserve biodiversity. Intensive forestry and agriculture are the main culprits behind the loss of biodiversity in Finland. According to a survey on threatened species in Finland completed in 2000, one in ten of the 15,000 or so studied species, i.e. 1,505 species, are currently threatened. There are 186 species that have become extinct, while 1,060 species are defined as near threatened and need to be monitored. While the most important habitat for threatened species is the forest, the threat of extinction has increased the most among species living in open environments such as shore habitats, meadows and fields and various cultural and natural heritage areas. In fact the latest survey on threatened species has shown that the closing of open habitats is the single most important reason for the extinction of species. Factors related to forest usage have been just as significant in their general impact.

Ways of striving to maintain biodiversity include setting up conservation areas to protect unspoilt natural environments, protecting threatened species, and integrating

the interests of nature conservation with the demands of land use planning. Strictly protected areas amount to 1,665,000 hectares, or 7.2 per cent of Finland's total forest and scrublands. There are additionally 97,000 hectares (0.4 per cent) of areas in which careful tree harvesting is permitted. Of the actual productive forestland, 834,000 hectares (4.1 per cent) is strictly protected. In Southern Finland, 1.0 per cent of productive forestland is strictly protected, while 2.2 per cent is less strictly protected. An additional 1.5 million hectares of wilderness area are protected by law. In addition, Metsähallitus decided in June 2005 to independently and permanently protect about 100,000 hectares of forest that had previously been used for forestry, the surrounding swampland and other forested areas in northern Finland. These areas include about 55,000 hectares of forestland proper. About half of the surface area has earlier been marked as subject to use restrictions in regional landscape ecological plans.

The nature conservation area network in Finland has been developed with the help of various conservation programmes. A funding package for nature conservation

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

	2002	2003	2004	2005	2006
	A	A	A	B	BP
Purchase of conservation areas	23	22	29	26	25
<i>Purchases of private land</i>	13	6	14	26	25
<i>Land exchanges</i>	10	15	15	–	–
Management of conservation areas	16	24	21	25	26
Compensation payments	16	9	16	17	14
Life Nature	2	2	2	1	1
Employment promotion scheme	2	1	1	1	1
Total	59	58	69	70	67

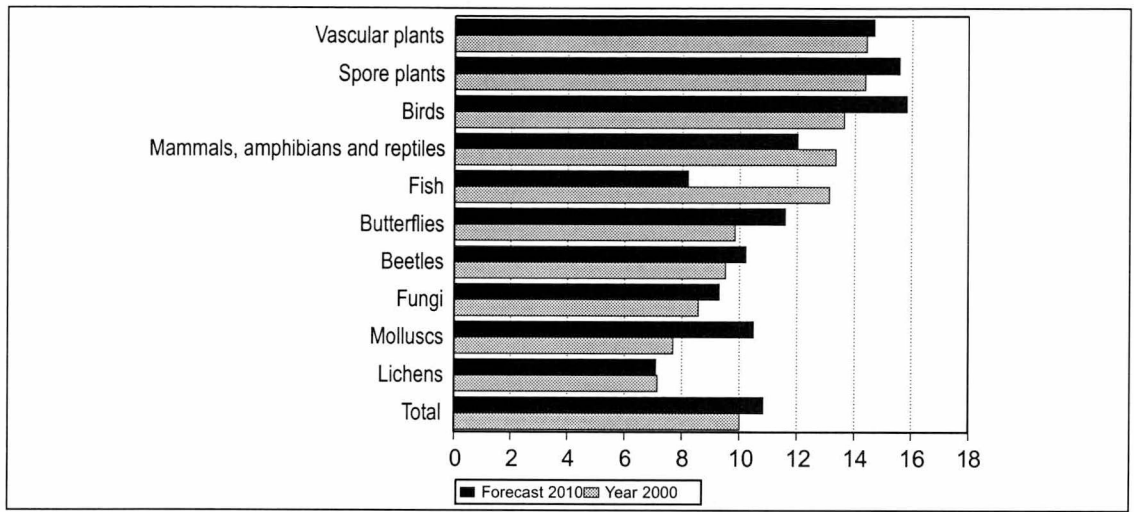
A = Final accounts.

B = Budget.

BP = Budget proposal.

– = not in use.

Figure 29. Proportion of threatened species out of all surveyed species, by group in 2000, and the forecast for 2010 (per cent)



programmes started in 1996 aims to implement the programmes by the end of 2007. In 2004, almost 30,000 hectares was acquired. The Government had acquired 12,739 hectares of land covered by approved nature conservation programmes, and 16,902 hectares of privately protected forest had been established. In 2005 around EUR 43 million will be used for the acquisition of nature conservation areas and for compensation.

In order to fulfil the requirements of the European Commission's Habitats and Birds Directives, a common network of areas to be protected is being created – Natura 2000. The Commission has finally approved nearly all of the conservation areas proposed by Finland on the basis of the Habitats Directive. In addition, the network includes special protected areas subject to the Birds Directive, which member states notify the Commission of after a national survey. The Natura areas can be protected in many different ways, depending on the type of nature and the need for protection of species in each area.

After the Government's supplementary decision of June 2005, Finland has 1,715 areas subject to the Habitats Directive and 467 areas subject to the Birds Directive. These areas partly overlap. The area of the Natura network is around 4.9 million hectares. Of this, about three-quarters or 3.6 million hectares is land area. The most expansive Natura areas are in most northern Lapland, classified as Alpine region. Their combined surface area is 1.79 million hectares, which accounts for about 38 per cent of the surface area of Finnish proposals under the Habitats Directive. The majority (97 per cent) of Finland's Natura areas are already established conservation areas, or belong in national conservation programmes or are areas protected by other means.

The LIFE fund set up by the EU in 1992 subsidises nature conservation and environmental projects that advance EU environmental policy and legislation. The programme will terminate in its present form at the end of 2005. In its budget 47 per cent is directed to nature conservation (LIFE Nature) and around 47 per cent to

new creative environmental technology projects (LIFE Environment). LIFE Nature is designed to protect the species and habitat types listed under the Birds and Habitats Directives and in particular, to implement the Natura 2000 network.

Since Finland's accession to the EU in 1995, it has received a total of EUR 33 million in LIFE Nature funding for 42 projects. Money has also been directed from other Community funds, such as the rural development fund and the structural funds, for the protection, management and use of the Natura 2000 network. An investigation is currently underway concerning the principles by which the EU's funding for the Natura 2000 network can be ensured for the financial period beginning in 2006.

26. Natura barometer in EU15 member states, 15 March, 2005

	Number of SCI areas	Total area (km ²)	% of total land area	Hectares per capita
Denmark	254	11 136	25,8	0,21
Spain	1 382	119 122	23,6	0,29
Greece	239	27 641	20,9	0,25
Netherlands	141	7 508	18,0	0,05
Portugal	94	16 503	17,9	0,16
Luxembourg	47	383	14,7	0,08
Italy	2 256	43 978	14,6	0,08
Finland	1 660	47 932	14,2	0,92
Sweden	3 903	62 356	15,0	0,69
Ireland	413	10 561	15,0	0,26
Austria	164	8 884	10,6	0,11
Belgium	278	3 221	10,6	0,03
United Kingdom	610	25 100	10,3	0,04
Germany	3 535	32 146	9,0	0,04
France	1 219	42 201	7,7	0,07
Total	16 195	453 009	13,7	0,12

The built environment

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 a way that creates a basis for a good living environment, promoting ecologically, economically, socially and culturally sustainable development. In addition, the law requires increased utilisation of existing infrastructure and building stock and the continuous, systematic maintenance of the built environment and building stock.

Zoning is the most important tool in land use planning. In zoning, areas are treated as a whole by co-ordinating measures targeted at different sectors. Zoning can be used to improve environmental quality and on its part to help prevent environmental damage. In drafting zoning plans, the effects of their implementation on the environment must be sufficiently investigated. The quality of zoning affects not only citizens' wellbeing, but also the functioning of society at large, the economy and sustainable development. From the perspective of sustainable development, the relative locations, intervening distances and traffic between residences, work places, services and other businesses are critical.

Finland is a sparsely settled country in which communities have been built close to nature and are quite spread out. Only 2 per cent of the land area is built up. The built environment includes buildings, structures, roads, streets, parks and various other facilities. In Finland, 28 per cent of fixed national assets is composed of apartments and over 30 per cent is composed of other buildings and structures. There are about 2.5 million dwellings and almost 0.5 million holiday homes. Finland's regional

structure is being affected by two long-term trends – an increase in the percentage of people living in densely populated areas and a corresponding decrease in the rural population. Currently, around 80 per cent of the population lives in densely populated areas. The growth centres of the large urban areas have increased their share, and now house nearly half of all Finns.

The community structure is constantly changing because of changes in the economic structure and transport, for example. The decisions of companies, residents and consumers on where to locate, live or shop influence development. New forms of business and a young population are locating in growth areas. The increase in urban populations and the strong desire for more living space has caused a rapid rise in the number of dwellings. In recent years much of the housing development has occurred within the existing built environment, as extensive industrial, warehouse and transport areas have been redeveloped in city centres for residential use. According to the results of a residential survey in 2004, the Finns living in population centres of over 10,000 inhabitants are very satisfied with their living conditions. Compared with the residential sur-

vey of 1999, a deterioration can be noticed in the availability of basic services, such as grocery stores, primary education and transport services, especially in smaller towns of 10,000–20,000 inhabitants.

In 2002, the Ministry of the Environment issued building codes on energy consumption requirements in buildings. The regulations and guidelines concern the heat insulation, indoor air quality and ventilation of new buildings. The aim is to reduce the energy consumption of buildings by 25–30 per cent. Improvements in energy efficiency are demanded by both the Kyoto Protocol and the Finnish Climate Strategy. The Climate Strategy is also being implemented with energy grants for repairs that improve the energy efficiency of properties in blocks of flats and row houses. Improvements in the energy efficiency of housing are being advanced with a voluntary energy-saving agreement signed at the end of 2002 by the Ministry of the Environment, the Ministry of Trade and Industry, and the ASRA Federation of Housing Property Owners and Developers.

In the European Union, the building stock is estimated to account for over 40 per cent of energy consumption. According to a Commission projection, it would be possible to achieve a 22 per cent saving on consumption by 2010. A directive on the energy performance of buildings came into force in January 2003, and its national implementation is underway. In accordance with the directive, a methodology for calculating the integrated energy performance of buildings is being prepared, minimum standards on the energy performance of new buildings are being set, and legislation is being passed for the establishment of energy certification systems and for regular inspections of boilers and air condi-

27. Different types of residences and holiday homes in Finland (1000s of residences)

	Detached houses	Row houses	Blocks of flats	Others	Holiday homes
1980	774	126	766	116	252
1995	898	291	928	64	416
1999	1 010	312	1 080	76	444
2000	1 014	338	1 094	67	451
2001	1 026	344	1 115	58	457
2002	1 031	349	1 133	62	461
2003	1 041	353	1 148	62	466

tioning systems. Energy performance requirements are also being set for existing buildings, and these will be followed in conjunction with major renovation work. The requirements apply either to the entire building or to the parts of the building being renovated. The legislation implementing the directive must be in force at the beginning of 2006. However, there is extra time until the beginning of 2009 to establish full use of the energy certification procedure and inspection measures.

The national construction policy agenda drawn up at the beginning of 2003 outlines the Government's approach for developing the properties and construction sector. The agenda improves the Government's ability to take into

28. Population density and housing structure in 14 EU countries

	Population density in 2003 (residents per km ²)	Detached houses in 2001 (%)	One-person households in 2003 (%)	Proportion of people living in cities in 2003 (%)
Netherlands	456	70.9	34	65.8
Belgium	339	80.0	32	97.2
United Kingdom	243	..	31	89.1
Germany	231	45.6	37	88.1
Italy	190	30.3	25	67.4
Denmark	125	58.5	37	85.3
Portugal	113	56.8	17	54.6
France	109	55.9	30	73.3
Austria	96	65.8	31	65.8
Greece	83	57.8	20	60.8
Spain	81	37.7	20	76.5
Ireland	56	92.4	22	59.9
Sweden	20	45.7	47	83.4
Finland	15	40.3	39	62.1

account the goals of the properties and construction sector when making decisions on long-term actions and developing the facilities of the sector. The properties and construction sector is also expected to answer to the challenges of the industry through its own development efforts. According to the construction policy agenda, development work in the properties and construction industry must aim for more flexible zoning, more efficient infrastructure, increased expertise in lifecycle thinking and environmental issues, and better competition and productivity. Other goals include building on the inhabitant's terms, more efficient management and wider scope of co-operation.

A programme for the promotion of timber construction was launched for 2004–2010, and the promotion of timber construction has been set as a goal in the Government programme. The Government's goal of increasing the construction of detached houses in urban areas has also been taken into account in developing the programme. On 17 March, 2005 the Government made a decision in principle concerning the promotion of the use of timber and timber construction. Its purpose is to promote and support measures by which the use of non-renewable natural resources can be replaced by renewable natural resources in construction, for example, and by which the use of wood can be increased by international co-operation, particularly in the EU and in Finland's neighbouring areas.

7 Towards sustainable development

The progress of sustainable development was evaluated at a ten-year follow-up summit (the World Summit on Sustainable Development, WSSD) at Johannesburg in 2002. The primary aims currently include sustainable production and consumption, eradication of poverty and the preservation and sustainable use of natural resources. Among the key achievements of the summit were a decision to create ten-year framework programmes to promote sustainable production and consumption, and scheduled goals relating to biodiversity, chemicals and fish stocks. The UN has declared 2005–2014 as the decade for education for sustainable development. Finland is also involved in the development work.

Over the last decade, the European Union has taken a leading role in promoting the policies and actions of sustainable development. The EU's strategy closely integrates the policies of economically, socially and ecologically sustainable development. The EU also ratified the Kyoto protocol before the Johannesburg summit. One of the most important methods of reducing greenhouse gas emissions will be the EU-wide emissions trading, which started at the beginning of 2005. EU chemicals legislation is also expected to enter into force during 2006.

Finland's current Government programme aims to promote the practical implementation of the Johannesburg summit's action plan. The goal is to increase the efficient usage of materials and energy through all stages of product life cycles. The broad-based "KULTU Committee" completed its proposal on promoting sustainable consumption and production in June 2005. The objective is to increase eco-efficiency throughout production chains to make Finland one of the world's most eco-efficient societies. This will give rise to new business opportunities and jobs in fields that improve wellbeing and create environmental innovations. The proposals include 73 specific measures broadly affecting different sectors of society. The

achievement of goals will also require new policy instruments. A sustainable consumption and production society will require networking and dialogue between various sectors, the promotion of environmental and social innovations, expert services on material efficiency, financial incentives, good examples in the public sector and increased awareness of environmental issues.

According to the proposal, Finland must become much more efficient in materials usage, with smaller amounts of natural resources being used per unit produced. To promote such efficiency, it is proposed that a service centre be set up to provide services for business and co-ordinate guidance on materials efficiency. The results of research can be applied in joint discussions to set materials and energy efficiency targets in sectors where improvements in eco-efficiency are feasible. Rising rates of energy consumption must be curbed within a decade and the usage of renewable energy and alternative fuels further increased. Far-reaching policies on the renewal of the tax structure must be made to encourage the sparing use of natural resources and reduce the burden on the environment. As 15 per cent of Finland's GDP consists of public sector purchases, by 2010 the public sector should integrate environmental considerations into all purchases. It is proposed that the agri-environmental support scheme for 2007–2013 be improved by rechanneling the support.

Work has also started on a new national sustainable development strategy. The Nordic sustainable development strategy has just been renewed for its second execution period, 2005–2008. New foci in the strategy include the social dimensions of sustainability and sustainable forms of consumption and production. Forming an overall view of the state of the environment and its threats is one of the great challenges. Finland will continue in the coming years to develop monitoring methods concerning the state of the environment.

Principal international environmental agreements to which Finland is committed and their objectives and implementation

Agreement	Objectives	Implementation
<p>Climate change</p> <ul style="list-style-type: none"> UN Framework Convention on Climate Change, 1992 (Rio de Janeiro). Kyoto Protocol, 1997. 	<p>To stabilise greenhouse gas concentration in the atmosphere at a safe level.</p> <p>Kyoto Protocol industrial countries committed themselves to reducing their greenhouse gas emissions by a total of 5% from the 1990 level by 2008-2012. Finland's obligation in the joint EU target is to keep emissions at the 1990 level during the 2008-2012 period.</p>	<p>The protocol has been ratified by 143 countries and the EU. The protocol entered into force on 16 February 2005. In 2003 Finland's emissions were 15 million tonnes higher than the Kyoto requirements.</p>
<p>Substances depleting the ozone layer</p> <ul style="list-style-type: none"> The Vienna Convention for the Protection of the Ozone Layer, 1985. Montreal Protocol, 1987. 	<p>To stop the use of substances causing depletion of the ozone layer in the upper atmosphere.</p>	<p>The Vienna Convention has been ratified by 188 countries and the EU, and the Montreal Protocol has been ratified by 187 countries and the EU. The production, consumption, use, import and export of substances causing depletion of the ozone layer has been restricted by EU Regulation 2037/2000 and a Government decision (262/1998).</p>
<p>Biological diversity</p> <ul style="list-style-type: none"> Convention on Biological Diversity, 1992 (Rio de Janeiro). Cartagena Protocol for Biosafety, 2000 (Cartagena). Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES), 1973 (Washington). 	<p>To protect the diversity of global ecosystems, animal and plant species and their genes, to establish a pattern for their sustainable use and to achieve an equitable division of the benefits gained from the use of genetic resources.</p> <p>The Protocol aims to ensure the safety of importing genetically modified organisms in terms of both biological diversity and human health.</p> <p>To regulate the international trade of endangered species and their products.</p>	<p>The convention has been ratified by 167 countries and the EU. Finland ratified the convention in 1994. The third follow-up report of the Finnish national action programme was completed in 2004. The scientific evaluation of the Finnish national action programme on biological diversity (1997-2005) was completed at the beginning of 2005.</p> <p>The Cartagena Protocol came into force on 11 Sept. 2003. It has been signed by 139 countries and the EU and ratified by 116 countries and the EU. Finland ratified the protocol on 9 July 2004.</p> <p>The convention has been ratified by 167 countries, but not the EU. The convention is implemented with the EU Regulation 338/1997. In Finland the convention entered into force on 8 Aug. 1976.</p>
<p>Hazardous waste</p> <ul style="list-style-type: none"> Basel Convention on the Transboundary Transport of Hazardous Waste and Supervision of its Handling, 1989 (Basel). Basel Protocol on Liability and Compensation for Damage resulting from Transboundary movements of Hazardous Waste and their Disposal, 1999 (Basel). 	<p>Environmental viewpoints to be considered in the transboundary transport of hazardous waste. The production of waste to be limited and attempts made to utilise and process waste as close as possible to its place of origin.</p> <p>The aim of the protocol is provide for a regime for liability and compensation for damage resulting from the transboundary shipment of hazardous waste, and for measures to restore the environment.</p>	<p>The Basel Convention has been signed by 166 countries and the EU, and ratified by 163 countries and the EU. The monitoring of hazardous waste transport has improved because of the convention. 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.</p> <p>The protocol on liability and compensation for damage has been signed by 72 countries and the EU, and ratified by 86 countries and the EU. Finland ratified the protocol on 4 June 2004, and the EU on 22 Dec. 2002.</p>

Agreement	Objectives	Implementation
<p>Persistent organic pollutants</p> <ul style="list-style-type: none"> Stockholm Convention on Persistent Organic Pollutants (POPs) 2001 (Stockholm). 	<p>To halt production and use of 10 pesticides and industrial chemicals, to regulate dioxin and furan emissions.</p>	<p>The agreement entered into force on 17 May 2004. The agreement has been signed by 150 countries and the EU, and ratified by 95 countries and the EU. Finland ratified the agreement on 3 Sept. 2002. The EU ratified the agreement on 16 Nov. 2004.</p>
<p>Trade in hazardous chemicals</p> <ul style="list-style-type: none"> Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (PIC), 1998 (Rotterdam). 	<p>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 38 chemicals or chemical groups.</p>	<p>The agreement entered into force on 24 Feb. 2004. The agreement has been ratified by 72 countries and the EU, and ratified by 86 countries and the EU. Finland ratified the agreement on 4 June 2004, and the EU on 22 Dec. 2002.</p>
<p>Convention on Long-Range Transboundary Air Pollution, 1979.</p> <ul style="list-style-type: none"> Volatile organic compounds (VOCs) (Geneva, 1991). Sulphur (Oslo, 1994). Nitrogen oxides (Sofia, 1988). Heavy metals (Århus, 1998). Persistent organic pollutants (POPs) (Århus, 1998). Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (Göteborg, 1999) 	<p>To cut emissions of VOCs by 30% from the 1998 level by 1999.</p> <p>To ensure in the long run that sulphur deposition does not exceed the critical load for each area. Finland is committed to cutting its sulphur emissions by 80% from the 1980 level by 2000.</p> <p>The general aim is initially to freeze the level of nitrogen oxide emissions. The most common benchmark year is 1987.</p> <p>To reduce emissions of mercury, lead and cadmium below the 1990 level.</p> <p>To restrict or discontinue the use of persistent organic pollutants.</p> <p>To cut emissions of sulphur, nitrogen oxides, ammonia and volatile organic compounds (VOCs). Finland's emission ceilings as from 2010 are 116,000 tonnes of sulphur, 170,000 tonnes of nitrogen oxides, 130,000 tonnes of VOC and 31,000 tonnes of ammonia.</p>	<p>In 1979 the convention was signed by 31 countries and the EU. In 2004 the convention celebrated its 25th anniversary. The convention has been ratified by 48 countries and the EU. Finland ratified the convention on 15 April 1981.</p> <p>The protocol has been signed by 22 countries and the EU, and ratified by 21 countries. Finland's emissions in 2002 were 33% lower than in 1998.</p> <p>The protocol has been signed by 28 countries and the EU, and ratified by 24 countries and the EU. Finland's emissions in 2003 were 83% lower than in 1980.</p> <p>The protocol has been signed by 25 countries, and ratified by 28 countries and the EU. Finland is committed to freezing nitrogen oxide at the 1987 level by the end of 1994. Finland's emissions in 2003 were 24% lower than in 1987.</p> <p>The protocol did not entered into force on 29 Dec. 2003. It has been signed by 35 countries and the EU, and ratified by 23 countries and the EU. Finland ratified the protocol on 20 June 2000</p> <p>The protocol entered into force on 23 Oct. 2003. It has been signed by 35 countries and the EU, and ratified by 21 countries and the EU. Finland ratified the protocol on 3 Sept. 2002, and the EU on 30 April 2004.</p> <p>The protocol entered into force on 17 May 2005. It has been signed by 31 countries and ratified by 15 countries and the EU. Finland ratified the protocol on 23 Dec. 2003, and the EU on 23 June 2003.</p>

Agreement	Objectives	Implementation
<p>Protection of the Baltic Sea</p> <ul style="list-style-type: none"> • Helsinki Convention on the Protection of the Marine Environment of the Baltic Sea Area, 1992. • Baltic Sea Joint Comprehensive Environmental Action Programme, 1992. • Baltic Marine Environment Protection Commission (HELCOM) Recommendations and Ministerial Statements, 1988 and 1998. 	<p>To prevent and stop the pollution of the Baltic Sea, to promote its ecological recovery and to preserve its ecological balance.</p> <p>To eliminate the Baltic Sea's worst point source and diffuse pollution inputs.</p> <p>To reduce emissions and discharges of nutrients, heavy metals and persistent or toxic organic pollutants into the Baltic Sea by 50% from the 1987 level by 2005.</p>	<p>A revised agreement came into force on 17 Jan. 2000; the revisions to annexes III and IV on the prevention of pollution from agriculture and on organising the reception of ship-generated waste came into force on 31 Dec. 2000.</p> <p>Will be implemented through national permits and bilateral and multilateral co-operation, especially in neighbouring areas.</p> <p>The targets will be implemented through the "Aims of River Basin Protection 2005" programme, accepted by the Government, and the "Operational Programme for River Basin Protection Until 2005", accepted by the Ministry of the Environment, and through the Finnish Baltic Environmental Protection Programme and EU regulations.</p>
<p>Environmental impact assessment</p> <ul style="list-style-type: none"> • Convention on Environmental Impact Assessment in a Transboundary Context (Espoo, 1991). • Protocol on Strategic Environmental Assessment (Cavtat, 2003). 	<p>To assess the environmental effects and prevent and limit the harm caused by projects that cause significant transboundary environmental damage, before making decisions related to them.</p> <p>Assessment of plans or programmes with likely significant environmental effects and, where applicable, the environmental assessment of policies and legislation providing for public participation an assessment is a key component of the protocol.</p>	<p>The convention came into force in 1997. By the end of 2004 it had been ratified by 39 states and the EU. Finland has applied the convention to 9 projects and has been the recipient 5 times.</p> <p>The protocol has been signed by 36 countries and the EU. In Finland, the Government approved a law regarding the ratification of the protocol in Feb. 2005.</p>
<p>Access to information and participation</p> <ul style="list-style-type: none"> • Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (Århus, 1998). • Kiev Protocol on Pollutant Release and Transfer Register (PRTR) (Kiev, 2003). 	<p>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.</p> <p>To improve access to information in environmental matters with the help of a pollutant and transfer register.</p>	<p>The convention entered into force on 30 Oct. 2001. The convention has been signed by 39 countries and the EU, and ratified by 34 countries and the EU. Finland ratified the convention on 1 Sept. 2004 and the EU on 17 Feb. 2005. Finnish legislation fulfils the majority of the convention's requirements.</p> <p>The protocol has been signed by 36 countries and the EU. None of the signatories have ratified the protocol.</p>

Statistical appendix

1. Population trend globally, in the EU15 member states and in the new EU member states (1950=100)

	World	EU15	New EU member states
1950	100	100	100
1955	109	103	107
1960	120	107	114
1965	132	111	119
1970	147	115	123
1975	162	118	127
1980	176	120	132
1985	192	121	135
1990	209	123	138
1995	225	126	138
2000	241	128	137
2005	256	129	136
2010	271	130	135
2015	286	130	133
2020	299	130	132
2025	312	130	129
2030	323	130	127
2035	333	129	124
2040	341	128	120

Source: European Environment Agency. EEA Signals 2004.

2. Environmental sustainability index for designated countries (ESI 2005)

	Index		Index		Index
Finland	75.1	Ireland	59.2	Chile	53.6
Norway	73.4	Colombia	58.9	United States	52.9
Uruguay	71.8	Lithuania	58.9	Slovakia	52.8
Sweden	71.7	Albania	58.8	Belarus	52.8
Iceland	70.8	Estonia	58.2	Hungary	52.0
Canada	64.4	Denmark	58.2	Tunisia	51.8
Switzerland	63.7	Panama	57.7	Uganda	51.3
Austria	62.7	Slovenia	57.5	Israel	50.9
Argentina	62.7	Japan	57.3	Tanzania	50.3
Brazil	62.2	Germany	56.9	Nicaragua	50.2
Australia	61.0	Namibia	56.7	United Kingdom	50.2
New Zealand	60.9	Russia	56.1	Greece	50.1
Latvia	60.4	Botswana	55.9	Italy	50.1
Peru	60.4	France	55.2	Mongolia	50.0
Paraguay	59.7	Portugal	54.2	Bulgaria	50.0
Costa Rica	59.6	Malaysia	54.0	Thailand	49.7
Croatia	59.5	Netherlands	53.7	Spain	48.8
Bolivia	59.5	Mali	53.7	Indonesia	48.8

2. Environmental sustainability index for designated countries (ESI 2005) (continues...)

Index		Index		Index	
Venezuela	48.1	Morocco	44.8	Lebanon	40.5
Jordan	47.8	Ukraine	44.7	Pakistan	39.9
Honduras	47.4	Belgium	44.4	Iran	39.8
Turkey	46.6	Bangladesh	44.1	China	38.6
Czech Republic	46.6	Guatemala	44.0	Ethiopia	37.9
Romania	46.2	Egypt	44.0	Saudi Arabia	37.8
South Africa	46.2	El Salvador	43.8	Kuwait	36.6
Mexico	46.2	Syria	43.8	Sudan	35.9
Algeria	46.0	Sierra Leone	43.4	Haiti	34.8
Nigeria	45.4	South Korea	43.0	Iraq	33.6
Kenya	45.3	Angola	42.9	North Korea	29.2
India	45.2	Vietnam	42.3		
Poland	45.0	Zimbabwe	41.2		

Source: 2005 Environmental Sustainability Index. An Initiative of the Global Leaders of Tomorrow. World Economic Forum.

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

	GDP at 2000 prices (EUR billion)	Consumption of materials (million tonnes)	Total consumption of energy (ktoe)
1980	80.1	163.6	22 623
1981	81.7	158.2	22 430
1982	84.4	164.1	22 038
1983	86.7	179.4	22 504
1984	89.5	181.1	23 417
1985	92.6	188.1	25 007
1986	94.7	183.3	24 803
1987	98.8	194.5	26 279
1988	103.5	194.8	26 573
1989	108.4	218.6	26 727
1990	108.1	210.1	27 296
1991	101.2	187.8	26 858
1992	97.3	182.8	26 518
1993	96.1	174.5	27 243
1994	99.9	187.4	29 135
1995	103.3	188.2	28 606
1996	107.4	184.0	29 898
1997	114.1	194.2	30 749
1998	119.8	204.0	31 277
1999	123.8	210.3	32 015
2000	130.1	209.5	31 693
2001	131.5	211.0	32 805
2002	134.5	214.1	33 696
2003	137.6	222.8	35 520
2004	142.7	221.3	35 353*)

Source: Statistics Finland. *) = preliminary data.

4. Trends in real GDP and atmospheric emissions in Finland

	GDP at 2000 prices (EUR billion)	Carbon dioxide emissions** (million tonnes)	Sulphur dioxide emissions (1000 tonnes)	Emissions of nitrogen oxides (1000 tonnes)
1980	80.1	54.1	583	284
1981	81.7	44.8	534	286
1982	84.4	43.3	483	261
1983	86.7	43.0	371	250
1984	89.5	44.4	367	247
1985	92.6	50.3	382	263
1986	94.7	48.9	331	266
1987	98.8	52.4	328	277
1988	103.5	52.2	302	279
1989	108.4	52.0	244	288
1990	108.1	53.7	260	285
1991	101.2	53.4	194	271
1992	97.3	52.2	140	265
1993	96.1	52.5	122	265
1994	99.9	58.7	115	267
1995	103.3	55.7	97	243
1996	107.4	61.0	105	250
1997	114.1	59.9	100	244
1998	119.8	57.1	90	227
1999	123.8	56.7	86	220
2000	130.1	55.0	76	208
2001	131.5	60.6	87	210
2002	134.5	62.3	85	210
2003	137.6	70.4	99	217
2004	142.7	67.0	93*)	214*)

*) = preliminary data. **) = from fossil fuels and peat.

Source: Statistics Finland.

5. Finland's greenhouse gas emissions 1990–2003 and climate strategy target to 2012*
(million carbon dioxide equivalent tonnes)

	Carbon dioxide	Methane	Nitrous oxide	F-gases	Total	Climate strategy target**)
1990	62.7	6.4	7.6	0.1	76.7	–
1991	61.2	6.3	7.2	0.1	74.8	–
1992	58.8	6.4	6.6	0.0	71.7	–
1993	59.3	6.4	6.7	0.0	72.4	–
1994	65.6	6.4	6.8	0.0	78.6	–
1995	62.8	6.2	7.1	0.1	76.2	–
1996	68.3	6.2	7.1	0.2	81.8	–
1997	67.0	6.1	7.4	0.3	80.7	–
1998	64.8	5.8	7.2	0.3	78.1	–
1999	64.3	5.7	7.0	0.4	77.5	–
2000	62.5	5.5	6.5	0.6	75.0	–
2001	68.1	5.4	6.5	0.7	80.6	–
2002	69.5	5.2	6.6	0.5	81.7	–
2003	76.1	4.9	6.9	0.6	88.5	–
2004	..	..	..	..	..	87.3
2005	..	..	..	..	..	84.3
2006	..	..	..	..	..	85.4
2007	..	..	..	..	..	85.3
2008	..	..	..	..	..	82.5
2009	..	..	..	..	..	79.6
2010	..	..	..	..	..	76.8
2011	..	..	..	..	..	73.9
2012	..	..	..	..	..	71.1

– = not in use. .. = data not available. *) = 2004 Inventory **) = forecast.

Source : Statistics Finland. Greenhouse gas inventory 2005: <http://www.stat.fi/til/khki/index.html>

6. EU member states in relation to Kyoto target levels in 2002 (per cent)

Spain	+ 30.0	Finland	+ 7.0	Czech Republic	- 21.0
Portugal	+ 25.0	Netherlands	+ 4.0	Slovakia	- 24.0
Ireland	+ 21.0	Slovenia	+ 3.7	Hungary	- 27.0
Austria	+ 16.0	Luxembourg	+ 2.0	Poland	- 29.0
Italy	+ 13.0	France	- 2.0	Estonia	- 50.0
Denmark	+ 12.0	Sweden	- 6.0	Lithuania	- 55.0
Greece	+ 11.0	Germany	- 6.0	Latvia	- 58.0
Belgium	+ 7.0	United Kingdom	- 7.0		

Source: European Environment Agency.

7. Breakdown of electricity production by energy sources in 2004 (per cent)

Nuclear power	24	Biofuels	12	Oil	2
Coal	18	Peat	8	Waste fuels	1
Hydropower	17	Net imports	6	Wind	0
Natural gas	12				

Source: Statistics Finland.

8. Total energy consumption in selected countries by GDP unit in 2002

Total energy consumption Kilograms of oil/USD 1000		Total energy consumption Kilograms of oil/USD 1000	
Poland	512	Luxembourg	155
Iceland	381	Netherlands	154
Turkey	368	Norway	146
Canada	333	France	145
United States	249	Italy	140
Finland	211	Germany	128
Portugal	199	Ireland	127
Greece	193	Austria	111
Spain	178	Denmark	93
Belgium	177	Japan	90
Sweden	170	Switzerland	80
United Kingdom	165		

Source: IEA/OECD; Energy Balances of OECD Countries.

9. Renewable energy sources as a proportion of electricity consumption in 2002, and the target for 2010 (per cent)

	In 2002	In 2010
Austria	66.0	12.1
Sweden	47.0	13.0
Portugal	20.8	18.2
Finland	23.7	7.8
Denmark	19.8	9.6
Spain	14.4	14.6
Italy	14.3	10.7
France	13.5	7.5
Germany	8.1	12.0
Greece	6.0	7.2
Ireland	5.4	7.1
Netherlands	3.6	6.4
United Kingdom	2.9	6.1
Luxembourg	2.8	3.2
Belgium	2.3	3.4

Source: European Union and Eurostat.
http://europa.eu.int/comm/dgs/energy_transport/figures/pocketbook/doc/2004/pb2004_part_2_energy.pdf

10. Percentage of electricity produced in combined heat and power production in total electricity production in EU15 member states in 2000

Denmark	61.6
Netherlands	48.2
Finland	36.4
Austria	10.4
Luxembourg	17.7
Italy	6.8
Spain	9.2
Portugal	10.0
Germany	10.6
Sweden	6.2
United Kingdom	6.1
Belgium	6.5
France	3.0
Greece	2.1
Ireland	2.4
EU15 average	9.8
EU15 target for 2010	18.0

Source: European Union.

11. Finland's sulphur dioxide emissions and target level for 2010 (thousand tonnes)

	Road traffic	Other transport and work machines	Energy production	Industry	Total
1980	8.9	4.3	274.0	296.0	583.0
1981	8.6	4.3	223.0	298.0	534.0
1982	8.4	4.3	122.0	348.0	483.0
1983	8.1	4.1	87.0	272.0	371.0
1984	7.9	4.3	97.0	258.0	367.0
1985	7.7	4.4	110.0	260.0	382.0
1986	7.3	4.4	87.0	232.0	331.0
1987	7.1	4.6	97.0	219.0	328.0
1988	6.3	4.6	81.0	210.0	302.0
1989	6.6	4.7	80.0	153.0	244.0
1990	5.3	4.6	94.0	156.0	260.0
1991	4.8	4.6	72.0	113.0	194.0
1992	4.7	4.4	53.1	78.2	140.0
1993	3.8	4.5	50.4	63.7	122.0
1994	2.2	4.7	49.0	59.4	115.0
1995	1.8	4.5	39.6	51.0	97.0
1996	1.2	4.4	51.6	48.0	105.0
1997	0.4	4.6	47.0	48.0	100.0
1998	0.3	4.4	37.0	48.0	90.0
1999	0.3	4.5	35.0	46.0	86.0
2000	0.2	4.4	29.0	42.0	76.0
2001	0.2	4.1	43.1	39.6	87.0
2002	0.2	4.3	44.3	36.3	85.0
2003	0.1	4.2	58.2	36.8	99.0
2004*)	..	..	..	..	93.0
2010**)	..	..	..	..	117.0

Source: Statistics Finland. .. = data not available. *) = preliminary data. **) = target.

12. Finland's nitrogen oxides emissions and reduction target for 2010 (thousand tonnes)

	Road traffic	Other transport and work machines	Energy production	Industry	Total
1980	127.0	41.0	90.0	26.0	284.0
1981	127.0	42.0	86.0	31.0	286.0
1982	127.0	43.0	42.0	49.0	261.0
1983	128.0	42.0	36.0	44.0	250.0
1984	128.0	44.0	34.0	41.0	247.0
1985	129.0	45.0	47.0	42.0	263.0
1986	132.0	46.0	45.0	43.0	266.0
1987	133.0	48.0	52.0	44.0	277.0
1988	135.0	49.0	51.0	44.0	279.0
1989	138.0	51.0	53.0	46.0	288.0
1990	134.0	52.0	54.0	45.0	285.0
1991	124.0	52.0	55.0	40.0	271.0
1992	119.0	51.0	53.5	41.2	265.0
1993	116.0	51.0	56.2	42.1	265.0
1994	111.0	53.0	57.8	44.7	267.0
1995	106.0	51.0	44.2	42.2	243.0
1996	101.0	52.0	54.5	42.1	250.0
1997	95.0	53.0	52.0	44.1	244.0
1998	89.0	51.0	..	..	227.0
1999	84.0	51.0	..	..	220.0
2000	78.0	50.0	41.7	38.1	208.0
2001	74.0	48.0	53.4	35.0	210.0
2002	70.0	47.0	57.6	35.6	210.0
2003	66.0	46.0	68.7	36.7	217.0
2004*)	..	..	..	..	214.0
2010**)	..	..	..	..	170.0

Source: Statistics Finland. .. = data not available. *) = preliminary data. **) = target.

13. Pulp and paper industry production and effluent load on the rivers and lakes (tonnes per year)

	Paper and board production	Pulp production	Chemical oxygen demand	Organically bound chlorine	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
2002	12 776 000	7 143 000	182 354	1 142	193
2003	13 059 000	7 350 000	189 095	1 164	209
2004	14 036 000	7 783 000	181 719	1 129	182

Source: Finnish Forest Industries Federation, Yearbooks of Environmental Protection.

14. Pulp and paper industry production and emissions into the atmosphere (tonnes per year)

	Paper and board production	Pulp production	Sulphur dioxide	Nitrogen oxides	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
2002	12 776 000	7 143 000	5 649	21 269	4 614
2003	13 059 000	7 350 000	5 791	21 257	5309
2004	14 036 000	7 783 000	5 516	22 041	5 932

Source: Finnish Forest Industries Federation, Yearbooks of Environmental Protection.

15. Recovery of waste paper in the EU15 countries in 2003

Recovery rate (%)		Recovery rate (%)	
Germany	73.7	Denmark	53.1
Finland	72.9	United Kingdom	51.1
Switzerland	69.9	Spain	50.5
Netherlands	67.7	Portugal	50.5
Sweden	67.6	Italy	47.0
Austria	62.0	Ireland	37.6
France	54.4	Greece	33.3
Belgium	53.4		

Source: CEPI. Annual statistics 2004.

<http://www.cepi-eurokraft.org/>

<http://www.paperinkerays.fi/tietoa/tietopankki/tilastot>

16. Trends in use of public transport and cars (million kilometres)

	Total	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	69 653	55 700	900	13 053
2001	70 802	57 000	900	12 902
2002	72 045	58 300	900	12 845
2003	73 241	59 590	900	12 751
2004	74 749	60 940	900	12 909

Sources: Statistics Finland, Finnish Road Administration, VR Group Ltd, Finnish Maritime Administration, Civil Aviation Administration and Helsinki City Transport.

17. Trends in emissions from road traffic and projection to 2010 (thousand tonnes)

	Carbon monoxide (CO)	Hydrocarbons (HC)	Nitrogen oxides (NO _x)	Particles	Carbon dioxide (CO ₂)
1980	485.4	64.5	126.9	7.1	7 435
1981	489.9	65.0	127.3	7.4	7 534
1982	492.0	65.6	127.4	7.6	7 713
1983	496.6	66.2	127.6	7.8	7 980
1984	497.9	67.0	128.2	8.0	8 227
1985	491.5	66.7	129.4	8.2	8 618
1986	485.7	67.0	131.6	8.4	9 224
1987	485.7	67.8	132.5	8.3	9 688
1988	485.4	69.0	135.3	8.3	10 078
1989	485.6	70.2	137.7	8.1	10 705
1990	469.1	68.0	134.3	7.9	10 872
1991	446.2	64.2	123.8	7.4	10 564
1992	432.5	62.0	119.0	7.1	10 529
1993	414.0	59.4	115.5	7.0	10 058
1994	399.6	57.0	110.7	6.7	10 391
1995	390.9	55.2	106.3	6.4	10 245
1996	378.9	52.6	100.7	6.0	10 179
1997	370.2	50.4	95.2	5.6	10 684
1998	360.4	48.0	89.3	5.1	10 780
1999	349.3	45.5	84.3	4.7	10 942
2000	332.8	42.5	78.4	4.2	10 850
2001	320.3	40.1	73.8	3.9	11 032
2002	304.7	37.5	69.7	3.6	11 256
2003	286.8	34.9	66.0	3.5	11 440
2004*)	251.2	30.7	60.5	3.1	11 434
2005*)	226.0	27.1	55.6	2.8	11 450
2006*)	199.3	23.8	50.6	2.6	11 438
2007*)	177.8	20.9	46.1	2.4	11 478
2008*)	157.3	18.2	41.5	2.2	11 435
2009*)	139.9	16.1	37.4	2.0	11 409
2010*)	130.5	15.0	34.4	1.9	11 459
2011*)	124.2	14.3	31.8	1.8	11 456
2012*)	117.9	13.6	29.3	1.8	11 377
2013*)	113.1	13.2	27.4	1.7	11 395
2014*)	108.3	12.7	25.3	1.6	11 382
2015*)	103.6	12.3	23.6	1.6	11 389

*) = projection.

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

<http://lipasto.vtt.fi/lipasto/liisa/paastodata.htm>

18. Retail prices of motor fuel (95E) on 15 August 2005 (euro cents per litre)

	Refinery price	Consumer price	Taxes	Proportion of tax, %
Netherlands	53	142	89	62.7
United Kingdom	42	130	88	67.7
Finland	47	129	82	63.6
Germany	45	129	84	65.1
Denmark	48	128	80	62.5
Belgium	45	126	81	64.3
Sweden	47	125	78	62.4
Italy	47	125	78	62.4
France	42	121	79	65.3
Portugal	47	121	74	61.2
Hungary	47	113	66	58.4
Austria	48	109	61	56.0
Luxembourg	49	108	59	54.6
Poland	45	105	60	57.1
Ireland	43	105	62	59.0
Spain	47	102	55	53.9
Czech Republic	44	100	56	56.0
Slovakia	44	100	56	56.0
Slovenia	43	95	52	54.7
Greece	48	93	45	48.4
Cyprus	48	90	42	46.7
Malta	44	89	45	50.6
Lithuania	45	87	42	48.3
Estonia	43	85	42	49.4
Latvia	44	84	40	47.6
United States*)	44	56	12	21.4

Source: EU countries: EU/Oil Petrolier and Finnish Oil and Gas Federation; USA: Energy Information Agency.

*) = 22 August 2005.

19. Urban air particle concentrations in the largest cities (1999=100)

	pm10	pm2.5
1999	100.0	100.0
2000	90.5	92.0
2001	87.3	79.7
2002	98.0	82.4
2003	94.7	84.9
2004	95.7	79.6

Source: Finnish Meteorological Institute.

20. Trends in real world market prices of selected 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	77.0	94.9	75.7	113.4
2005*)	90.4	90.7	60.5	79.7

*) = I-VII/05. Source: United Nations, United Nations Conference on Trade and Development - UNCTAD, Monthly Commodity Price Bulletins. <http://www.worldbank.org/prospects/pinksheets/>

21. World oil consumption and real world market price (USD per barrel)

	Current prices	Real (1996) prices	Billion tonnes		Current prices	Real (1996) prices	Billion tonnes		Current prices	Real (1996) prices	Billion tonnes
1970	2.1	7.0	2254	1982	31.4	41.2	2776	1994	15.5	16.2	3192
1971	2.6	8.4	2377	1983	28.4	36.7	2761	1995	16.9	17.4	3235
1972	2.8	8.8	2556	1984	28.3	35.8	2809	1996	20.4	20.4	3316
1973	3.1	8.9	2754	1985	27.0	33.8	2801	1997	19.2	19.2	3388
1974	11.2	27.9	2710	1986	13.8	17.5	2893	1998	13.1	11.5	3398
1975	10.6	23.9	2678	1987	17.8	22.2	2949	1999	18.1	14.7	3469
1976	11.8	25.5	2852	1988	14.2	17.3	3039	2000	28.2	26.8	3504
1977	12.8	26.0	2944	1989	16.9	19.5	3088	2001	24.5	23.1	3554
1978	12.9	24.3	3055	1990	17.6	19.6	3136	2002	25.0	23.2	3855
1979	29.2	49.4	3103	1991	18.3	19.7	3134	2003	26.7	24.1	3935
1980	35.5	52.9	2972	1992	18.2	19.4	3165	2004	33.5	29.6	4109
1981	34.1	46.6	2868	1993	16.1	17.0	3135	2005*)	49.6	43.5	4752

*) = I – VII/05. NB. Crude petroleum/Dubai, UK Brent ja Alaska Average/W.Texas Average, spot, F.O.B.

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

22. Mining of ores and industrial minerals and quarrying of limestone in Finland in 1980–2004 (million tonnes)

	Ores	Limestone	Industrial minerals		Ores	Limestone	Industrial minerals
1980	10.5	3.1	3.1	1993	4.9	4.1	8.7
1981	9.9	5.0	3.5	1994	4.6	3.9	9.2
1982	9.7	5.5	5.1	1995	3.2	3.4	9.3
1983	9.0	6.0	6.0	1996	3.4	3.4	9.3
1984	9.5	5.6	7.1	1997	3.5	3.7	9.9
1985	8.4	5.8	7.2	1998	3.2	4.0	10.0
1986	6.9	5.0	7.2	1999	3.1	3.9	10.4
1987	6.1	5.0	7.9	2000	3.3	3.8	10.2
1988	6.1	5.4	8.3	2001	2.9	4.1	10.7
1989	5.5	5.5	8.6	2002	3.2	3.7	10.8
1991	5.5	5.3	7.2	2003	3.2	4.0	11.5
1992	4.7	4.4	8.0	2004	3.6	4.1	11.5

Source: Ministry of Trade and Industry.

23. Consumption of land extractable resources in Finland in 1990–2004 (million tonnes)

	Gravel and sand	Crushed gravel	Crushed rock
1990	51	31	24
1991	44	26	24
1992	39	23	24
1993	31	18	24
1994	30	20	26
1995	28	20	28
1996	27	18	28
1997	28	20	30
1998	32	20	33
1999	35	20	36
2000	32	23	37
2001	30	23	38
2002	29	22	39
2003	31	24	40
2004	31	24	42

Source: The Central Association of Earth Moving Contractors in Finland.

24. Municipal waste delivered to landfill sites (thousand tonnes)

	1997	2001	1998	1468
1998	1514	2002	1498	
1999	1446	2003	1400	
2000	1580			

Source: Finnish Environment Institute and Statistics Finland.

25. Growing stock increment and total drain (million solid cubic metres)

	Increment	Total drain
1980	70.50	59.70
1980	71.40	56.00
1982	72.30	48.50
1983	73.20	49.40
1984	74.10	52.30
1985	75.00	55.20
1986	75.90	49.60
1987	76.80	54.10
1988	77.70	57.10
1989	78.60	58.70
1990	79.50	55.10
1991	80.40	44.70
1992	81.30	51.00
1993	82.20	53.80
1994	83.10	61.70
1995	84.00	63.60
1996	84.90	59.00
1997	86.70	65.80
1998	86.70	69.40
1999	86.70	69.40
2000	86.70	70.00
2001	86.70	67.70
2002	86.70	68.70
2003	86.70	69.90
2004	86.70	69.93

Source: Finnish Forest Research Institute.

26. Fertiliser use in agriculture (kilograms per arable hectare)

Year of fertilisation 1 July - 30 June	Nitrogen	Phosphorus	Year of fertilisation 1 July - 30 June	Nitrogen	Phosphorus	Year of fertilisation 1 July - 30 June	Nitrogen	Phosphorus
1979/80	83.3	27.9	1988/89	100.3	29.7	1997/98	85.0	11.4
1980/81	82.4	27.8	1989/90	111.5	30.7	1998/99	81.0	11.0
1981/82	78.7	26.8	1990/91	109.4	26.3	1999/00	84.2	10.4
1982/83	91.4	29.9	1991/92	92.8	19.9	2000/01	83.2	10.8
1983/84	90.7	30.9	1992/93	94.3	19.4	2001/02	80.5	10.1
1984/85	88.9	30.8	1993/94	94.1	19.0	2002/03	80.3	9.9
1985/86	90.0	30.2	1994/95	101.6	20.0	2003/04	76.5	9.3
1986/87	94.4	31.0	1995/96	92.3	16.1			
1987/88	98.2	32.0	1996/97	86.0	11.8			

Source: Information Centre of the Ministry of Agriculture and Forestry.

27. Use of pesticides in agriculture (1000 kilograms of active ingredient)

	Weed killers	Others	Total
1990	1 580.1	413.6	1 993.7
1991	1 375.4	312.3	1 687.7
1992	1 006.7	332.9	1 339.6
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	1 140.1
2000	862.4	284.9	1 147.3
2001	1 120.1	303.1	1 423.2
2002	1 277.8	342.4	1 620.2
2003	1 339.4	327.2	1 666.6
2004	1174.2	314.7	1488.9

Source: Plant Production Inspection Centre.

28. Finland's phosphorus discharge into watercourses from industry, communities and fish farming sources (tonnes)

	Industry	Fish farming	Communities
1990	702	252	397
1991	583	204	292
1992	501	199	286
1993	417	182	245
1994	378	160	270
1995	358	165	245
1996	282	154	247
1997	273	135	235
1998	263	128	268
1999	250	122	259
2000	231	125	249
2001	234	120	224
2002	225	95	201
2003	230	80	204
2004*)	210	80	220

*) = preliminary data.

Source: Finnish Environment Institute.

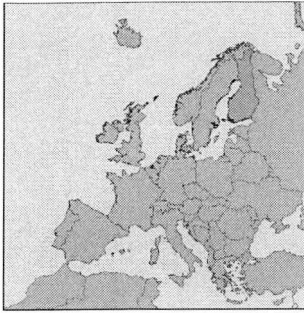
29. Proportion of threatened species out of all surveyed species, by group in 2000, and the forecast for 2010 (per cent)

	År 2000	Prognos 2010
Vascular plants	14.4	14.7
Spore plants	14.4	15.6
Birds	13.6	15.8
Mammals, amphibians and reptiles	13.3	12.0
Fish	13.1	8.2
Butterflies	9.8	11.6
Beetles	9.5	10.2
Fungi	8.6	9.3
Molluscs	7.7	10.5
Lichens	7.1	7.1
Total	10.0	10.8

Source: Finnish Environment Institute. The Finnish Environment 770 -publication.

<http://www.environment.fi/publications>

Finland in Figures



Suomi
Finland



Population: 5.2 million, with average density of only 17 persons per square kilometre; annual growth 0.2 per cent. Average household size is 2.2 persons. Of the total population, 79 per cent are urban dwellers, with 1.0 million living in the capital city of Helsinki and its surrounds. Ninety-two per cent speak Finnish and six per cent Swedish. Eighty-four per cent are Evangelic-Lutheran and one per cent Greek Orthodox. Seventy-three per cent of the population aged 25 to 64 have completed post-comprehensive education and 33 per cent have university degree or equivalent. Sixty-eight per cent of Finnish households own a personal computer and 56 per cent have an Internet connection. Ninety-six per cent of households have a mobile phone.

Area: Situated in northern Europe with an area of 338,145 square kilometres of which 304,530 square kilometres land area. Land boundary 586 kilometres with Sweden, 727 kilometres with Norway and 1,269 kilometres Russia. Coastline approximately 1,100 kilometres. The greatest length is 1,157 kilometres, from Hanko to Utsjoki, and the highest point, Halti, 1,328 metres above sea level. Of the total area 10 per cent is covered by water. There are 188,000 fresh water lakes in Finland. Forests, mainly pine and spruce, cover 68 per cent of the country while 6 per cent of the land area is under cultivation, with barley and oats as the main crops.

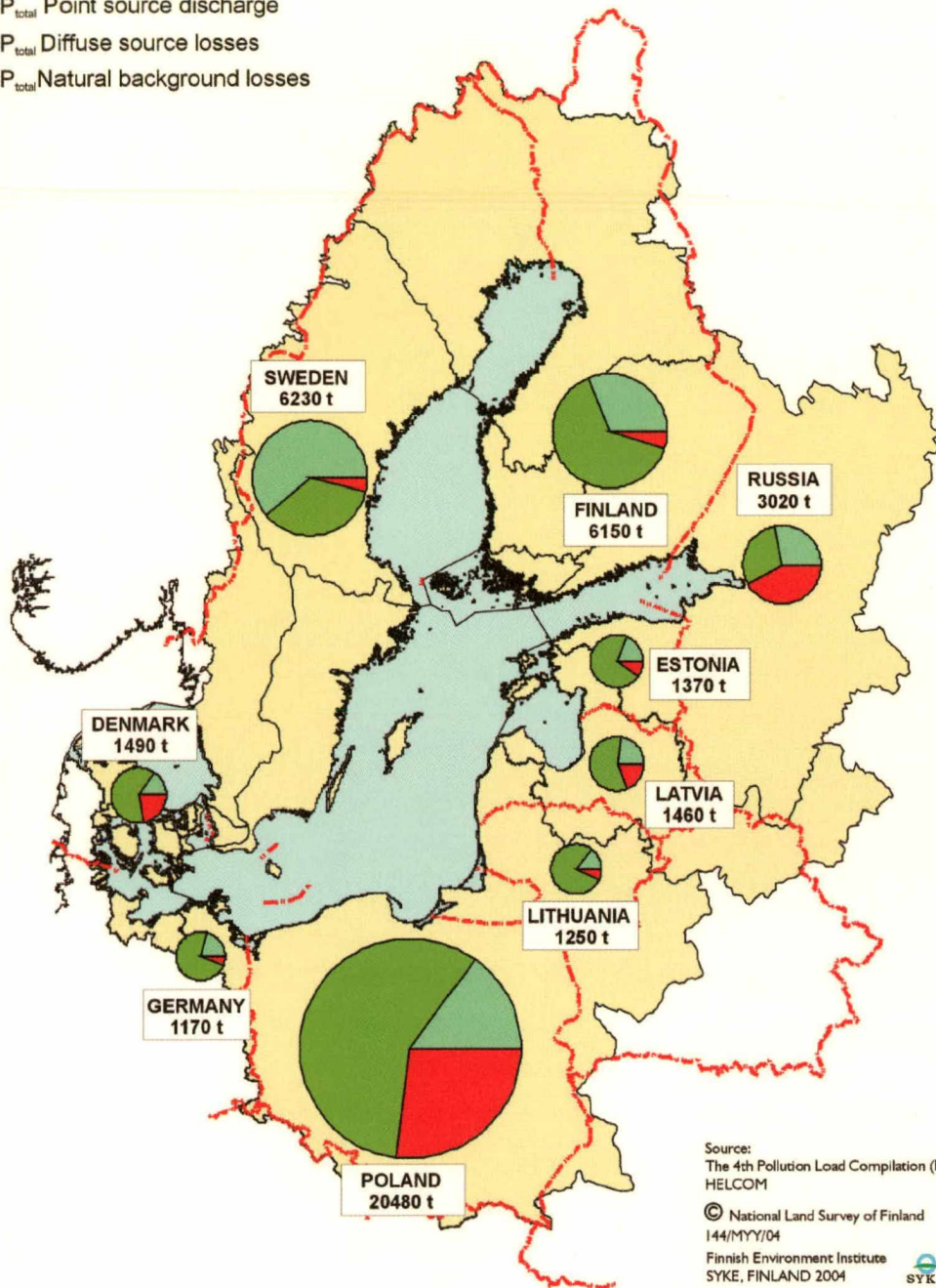
Government: Finland has been a sovereign parliamentary republic since 1917. The head of the state is the president, elected every six years. The post has been held by Ms Tarja Halonen since 1 March 2000. The Parliament comprises 200 members, elected for a four-year term. The country is divided into 5 provinces and the Autonomous Territory of the Åland Islands. Member of the European Union since January 1995.

Economy: GDP in 2004 totalled EUR 150 billion (USD 140 billion), i.e. EUR 24,800 per capita when adjusted for purchasing power parity. One of the highest standards of living in the world. Of the total labour force 20 per cent are employed in industry, 33 in services, 16 per cent in trade, 13 per cent in financial and business services, 7 per cent in transport and communications, 5 per cent in agriculture and forestry and 6 per cent in construction. Unemployment rate, calculated according to EU standards, was 8.6 per cent in 2004.

Foreign trade: Main trading partners are Germany, Sweden, United Kingdom, USA and Russia. The value of imports totalled EUR 40 billion and that of exports EUR 49 billion in 2004. Of the imports 39 per cent were raw materials and 28 per cent consumer goods. Main exports are electrical equipment, pulp and paper products, machinery, and metal and chemical products.

Phosphorus discharges in the catchment area of the Baltic Sea

- P_{total} Point source discharge
- P_{total} Diffuse source losses
- P_{total} Natural background losses



Finland's Natural Resources and the Environment 2005 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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