CITY OF HELSINKI

Sustainable Energy Action Plan

Covenant of Mayors

Energy Savings Board

1.12.2010

City of Helsinki

Covenant of Mayors
Committed to local sustainable energy

Preface

During the preparation of Sustainable Energy Action Plan City of Helsinki participated a project called COMBAT, Covenant of Mayors in Central Baltic Capitals, together with cities of Riga, Stockholm and Tallinn. The aim of this project was to compare all aspects of working with sustainable energy action plans and collect best practices and lessons learned to a Report Guidelines for other Covenant cities.

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Abstract

The City of Helsinki has committed itself to reducing its greenhouse gas emissions by at least 20% from the 1990 level by the year 2020 in the fields of activity within the city's sphere of authority. In 2009, the total emissions covered by the Sustainable Energy Action Plan are approximately 9% lower and the per capita emissions approximately 22% lower than in 1990. Thus, the per capita emissions have already been lowered by more than 20% from the 1990 level. The achieved reduction in emission is a result of both long-term energy-saving work and changes in the production of energy. Decreasing the total amount of emissions has been made more difficult in the long term by the increase in the city's population.

The share of the city's own activity in the total amount of carbon dioxide emissions is approximately 14%. Even if the city were to decrease the emissions caused by its own activity by more than 20%, the effect on the total emissions in the city would only be approximately 3%. Therefore the measures have to focus on other sectors as well.

It is possible for the city to influence the carbon dioxide emissions caused by its own energy use, but it is also partly possible to influence missions caused by energy use in other sectors, through tools such as land use planning, traffic planning and the supply of advice services, and more generally by acting as a good example and spreading information on best practices. Approximately 34% of the emissions in the city are estimated to be within the power of the city.

This action plan presents measures for reducing the carbon dioxide emissions caused by energy consumption especially in buildings and in traffic. The most important methods are low-energy construction; the adaptation of energy-efficient technology in buildings, services and traffic; consolidation of the city structure; increasing the use of public transport and the number of pedestrians and cyclists; and different types of advice services in relation to energy-efficient living, working and movement.

The aim of the Covenant of Mayors is to reduce carbon dioxide emissions in cities by at least 20% in the fields administered by the city. This target is demanding, and reaching it will require seamless cooperation both within the municipal organisation and between different actors in the city. The role of the Finnish state is also important in reaching the goal.

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1 Covenant of Mayors

The Covenant of Mayors was launched in 2008 at the initiative of the Commissioner for Energy of the European Union. The City of Helsinki promoted the start of the covenant by arranging an international conference in Helsinki in November 2008. The Helsinki City Government decided to join the covenant in January 2009. By November 2010, more than 2,100 cities in Europe had joined.

The share of cities in the end use of energy in Europe is approximately 80%. The purpose of the Covenant of Mayors is to demonstrate the cities' activity and preparedness in the reduction of carbon dioxide emissions. The cities in the Covenant are committed to reducing their CO_2 emissions by at least 20% from the 1990 level by the year 2020. The commitment covers all energy use in the area of the cities under its jurisdiction. An important part of the commitment is to activate citizens and different sectors to get involved in reducing their emissions and developing measures for reduction.

In Helsinki, the commitment is a part of the long-term work in improving energy efficiency that started already in the beginning of the 1970s. Helsinki has participated in national-level energy efficiency agreements for four consecutive contractual periods. It has committed itself to a shared climate strategy together with the other cities in the capital region and prepared its own energy policy guidelines. Development work related to the reduction of CO_2 emissions has also been previously carried out, for instance in the action plans for sustainable development, ecological construction, air quality and traffic system planning. Since the 1990s, environmental programmes have also been drawn up. The Covenant of Mayors is in line with these commitments and action plans. The aims of the covenant are similar to these. The Covenant of Mayors collects together the measures listed in the earlier plans to reduce energy use and the resulting carbon dioxide emissions.

2 The Sustainable Energy Action Plan

The Sustainable Energy Action Plan (SEAP) presents the methods needed to reach the emission reduction target. The purpose of the action plan is to function as a practical tool for different sectors of the city in the implementation of the measures. For this reason, the plan intends to define for each measure its timetable, the responsible party, the effect on carbon dioxide emissions, the estimated costs of implementation, the required resources and other such matters.

The action plan has primarily been compiled from existing plans. These include, among others, the energy policy lines of the City of Helsinki; the action plan related to the City Energy Efficiency Agreement; the Metropolitan Area Climate Strategy 2030; the environmental programme of the City of Helsinki Premises Center; the

Ecological Construction Programme; and the Green Digital Charter. The reduction target for carbon dioxide emissions and part of the aims of the action plan have also been entered in the city's strategic plan for 2009–2012.

In the Covenant of Mayors, the cities have also committed themselves to submitting an action plan within one year of joining. An extension of the deadline for work on the action plan was applied for from the Covenant of Mayor's Office until the end of 2010.

2.1 Scope and limitations

The action plan deals with carbon dioxide emissions caused by energy use in the city area. In accordance with the instructions, the discussion has excluded

- greenhouse gas emissions generated in agriculture and waste disposal (energy consumption by buildings, vehicles and work equipment in these sectors is included)
- sea and air traffic (ferries in local traffic are included)
- the emissions trading sector (energy production of over 20 MW and industry)

With the exception of the emissions trading sector, the share of these sectors is not significant in the carbon dioxide emissions of Helsinki.

Helsingin Energia, which falls within the scope of emissions trading, carries out measures to reduce carbon dioxide emissions in accordance with its own development plan. Its measures have not been included in this action plan. The measures planned by Helsingin Energia are nevertheless presented briefly in Section 6, together with their effect on emissions.

The action plan includes measures by the municipal organisation itself and measures by other parties affecting energy consumption in the city area (e.g. the private service sector, the private housing sector, private car use).

The city is able to affect the implementation of measures in other sectors primarily by supplying advice services, by planning and normative steering, by financial incentives, by partnership programmes, by its own exemplary actions and through other forms of motivation. Municipal directives and orders as such are little used. The action plan presents informatively the potential reductions in emissions that could be achieved in other sectors if the same measures the city intends to take in relation to its own energy use were adopted.

2.2 Compilation of the action plan

The action plan has been prepared by a shared working group of HKR-Rakennuttaja and the Environment Centre. The working group has had discussions with several departments of the city government. These are for example: The City

Planning Department; the Building Regulation Department; the Premises Center of the Real Estate Department; the Procurement Centre; the Economic and Planning Centre; Helsinki City Transport; Helsinki Region Transport; and Helsingin Energia.

In addition to the parties that have already participated, the development of the action plan continues in cooperation with other city departments and with communities outside the city corporation.

Measures compiled from earlier action plans have been supplemented and will be supplemented further by naming responsible parties, by preparing estimates on timetables and on the effects on emissions; and through cost estimates.

The progress of the action plan's preparation has been supervised by the City of Helsinki Energy Savings Board, appointed to the role of a supervisory body.

2.3 Continuity after the completion of the action plan

The action plan is intended as a tool to be maintained and developed throughout the period of commitment. New measures and responsible parties can be added. Estimates of costs and effects on emissions can be updated, as can the situation regarding the implementation of measures. Conversely, measures can be also dropped if the timetable for their implementation is moved outside the timeframe of the Covenant or they are found obsolete, needless or otherwise unviable.

As the action plan is based on earlier action plans, the implementation of many measures has already started. Under the action plan, the state of each measure will be monitored to see which measures have been started, which have been completed and which are still awaiting their start.

The next phases in the development of the action plan are the involvement of civil society regarding the content and implementation of the measures and the charting of possibilities for cooperation between different interest groups in the city area. The timetabling of the measures' implementation is also being started next, together with the preparation of investment assessments.

2.4 Monitoring

The implementation of the action plan is monitored in Helsinki on two levels. The emission inventories calculated annually on the basis of figures such as the information collected on energy consumption and the estimated traffic numbers will show the realised amount of carbon dioxide emissions and the direction of development. Monitoring of the action plan shows which measures presented in the plan have been implemented.

Many of the measures presented in the action plan are not individual measures with a clear start and end date. Instead, they are changes in ways of acting and forms of

continuous activity. Their implementation can be monitored on an annual level by looking at indicators such as the number of training sessions and the number of people participating; information on the total area of buildings completed or renovated; and so on. The situation with the implementation of measures is monitored every year.

The Energy Savings Board monitors and supervises the implementation of the measures and the maintenance and development of the action plan. The Covenant of Mayors is on the agenda in nearly every meeting of the Board.

The Mayor is informed once a year on the progress of the measures related to the Covenant.

In the European Union, the implementation of the Covenant's aims is monitored by the Covenant of Mayors Office, where each city has a named contact person. The cities must report on the current situation in the implementation of the measures every two years. A new emissions inventory must be presented every four years.

3 The current situation with carbon dioxide emissions and the reduction target up to 2020

In the Covenant of Mayors, the reference year for carbon dioxide emissions is 1990. The development of the emissions is followed with both realised annual energy consumption figures and emission factors and with emission factors calculated as five-year averages. The examination of emissions presented with the corrected initial information usually shows the emissions' direction of development better than the absolute figures. The weather conditions in some years and the resulting differences in the production structure of electricity and in heat consumption are distributed evenly to more than one year. Due to the changing weather conditions, changes in the emission levels in isolated years can be so large that they hide from view the longer trend of change in the emissions.

3.1 Energy consumption

Energy consumption in Helsinki has grown by approximately 10% from 1990 to 2009. The use of electricity has grown the most, by nearly 22%. The consumption of district heating and heating electricity has also grown. Energy consumption by industry and work equipment has decreased significantly. Energy use in traffic and separate heating has decreased slightly. Energy use per capita has increased by approximately 5% from 1990 to 2009. The development of energy consumption by sector is presented in Figure 1.

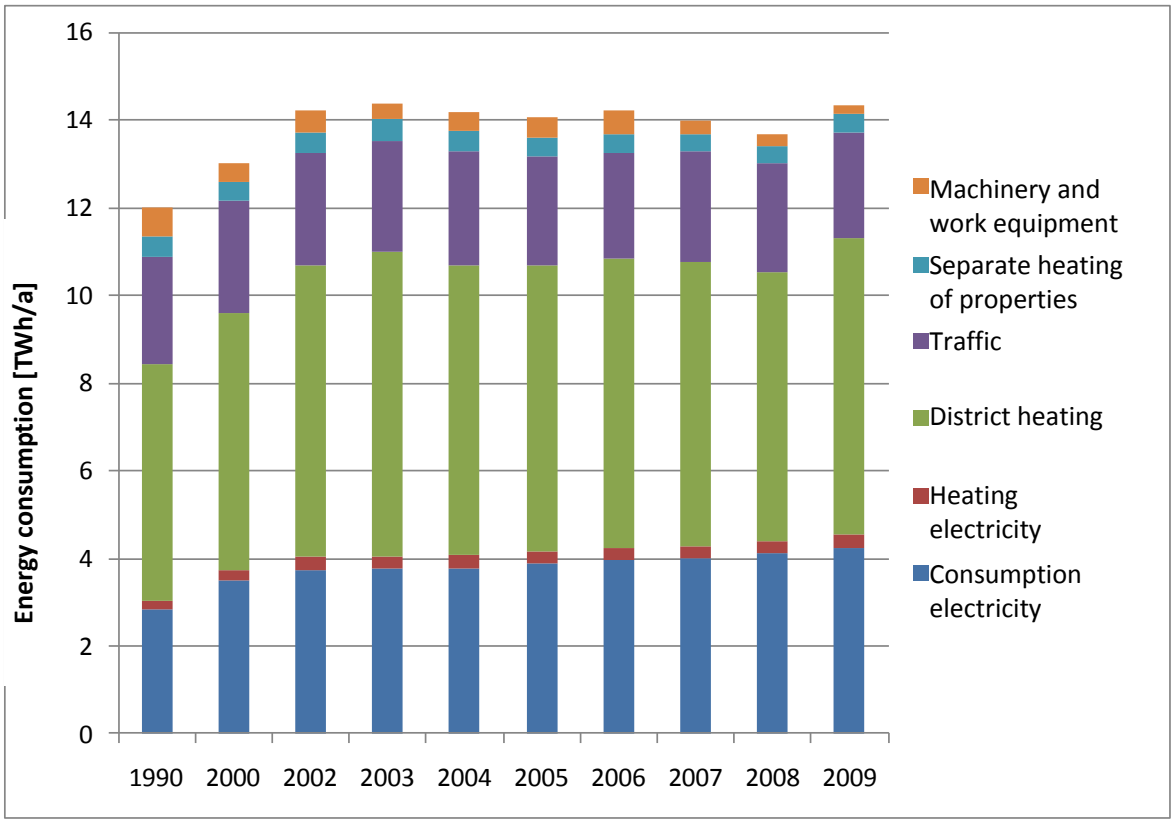

Figure 1. Energy consumption in Helsinki by sector in 1990 and 2000–2009.

3.2 Emission factors

In Finland and Europe, several accepted methods are in use for the calculation of carbon dioxide emissions from energy use. The benefit allocation method has been selected for calculating the emissions inventory. In Finland, a research project is in progress to define a commonly agreed model for the calculation of emissions, together with the emission factors on whose basis the calculation will be done in the future.

The emission factors do not take into account life-cycle effects, e.g. the CO_2 emissions from the production processes of fuels.

In Helsinki, district heating is produced locally in city's combined heat and power plants and partly also in heating plants. The electricity produced in the city's power plants is sold to the Nordic Power Exchange. The consumers of electricity can acquire it from the supplier of their choice. The assignment of the fuel energy of the combined heat and power plants and the deregulated electricity market hamper the calculation of emissions.

The carbon dioxide emissions from energy use in the city area have been calculated using the average emission factor from electricity production in Finland, and the emission factor for district heating has been calculated using the benefit allocation method from energy production by Helsingin Energia. In the weather-

corrected examination of emissions, the heat consumption of buildings has been corrected to smooth out the annual variation due to weather conditions. The emission factors have been calculated from five-year factors. The values of the emission factors are shown in Table 1.

Table 1. The emission factors used in the calculation of the emissions inventory (g_{CO2}/kWh).

	1990	2000	2006	2007	2008	2009
Electricity	233	182	244	255	207	186
District heating	295	210	210	218	210	210

3.3 The information and limitations used in the calculations

Calculations for the emissions inventory have used information on energy consumption collected

- for the city's annual internal energy reporting and the annual reporting of the energy efficiency agreement
- for the annual environmental statistics on the entire city area

For this reporting, the information is collected from sources such as the stock of buildings owned by the city; the consumption of heat and electricity in the stock of buildings; the fuel consumption of vehicles and work equipment owned by the city; the electricity consumption of outdoor lighting and traffic lights; total fuel consumption by traffic; and consumption of heat and electricity in the city area. The information is received from the consumption monitoring of the city's own properties; from Helsingin Energia; from the fuel consumption monitoring of the city's own traffic; from mileage figures; and from estimates of traffic volume. The required information is produced and collected in several city departments. It is collected together at HKR-Rakennuttaja and at the Environment Centre.

The limitations described in Section 2.1 have been observed in the calculations. In other contexts (e.g. the city's environmental report and the HSY calculations related to monitoring of the climate strategy), the calculations include the entire industry in the city area and the emissions from waste disposal and agriculture. For this reason, the figures are slightly higher in these cases.

3.4 The carbon dioxide emission inventory and the emission reduction target

Carbon dioxide emissions in the city area

The carbon dioxide emissions in the city area are examined from the viewpoint of all the energy being used up. The emissions are assigned to the location where the energy is used and not the location where it is produced.

Emissions calculations by sector are shown in Figure 2.

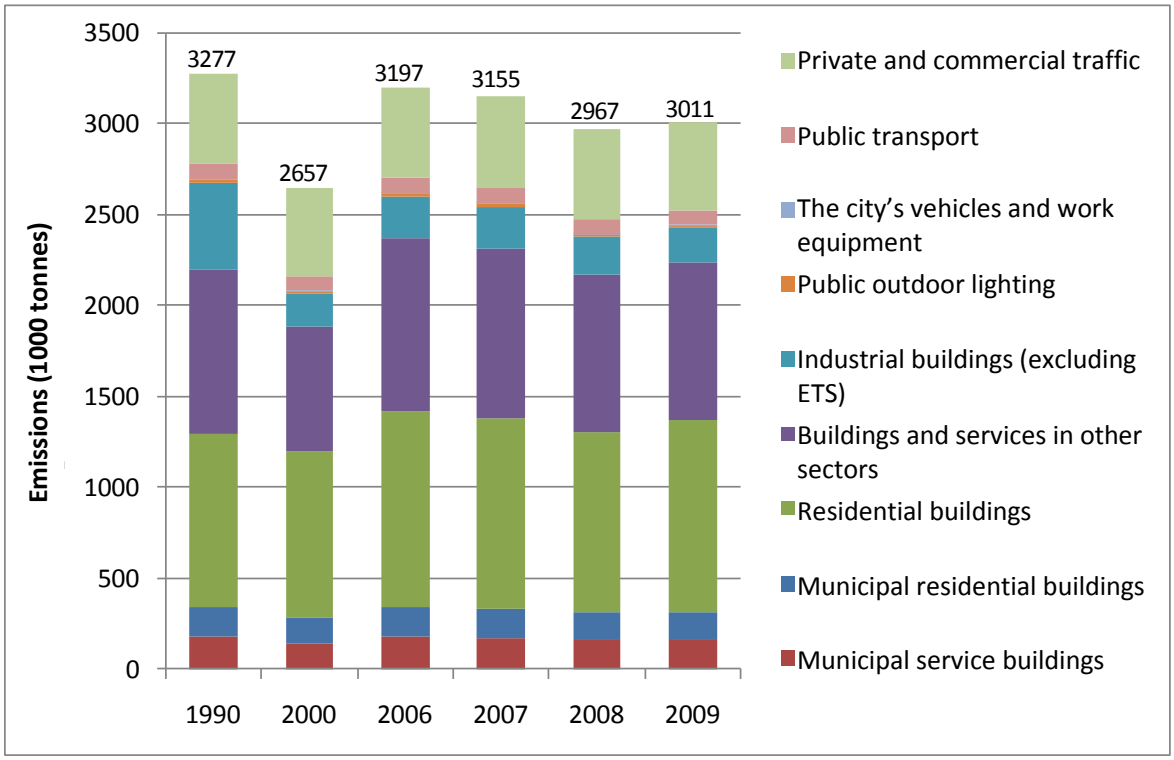

Figure 2. Emission inventory for 1990, 2000 and 2006–2009.

The figure shows that the total amount of CO_2 emissions covered by the Sustainable Energy Action Plan in 2009 was approximately 9% lower than in 1990. (Considering all sectors, emissions were approximately 13% lower in 2009 than in 1990.)

The City of Helsinki is committed to reducing its carbon dioxide emissions by at least 20% from the 1990 level. The numerical target for the level of carbon dioxide emissions can be calculated both from the total emissions and the per capita emissions. As the city area is being enlarged and the population, stock of buildings and amounts of traffic are all increasing, it is challenging to limit the total amount of emissions. For this reason the action plan also examines per capita emissions.

The carbon dioxide emissions target has been calculated by deducting 20% from the total 1990 emissions and by dividing the total emissions by the projected population. The maximum target values for the year 2020 are 2 621 thousand tonnes for the total emissions and 4.21 tonnes for the per capita emissions. Thus the reduction target for carbon dioxide emissions in the entire city area is at least 655.4 thousand tonnes.

The development of carbon dioxide emissions from 1990 to the present and the development of per capita emissions are presented in Figures 2 and 3. They show

both absolute emissions and the emissions according to weather-corrected energy consumption in heating.

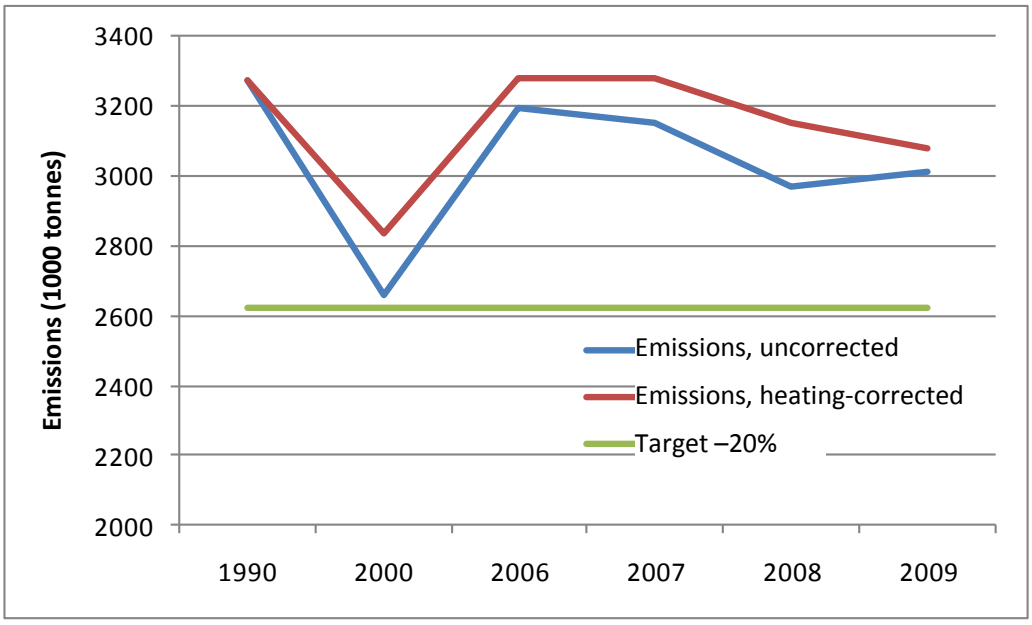

Figure 3. The development of total carbon dioxide emissions in Helsinki, 1990–2009.

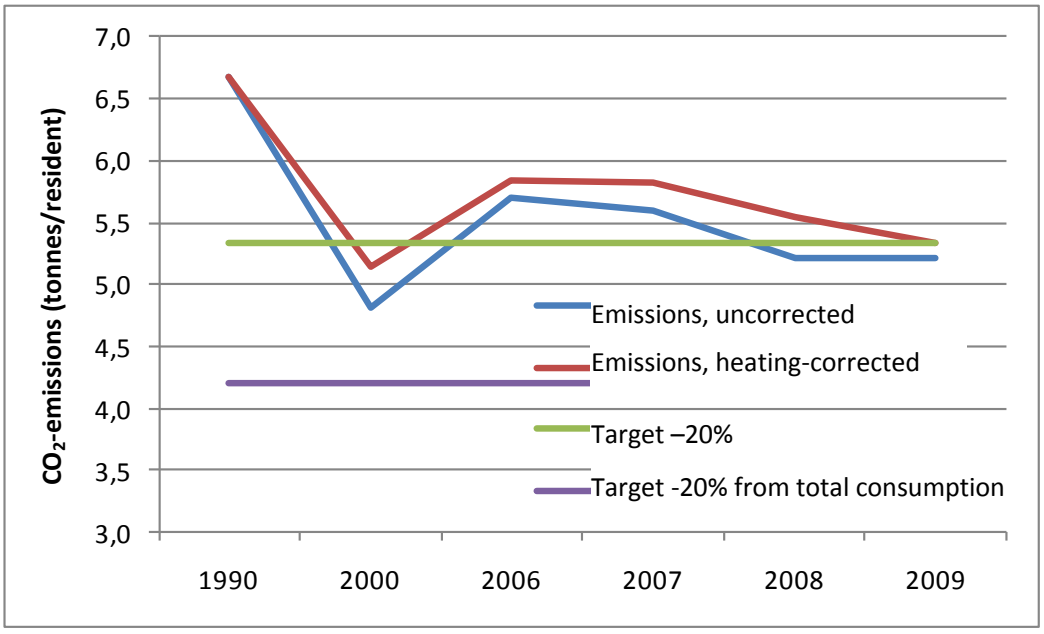

Figure 4. The amount of carbon dioxide emissions per capita in Helsinki, 1990–2009.

The figures presented graphically above are listed numerically in Table 2.

Table 2. Total carbon dioxide emissions and per capita emissions in 1990–2009 and the target for the year 2020.

	1990	2007	2008	2009	Target 2020
Total emissions (1000 tCO_2)	3 276,9	3 155,1	2966,9	3010,7	2 621,5
Population	490 872	564 521	568 531	576 632	631 000(e)
Per capita emissions ($kgCO_2$)	6 676	5 589	5 218	5221	4 155

The table shows that the total carbon dioxide emissions have been reduced between 1990 and 2009 by approximately 9%. At the same time, the population of Helsinki and the energy consumption have grown by more than 17%. The per capita emissions have been reduced between 1990 and 2009 by approximately 22%.

Carbon dioxide emissions within the power of the city

The carbon dioxide emissions within the jurisdiction of the city are the emissions caused directly by the city's own activity and the emissions from energy production. The city is indirectly also able to affect part of the emissions from traffic and from the stock of buildings not owned by the city.

The share of the city corporation from the CO_2 emissions of energy use in the city area is presented by sector in Table 3.

Table 3. The share of the carbon dioxide emissions in Helsinki by sector.

	City corporation (%)	Other sectors (%)
Housing	15	85
Services	16	84
Traffic	14*	86

*) Figure includes HSL public transport in Helsinki

On the basis of the table, it can be calculated that even if the city were to decrease the emissions caused by its own activity by more than 20%, the effect on the total emissions in the city would only be approximately 3%. Therefore the measures have to focus on other sectors as well. In addition to its own energy use, the city has the best opportunities to influence traffic and the personal use of energy of city residents. Land use planning and traffic planning also offer means for reducing carbon dioxide emissions in the entire city area.

The CO_2 emissions within the power of the city are:

- emissions from energy use in the residential and service buildings owned by the city
- emissions from energy use in public outdoor lighting
- emissions from energy use in the city's vehicles and public transport
- part of the emissions from energy use in other traffic
- part of the emissions from energy use in other buildings

As emissions from energy production have been excluded from consideration in this action plan, reductions achieved by measures in energy production have not been included in the following calculations. The effect of changes planned in energy production has nevertheless been assessed as a whole in Section 6.

The share of emissions within the city's jurisdiction is approximately 34% of the total emissions in the city area or approximately 1126.5 thousand carbon dioxide tonnes. The minimum emissions reduction target calculated from this is approximately 225.3 thousand tonnes. This corresponds to approximately 34% of the 20% target calculated from total emissions in the city.

The target is presented in Table 4.

Table 4. Total carbon dioxide emissions and per capita emissions within the city's power in 1990–2009 and the target for the year 2020.

	1990	2007	2008	2009	Target 2020
Total emissions (1000 tCO_2)	1 126,5	1 165,3	1 130,8	1 085,4	883,4
Population	490 872	564 521	568 531	576 632	631 000(e)
Per capita emissions ($kgCO_2$)	2 295	2064	1989	1882	1428

These figures are shown graphically in Figures 5 and 6.

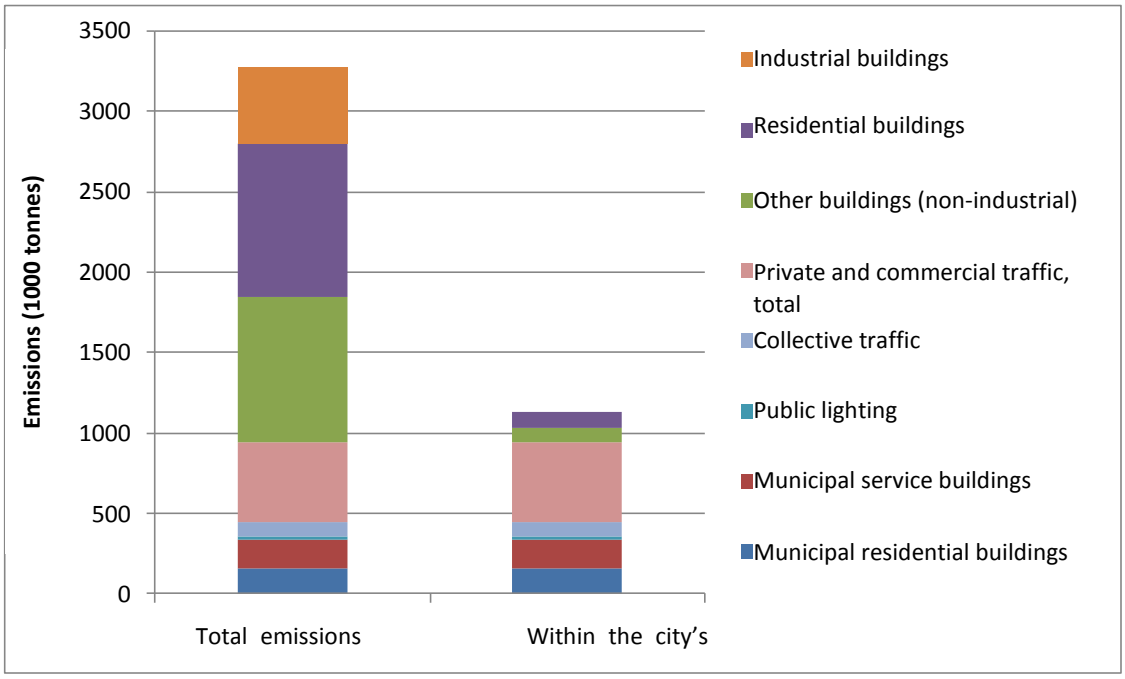

Figure 5. Emissions in the city area and emissions within the power of the city in 1990.

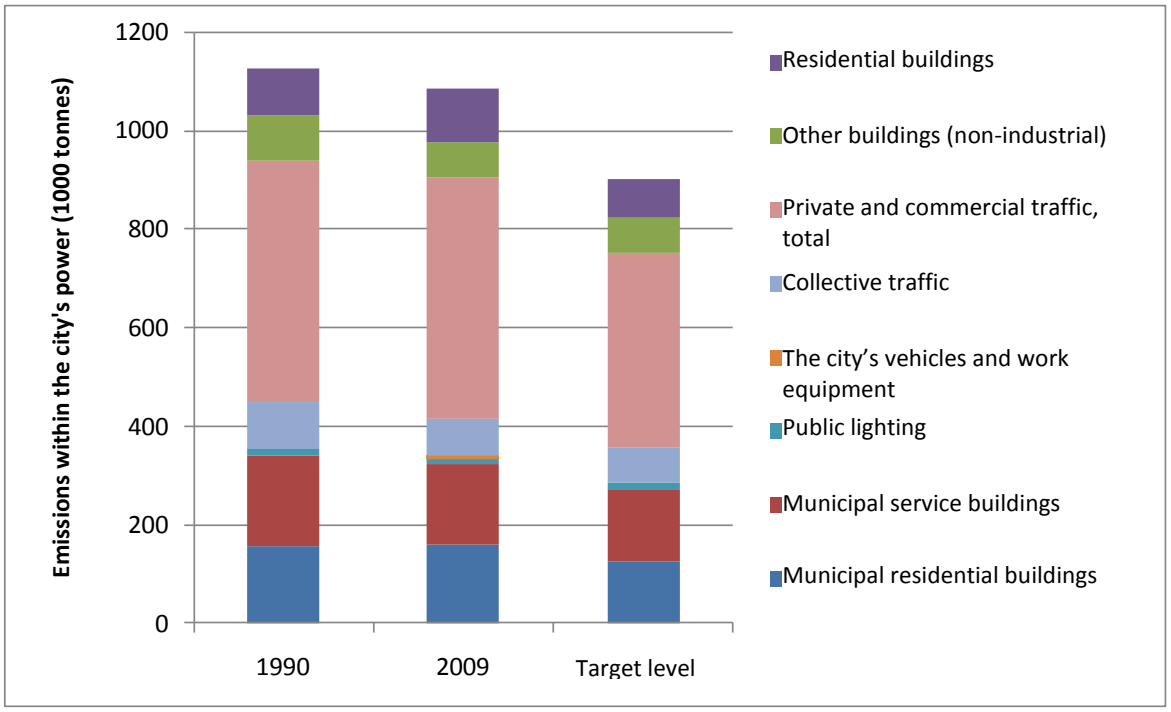

Figure 6. CO_2 emissions within the power of the city in 1990 and 2009 and the target level for 2020.

4 The means for reducing carbon dioxide emissions

4.1 Summary of measures

More than 70% of carbon dioxide emissions in Helsinki are caused by the energy consumption of buildings. Thus, the most important group of measures in reducing emissions is the reduction of energy use by buildings. Measures related to this include: low-energy construction in both new buildings and renovations; individual energy-saving investments and repairs; and the efficient use of the technical control and adjustment systems of the buildings. The implementation of these measures requires the preparation of detailed planning instructions; the training of planners and builders; and the training of operation and maintenance personnel. The users of the buildings and the maintenance personnel need more information in more detail on the energy consumption of the buildings and the possibilities for saving energy.

The second largest source of carbon dioxide emissions in Helsinki is traffic. The share of passenger cars and commercial traffic is 85% of traffic emissions. Measures to reduce traffic emissions are: increasing the share of public transport, pedestrians and cyclists; decreasing the fuel consumption of vehicles; and the use of renewable fuels. Increasing the share of public transport, pedestrians and cyclists requires, among other things, increasing the efficiency of the rail network; improving crosstown traffic; improving the opportunities for park-and-ride; and the location of new service buildings in places accessible to good public transport and facilities for pedestrians and cyclists.

In relation to land use and city planning, the most important measures in addition to traffic planning include: condensing the urban structure; making the permit practices and the conservation and city planning regulations more favourable to energy efficiency and the small-scale production of renewable energy; and the addition of energy efficiency and energy form requirements to the conditions for land allocation.

In Helsinki, there is as yet only little local production of renewable energy. Quantitatively, the most popular forms of local production are probably the air source heat pumps used in single-family houses, and as an actual form of heating, the ground source heat pumps and heating with wood. In some individual buildings there have been experiments in the production of electricity with solar panels or small-scale wind power, as well as the heating of household water with heat produced with solar collectors. In the area of the district heating network, buildings are encouraged to use district heating.

The measures listed also include: the development of partnership programmes together with industry and commerce; participation in experimental projects and the adaptation of the good practices that emerge; participation in the development of

new funding practices; and the encouragement of individual actors to promote energy efficiency.

The measures are presented by actor in some more detail in the following sections. The more detailed breakdown of the measures is in the accompanying table.

4.2 The city's measures to reduce CO_2 emissions from its own activity

Building of service buildings and residences

The aimed is to use the facilities as efficiently as possible. According to current practice, the opportunities for using existing facilities and making them more efficient are charted when new needs arise.

Currently, all residential and service buildings either newly built or undergoing refurbishments are built as low-energy buildings. Methods are being developed so that the service buildings will be built as nearly zero-energy buildings in the future and the residential buildings as passive-energy buildings by the 2020s.

When energy-efficient public construction is the goal, the supervision of planning and building has to be developed, new methods have to be created for the financial supervision, planning and acceptance of buildings; and new technical solutions have to be adopted. Experiences will be gathered from pilot projects for developing construction practices in buildings either newly built or undergoing refurbishments.

The good energy efficiency of the buildings is ensured and verified in the acceptance phase and when the buildings are taken into use. To transmit information related to the buildings' ways of use to their users and their maintenance personnel, new practices have to be created. Among other things, the preparation of instructions for use and guidance in use has to be developed further.

Use and maintenance of buildings

A key method for ensuring the energy efficiency of buildings during their use is the efficient and active monitoring of consumption. The technical opportunities related to metering of energy consumption, the reporting practices and the utilisation of consumption information will be developed so that changes in consumption are easily detected and can be quickly reacted to.

Energy audits function as a tool for charting potential energy savings in both residential and service buildings. The implementation of the measures that emerge in the audits will result in significant energy savings each year. The experiences from the audited sites can be utilised in other buildings too, but this demands the development of maintenance procedures, training in building maintenance and new technical solutions.

The actions of the buildings' users have a key role in achieving energy efficiency. To improve the energy efficiency of the IT environment, training of staff is continued and developed further. Energy efficiency is also taken into account in the equipment's settings and use. It is intended to motivate users to energy saving through active guidance and the transmission of information on the best practices.

Municipal street lighting

The energy efficiency of outdoors lighting is improved by utilising new fixture and lamp types in maintenance and in new installations.

Local energy production

The first pilot projects in solar energy have been implemented in the city's own buildings. The opportunities of using renewable forms of energy are charted by examining the opportunities of using ground source cooling outside the district cooling area and of implementing small-scale wind power plants. More wide-ranging projects will be realised on the basis of the experiences gathered.

Public procurements

In the public sector, a significant amount of energy-using equipment and services (e.g. transportation, nursing and meal services) are procured every year. The city also uses planning and consulting services that affect the energy use of new service buildings being built, among other things.

In the city's own procurements, the aim is to promote material efficiency, energy efficiency and low emissions. The best practices in procurements are found out; the guidelines for energy efficiency are developed; and energy efficiency is adopted as one of the criteria for procurement in individual and collective procurements. In the procurement of services, energy efficiency is emphasised. Expertise in the energy field is taken into account in the competitive tendering of planning, construction and maintenance services.

Transportation

Traffic emissions caused by the city's own actions are reduced by replacing old vehicles with low-emission ones and by taking energy efficiency into account in the acquisition of vehicles and the training of drivers. Logistics planning has a great significance in the reduction of emissions. Reducing the amount of transportation and sharing the use of vehicles can result in energy savings. Municipal employees are motivated to walk, cycle or use public transport when commuting.

Business policy and expertise

To develop new models of acting and new technical solutions, the city will participate in development and cooperation projects related to energy efficiency. The experiences received will be utilised in the city's own activities and by informing the residents.

4.3 Measures to reduce other CO_2 emissions in the city

Buildings and properties other than those owned by the city corporation

The city guides private-sector builders towards low-energy construction by leading the way in the city's own projects and by offering advice By setting a good example, the city will encourage owners of properties in the private sector to join energy-efficiency agreements, commission energy reviews and realise energy-saving measures.

Advice on energy efficiency

The city will offer information on efficient energy use to residents, businesses and other local groups, motivating them towards energy efficiency. The information can be used to commit the entire community to energy saving. It is important that the public sector sets a good example in the activities to promote energy efficiency.

The aim is to affect the energy use of residents by offering advice and training in relation to construction and the energy use of buildings. Services are developed and made more wide-ranging and the opportunities to receive information are improved, for instance in relation to energy efficiency in traffic.

New ways of distributing information are developed to enable the experiences of good planning, construction and procurement practices in public-sector building, as well as the models created in the city’s pilot projects, to set an example to the private sector.

Local energy production

The adoption of renewable energy sources and other low-emission heating technologies is promoted outside the district heating network by giving guidance to private-sector property owners.

Land use and community structure

The strategic decisions related to the development of the city area affect the city structure and reduce energy use in traffic. Condensing and consolidating the city structure, increasing supplementary construction and promoting ecological sustainability in city planning are key measures in the Helsinki area.

Energy efficiency is also a key aim in the planning of new areas. Several pilot area projects are in progress, developing new ways of acting in relation to energy efficiency requirements and the use of renewable energy sources. The experiences will be utilised in land use planning and in guidelines for construction.

The aim is to reduce the use of passenger cars through the methods of traffic planning, e.g. by increasing rail traffic, improving crosstown traffic and developing the facilities for pedestrians and cyclists. When new areas are planned, alternative traffic systems are compared and the location of service buildings is centralised, taking public transport into account.

Traffic

The development of facilities for pedestrians and cyclists and the service level of public transport are key factors in decreasing the use of private cars.

Public transport will be made more attractive, for example by making it operate faster; by keeping ticket prices competitive; and by developing the routes, the opportunities for park-and-ride, the commuter ticket benefit, timetable information and request-guided traffic. The traffic of the oldest and most polluting vehicles in the downtown area will be limited through the creation of environmental zones.

Business policy and expertise

To develop new models of acting and new technical solutions, the city will participate in development and cooperation projects related to energy efficiency. The experiences received will be utilised in the city's own activities and by informing the residents.

Other sectors and fields

Private actors are encouraged to realise models of acting that promote energy efficiency.

4.4 Measures to reduce CO_2 emissions in the other sectors

Energy use in buildings

A significant share of the stock of buildings in the city is not municipally owned. If energy efficiency is improved in these buildings according to the city's example, for instance by carrying out refurbishments aiming at a low level of energy, making special energy-saving investments, developing the monitoring of consumption and improving maintenance activity, this will have a significant effect on the CO_2 emissions in the city.

The most important individual actor in this sector is the Finnish state, which is able to to influence energy efficiency by means such as energy-efficiency agreements in the building and property field; building regulations; energy certificates; tax policies; and energy subsidies. The environmental classifications of buildings and the environmental supervision systems in the property field are other means of increasing property owners' activity in promoting energy efficiency.

A significant role is played especially by all property owners, parties responsible for building maintenance and parties responsible for the planning and implementation of renovation projects. Significantly increased resources are needed to train these groups and to motivate them to improve energy efficiency in their properties.

Traffic

It is possible that emissions from traffic will decrease by more than the targeted 20% by 2020.

National-level measures to increase the share of biofuels in traffic fuels have a significant role also in the reduction of emissions from Helsinki traffic. If the Finnish state's aim of increasing the share of renewable energy sources in traffic fuels to 20% by the year 2020, this alone will reduce CO_2 emissions from traffic in Helsinki by the corresponding amount.

Newly registered cars consume approximately 15% less fuel than the existing stock of cars. Due to this, significant reductions in emissions can also be expected from the renewal of the stock. The CO_2 tax entering into force in 2011 will also speed up the renewal of the stock of cars to a low-emission one.

The Ministry of Transport and Communications is currently preparing a proposal for congestion charges in the Helsinki area. If realised, the congestion charge will reduce emissions.

4.5 Assessment of the measures' effect on emissions

The effect of the measures on energy consumption has been assessed separately for each measure. Among other things, the calculations are based on the current stock of buildings; the estimated renewal of buildings on the basis of realised new construction and renovations; the target values for energy consumption; the effects of energy-saving measures taken on the basis of energy reviews; and so on.

All the calculations on the measures' effects on emissions are rough estimates that will be made more accurate as the need arises. For all measures it was not possible to collect the initial information needed in the calculation of effects. For this reason, the effects of these measures have not been estimated at this stage.

Many of the planned measures for reducing emissions are focused on improving the energy efficiency of new areas. In these cases, the reductions have been calculated from energy consumption not yet realised. This leads to some illogicality in the calculations: the future savings have been estimated, but the future growth in energy consumption has not been taken into account. However, in the first version of the Sustainable Energy Action Plan, the share of these measures in the calculated total reductions in emissions is still slight.

The reduction in carbon dioxide emissions resulting from energy savings has been calculated with the same emission factors as in the emission inventory calculations. Renewable energy has been expected to replace current or similar energy consumption, examined measure by measure. Thus, possible future changes in the production structure of energy have not been taken into account when estimating the effects on emissions, except in the estimate presented at the end of Section 6.

The effects on carbon dioxide emissions from traffic have not been assessed individually for projects currently being drawn up for traffic planning in the capital

area. As the area has a shared traffic system, the assignment of effects on emissions to individual cities is very difficult.

4.6 Potential reductions in emissions

The potential reductions in emissions achievable through the measures presented in the Appendix are listed in Table 5.

Table 5. The measures to reduce carbon dioxide emissions. CALCULATIONS PARTLY UNFINISHED

	The city's own		Other sectors		Total	
	tCO_2	%	tCO_2	%	tCO_2	%
Buildings	97 000		225 700		322 600	
Advice			23 500		23 500	
Local energy production			1 100		1 100	
Procurements	8 900				8 900	
Land use			34 000		34 000	
Traffic	15 100		252 400		267 500	
Other						
Total	121 000		513 200		657 600	

5 New measures to reduce carbon dioxide emissions

This action plan has proposed measures to achieve a total reduction of 20% in the CO_2 emissions in Helsinki. However, the city has no means for ensuring that all the proposed measures are undertaken, especially in the private building sector, in private services and in households.

As the city grows, energy consumption will also grow as the amount of residents, services, buildings and traffic increases. Because of this growth, the measures proposed in this action plan will no longer be sufficient by 2020 to reach the 20% target. It is therefore necessary to find new measures to improve energy efficiency and to reduce carbon dioxide emissions.

The environment in which energy efficiency is to be promoted and carbon dioxide emissions reduced is changing fast. Among other things, this environment is affected significantly by measures undertaken by outside parties and by the market price of energy. The legislation and steering measures of the Finnish state have an especially significant role. The investments required to implement the measures and the cost effects of the reductions in emissions will change with the environment. Therefore the financial profitability of the measures will also vary.

6 Measures by Helsingin Energia to reduce CO_2 emissions from energy production

The development programme of Helsingin Energia published in 2010 includes a list of measures to reduce emissions from energy production by 20% from the 1990 level by the year 2020. In the year 2050, energy production will be carbon neutral. Among other things, these measures include wind power investments in offshore wind parks and the acquisition of biomass gasifiers for the Hanasaari and Salmisaari power plants in 2014–2018.

If the measures listed in the development programme are implemented as planned, they will have a significant effect on the carbon dioxide emissions from energy use in the city. At the current level of energy consumption, their effect on the total emissions in the city is a reduction of approximately 7.4%* from the 1990 level. In addition, other changes in the structure of electricity production on a nationwide level are likely to reduce carbon dioxide emissions from the use of electricity. If realised, the changes in energy production will slightly reduce the effect on carbon dioxide emissions of the measures achieved by making the end use of energy more efficient. The estimated total effect of the measures in the Sustainable Energy Action Plan is approximately 19%.

*) the calculation is based on emissions from energy production in 2007 and the total emissions from energy use in the city

7 Conclusions

The share of the energy use of the City of Helsinki's own activities is approximately 14% of all carbon dioxide emissions in the city. It is clear that the city cannot achieve reductions of 20% in the carbon dioxide emissions in the city merely by making its own energy use more efficient.

The city can also affect carbon dioxide emissions in other sectors through measures such as land use planning, land allocation terms, traffic planning, the service level of public transport and the supply of advice services. Through land use planning and land allocation conditions, the city is primarily able to affect emissions caused by new buildings. Conversely, the city currently has no means of improving energy efficiency in existing buildings. Emissions in this sector are a significant part (approximately 70%) of the total emissions in the city.

Approximately 34% of the emissions in the city can be said to be within the power of the city. Here, the energy consumption of the city corporation, the traffic in the city area and part of the energy consumption of other buildings is taken into account.

The most important means for achieving the targeted reductions in emissions are measures to reduce energy consumption in buildings and in traffic and the city planning aiming at tightening the city structure. The city's actions in the planning of new residential areas, in new construction and in the low-emission requirements of new public transport vehicles are steps in the right direction. However, more measures should be directed at improving the energy efficiency and emission levels of currently existing services and functions. As the city grows, energy consumption will also inevitably grow. Even if the new functions are implemented with as low a level of emissions as possible, the focus of energy use and carbon dioxide emissions will stay on the currently existing buildings and services for several decades to come.

More measures are needed especially in improving the energy efficiency of existing buildings. At its simplest, this means improving efficiency in the buildings' use and maintenance and realising financially viable energy-saving measures. The implementation of even these kinds of measures requires better than current expertise in the maintenance and ownership of buildings. To reach the targeted reductions in emissions in the long term, even some measures whose financial profitability is weak must be carried out in the buildings. The implementation of such measures in the private sector requires financial support; legislative or tax-incentive-related methods of guidance; and the supply of advice and services.

From the viewpoint of carbon dioxide emissions in Helsinki, the measures presented in the development programme of Helsingin Energia are extremely important, as the city can use them to affect emissions from all energy use in the city with the exception of traffic emissions.

The aim of the Covenant of Mayors is to reduce carbon dioxide emissions in cities by at least 20% in the fields belonging to the city's tasks. This target is demanding, but it is likely that even more stringent targets will be set for the development of carbon dioxide emissions in the future. Thus, the future development of the Sustainable Energy Action Plan must prepare to exceed the current targets. Reaching the current target requires seamless cooperation both within the municipal organisation and between different actors in the city. It is important that all the functions of the city support reaching the goal as well as possible. It is equally important to develop functional forms of cooperation with other actors in the city, enabling the emission reduction target to be reached in all sectors and as the result of cooperation between all actors in the area.