



CITY OF HELSINKI

ENVIRONMENT CENTRE

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The State of the Environment in Helsinki

Summary Report



Pia Korpinen ja Kari Silfverberg

Helsinki 1999



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THE STATE OF THE ENVIRONMENT IN HELSINKI

SUMMARY REPORT

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1. INTRODUCTION

This compendium is a condensed description of the City of Helsinki and a summary of recent data on the state of the environment in Helsinki and the surrounding metropolitan area. Presented data were collected from a number of environmental and statistical reports. Collection of data, translations from Finnish language and editing was carried out by Pia Korpinen

and Kari Silfverberg.

The 'Helsinki Environmental Statistics Report', published in Finnish 1998, includes statistical data table explanations also in English. The updated 'State of the Environment in Helsinki', similarly published last year, is only available in Finnish but includes data table explanations in Swedish.

2. GENERAL DESCRIPTION OF HELSINKI AND THE METROPOLITAN AREA

Helsinki was originally founded at the mouth of Vantaa River in 1550 by King Gustavus Wasa of Sweden to compete with the Hanseatic cities of the Baltic region. In 1643 the town was moved further south to its present location, which had better harbor possibilities. Construction of a strong naval fortress called Sveaborg, in Finnish Suomenlinna, was initiated in 1748 on the rocky islands at the seafront of Helsinki. This huge construction project, which was financed with more than 70 barrels of French gold, gave a powerful boost to the economic life of Helsinki.

The 600-year period of Swedish rule in Finland ended in 1809 during the Napoleonic wars, when Sweden lost Finland to Russia, and Finland became an autonomous grand duchy within the Russian empire. Shortly after the change of the power centre Helsinki was designated the capital city of Finland in 1812.

Helsinki's architecturally outstanding historic center, including a cathedral, government and municipal offices and university buildings surrounding the Senate-square, was built in the mid-19th century following classical architectural principles with models from St. Petersburg.

A rapid urban growth period started with industrial development in the late 19th century. When Finland gained independence after the Russian revolution in 1917, Helsinki had already about 155 000 inhabitants. Since then Helsinki has been steadily growing except during war periods in 1918 and 1939-44. Incorporation of neighboring communities in 1946 and 1966 enlarged the city territory significantly.

Today Helsinki has about 546 200 inhabitants and the municipal territory covers 185 square km of land area and 501sq km sea area.

Helsinki is a northern and maritime city, located at approx. 60 degrees northern latitude at the southern Baltic Sea coast of Finland (the Gulf of Finland). The southern tip of Greenland and the southern parts of Alaska are located at the same latitude, but the warm Atlantic Gulf Stream makes Helsinki's climate milder. The sea evens out the temperature peaks in summer and winter. The wind blows most frequently through the city from west or south-west.

Helsinki's landscape is dominated by exposed bedrock and rocky hills alternating with flat clay areas which once constituted the seabed. The shoreline is winding with a length of 96 km, and in the sea area there are altogether 315 islands, most of which are small rocky outcrops from the sea. Helsinki has literally risen up from the sea, since the Finnish coastline has been slowly rising after the previous ice age when land masses where compacted by the weight of enormous ice layers. The next ice age is expected to start after some 5000 - 10 000 years.

Biogeographically Helsinki belongs to the mixed-forest zone, which is a change zone between north-central European broadleaf forest biomes and northern coniferous forest biomes (northern taiga). The sea, archipelago, shoreline, Vantaanjoki river valley, forests, farmland and rocky hills provide the city's animals with a wide variety of habitats and gives Helsinki's landscape a diverse and alternating character.

Helsinki as a part of the Metropolitan Area

The development of Helsinki Metropolitan Area into a conurbation of almost one million people has been rapid. Until the Second World War (1939) growth took place mostly within the boundaries of the current inner city. Only in the 1950's, suburban Helsinki and the neighbouring communities started growing.

Development of suburban centers along railway and metro lines within the metropolitan area was connected to a strong urbanization boom in the 1970's and early 1980's. Major local centers within the metropolitan area are Pasila, Itäkeskus and Malmi in Helsinki, Tapiola, Leppävaara, Espoon keskus and Espoonlahti in Espoo and Tikkurila and Myyrmäki in Vantaa. Helsinki Metropolitan Area has become a continuous urban structure consisting of 4 individual municipalities: the City of Helsinki, the City of Espoo to the west of Helsinki (with the small municipality of Kauniainen located inside it) and the City of Vantaa located to the north. In addition there are eight small towns and municipalities, which altogether constitute the Greater Helsinki Region with a population of more than 1.1 million.

The population of Helsinki Metropolitan Area is today about 920 000, which is 18 % of the total population of Finland. This area, however, produces 28% of the national economic output and has 23 % of all jobs.

Formerly Helsinki was predominantly an industrial city, but in the 1980's and 1990's many industries moved to more spa-

cious sites in the neighbouring municipalities, and thus Helsinki's economic profile became more dominated by administration, services, business, research and higher education. However, some important industries are remaining in Helsinki, for example the famous Masa Yards shipyard.

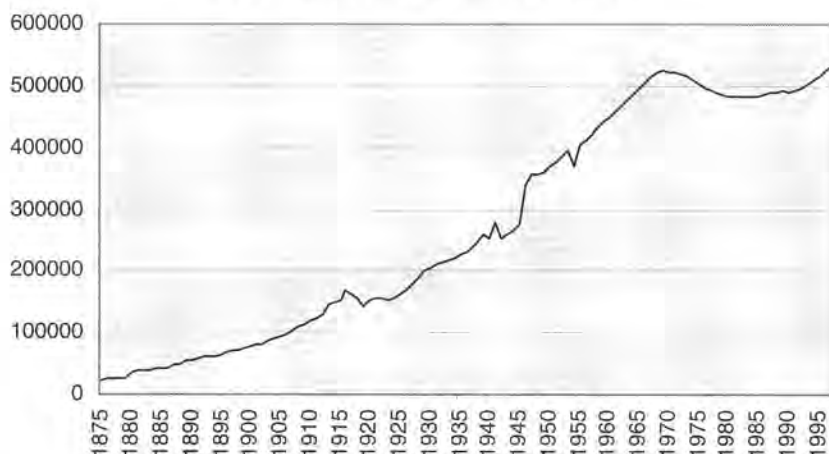
European Cultural Capital in the Year 2000

In the year 2000 Helsinki will celebrate its 450th anniversary, and is also one of the nine "European Cities of Culture". These two events will be combined to provide a unique blend of activities, and they will also enable us to consolidate the cultural profile of Helsinki internationally. More information about the event can be found at the internet address <http://www.2000.hel.fi>

The specific physical features of Helsinki, as compared with other European cities, are particularly the greenness of the city, its diverse coastline and archipelago, including the Suomenlinna naval fortress-, as well as the classical old centre with a surrounding stone-town of national-romantic residential districts from 1900-1915, garden suburbs from the 1920's and finally also a number of modern suburbs representing Nordic post-war functionalist architecture.

Increasing cooperation within the Baltic Sea region gives Helsinki also new opportunities as a member of the family of northern Baltic harbour cities, such as Riga, Tallinn, St Petersburg, Turku, Pori and Stockholm.

Population in Helsinki 1875-1998



Source: City of Helsinki Urban Facts

3. POPULATION, JOBS AND HOUSING

Population and Jobs

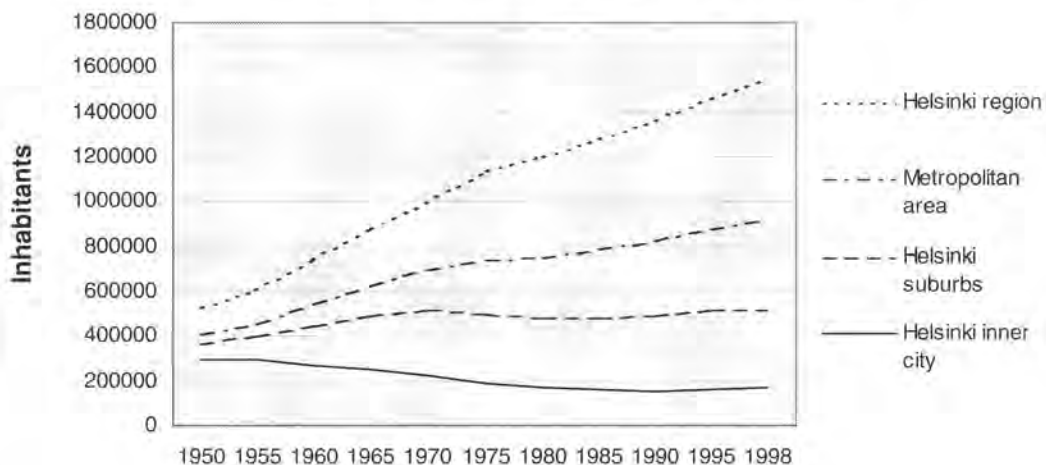
One-tenth of the inhabitants of Finland lives in Helsinki. At the beginning of 1999 there were approximately 546 200 people residing in the city. Population increase has in the 1990's become as rapid as during the "crazy years" of the 1970's. Since the beginning of the decade the population has increased with almost 50 000 inhabitants. The average population density at the beginning of 1998 was in Helsinki 2931 people/sq. km, while the density over the metropolitan area as a whole amounted to 389 people/sq. km.

In the last few years the region has been one of Europe's

near future, as the big age groups will go in pension.

Close on half of the residents in Helsinki live in one-person households. The number is clearly higher than in the neighboring municipalities and in the country as a whole. In 1998 the share of households with children under 18 years of age was only 16 %. Most families with children live in south-eastern, eastern, northeastern and northern parts of the city. Nearly half of the dwellings are owner-occupied. In spite of the population increase the housing space has increased to an average of 32sq m. per inhabitant. The additional space has come from new buildings and from the increasing exploitation of the existing dwelling stock. Blocks of flats constitute

Population in Helsinki and surrounding areas 1950-1998



Source: City of Helsinki Urban Facts

fastest growing urban areas, and this trend is expected to continue. According to a forecast projecting up to 2015, only Lisbon is predicted to grow faster than Helsinki metropolitan area. According to a recent prognosis the population in Helsinki metropolitan area will amount to 1,1 million in 2020.

Though nativity has slightly increased in Helsinki in the 1990's, the overwhelming majority of the population increase is a result of immigration from other parts of Finland as well as from abroad. A significant number of the 30 000 domestic immigrants are young people with academic education. Immigration from abroad amounts to 3000-4000 persons/year. The dominant population group in Helsinki is still adults in working age. The amount of elderly people above 65 years of age is at present 14 %, their share will however rapidly increase in the

about 85 % of the dwelling stock.

Today Helsinki has about 307 000 jobs. Of these vacancies some 120 000 are occupied by people that commute to work in Helsinki from surrounding and even more distant municipalities. During the 1990's the structure of employment in the city has become closer to the European model with a service-dominated economy. At the same time, however, the city has lost one fifth of its jobs.

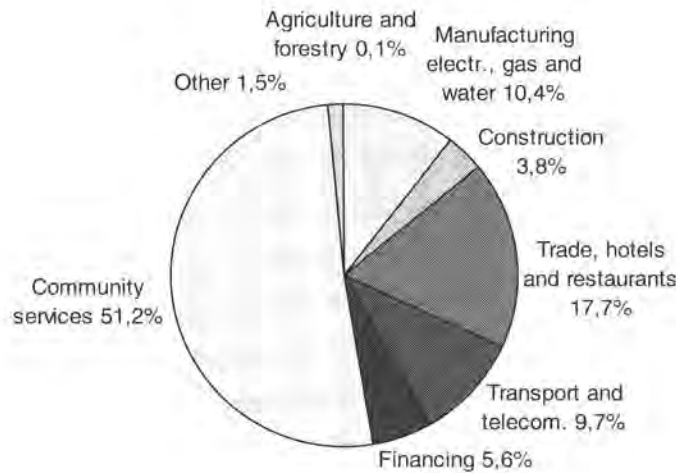
About 80 % of the employees are now working in various service industries including trade, communication, banking and insurance as well as personal and social services. Despite the fact that jobs in manufacturing and constructing have declined, Helsinki continues to be Finland's largest industrial conurbation. Within manufacturing elector-technology is strongly rep-

resented as well as publishing, printing, food industries and shipbuilding. The importance of forestry and fishing is very small.

combined production of electricity and heat.

Although the quality of construction work has been reasonably good in Finland, there are now significant problems with prefabricated houses built in the 1960's and 1970's. Building

Jobs by industry in Helsinki 1996



Source: City of Helsinki Urban Facts

Housing

The housing stock of Helsinki contains at present about 282 987 dwellings. Around 85 % of these are located in blocks of flats, and almost half of all dwellings are owner occupied. The average floor area per dwelling is about 62sq m and the average floor area per inhabitant about 32sq m, which is slightly less than in the country as a whole.

The housing stock of Helsinki is rather new, with more than 60 % built after the Second World War. Thus the dwellings are also well equipped and serviced. Central heating and connections to Helsinki's district heating system is provided for all blocks of flats and also for many detached houses. Bathrooms with warm water have also become a standard in almost all dwellings. In addition there are sauna baths (traditional Finnish steambaths) in numerous houses, either individually in dwellings or as shared saunas in blocks of flats. Saunas in detached houses and in rural areas are often equipped with wood-burning stoves, while the stoves in blocks of flats are mainly electrically heated.

The energy efficiency in Finnish dwellings is nowadays rather good, since building regulations concerning insulation of houses were much sharpened already in the 1970's after the so called oil crisis. The district heating system is based on

methods and materials changed rapidly when markets were flooded with new industrially produced materials such as concrete, rock-wool, metal sheets, various kinds of polymeric materials, asbestos sheets, plastic paints etc., which replaced traditional and well tested materials like wood, natural stone and burnt bricks.

These new materials have later been found to be less durable, and some of them even hazardous to human health and the environment (e.g. asbestos, PVC floor materials, polymers containing PCB, foam insulation containing CFC's etc.). Also moisture problems resulting from insufficient or wrongly designed ventilation, leaking flat roofs etc. have become increasingly common. Repair and rehabilitation of bad quality prefabricate housing stock is now under way in Helsinki and the metropolitan area. The task of suburban upgrading is big and it will require considerable funds for a long period.

Construction of new housing units has been very low in Helsinki during the 1990's, partly due to economic recession and partly due to lack of available space for large-scale new developments. Construction activities are becoming more geared towards urban upgrading and rehabilitation as well as changing old industrial and harbor areas into residential units. Large-scale housing construction is increasingly becoming directed to Espoo and Vantaa and even further away.

The interest for ecologically sustainable housing development is increasing in Helsinki, and at present there are some interesting projects under planning or implementation also in Helsinki, for ex in the Viikki area. Buildings constructed in this area may not exceed the approved levels of emissions into the ground or of non-recyclable waste. Maximum levels have been set for carbon-dioxide wastewater, construction site- and

residential waste. Furthermore, one-third of the domestic hot water is planned being produced with solar panels. Generally, solid-wood, burnt bricks and roof tiles, traditional paints etc. are again becoming popular among house-builders. Also renewable energy sources, waterless toilets, home gardens in residential areas, bio-waste composting etc. are slowly gaining popularity.

4. LAND-USE AND TRAFFIC

Land-use and Planning

The physical structure of Helsinki is clearly divided into the densely built inner city, located on a rather narrow peninsula, and the more open development in the suburban areas. A network of green and recreational areas separates the individual suburbs from each other. With increasing population there are also increasing development pressures on existing green areas.

portant in planning of land use and infrastructure. This is especially emphasized in Finland's Environmental Impact Assessment Act of 1994 and recent additions to the Building and Planning Act.

The master plan intends to preserve Helsinki's fingers-on-a-hand city form and at the same time most of the existing recreational areas. The majority of unbuilt seashore areas will also be preserved for recreational use and nature areas of special significance will be preserved in their entirety.

Land-use categories in Helsinki 1998

<p><u>Housing 21%</u> -blocks of flats 9% -detached houses 12%</p> <p><u>Recreation and Green areas 40%</u> -sports, camping , recreation 9% -parks 18% -forest and farmland 13%</p> <p><u>Public Buildings and Storage 7%</u></p>	<p><u>Traffic Space 17%</u> -streets and squares 8% -other traffic space 9%</p> <p><u>Commercial and Industrial space 7%</u> -shops and offices 2% -industry and storage 5%</p> <p><u>Other 8%</u></p>
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Source: City of Helsinki Urban Facts

The most crucial question for Helsinki's land-use planners will in the near future be: Where is the preferred balance between built-up areas, traffic areas and green areas? Where are the limits to built structures within the municipal boundaries?

The present master plan, approved by the City Council in 1992, establishes the main aspects of future land use in Helsinki. Improved sustainability is mentioned as a target in the plan.

Environmental considerations are becoming increasingly im-

portant in planning of land use and infrastructure. This is especially emphasized in Finland's Environmental Impact Assessment Act of 1994 and recent additions to the Building and Planning Act.

The master plan intends to preserve Helsinki's fingers-on-a-hand city form and at the same time most of the existing recreational areas. The majority of unbuilt seashore areas will also be preserved for recreational use and nature areas of special significance will be preserved in their entirety.

According to the master plan, new areas designated for building are, almost without exception, located within the urban structure in connection to the existing infrastructure networks. However, conflicting interests between new developments and the preservation of existing green areas have been identified. The most significant land use changes will take place in old industrial and harbor areas, which are undergoing transformations to residential, commercial, office or service uses. A growing environmental problem associated with this change in land use is the problem of contaminated land. Most of the

old industrial areas contain sites contaminated with oil products and other hydrocarbons, heavy metals and various toxic substances. New construction for housing and social services etc. cannot be allowed unless the sites have been rehabilitated and cleaned prior to construction. The amount of areas where soil renewal has been studied or implemented has grown from 53 in 1996 to 197 in 1998. Where soil renewal has been carried out the contamination has varied from small oil-leaks to large-scale industrial pollution. A rather expensive soil clean-up operation was carried out in 1994-1997 when the former oil harbor of Herttoniemi was rebuilt with residential houses.

A major relocation project included in the 1992 Master Plan is the transfer of the present port activities in Jätkäsaari (West Harbor) and Sörnäinen (East Harbor) to Vuosaari at the eastern corner of Helsinki. An environmental impact assessment study (EIA) was carried out as part of the project planning process identified a number of potential environmental problems. These are mainly connected to the projected land transport lines (road and rail), that will cross the valuable wetland and forest area of Mustavuori-Porvarinlahti. Mustavuori-Porvarinlahti was included in the Natura 2000-network in August 1998. Final statements on the assessment study will be given in spring 1999 from all parts involved. The City Council is expected to give a final decision of the harbour project late in 1999.

Furthermore the master plan promotes the improvement of public transport networks with more emphasis on light rail, metro, and trams. Priority will be given to the pedestrians in the city-center by making more pedestrian precincts and bicycling will be encouraged by the development of more cycle ways. In order to reduce the need for commuter traffic, there is a target to locate workplaces and residential units mainly along metro and railway lines. Transverse connections with public transport will also be developed.

Traffic

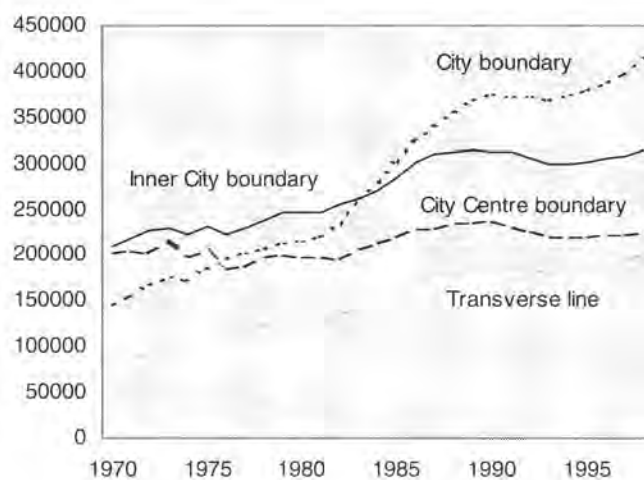
Vehicular traffic is the main source of air pollution and noise disturbance in Helsinki. These problems affect particularly the densely built inner city and areas surrounding major traffic arteries. The overall traffic policy of Helsinki has already from mid-1980's been to prioritize public transport and restrict the growth of car traffic. During the 1990's there has also been a

policy to improve the conditions for bicycle use.

As during the decades before, traffic has increased in the 1990s most at the city boundary and at the transverse lines. The traffic flows at the city boundary have increased from about 150 000 vehicles/day in 1970 to 410 000 vehicles/day in 1998. The increase at the inner city and city center boundaries has been slower, though in 1998 there was a quite high increase of traffic flows at the inner city boundary, 3% compared to the year before. The overall land use policy within Helsinki metropolitan area to locate all major local centers along metro or railway lines has contributed to the slowing down of the increase of car traffic in the 1980's and 1990's. However, stronger measures than before are needed in order to solve the air quality problems of Helsinki. The total amount of vehicular traffic in the metropolitan area is expected to grow more than 60% by 2020.

One much debated traffic problem is the extensive use of

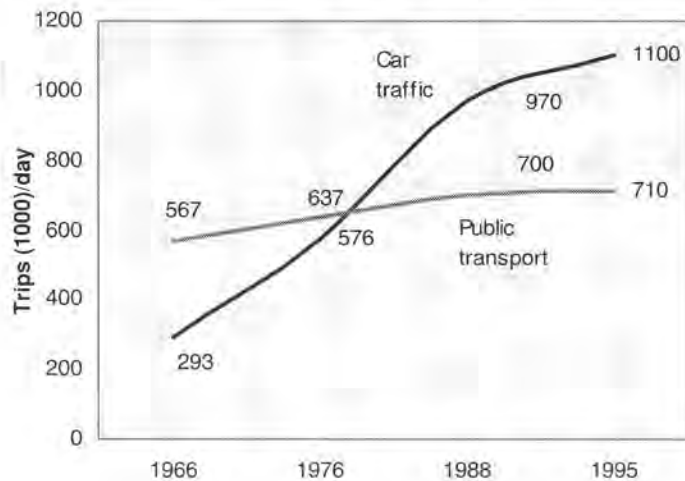
Development of vehicular traffic at the observation lines 1970-1998



Source: City of Helsinki, City Planning Department

cars in trips to Helsinki by the inhabitants of southern Espoo to the west of Helsinki. Helsinki has had plans already in the 1980's to extend the western metro line to Espoo, but these plans have not been implemented due to unwillingness from the City of Espoo. Now it looks like the attitudes have changed a bit, as Espoo recently decided to investigate the different alternatives in lining the metro westwards. It is probable that the metro will be extended to Espoo, but no final decisions have been made yet.

Trips made by cars and public transport metropolitan area 1966-1995



Source: Helsinki Metropolitan Area Council

Car traffic

At present a third of Helsinki's inhabitants own a car. Car density fell in 1993 and has since then increased slightly. The population increase of the past years has however brought along an increase of the vehicle stock. Since 1994 the vehicle stock has grown with 12%. Half of the increase, 6%, occurred during 1998.

The fact that the vehicle stock in Helsinki has been renewed during the past few years has been advantageous to the health of the population as well as to the environment. Both the consumption of fuel and the exhaust emissions have dropped with the adoption of better engines and catalytic converters. These advantages are however lost if the car fleet and use of cars continues to grow.

The main methods of controlling the growth of car traffic are the following:

- * Taxation of vehicles and fuels
- * Supply and price of parking places in the inner city
- * Cost and efficiency of public transport
- * Environmental awareness

A rather strict parking policy in the inner city has in recent years to some extent decreased car use in work trips, but there has been a clear increase in car use for shopping and recreational trips.

The means of public transport in Helsinki are local trains to the northern and northwestern directions, one metro-line in east-west direction, a tram network in the inner city and bus-lines, both from the city stations. The metro-line was extended in 1998 further eastwards to Vuosaari. The service level and efficiency of public transport is good in Helsinki, but the price level is internationally compared high, except for people using monthly or yearly tickets.

The popularity of public transport has recently increased due to the new stricter parking policy for the inner city, the reduced price of tram tickets and increased population base along the metro-line in eastern Helsinki. In 1998 the number of passengers using the metro grew by

8% compared to the year before, and the passenger numbers in local trains and trams grew with 4%. The popularity of regional transport increased, while the internal bus-lines in Helsinki had less passengers than the preceding year.

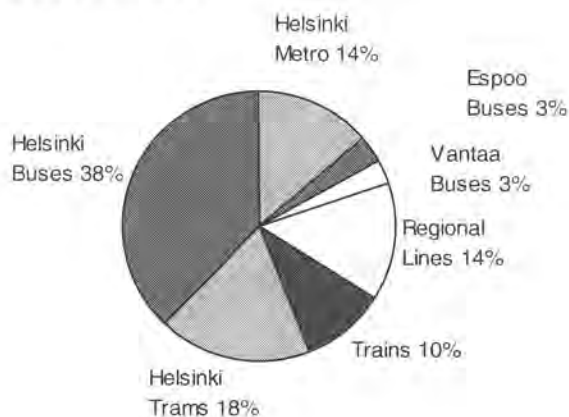
The Helsinki Metropolitan Area Council (YTV) has recently prepared a long-term plan for the transportation system of the metropolitan area for the year 2020. This plan aims at improving the service level and efficiency of public transport by constructing new rail-links, for ex. to the Helsinki-Vantaa airport, to extend the metro-line to Espoo and to improve the public transport information system. It is also committed to increase the amount of light traffic and to fulfil plans for car-free pedestrian areas, for example in the inner city of Helsinki. Further it also gives high priority to traffic connections to the planned harbor in Vuosaari, including a rail-link, highway connections and a waterway. The capacity of the road network is planned to be increased and some new links to be constructed.

Also light traffic (pedestrian and bicycle) will in the future have a more prominent role in the metropolitan transport system. Cycling will be improved by connecting suburbs with each other, with workplaces and with services by safe and convenient bicycle paths. Although improvement of cycle way networks has been carried out already since the early 1980's, there are still considerable gaps in the networks. The amount of bicycle traffic has steadily increased during the 90s, though the impact of weather is clearly visible as ups and downs in the amount of cycling.

Helsinki is a member of the Car Free Cities-network that aims to reduce the dependence of cars in the member cities. The idea in the cooperation is to promote exchange of knowledge

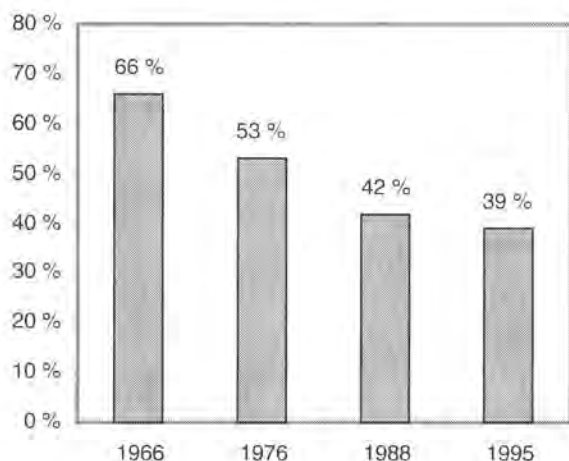
and experience, and to find practical solutions to improve the environment and possibilities of transportation in the city. Helsinki is, among others, taking part in the cooperation project for detailed planning of the cycle paths in the inner cities. Plans have also been prepared for certain car-free residential units.

Passenger figures in public transport in Helsinki metropolitan region 1997. Total of 1.020.000 passenger trips/weekday



Source: Helsinki Metropolitan Area Council

Share of public transport in the metropolitan area



Source: Helsinki Metropolitan Area Council

Noise

Noise is a disturbance and environmental health problem common to all European cities. Its health effects range from general disturbance, to mental stress and physiological changes in heart rhythm and blood pressure etc. The Council

of State in Finland has set 55 decibels (dB) as a guideline limit for noise during the daytime, and a noise level of over 65 dB is already considered as extremely disturbing.

Traffic noise

Some 120 000 Helsinki residents live in areas affected by traffic noise exceeding 55 dB. In an area occupied by around 22 000 residents the noise from road traffic exceeds 65 dB. The over 55 dB area spans almost the entire inner city, in addition to a large part of the suburbs. In the immediate vicinity of the noisiest streets the decibels exceed at some places 75.

Traffic noise is affected by the number of vehicles, driving speed and the proportion of heavy vehicles as well as physical properties of the road environment (e.g. existence of trees and other noise barriers, possible reflecting surfaces etc.). The noise situation in the inner city has been improved by banning heavy vehicles. Noise can be reduced in the vicinity of fast roads by imposing speed limits. Though the noise-emissions of new cars have reduced, noise pollution will increase if the traffic increases.

Residential areas alongside the busiest roads have been protected against noise by means of vegetation, landforms, special fences and concrete walls. Where possible, embankments will be preferred, as they have proved to be the most effective noise absorbers. By 1999 Helsinki had constructed around 35 km of various kinds of noise barriers. Money is allocated both for the building of new barriers as well as for improving the existing ones.

When building new residential areas noise abatement must be taken into account at the planning stage. Between places of residence and roads suitable noise protection zones should be left. Sometimes may industrial and office buildings and multi-store car parks be located as noise attenuates on the side of the residential area facing the road.

Aircraft noise

Around 4800 Helsinki residents live in the area considerably affected by aircraft noise (>55dB) caused by the traffic at Helsinki-Vantaa airport. Lately the noise caused by the airport has diminished due to changes in the use of the runways as well as restrictions on the night-flights over northern Helsinki. The amount of Helsinki residents living in the noise zone will

be reduced approximately to 4000 in the year 2003, when a third runway will be completed. About 2400 residents live at present in the noise area (>55dB) of Helsinki-Malmi airport. In 2010 the noise (>55dB) from Helsinki-Malmi airport is estimated to affect 5000 inhabitants.

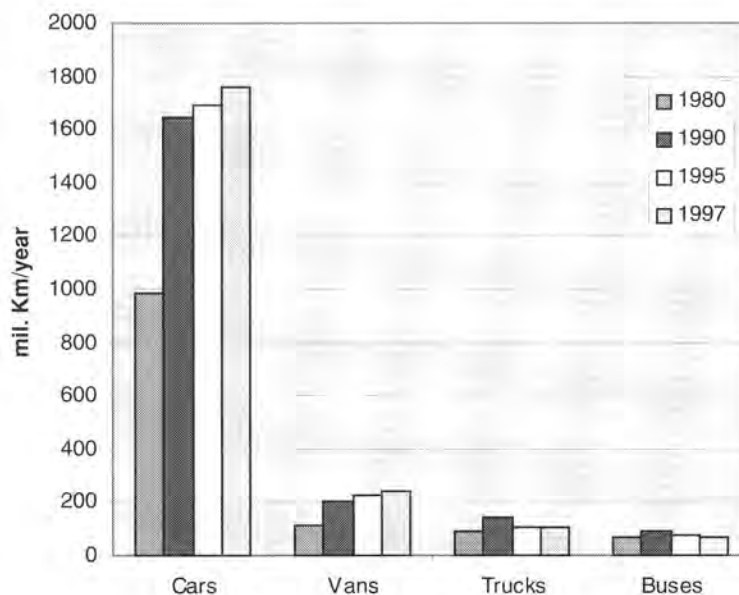
Rail traffic noise

Finland's busiest sections of rail are those passing through Helsinki. Hundreds of daily local train-runs take place along the Vantaankoski line, the main northern line and the western line to Turku. Altogether about 6 300 inhabitants are living in the area affected by railway noise (>55dB).

The area of noise disturbance caused by railway traffic will grow larger if the number of local-trains increases and the speed of long distance-trains increase. According to some estimates train noise will spread into the residential areas of more than 9000 Helsinki inhabitants, unless noise barriers are constructed. In order to mitigate this noise pollution, it would be necessary to construct approximately 11 km of noise barriers.

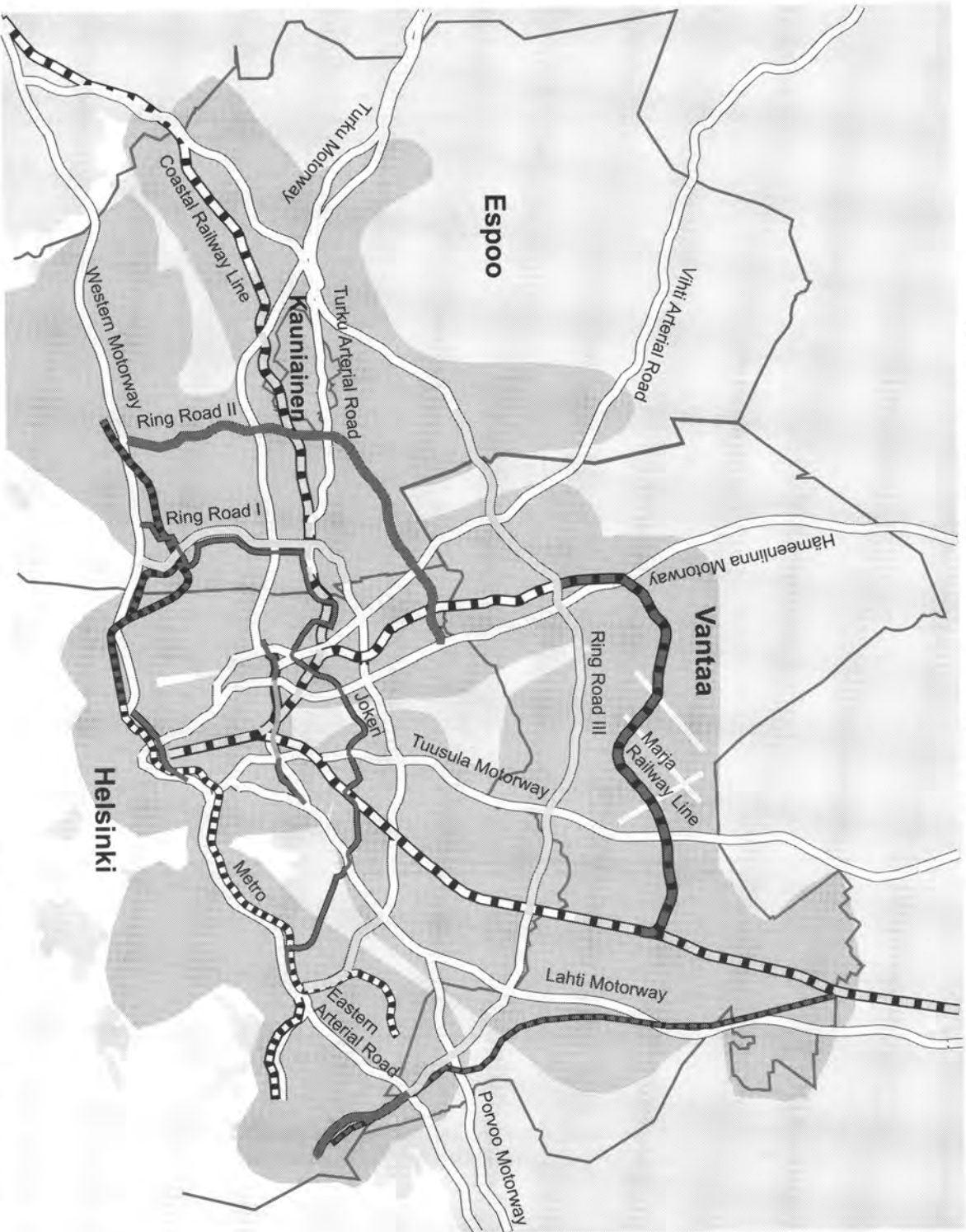
Some factories and plants also cause noise pollution in their vicinity. Furthermore for example motor sports tracks and rifle ranges create distressing noise and now require a permit for their activities. Noise abatement regulations are incorporated in plant location or environmental permits and the terms set are supervised by making noise measurements

Annual estimate of vehicular traffic performance in Helsinki street and road network 1980-1997



Source: City of Helsinki, City Planning Department

Helsinki Metropolitan Area Transport System 2020



Source: YTV/Helsinki Metropolitan Area Council 1999

5. URBAN NATURE AND PROTECTED AREAS

Helsinki is by Central European standards a green city with a rich variation in landscape and natural habitats. The sea, archipelago, shores, Vantaanjoki valley, forests, farmland and rocky hills provide the city's animals with a wide variety of different habitats. Biogeographically Helsinki belongs to the so-called mixed forest zone, in which Central European broadleaf forests become boreal coniferous forests (taiga).

Biodiversity is further increased by the mixing of a western maritime species assemblage with one from the east. Long established settlement has also added many plant species to the original flora. The flora in Helsinki is rich, the amount of different species are close on 1100. The species are presented in Helsinki Flora, published in 1998. Fourteen of the plant species are found on the list of endangered plant species in the Law on Nature Protection. A systematic data collection of the fauna begun with studies of the breeding avifauna in 1996-97. Confirmed or probable breeding in Helsinki was recorded for a total of 123 species. Thirtyfive of these species are listed in Species of Special European Conservation Concern. Construction, traffic and physical wear and tear on the habitats have adversely affected the living conditions for many species. It is for example only at the outskirts of the city one can find forests in natural stage. Helsinki is like all cities a spatial entity where man-made structures replace natural habitats.

Nature Protection

Nature conservation and protection, and management of green areas is an integral part of environmental protection in Helsinki. The city drafted in 1989 a 41-point nature conservation programme for the protection of valuable nature areas, and subsequently the programme has been implemented. The principles of nature protection and sustainable development are furthermore embodied in the city's master plan, which was approved in 1992.

The most representative areas within the nature conservation network include an internationally valuable wetland, the 250-hectare Vliikki- Vanhakaupunki 'bird paradise' right in the geographical center of the city area. This site has been incorporated in the Ramsar Convention of Protection of Wetlands of International Importance.

Sites of national importance comprise the city's four valuable groves, one moraine deposit and the as-yet unprotected ma-

rine bay already approved for the bird wetland protection programme by the Council of State. Locally valuable protected sites include among others three peatland ecosystems, an area of old growth forest, an arboretum and protected islets in the archipelago. Recently eight more islet areas received protection due to their specific flora or avifauna. The European Natura 2000 Network of Nature Protection Areas includes three sites in Helsinki: Vliikki-Vanhakaupunki wetland area, Kallahdenharju ridge and Mustavuori-Porvarinlahti forest and wetland. Conflicts of interest however exist concerning the third site due to Helsinki's plans to transfer the cargo ports eastwards to Vuosaari area.

Recreational Areas

The city has systematically accomplished a finger-shaped green area network forming continuous eco-corridors between residential neighbourhoods and work areas. The master plan for Keskuspuisto Central Park, approved in 1978, guarantees a green lung for the city area, covering about 1 000 hectares and stretching 11 km northwards from Töölönlahti Bay in the City Centre.

Helsinki has a wide variety of recreation areas: seashores, sports grounds, fields, meadows, forests, parks of various kinds, protected areas, allotments and cultivated gardens and fields. Altogether recreation areas accounts for one-quarter of the city's land area. However, in the inner city there are few nearby green areas in comparison to the population. Recreational areas in the inner city mainly take the form of managed parks and park-like entities, whilst most forests and fields can be found in the northern and eastern parts of the city. The preservation of biodiversity has been taken as one of the main goals in the City of Helsinki Forest Management Plan. Natural management of forests has generally become more popular, but on the other hand the total forest area has shrunk.

The coastal sea area and archipelago is an extremely valuable recreational area for the inhabitants of Helsinki. Boating, fishing, swimming and canoeing are popular summertime activities, and during wintertime it is possible to reach islands by skiing or walking over the ice-covered sea.

Spring and summertime guided nature tours have been arranged since the early 1980's with the aim of enhancing citizens personal nature contacts and experiences and improv-

ing peoples knowledge of nature. These tours, which are free of charge have become very popular.

The Nature House on Harakka island acts as a centre for information on archipelago wildlife and habitats. The island has permanent summer and winter nature trails as well as a small scale archipelago's nature exhibition. The Nature School on the island is aimed for secondary school children. The purpose is to provide every child in Helsinki with an opportunity to spend one day experiencing archipelago nature - Baltic her-ring fishing, the splendour of butterflies and so forth.

The need to preserve green areas and urban nature is at present to some extent in conflict with the need to construct new housing and to increase the building density of the city. In

order to achieve a balanced physical structure, a healthy living environment and sufficient biodiversity also in the future, Helsinki will need to have stronger legal protection for existing green areas. A comprehensive Green Area Programme for 1999-2008 was recently drawn up as a product of cooperation between citizens, authorities and decision-makers. It defines the correct management principles for different types of green areas, provides information for all instances involved in the planning process and to the decision makers. Furthermore it aims at increasing citizen involvement and at improving the co-operation between different authorities responsible for green area planning.

6. ENERGY PRODUCTION AND CONSUMPTION

Energy consumption per capita in Finland is relatively high due to our cold climate and dispersed settlement structure as well as owing to the energy-consuming pulp and paper industry. The highest demand of energy is during midwinter in January-February.

The main sources of energy are fossil fuels (natural gas, coal and oil), nuclear power, bio-mass fuel (fuel-wood, peat and agricultural residues) and hydropower. Wind and solar energy utilization is still low, but it is increasing swiftly. Fuel-wood is a domestic energy source with development potential, but until now it has not been able to compete on the market with cheap Polish coal.

Combined production of heat and electricity

Helsinki's energy demand is mainly met by imported fossil fuels. In the city's own energy production coal and natural gas are mainly used, whereas most of the oil products are consumed by traffic. In 1998 natural gas accounted for slightly over 50%, coal for a little less than 50%, and oil for 2% of the total consumption of fuels used by the municipally owned energy supplier, Helsinki Energy. The previous year natural gas accounted for only one third of the fuels. The replacement of coal with natural gas was made possible by the opening of a second natural gas combined cycle power plant in spring 1998

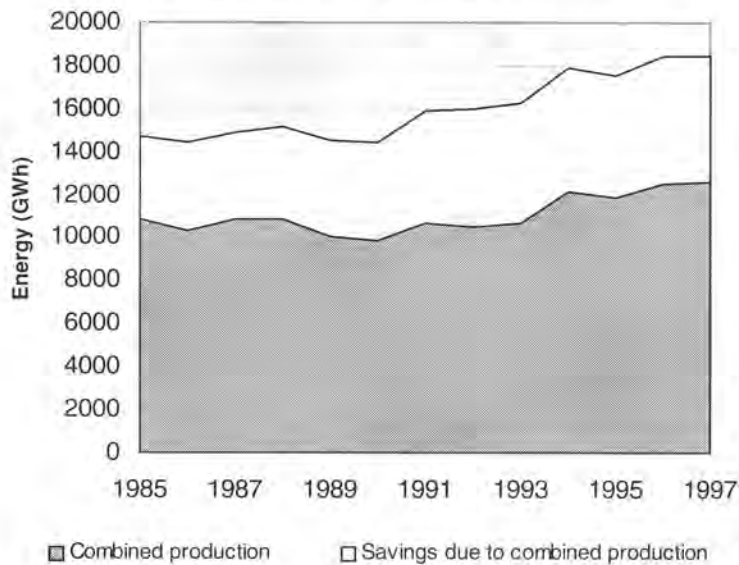
in Vuosaari.

Helsinki Energy produces almost all the electrical and heating energy required by the city. The energy efficiency of the city is rather good due to the combined production of electricity and heat for the district heating system. Due to the combined production the fuel consumption efficiency rate in the power plants can reach 90%, while the efficiency rate in separate production is around 35-40%. Helsinki Energy received in 1991 the UNEP Environment Award for its' combined heat and power production.

About 67% of the total electricity supply in Helsinki are generated by Helsinki Energy's own power plants. The combined generation process accounted for 59% of this production, separate generation of electricity accounted for the remaining 8%. A total of 26% of electricity came from power-generation shares owned by Helsinki but situated outside the city. Of this hydropower accounted for 5%, nuclear power for 16% and 5% was produced using coal and gas. The remaining 6% of electricity used by Helsinki were bought from other producers. The service sectors and the City and State offices consume over half of Helsinki's electricity, while households account for about one third of the consumption. There is no energy-dominated industry in Helsinki, manufacturing accounts for only 12% of the total electricity consumption.

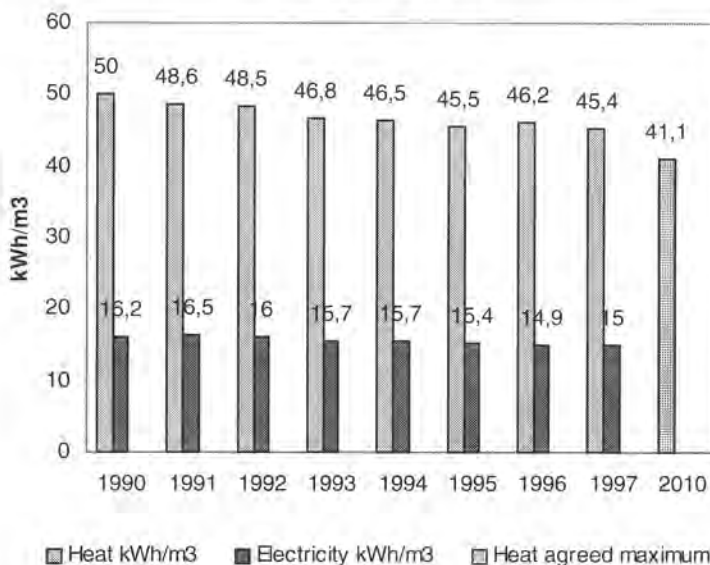
Of the building volume requiring heating in Helsinki, about 95% are connected to the district-heating network. In 1996 the bulk of district heat, or about 83%, was produced at co-

Savings of fuel due to the combined production of electricity and heat, as compared to separate production



Source: Helsinki Energy

Specific consumption of heating energy and electricity for all real estate owned by the City of Helsinki



Source: Helsinki Energy

generation plants together with electricity generation. Consumption of heating energy per cubic meter of building volume has been continuously decreasing since 1989. The total consumption of heat varies each year according to temperatures. A long-time trend reveals a very slight increase in the

total consumption of heat.

Total consumption of energy has increased in Helsinki on an average 4 % annually since the mid-1970s. During 1991-94 the growth was very small due to economic recession.

Means of conducting the use of energy

A special Energy Saving board has been established by the city to monitor energy consumption and to coordinate the implementation of the energy savings work. All the departments of the City are represented on the board, and a network of contact persons has been created to provide information and make recommendations.

One of the tasks of the board is to validate new projects that promote energy saving. The projects are mostly carried out by the bureau of Building Services of the Public Works Department. The board monitors energy consumption in the real estate of the City, collects and disseminates information on new measures, objectives and results in energy saving efforts, and develops practical methods that enhance energy saving. One of the goals is to coordinate energy saving between the various departments of the City, to encourage new projects and to publicize relevant information about energy saving.

Thanks to extensive cooperation and improved methods, the energy saving project has achieved many of its objectives. Increasingly centralized control, more efficient energy economy and, above all, wider distribution of information on energy-saving goals and methods have contributed to the results. Cooperation between the City departments is a prerequisite for achieving these goals.

In order to safeguard the utilization of the latest methods and the best possible quality, cooperation is also needed between the City and its partners. The energy Saving Board has made an

agreement with the Technical Research Center of Finland, and has started an international EU-funded project with Austrian, Belgian and Dutch partners. The City of Helsinki is also participating to develop and implement an energy certificate for buildings based on the EU SAVE directive.

Future challenges

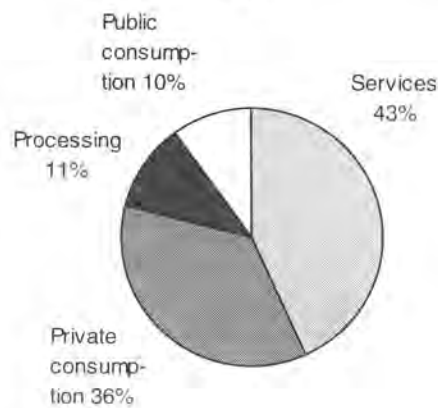
In the future, one of the biggest challenges will be the reduction of carbon dioxide emissions to the level set by international agreements. The target to reduce greenhouse gas emissions has been included in the Helsinki Local Agenda 21 Programme.

The City of Helsinki has a special computer program to follow up the effect of the implementation of energy savings measures. The district-heating clients of Helsinki Energy receive periodic review reports on their energy consumption. Electricity consumers get feedback reports with their bills concerning their energy consumption over the previous five years plus an annual estimate that can be compared with average consumption rates.

The targets of the development of the public transportation system in Helsinki are to increase the share of passenger transport and simultaneously to reduce energy consumption per passenger and kilometer. Results have been achieved by improving services and by increasing the number of vehicles, as well as by improved traffic flow and subsidized ticket prices.

Solar power utilization has not yet become commercially viable in Helsinki, but a certain potential exists despite Finland's long and dark winter. Wind power generation has also a good potential on the Baltic Sea coastline, and wind generators may hopefully in the future contribute to electricity production for Helsinki. Though the use of natural gas has increased lately, large-scale utilization will however require a connection between the North Sea gas supply network and the Russian networks in order to ensure the reliability of gas supply.

**Consumption of electricity in Helsinki
1997**



**Sales of district heat to the distribution
area 1997**



Source: Helsinki Energy

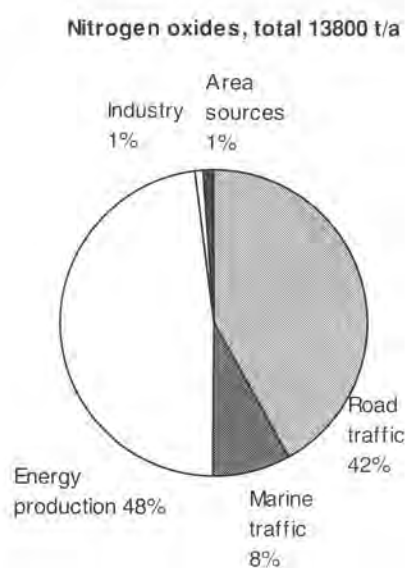
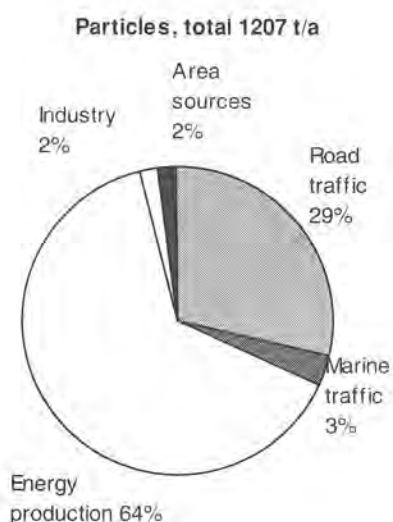
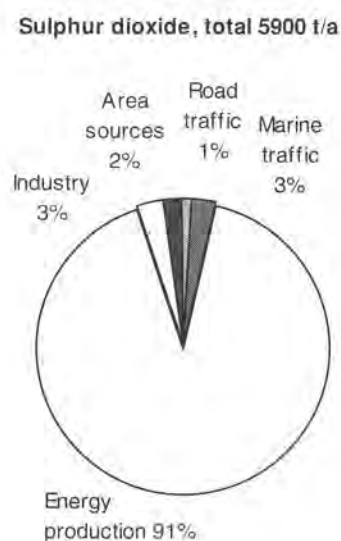
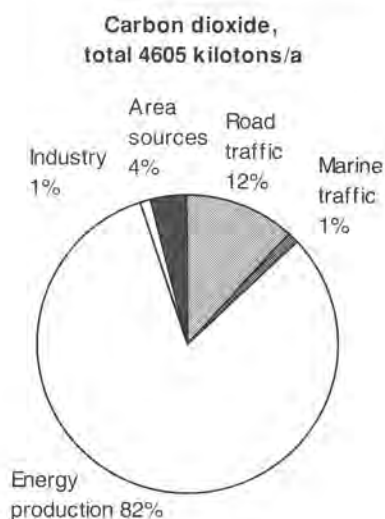
7. AIR QUALITY AND EMISSIONS

Air quality in Helsinki

Air quality is a crucial issue both for human health and the sustainability of our ecosystems. Air quality in Helsinki is fairly good and generally there has been a decreasing trend of air pollutant levels during the last few years. For sulphur dioxide (SO₂), carbon monoxide (CO) and lead (Pb) the concentrations are well below the health limit values. However, episodes with severely declined air quality can still occur under unfavourable weather conditions.

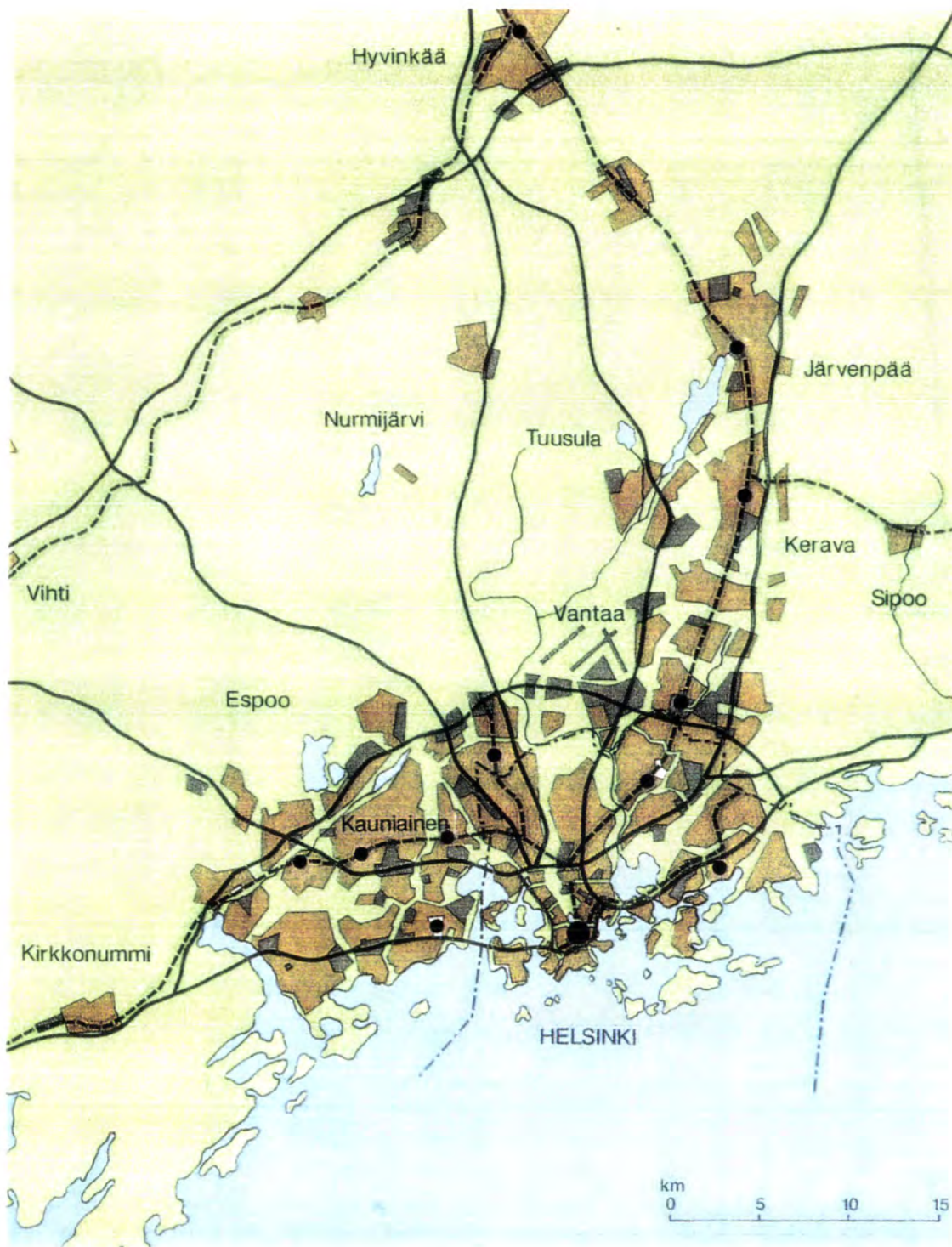
The majority of emissions to the air in Helsinki are caused by vehicular traffic and energy production. Because of the low emission height traffic has the major influence on pollutant concentrations at the ground level. Traffic is also indirectly responsible for high particle concentrations in the air. Most of the total suspended particles (TSP), i.e. the total mass of dust and PM₁₀, (i.e. particles with the size less than 10 micrometres), originates from both straight emissions from tailpipes and particles risen from the road sur-

Estimate of total emission by source in Helsinki 1997



Source: Helsinki Metropolitan Area Council

HELSINKI METROPOLITAN REGION



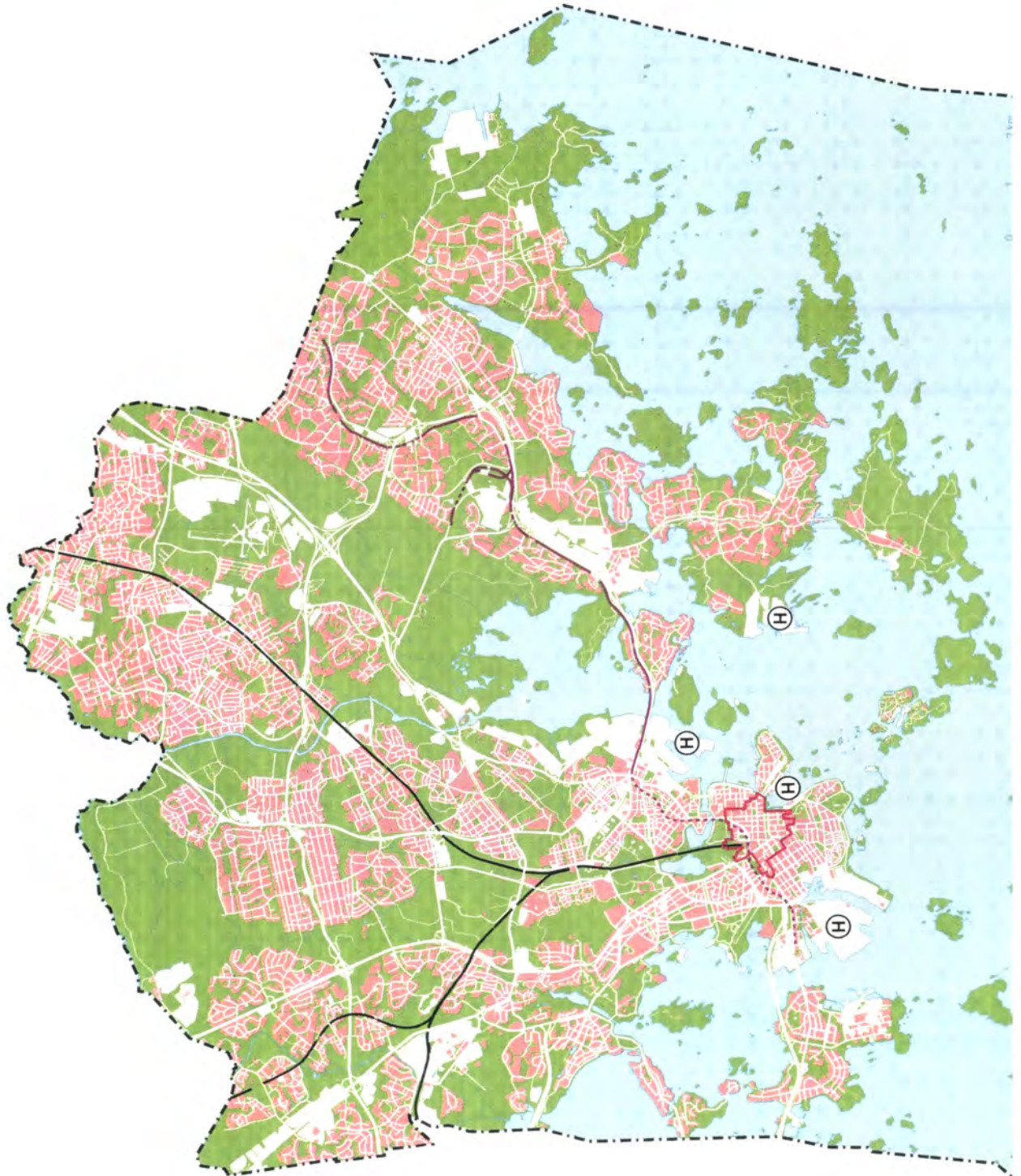
- | | |
|----------------------------|----------------|
| --- Helsinki city boundary | — Roads |
| Green areas | --- Railways |
| Housing areas | ● Main center |
| Employment areas | ● Local center |

Map ley: City of Helsinki, City Planning Department / Sari Yli-Tolppa.

CITY OF HELSINKI

LAND USE 1997

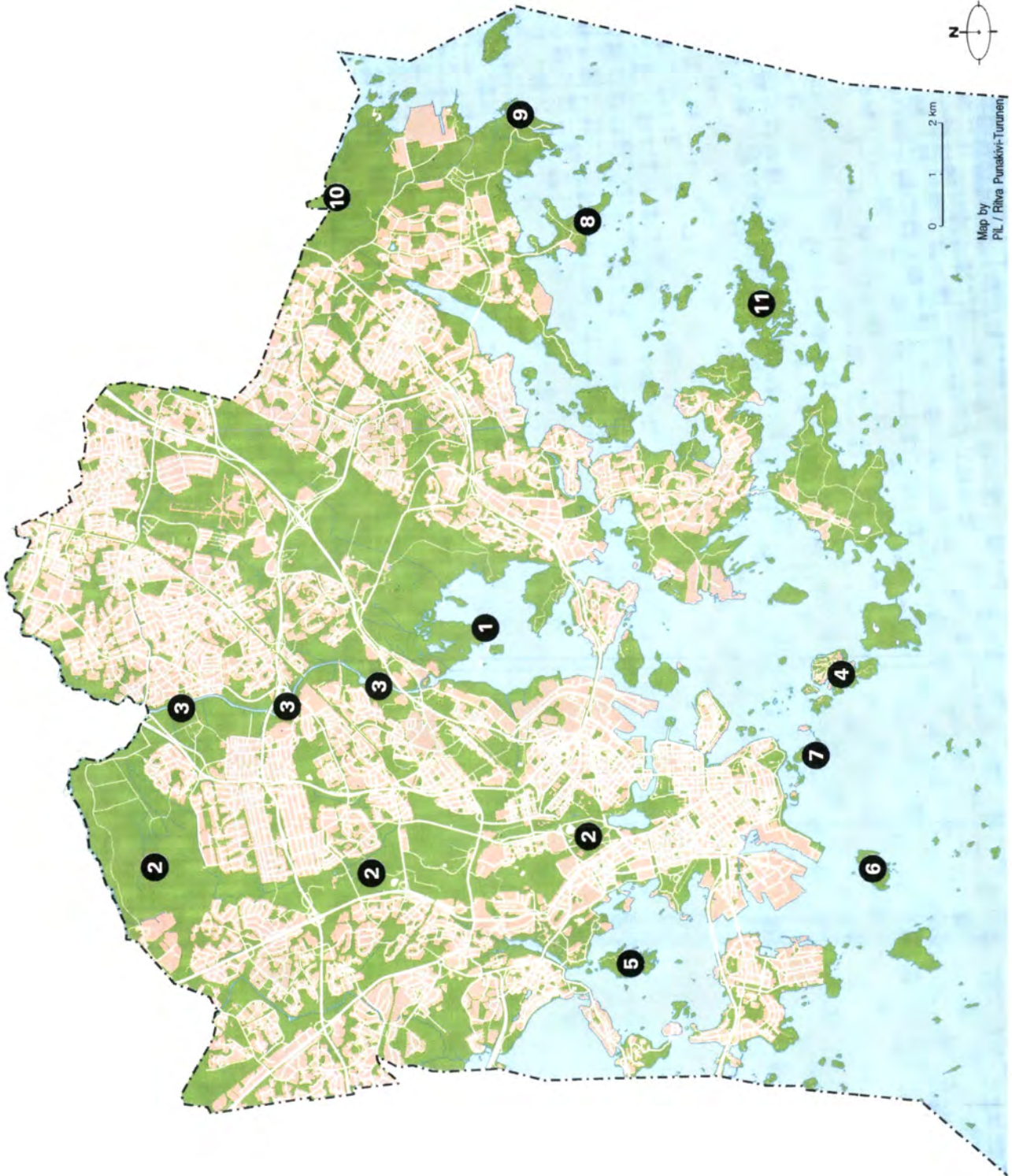
- WATER AREA (BALTIC SEA)
- HOUSING AREA
- GREEN AREA AND RECREATIONAL AREA
- INDUSTRIAL AREA
- HARBOUR AREA
- CITY CENTRE
- CITY BOUNDARY (MUNICIPALITY)
- METRO LINE
- RAILWAY LINE

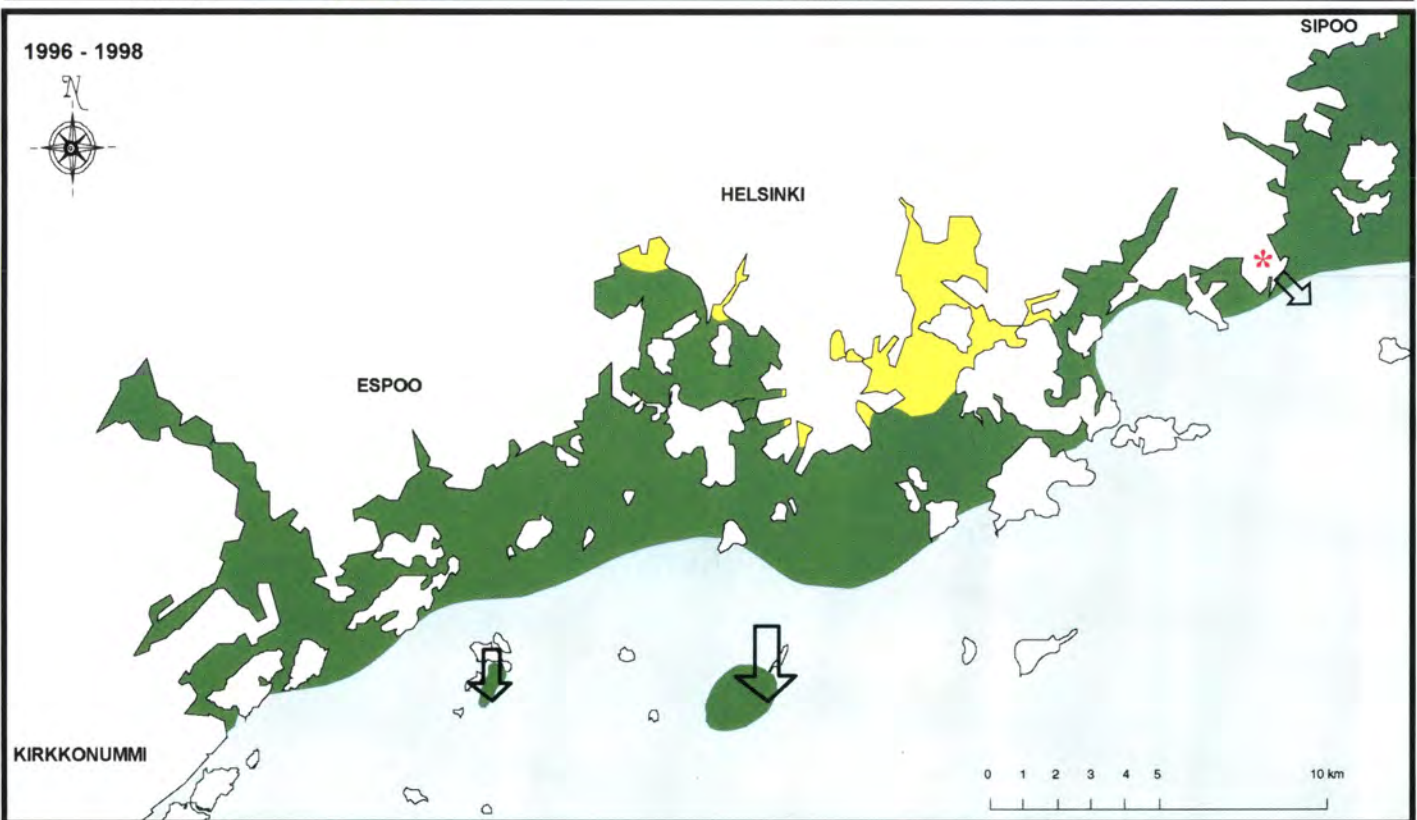
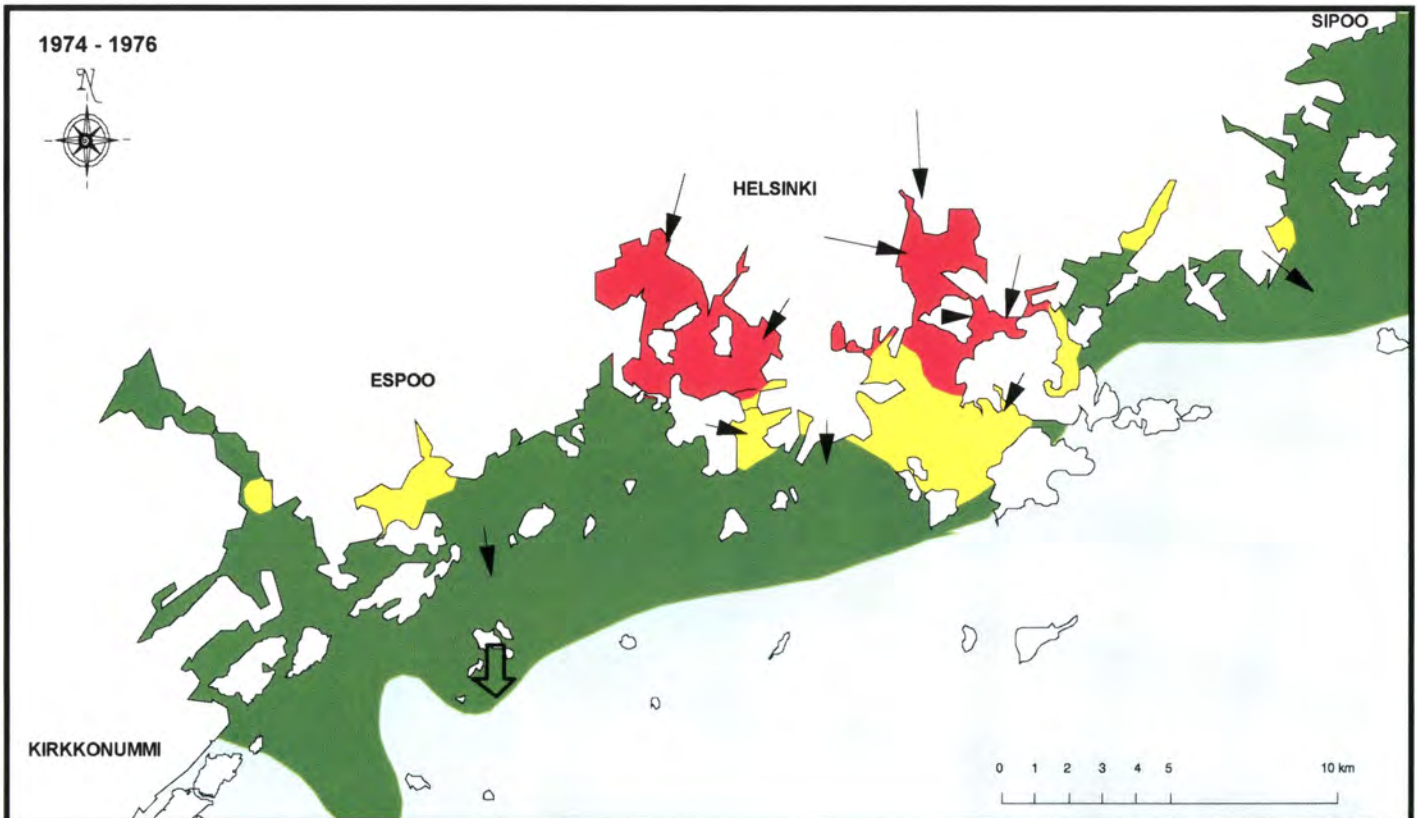


CITY OF HELSINKI

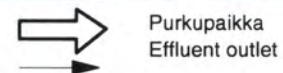
MAJOR GREEN AREAS AND PROTECTED AREAS

- 1** VIKKI NATURE PROTECTION AREA
- 2** HELSINKI CENTRAL PARK
- 3** VANTAANJOKI RIVER VALLEY
- 4** SUOMENLINNA NAVAL FORTRESS ISLANDS
- 5** SEURASAARI OPEN AIR MUSEUM
- 6** PIHLAJASAARI NATURE ISLAND
- 7** HARA-KA ISLAND NATURE SCHOOL
- 8** KALLAHDENNIEMI NATURE AREA
- 9** UUTELA RECREATIONAL AREA
- 10** MUSTAVUORI NATURE PROTECTION AREA
- 11** VILLINKI ISLAND





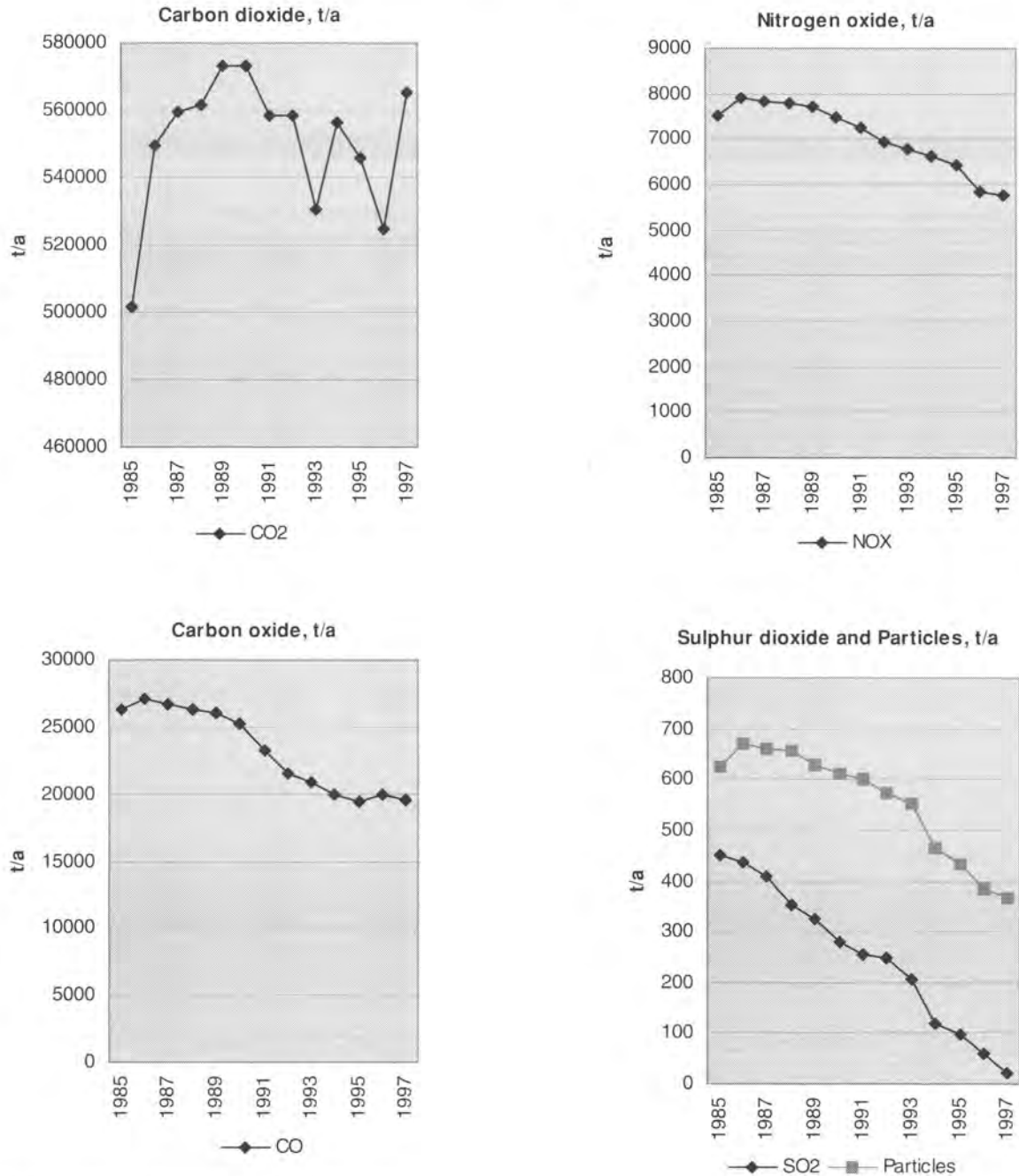
	I	Erinomainen	Excellent
	II	Hyvä	Good
	III	Tyydyttävä	Satisfactory
	IV	Välttävä	Fair
	V	Heikko	Poor



* The Vuosaari waste water treatment plant was closed down in autumn 1994

Water quality in the coastal zone of Helsinki and Espoo in 1974-76 and 1996-98

Exhaust emissions from car traffic in Helsinki 1985-1997



Source: Technical Research Centre of Finland

faces by traffic. Despite its relative efficiency, energy production causes most of the sulphur dioxide and carbon dioxide (CO₂) emissions in Helsinki. However, the sulphur emissions from the energy production have decreased considerably since the 1970's despite of the growth in energy production. The main reasons for this are the development of the district heating system, installation of desulphurization plants and partial substitution of coal with natural gas. However, when we look at the impacts of it on nature the acid deposition in the Helsinki region is still too high. About half of the acid fallout origi-

nates from local emission sources while the other half is coming as transboundary pollution.

Concentration of particles in Helsinki's air is mainly caused by traffic. The problem with high particle concentrations during early springtime originates from the need to use grit (sand and gravel) on the streets in wintertime in order to reduce slipperiness. During the past years the city has managed to reduce dust problems mainly by improving street cleaning equipment and improving the co-operation with estates in street cleaning. Moreover the amount of grit has been reduced, it

has been washed in advance and the finest material has been separated before the spreading the grit on the streets. When it comes to the removal of grit in late winter and early spring, washing is the most effective way of cleaning. However water can not be used at subzero temperatures and therefore the cleaning can be prolonged when temperatures fluctuate between warm and freeze.

Lead concentrations in the air in Helsinki are today almost non-existent. The sale of unleaded petrol was started in 1985, and in 1994 the share of unleaded was almost 100%.

During the past years nitrogen oxide (NOX) emissions from traffic as well as from energy production have fallen. Traffic has clearly the biggest impact on the concentrations of nitrogen oxides of urban air. Nitrogen monoxide (NO) concentrations have fallen clearly, while the concentrations of the more harmful nitrogen dioxide (NO₂) have decreased only slightly if any. This is due to the impact of ozone (O₂) concentrations in the air, as the nitrogen monoxide from exhaust fumes react with ozone to form noxious nitrogen dioxide. The ozone concentrations repeatedly exceed the WHO recommendation which is based on the effect of ozone on the vegetation. Ozone is carried by the wind to Helsinki, mainly from Central and Western Europe. The catalytic converters for their part also increase the relative amount of nitrogen dioxide in the exhaust fumes, especially in diesel vehicles.

The use of catalytic converters has diminished carbon monoxide, hydrocarbon and the absolute amount of nitrogen oxide emissions from petrol engines. The use of new oxygenated fuels has also to some extent contributed to lower hydrocarbon and carbon monoxide emissions, but may increase the nitrogen dioxide concentrations.

Air quality is improving, but the concentrations of nitrogen oxides and suspended particles (both TSP and PM₁₀) will continue to be a problem. Compared to other European cities of the same size, the air quality in Helsinki is in the summer good, while the concentrations of particles and nitrogen oxides are much the same during wintertime. The peak values though are in a European perspective in the cities of same size quite high.

Emissions

Vehicular traffic

Vehicular traffic causes almost all the carbon monoxide emissions, 43% of the nitrogen emissions and 12% of the carbon dioxide emissions, but only 1% of the sulphur dioxide emis-

sions. Until the early 1990's traffic emissions grew constantly, but the economic recession in the beginning of the decade and usage of catalytic converters changed the direction of the development. Since the beginning of 1990s the exhaust emissions from traffic have decreased with the exception of carbon dioxide.

The concentrations of pollutants vary considerably with time and location and depend also on weather conditions. The contribution of traffic towards air pollution, including nitrogen oxides, carbon monoxide, particles and hydrocarbons is in the inner city and along the main roads roughly 80-95% and in the suburbs 50-80%.

The concentrations of TSP in the air vary clearly depending on the time of the year. The concentrations are at highest in springtime in March-May. The re-emission of dust, i.e., dust raised from the streets by the traffic (including mostly TPS), has stayed a serious air quality problem. In every spring guideline levels are exceeded. For example 1998 the guideline for TSP concentration was exceeded in the inner city and suburbs in March and April.

Energy production

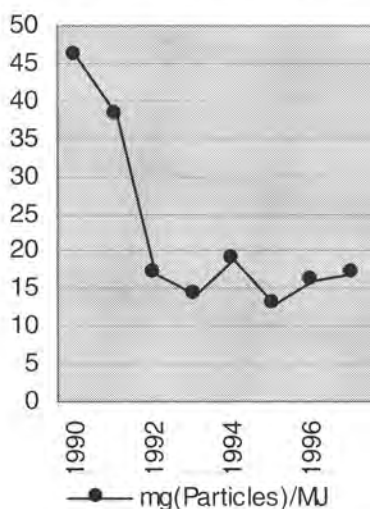
Despite its relative efficiency energy production causes most of the sulphur dioxide and carbon dioxide emissions in Helsinki. Nitrogen oxide and particulate emissions from energy production are equivalent to those from traffic. Nitrogen oxide emissions from energy production were in 1998 half of the amount they were in 1990.

Almost all sulphur dioxide emissions originate from the city's power plants. The annual sulphur dioxide emissions in the metropolitan area have fallen since the 1970's to one-fifth. This is the result of many changes: the increased share of district heating, the installation of desulphurization equipment, restrictions of the sulphur concentrations in the fuel and the increase in use of natural gas. The harbours are responsible for some 4% of the sulphur dioxide emissions in Helsinki. The ferries and part of the cargo ships have switched over to use fuel with less sulphur near the harbour and in nearby waters.

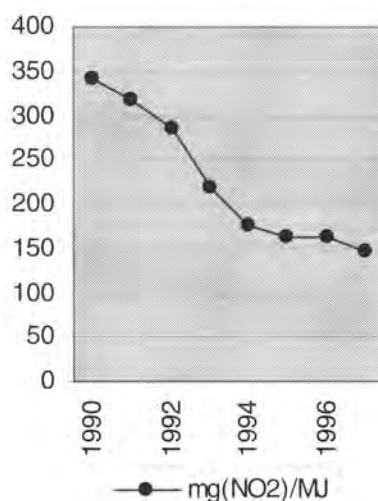
The total carbon dioxide emissions from energy production in 1998 were 8% higher compared to 1993, and 26% higher compared to 1983. The emissions have, however, not increased at the same ratio as the production of energy. This is mainly due to the substantial replacement of coal with natural gas. The amount of carbon dioxide emissions is largely a question of fuel types used in the power plants. Possible future use of wood-chips and other biomass fuels could improve the CO₂

Air emissions from energy production in Helsinki 1990-1997

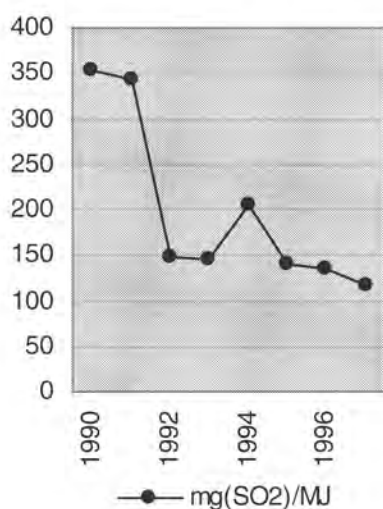
Particles, mg(Particles)/MJ



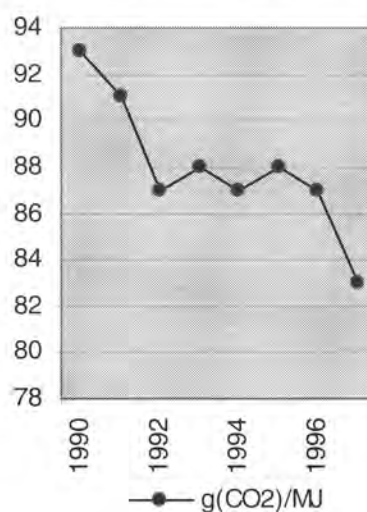
Nitrogen oxide, mg(NO2)/MJ



Sulphur dioxide, mg(SO2)/MJ



Carbon dioxide, g(CO2)/MJ



Source: Helsinki Energy

balance. Helsinki's Local Agenda 21 process includes a target of reduction of greenhouse gas emissions.

Industry

Compared to emissions from traffic and energy production, emissions from industrial plants in Helsinki are only slight. Air polluting industry has constantly moved away from the city and the remaining plants have reduced their sulphur dioxide, nitrogen oxide and particulate emissions.

The contribution of industry towards the city's hydrocarbon emissions amounts to roughly one third. One of the most dis-

turbing emissions from industry is unpleasant odour of various kinds.

Air Quality Monitoring in the Helsinki Region

The air quality in the Helsinki region is monitored by the Environmental Office of Helsinki Metropolitan Area Council (YTV) at six permanent and three mobile stations. The monitoring covers all typical pollutants, (SO₂, NO_x, CO, TSP, PM₁₀, O₃). Real-time data is available continuously. For informative rea-

sons a simple air quality index was introduced for the Helsinki metropolitan area in 1993, in order to inform the public about the current air quality in an easily understood way. The index was developed by the Environmental Office at the Helsinki Metropolitan Area Council (YTV). The pollutants included in the air quality index (AQI) are carbon monoxide, nitrogen dioxide, sulphur dioxide, ozone and particles, (PM10). YTV calculates the values for the centre of Helsinki and for the suburban areas.

National new air quality guidelines and limit values were brought on line in 1996. The guidelines express the aims of air quality management and are taken into account in land use, building and traffic planning and so on. The limit values are binding and the authorities are obliged to take measures to improve the air quality if these limits are exceeded.

Biomonitoring

In the Helsinki metropolitan area there are about 100 permanent biomonitoring sites in naturally growing spruce and pine forests. At these sites tree damages, species diversity of bark-living lichens, and the abundance of certain lichens and algae are monitored. Pine needles are analysed for their sulphur and nutrient levels. Heavy metal and ash depositions are estimated from moss samples. Acidity, nutrient levels and concentrations of certain heavy metals, including cadmium and lead, are determined from humus.

The latest monitoring study was conducted 1998. The most affected areas in Helsinki are concentrated to the inner city, where the sample sites form a "lichen desert" where only epiphytes that gain from polluting emissions can survive. Lichens that suffer from air pollution were missing at most of the sampling sites in Helsinki. The rich green-algae cover on the trunks of the pines and on the surface of the spruces is due to the nitrogen load. Sulphur and metal concentrations in pine needles and mosses, as well as the heavy-metal load, have decreased since the end of the 1980s. This may be an indication of a reduction in long-range transport, as the domestic decrease of emissions was already visible in the beginning of the previous study period 1988-93.

Environmental and Health Hazards of Air Pollution

The combined effect of air pollutants and acid deposition is reducing the buffering ability of the natural environment in Helsinki. Sulphur and nitrogen emissions acidify the soil and waterways. So-called critical loading levels have been set in accordance with the buffering ability of the natural environment against acidifying deposition. Although sulphur emissions have been drastically reduced over the last years, the critical loading continues to be exceeded. Most of the sulphur concentration in the air of Helsinki originates from industrial areas of Europe, some part also from other sources in Finland.

Compared to other population centres in Finland the level of polluting the air in Helsinki is about the same level, but the area and population affected is much larger. Compared to cities in central, western and southern Europe the air quality in Helsinki is still on the better side. Only in unfavourable weather situations the concentration of nitrogen dioxide and particles can reach internationally high levels. The impact of air pollution on health has been profoundly investigated in Helsinki, and the results have showed that even minor emissions cause health impacts. These impacts are mainly affecting the respiratory organs.

Indoor Air Quality

The quality of indoor air is affected particularly by tobacco smoke, moulds spreading in moist constructions, compounds emitted from building materials and indoor surfaces and also radon gas leaking out of the ground.

Since the early 1980's, radon-gas concentrations, formaldehyde and moulds, have been measured in homes in Helsinki. The measuring of volatile organic compounds commenced in the 1990's. Studies made so far show that around 4% of detached houses in Helsinki have radon gas concentrations that exceed the guidelines. Growths of mould on surfaces or structures in homes are almost always associated with damage due to damp. Each year around three hundred complaints of mould and damp are investigated in Helsinki. In old buildings the causes are most often water leaks, in new buildings the main causes of damage from moisture are bad design or structural faults. At present around one thousand households are waiting for an investigation of their indoor air quality for some of the reasons mentioned above.

Air quality guidelines and limit values in Finland

Compound	Guideline (20°C, 1 atm)	Statistical definition
Carbon monoxide (CO)	20 mg/m ³ 8 mg/m ³	the one-hour value the moving 8-hour average value of the hour values
Nitrogen dioxide (NO ₂)	150 µg/m ³ 70 µg/m ³	the 99 th percentile of the one-hour values in one month the second greatest 24-hour value in one month
Sulphur dioxide (SO ₂)	250 µg/m ³ 80 µg/m ³	the 99 th percentile of the one-hour values in one month the second greatest one-hour value in one month
Total suspended particulates (TSP)	120 µg/m ³ 50 µg/m ³	the 98 th percentile of the 24-hour values over one year the annual average value
Thoracic particulates (PM ₁₀)	70 µg/m ³	the second greatest 24-hour value in one month
Malodorous sulphur Compounds, Total (TRS)	10 µg/m ³	the second greatest 24-hour value in one month TRS is expressed as sulphur

Compound	Limit Value (20°C, 1 atm)	Statistical definition
Nitrogen dioxide (NO ₂)	200µg/m ³	the 98 th percentile of the one-hour values over one year
Sulphur dioxide (SO ₂)	80µg/m ³ 250µg/m ³	the median of the 24-hour values over one year the 98 th percentile of the 24-hour values over one year
Total suspended particulates (TSP)	300µg/m ³ 150µg/m ³	the 95 th percentile of the 24-hours value over one year the annual average
Lead (Pb)	0,5µg/m ³	the annual average

Source : Decision number 480 by the Council of State, 1996

8. WATER AREAS AND WATER QUALITY ISSUES

About 508 square kms of the area comprising Helsinki consists of water areas. Most of this is part of the Gulf of Finland, a shallow and small sea area of the Baltic Sea shared by three countries and three large cities, St Petersburg, Tallinn and Helsinki. The southern border of Helsinki extends to the national sea border.

Changes in the nutrient levels in Vantaa River and Helsinki coastal area effects the state of waters in Helsinki. The state of water in the sea area is affected by discharges carried by Vantaa River and discharges from the sewage treatment plants of the cities of Helsinki and Espoo. Also deposition of pollutants carried by winds affect the water quality in Helsinki. Nutrient rich waters from the eastern part of the gulf float to the Finnish sea area especially during spring and winter time.

The state of the inner bays

Bays and waters close to the shoreline became badly eutrophicated during the 1950's - 1970's. At that time sewage from the metropolitan area was discharged to the shoreline, in some places untreated. In the shallow marine bays the water mixes very poorly, and as a consequence these bays experienced a large build-up of nutrients. As the nutrient level rose, algal production increased and cyanobacterial blooms were commonplace. With the seawater becoming progressively more turbid, the more sensitive aquatic plants vanished and biodiversity among the bottom fauna and the fish stocks decreased. The most badly eutrophicated areas were Seurasaarenselkä, Laajalahti and Vanhakaupunginlahti.

Loading of the inner bays decreased at the end of 1970's, when wastewater treatment improved as a consequence of much more strict water legislation. Polluted sea bays begun to recover from the adverse effects of loading, and since the 1987 most of the treated wastewater have been conducted to the outer archipelago, which has decreased the load on coastal waters.

The decrease in the loading of the bays has improved the life conditions of the benthic fauna, aquatic vegetation is recovering and phytoplankton no longer builds up to the same level as formerly. Although the water quality in the bays has improved, these continue to be extremely eutrophic in comparison to the outer archipelago. Generally taken the biodiversity

of the benthic fauna is still low and the amount of phytoplankton high. Phosphorus has accumulated in the sea bed sediments and is slowly dissolving in the water. Nitrogen and phosphorus concentrations in the Vanhakaupunginlahti bay are also risen by the nutrient rich waters brought down by the Vantaa River.

The state of the Baltic Sea affects coastal waters in Helsinki area

The Gulf of Finland forms part of the Baltic Sea basin and thus the changes in water quality in the Baltic Sea also apply to the Helsinki coastal area. When highly saline and oxygen rich surface water from the North Sea surges through the Danish Belts, it sinks into depth and displaces the deeper lying nutrient-rich poorly oxygenated water. The first inflow of this decade (1994) ended an 18 year long period without any major inflows. Though the second large inflow of water came already in 1995, the amount of fresh oxygenated water has only been enough to replace the oxygen-deficient bottom-near water of the Baltic Proper. The old saline and oxygen-deficient bottom-near water from the Baltic Proper is partly pushed to the Gulf of Finland, and brings along a stronger salinity stratification in the gulf. Therefore the oxygen situation has lately turned less favorable in the Gulf of Finland; the water pushed to the gulf has had a low oxygen content and salinity has brought along a stratification that prevents the vertical mixing of the water.

The total load of nitrogen and phosphorus to the Gulf of Finland has decreased some in the 1990s. However, the Gulf of Finland is approaching a state where the internal load (nutrients in sediments) becomes a dominating negative factor in future development. In 1996 several oxygen-deficient areas were detected in the eastern and central parts of the gulf. The yearly algae-blooms in spring and late summer become more intensive.

The treated wastewater from municipalities in the metropolitan area is now conducted to the boundary of the outer archipelago. In Helsinki the sewage out fall lies in the vicinity of Katajaluoto, around 7km offshore, and in Espoo near Gåsgrundet, about 4km offshore. The effluents have not noticeably increased nutrient concentrations in the waters of the

outer archipelago, but close to the discharge points the microbiological quality of the water has weakened. Although the nutrient load originating from Finnish sources to the Gulf of Finland is relatively low- some 10% of the total load of the gulf- its' effects on the sea ecosystem are apparent.

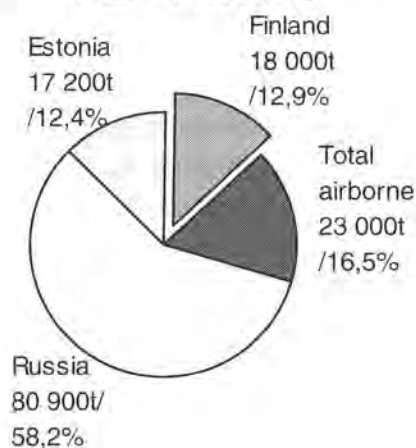
Environmental toxins are also threatening the entire delicate Baltic marine ecosystem. For instance, heavy metal concentrations in the Baltic are many times greater than in the North Atlantic. Oil and chemical spills may have catastrophic effects on fish and birds. Although the damage caused by localized spills is most obvious, most of the oil and hydrocarbons that pollute the Baltic come from small discharges from ships, harbors, industrial plants, agriculture and human settlements.

Water quality

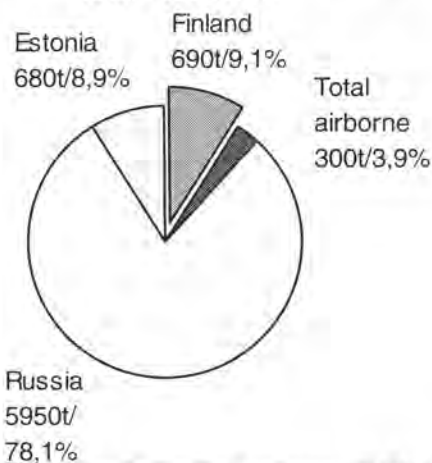
For assessing the quality of seawater outside Helsinki the requirements of recreational use are given the most weight. Aesthetic factors affecting such use include turbidity and the depth to which light can penetrate. The oxygen situation in the water, signs of eutrophication, and bacteria concentrations are also routinely investigated. In the major Helsinki bays water quality is classed satisfactory or fair; water is cloudy and rich in plankton algae.

A Coastal Master Plan for the whole archipelago has recently been approved by the City Council. The plan defines guidelines for the use of the water area and the 283 islands and islets of the area.

Nitrogen load into the Gulf of Finland 1995, total 139 100 tonns



Phosphorus load into the Gulf of Finland 1995, total 7620 tonns



Source: Baltic Marine Environment Protection Commission. HELCOM

Swimming beach waters have become cleaner

During the summer months water quality is monitored in 23 public beaches. Along almost all the seashores the bacteria concentrations are low and the waters are classed as good. Water in Vantaa River is only fair, but still suitable for swimming. An abundance of faecal bacteria and high ammonium phosphate concentrations reflect the impact of sewage on natural waters. Conducting the treated wastewater to the outer sea instead of the shoreline waters has improved the microbiological quality of the coastal water in recent years.

Cyanobacterial blooms restrict the use of swimming areas. In the waters along the swimming beaches of the Vantaa River cyanobacterial blooms have appeared almost every summer.

Vantaa River is clouded by clay

Vantaa River runs into the middle of Helsinki sea area. It winds through extensive clay areas in Uusimaa Province. In spring, with the melting of the snow, flood waters wash away soil from nearby farmlands into the river. Excavations and drainage increase the flow of solid material and nutrients into the Vantaa River waterway.

Most of the nutrient loading originates from agri-

culture along the river's course and from scattered settlements. Sewage treatment-plants at the upper reaches of the river also increases the loading. However the situation has greatly improved since 1985, with better efficiency at the treatment plants and more sophisticated sewer networks. The state of Vantaa River is weakened by rather high bacterial concentrations. Loading in the upper reaches of the river is also apparent in the swimming waters downstream in Helsinki.

Waste Water Treatment

Waste water treatment in Helsinki is today concentrated to one place. In 1994 the Viikinmäki waste water treatment plant was taken into use and the older smaller plants were subsequently closed down. Sewage from approximately 750 000 Uusimaa province inhabitants is treated at the new Viikinmäki sewage treatment plant in Helsinki. In 1998 around 50 tons of phosphorus and 1420 tons of nitrogen from Viikinmäki ended up in the Gulf of Finland. Almost 100 million cubic meters of sewage was handled by the plant. The current purification efficiency of the material consuming oxygen and of phosphorus is almost 95%. In the case of nitrogen the purification efficiency has been 57% since the beginning of 1998. Before that purification efficiency amounted only to 20%. Later this spring the Higher Water Court of Finland will decide about the new purification rates. Most likely Helsinki will be obliged to remove about 70% of nitrogen from year 2000 onwards. Helsinki and Espoo together produce 0,6% of the total phosphorus loading and 2,6% of the nitrogen loading in the Gulf of Finland.

Household Water

Water from the Vantaa River was used to supply households in Helsinki right up to 1982. Today raw water is brought from Asikkalanselkä in the southern part of Lake Päijänne, and transported by gravity through a 120-km long tunnel to the Pitkääkoski and Vanhakaupunki water purification plants.

Reductions in loading by the wood processing industry in recent decades has led to an obvious improvement

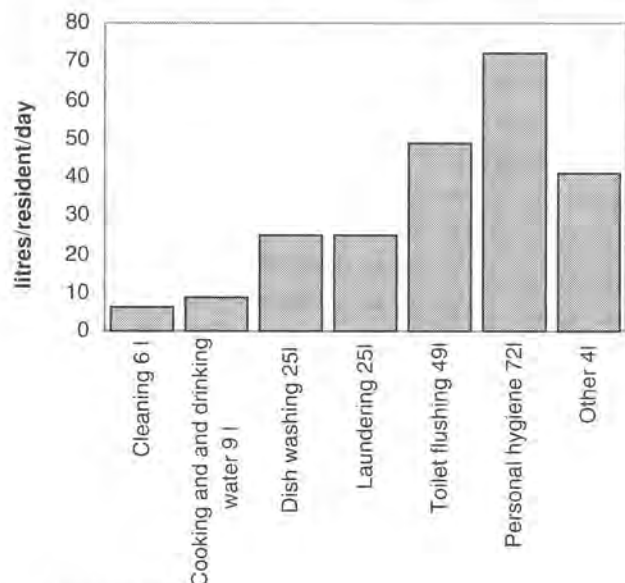
in water quality in the Asikkalanselkä area. Good quality raw water and modern purification techniques ensure that the tap water in Helsinki is of high quality. The tap water complies with the National Board of Health's norms, in addition to satisfying the requirements of the requisite EU directives. Quality targets set by the EU directive are also met, with the exception of aluminium concentrations. The flavor of the water improved considerably when the city started to pipe water from Lake Päijänne. Secondly, the chloroform formed as a by-product of chlorination decreased in the drinking water as a conse-

Daily water consumption in Helsinki 1960-1997, litres/resident/day



Source: Helsinki Water

Water consumption by use categories in 1998, litres/resident/day



Source: Helsinki Water

quence of the reduced need for disinfection. Since 1979 the water supply has been disinfected with ozone, which has also helped reduce the concentrations of harmful chlorine compounds in it.

Today Helsinki has four usable groundwater areas. The ground waters of those areas that have been examined are of

good quality. The total amount of groundwater is however small, and thus groundwater is not anymore extracted in large quantities. In cases of emergency the groundwater may be used for consumption.

9. WASTE MANAGEMENT

The targets for waste management within Helsinki metropolitan area were adjusted in 1996 and a new action plan prepared for the period 1997-2001. The aim included in this plan is to decrease the total amount of waste transported to the landfill, and to increase the total recycling rate by the end of the century to 60%. At present about 40% of all waste in the Helsinki area are already recycled.

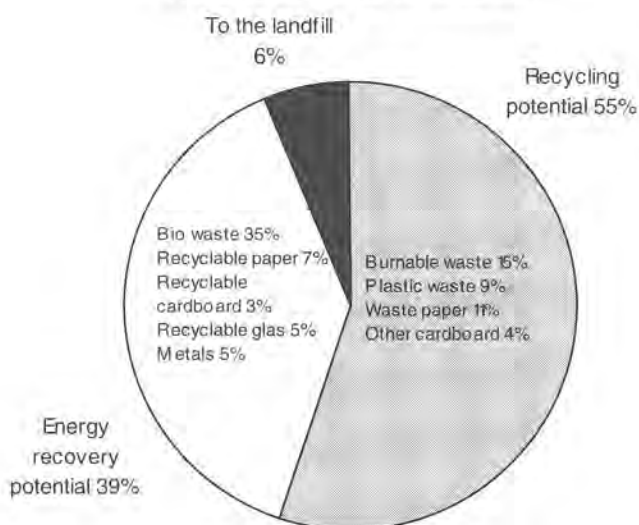
Helsinki Metropolitan Area Council (YTV) has the overall re-

sponsibility for waste management in Helsinki, Espoo, Vantaa, Kauniainen, Kirkkonummi and Tuusula. Approximately 49% of the waste are recovered while the resting 51% are collected to Ämmässuo landfill in Espoo, the only landfill site in the area. The amount of waste brought to Ämmässuo decreased steadily during the first half of the decade, partly due to the economic recession, but also thanks to strong efforts for separation at the source, reuse and recycling. Thereafter the economic growth and the population in-

crease affected the development adversely, and since 1995 the total amount of waste has increased with 38%. The amount of waste produced per inhabitant has, nevertheless, decreased. According to the Action Plan it was intended that despite economic growth and population increase, the amount of waste to be treated would be kept at the level of 1995, i.e. about 400,000 tons, at least up to the year 2001. Nevertheless, now it looks like these ambitions have to be revised.

One incineration plant for household waste was operational in Helsinki in the 1970's and early 1980's, but it was closed down in 1983 due to air pollution problems. Since then the strategy has been to reduce waste generation and to develop reuse and recycling.

Household waste in Helsinki



Source: Helsinki Metropolitan Area Council

sponsibility for waste management in Helsinki Metropolitan area, which consists of the municipalities of Helsinki, Espoo, Vantaa and Kauniainen. The tasks carried out by YTV include waste management planning, collection, transport and treatment of solid waste. YTV organizes separate collection of glass, paper and cardboard, bio-waste, metal and hazardous waste.

About 950,000 tons of solid waste is annually produced in the greater Helsinki area, i.e., the cities and municipalities of

Recycling rates

All residential estates with more than five residents are obliged to separate paper waste. The collecting of paper waste is mainly carried out by private companies. The share of collected recyclable paper and cardboard in 1995 was about 69%. According to present plans the amount will be increased by the end of the decade to 84%. This target requires especially improvements in the collection of cardboard. Shops and manu-

facturers are required according to the EU Packaging Directive to improve collection and recycling of cardboard.

The recovery rate of building waste is estimated to be around 20%. The aim is to increase the rate to 70%. The building sites in the metropolitan area have been obliged to separate wood and metal waste since 1995, but in order to reach the target further obligations for separating the waste at building sites and demolition works will be assessed. In 1995 around 77% of the metal waste was collected. Recycling of metal waste is mostly organized outside the municipal waste treatment ac-

ording to market requirements. In order to increase the amount of collected metal waste from households, it is planned to create a collecting network similar to that of glass waste collection. The aim is to increase the recovery of metal waste from households to 85%. So far metal waste is collected at the YTV waste stations.

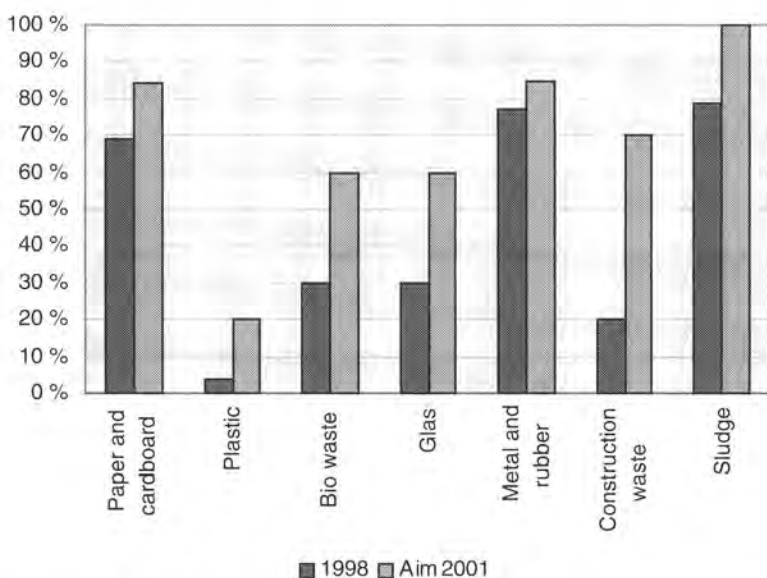
In the Helsinki metropolitan area there are over 400 public glass containers and glass is also collected by food and liquor shops. The recovery rate of glass waste is approximately 30%, the target being 60% by the end of the century. Return

bottles are in general use, and about 90% are recycled.

Bio-waste is collected separately in the whole region, including the Helsinki city-center, which was the last area to join the collection in the end of 1998. Until recently bio-waste was composted on the Ämmässuo composting field in open ridges, but in 1998 a new bio-waste composting plant was brought on line. The recycling rate of bio-waste is at present around 30% and the target is to increase it up to 60%.

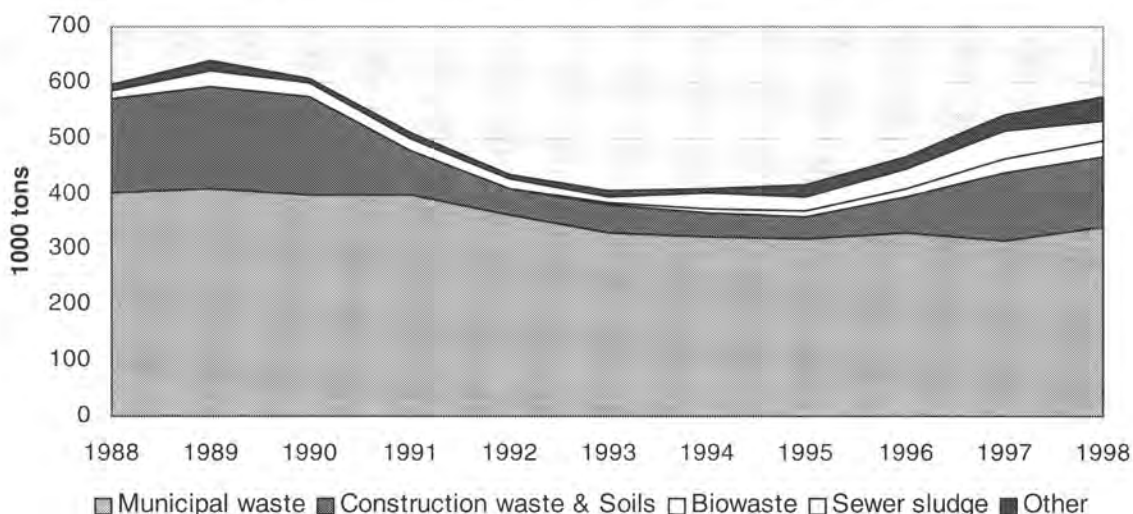
Reuse opportunities are offered in three Metropolitan Area Recycling Centers. The Metropolitan Area Recycling Center is a limited company founded in 1990 with the main share-

Recycling rates, present and aims



Source: Helsinki Metropolitan Area Council

The amount of waste received at Ämmässuo landfill



Source: Helsinki Metropolitan Area Council

holders being the cities of Helsinki, Vantaa, Espoo, Kauniainen, the Helsinki Metropolitan Area Council and several citizen's organizations. Citizens can bring to the center stuff they no longer use and take for free, or for a small price what they need. The center also offers free advice and an exhibition on how to reduce waste and on a more ecologically sound way of living.

Hazardous Waste

The cornerstone of hazardous waste treatment in Finland is the Ekokem Oy hazardous waste treatment facilities in the city of Riihimäki and a collection network that covers the whole country. Most of the waste brought to Ekokem from Helsinki is delivered by the companies themselves. The amount of hazardous waste brought to Ekokem from Helsinki amounted in 1998 to about 9 500 tons. The Metropolitan Area Council also offers hazardous waste collection both for companies and households. Twice in a year hazardous waste collection vehi-

cles make the rounds of 450 locations in the metropolitan area. Furthermore there are 81 permanent locations in Helsinki where households can bring their hazardous waste. In 1996 YTV started a pilot study on collection of burnable household-waste. The study will assess the amount of burnable waste produced in residential areas and the effectiveness of separation of burnable waste. The experiment will continue until the end of 1999, where after further actions will be decided.

Waste Prevention

Waste prevention is promoted with intensive advice and information by recycling advisers and customer service. Moreover, media campaigns will be used to reach larger customer groups. The overall objective of public awareness raising in waste management issues is to adapt the waste handling of communities to fit existing ecological systems. A closed material cycle is the ultimate target. Environmentally sound waste management is of course also an economical benefit.

10. THE LOCAL AGENDA 21 PROCESS IN HELSINKI

Global sustainability issues were originally included on the agenda of municipal administration in Helsinki in 1988 when the Ministry of the Environment distributed the report Our Common Future by the World Commission on environment and Development (the Brundtland Commission) to all Finnish municipalities for comments and consideration. Workshops and seminars on sustainability were then conducted in various municipal departments and organisations.

In the wake of the 1992 United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro, sustainability became a priority target on the municipal agenda of Helsinki. The process of moving towards sustainability and formulating a long-term Local Agenda 21 Programme for the City of Helsinki has been gradually developed since then. A political commitment to the Local Agenda (LA 21) process was reached in February 1995, when the City Board signed the Aalborg charter, and Helsinki thus joined the European Sustainable Cities and Towns Campaign.

Further strengthening of the LA 21 process was achieved in

March 1997 when the City Council made a decision on major targets and tasks of the process. A coordinating unit (LA 21 Project) was established in February 1998 within the Environment Centre, and in 1998 the public participation phase of the process was opened with a large LA 21 Forum and the founding of 17 thematic sustainability working groups.

Important Steps

1) A working Group on sustainable Development, including representatives of all municipal departments and co-ordinated by the environment Centre, was established in 1992. The working group initiated during 1992-93 a Municipal Campaign for Sustainability, which focused mainly on grassroot-level "ecologization" activities on all municipal workplaces. The topics of the campaign included environmental awareness raising, waste reduction and improved recycling practices, management of hazardous wastes, energy saving and improved

energy efficiency, water saving measures and introduction of environmental auditing within various departments of the city administration. As a result of the campaign altogether more than 1800 specific proposals on "good practices for workplace sustainability measures" were recorded. This set of proposals was presented to the City Board in 1993 and distributed to all departments and units.

2) Simultaneously the formulation of the second Environmental Protection Programme, covering the period 1994-98 was carried out. The programme was approved by the City Council in May 1994. Follow-up reviews of programme implementation were conducted in 1995 and 1997. Drafting of the Third environmental Protection Programme for 1999-2002 started in October 1997.

3) A report on sustainable city planning, "Towards Sustainability in Helsinki", was approved in 1994 by the City Planning Committee.

4) Representatives from Helsinki participated in the European Conference on Sustainable Cities and Towns in Aalborg in May 1994. The Aalborg Charter was signed by the City Board in February 1995, and thus Helsinki joined the European Sustainable Cities and Towns Campaign.

5) Following the signature of the Aalborg Charter, a follow-up report was prepared on the progress towards sustainability, achieved so far by all municipal departments and service organisations. The report was presented to the City Board.

6) During 1995-97 the Environment Centre has implemented a series of workshops on sustainability issues together with a network of contact persons from all municipal departments and organisations. The workshops have included also representatives of a newly established citizens' LA 21 action group called "Helsinki 21". Topics discussed during these workshops have included:

- Criteria and indicators for sustainability
- Contents and significance of the Aalborg Charter
- International co-operation in sustainability co-operation
- Main objectives and targets of the LA 21 process towards sustainability
- Obstacles for implementing a LA 21 process in Helsinki
- Alternative organisational set-ups and models for LA

21 process

- Methods and possibilities of enhancing citizens participation
- Awareness rising on sustainability issues
- Measures for strengthening "workplace ecologization" activities
- LA 21 activities in schools

7) Representatives from Helsinki participated also in the Second European Conference on Sustainable Cities and Towns in Lisbon in 1996. Case studies from Helsinki were represented in Conference workshops.

8) The Board of the Helsinki Metropolitan Area Council (YTV) approved in May 1996 a General Programme for sustainable Development within the Metropolitan area. In March-May the council implemented a process of participatory Future Scenario Workshops.

9) On the basis of the workshops and the earlier experiences of the Municipal Sustainability campaign of 1992-93, the Environment Centre formulated in March 1996 a detailed proposal to the City Council on the preparation of a long-term Local Agenda 21 Programme towards Sustainability, based on the principles of the Aalborg Charter. The proposal was approved by the Environment Committee in April 1996, and was later distributed for comments to all municipal departments and units. Following a process of discussions and commenting throughout the municipal administration, the City Council made a decision in March 1997 on the formal establishment of a Local agenda 21 process according to the principles of the Aalborg Charter.

The specific primary targets in the preparation of the Local Agenda 21 Programme for Helsinki, defined in the City Council decision of March 1997, are the following:

- A) Reduction of greenhouse gas emissions in accordance with the national targets set by the government
- B) Protection and enhancement of biodiversity and green areas within the city area and preparation and preparation of a comprehensive Green Area Development Programme
- C) Strengthening LA 21 partnership and citizens' participation and involvement in all spheres of municipal administration
- D) Development of appropriate tools and methods for the as-

assessment and evaluation of sustainability, to be applied in the preparation of plans, programmes and activity reports by all municipal organisations

E) Implementation of suburban housing rehabilitation and renewal schemes with a strong emphasis on improved users participation and development of ecologically sound construction methods

City Council Decision 1997

The LA 21 decision by the City Council was a starting point for a full-scale multisectoral and comprehensive Local Agenda 21 process, involving all departments and units of the administration as well as citizens, the business community and their various organisations and interest groups, such as dwellers and neighbourhood associations, professional organisations, church communities, youth and student associations, environmental groups, sports and recreational clubs, school communities, the chamber of commerce, various enterprises etc. The stated objective of the City Council is to develop a genuine partnership between the municipal administrative and the civic organisations.

Overall coordination and supervision for the LA 21 process and the drafting of the LA 21 programme is the responsibility of a LA 21 Steering Committee, nominated in August 1997. The committee is chaired by the Lord Mayor of Helsinki, Mrs. Eva-Riitta Siitonen, and other members include all deputy majors and the heads of strategic departments. The operational coordinating unit (The LA 21 Project) has been established within the Environment centre. The project is working within cooperation with a network of about 60 LA 21 contact persons representing all municipal departments and organisations.

Thematic Working Groups Established

In April 1998 the LA 21 process reached an important stage when public participation processes were started with a large LA Forum and the establishment of 17 thematic working groups on sustainability. Each working group included 2-3 representatives of the municipal departments and 15-20 committed citizens representing various civic organisations and interest groups, including dwellers associations and neighbourhood groups, environmental organisations, trade unions and pro-

fessional associations, the business community, educational and research institutions, voluntary assistance and charity organisations, sports and youth clubs, recreational organisations, church communities etc.

The ideas and proposals of the thematic working groups were presented and discussed at a second LA 21 Forum in September, and a report published in January 1999. This report will be widely circulated both within the city administration as well as within citizens' organisations. The comments and views of all stakeholders will be presented on a third LA 21 Forum in June 1999.

The main outcome of the LA 21 process will be a comprehensive Sustainability (LA 21) Action Plan, which is planned to be presented to the City Council by year 2000, when Helsinki will be one of the 9 European cultural capitals. The Action Plan is going to be a long-term strategic programme, which will have a steering function in respect to all sectoral and thematic plans and programmes, e.g. land-use and transportation master plans, environmental protection programmes, housing programmes, economic programming, social and health sector programmes, educational programmes and international co-operation programmes etc.

Furthermore, the LA 21 process of Helsinki also includes various sustainability projects and campaigns on neighbourhood level. These activities are carried out by citizens LA 21 working groups, environmental NGO's, networks of local residents' associations, sports and youth clubs etc., and they receive some financial support and professional advice from the municipal administration. A so-called Green Flag Campaign for schools has also recently been started under Helsinki's LA 21 umbrella.

RESEARCH PROGRAMME FOR 1999

(according to the research budget)

CITY OF HELSINKI ENVIRONMENT CENTRE

Director General of the Environment Centre

- Helsinki's environmental history
- Ecoplan Viikki, continuation project: a survey of the area's flora, with the aim of studying the effect of building on wildlife.

Administration

- Internet as an implement of participation.

Environmental Laboratory

- Sediments in the Helsinki marine area - establishment of a sample bank and survey of hazardous substances.

Environmental Health Unit

- School food quality
- Effect of air pollutants on health
- Food establishment surface cleanliness project
- Food poisoning risks in ethnic restaurants, rice glutamine study
- Heavy metals in fungi
- Accomplishment of, and attitudes towards, self-supervision.

Environmental Supervision Unit

- Survey of laundry establishments and groundwater
- Ammonia studies on indoor air in municipalities
- Health hazards of dwellings in Helsinki
- Occurrence of industrial plants using volatile organic compounds and producing bad smells and an assessment of the hazards
- Groundwater area risk survey.

Environmental Protection Unit

- Street dust project
- Preparation of the GIS (Geographical Information System) - based Nature Information System
- Inventorying of biotopes referred to by the Nature Conservation Act

- Helsinki fauna atlas
- Prioritisation of restoration areas on polluted ground
- Viikki-Vanhankaupunginlahti, flow model
- Östersundom bays flora survey.

Water Research

- Developing the Viikinoja stream: water quality and quantity determination and the creation of wetlands in the Viikki ecological residential area
- Flow model for the River Vantaanjoki
- Areal master plan for the water supply from the River Vantaanjoki.

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Research about the environment in Helsinki is also conducted within other departments of the City Administration.

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at City of Helsinki Urban Facts.

City of Helsinki Urban Facts on the internet: <http://www.hel.fi/tietokeskus/>

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Additional data has been obtained directly from various departments of the City Administration!



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