

First Global District Energy Climate Awards

Award application of Helsinki Energy DHC/CHP systems

Helsinki is the capital of Finland located at 60° altitude. It's world's northest capital with the population at 600 000. Helsinki Energy is owned by Helsinki City and it is a municipal company.

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District Heat

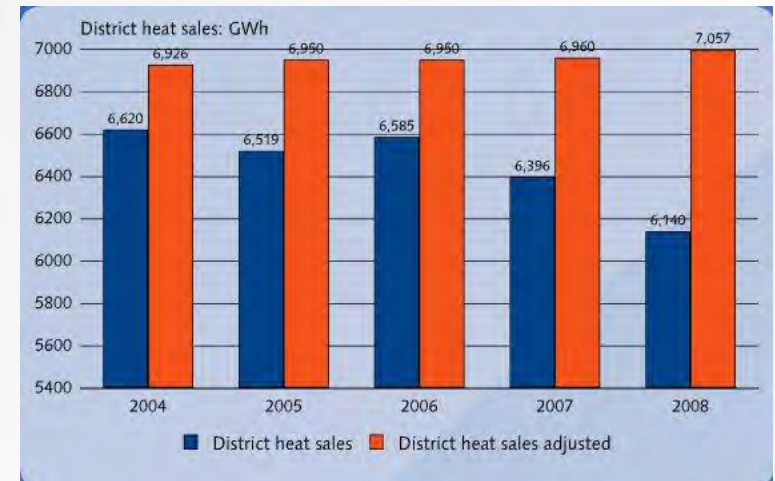
A quarter of Finland's District Heat

Helsinki Energy is the largest energy company in Finland producing, distributing and selling district heat.

The district heat supplied by Helsinki Energy constitutes approx. a quarter of the district heat supplied in the entire country.

More than 90 per cent of the capital's heating requirement is covered by district heat.

District heat is produced by combined heat and power generation efficiently and in an environmentally benign way.



Power Plants

Vuosaari

Vuosaari A

Commissioned:	1991
Electric power output:	160 MW
Heating output:	160 MW
Efficiency:	91 %
Fuel:	natural gas

Vuosaari B

Commissioned:	1998
Electric power output:	470 MW
Heating output:	420 MW
Efficiency:	92 %
Fuel:	Natural gas



Power Plants

Hanasaari

Hanasaari B

Commissioned:	1974, 1977
Electric power output:	228 MW
Heating output:	420 MW
Efficiency:	85 %
Fuel:	Coal



Power Plants

Salmisaari

Salmisaari A

Commissioned:	1953 (1986)
Electric power output:	-
Heating output:	180 MW
Efficiency:	92 %
Fuel:	Coal

Salmisaari B

Commissioned:	1984
Electric power output:	160 MW
Heating output:	300 MW
Efficiency:	88 %
Fuel:	Coal



The Katri Vala heating and cooling plant

Massive heat pump plant

The plant is the largest in the world to use heat pumps to produce district heating and district cooling from both purified sewage water and sea water.

Its output is 90 MW of district heating and 60 MW of district cooling. This is enough to heat a small town.

The plant is located in a space excavated underneath the Katri Vala park in the district of Sörnäinen.



The purified sewage water pump

District Heat

Reliable heating

The distribution reliability of district heat is high and the cut-offs are rare.

The heating network is designed so that district heat can be distributed via several routes.

The most important transmission pipelines are located in tunnels.

The DH-business activity is profitable.

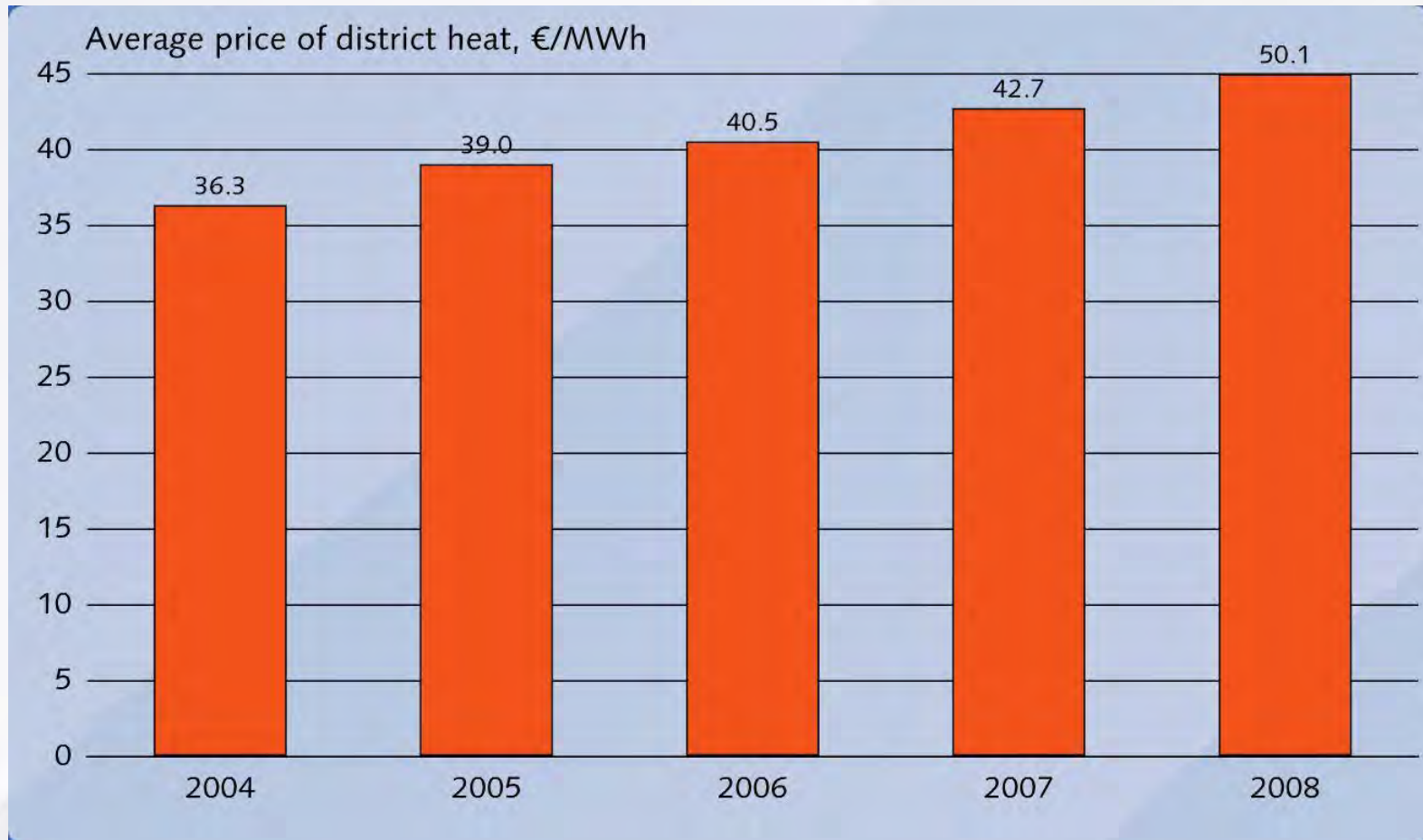


Helsinki Energy's DHC- district heating and cooling is a convenient and environmentally friendly method

- The benefits of DHC includes ease of maintenance, affordability and environmental friendliness. Energy produced through CHP+CDC achieves fuel savings. The concentration of heat generation in power plants has also contributed to a substantial improvement in urban air quality.
- DHC is suitable for the heating of buildings of all types and sizes, and both old and new buildings can be connected
- Helsinki Energy is the largest Finnish company engaged in the sale of district heating.
- Helsinki Energy sells 6 800 gigawatt hours of heat per year to more than 13 600 customer facilities, the bulk of which are residential buildings. District heating cover approx. 93% of Helsinki's total heating energy demand.
- Also in economic terms, district heating is the best and safest option for the customer in Helsinki.
- In the case of single-family dwellings, it is usually houses located close to the existing district heating network that are connected to the district heating network.
- Helsinki DH has all its history been business based. Customers have been connected at voluntary bases. Price level is competitive .

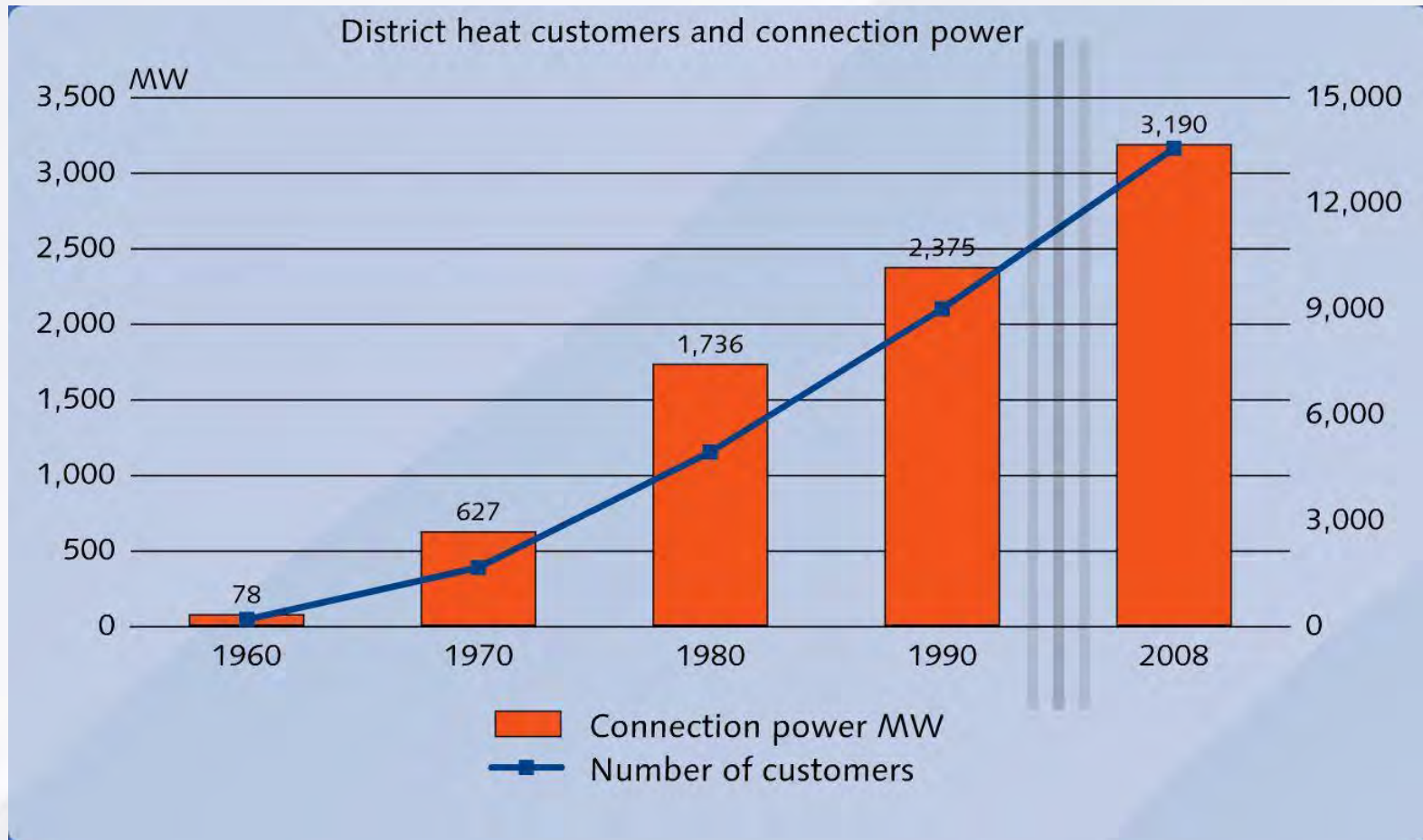
District Heat

Price of district heat



District Heat

Customers



Sustainable development as early as the 1950s

- The City of Helsinki's power plant began to supply district heat to companies and homes in Helsinki in the middle of the 20th century. The first customers to sign an agreement in the winter of 1953 were Lindström's laundry (14 January 1953) and the city's slaughterhouse. In November 1953, the city council decided that Helsinki should be engaged in large-scale district heating with CHP and charged the electric utility Helsinki Energy with its implementation.
- At first, district heating customers were supplied with steam heat. The first water district heat customer, Perhonkatu Hotel and Restaurant School, was connected to district heating in 1957. In the early stages, district heating operations faced a number of technical problems and were looked upon with suspicion even by leading electricity experts.
- After initial difficulties, district heating soon became common, however, and was established as a key part of the city's energy management in the 1960s and 1970s. As a result of the energy crisis in the 1970s, district heating was accepted without controversy. Today 93% of buildings in Helsinki are heated with district heating. Measured with the volume of heat delivered, Helsinki is one of the major cities using district heating in Europe. The building volume of district heated buildings is over 170 Mm³ and floor area over 60 Mm².

Production capacities

Production capacities of power plants located in Helsinki

Power plants

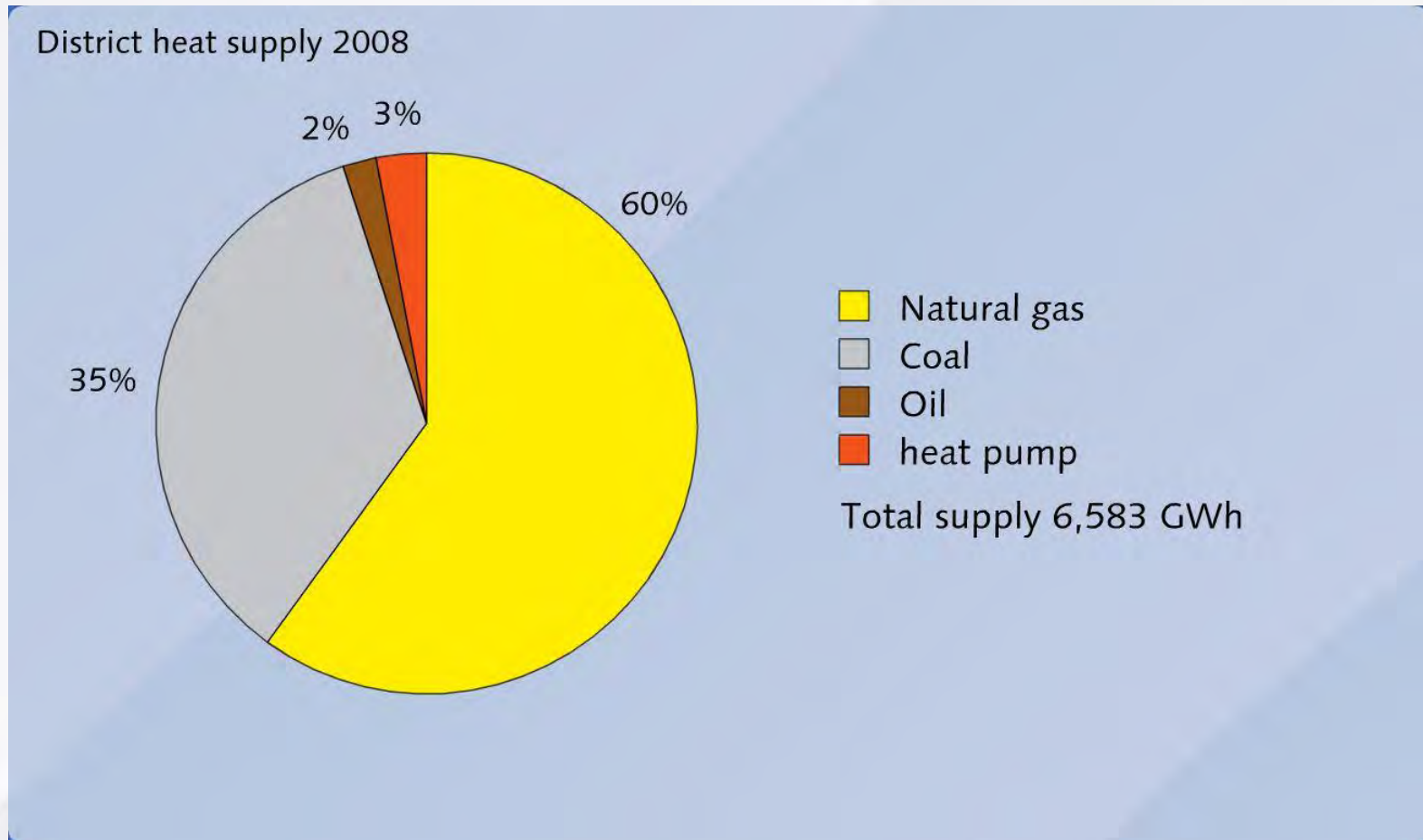
	Electric power output (net) MW	Heating output(net) MW
Vuosaari A	163	170
Vuosaari B	468	442
Salmisaari B	150	320
Hanasaari B	212	400
Kellosaari	118	
Total	1 111	1 332

Heating plants

Salmisaari A	170
Heating plants	1 760
Katri Vala heating and cooling plant	90
Metangas boiler (landfill)	2
Total	1 932

Production

District heat supply



Connecting to the district heating network is a smart choice

- The operational reliability of Helsinki's district heating network is excellent. The heating network has been built in such a way that heat can be delivered to the customer using several separate routes, if needed. At present, the total length of the district heating network is 1 300 kilometres. About 30 kilometres of new district heating network is being built annually. District heating is convenient. Once a building is connected to the district heating network, the heating equipment can last for years with minimal maintenance required. 50 km of main pipes are located in rocktunnels under the city. District cooling uses the same tunnels for main pipes under the city center. Annual heat losses of the network are 6,5%
- Annual cut-off times in DH are under 3h/customer. Over 95% of that is informed to the customers 1-2 days before the cut-off. The age of the network is 1-50 years and annual renewals of the pipelines are 5 kilometers.
- In DC all cut-offs are informed to the customers beforehand.

City of Helsinki, District Heating Area

(coloured areas are district heated)



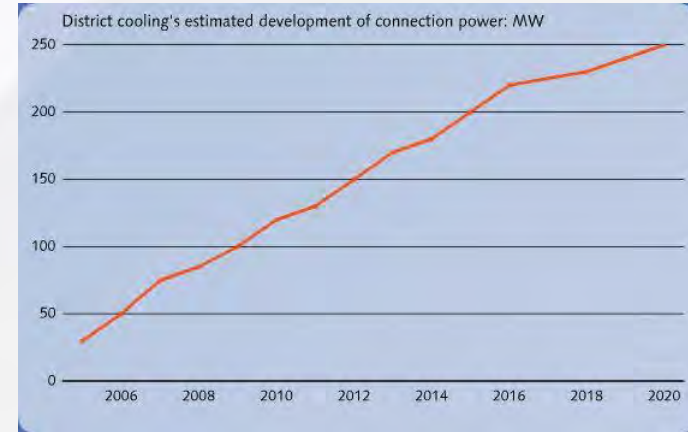
District Cool

District cooling is expanding in Helsinki.

It substitutes locally produced cooling.

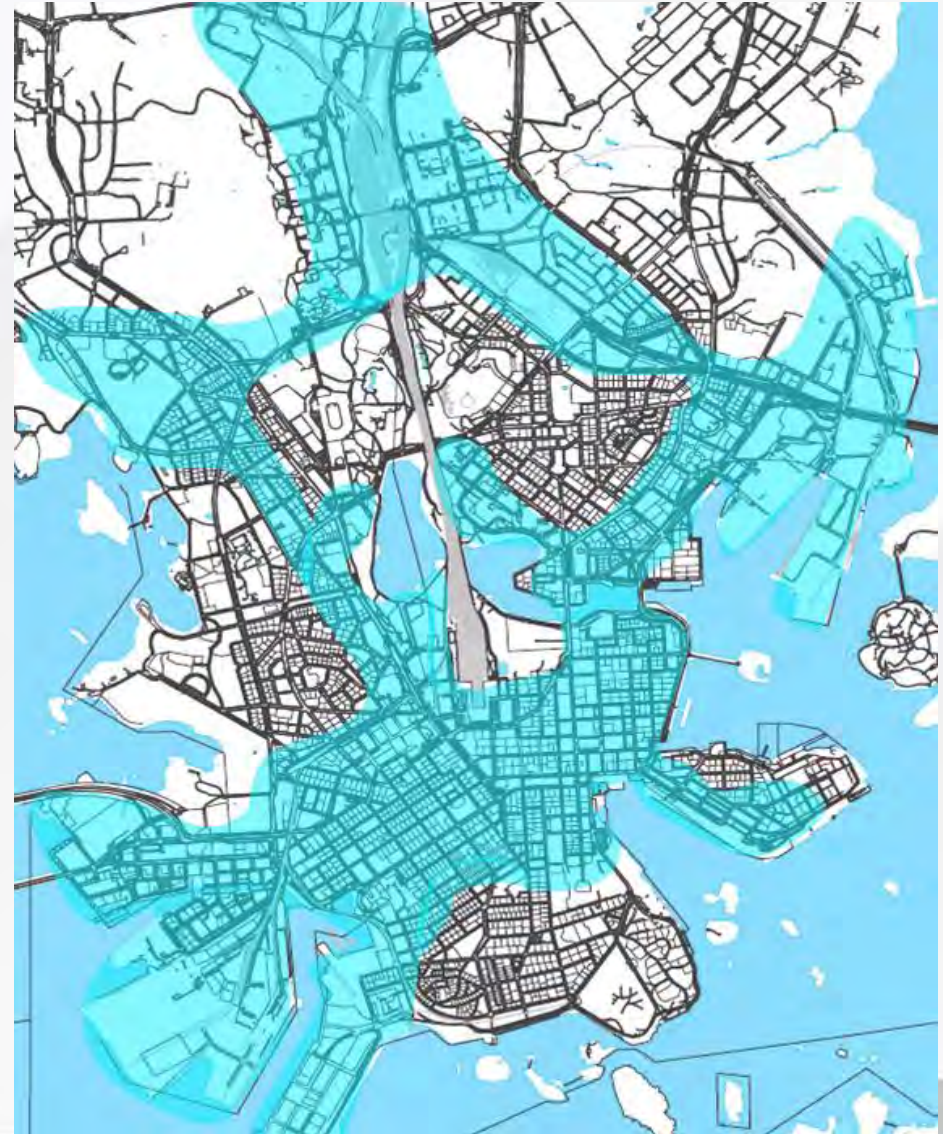
It saves energy and conserves the environment.

It is produced in an environmentally benign way.

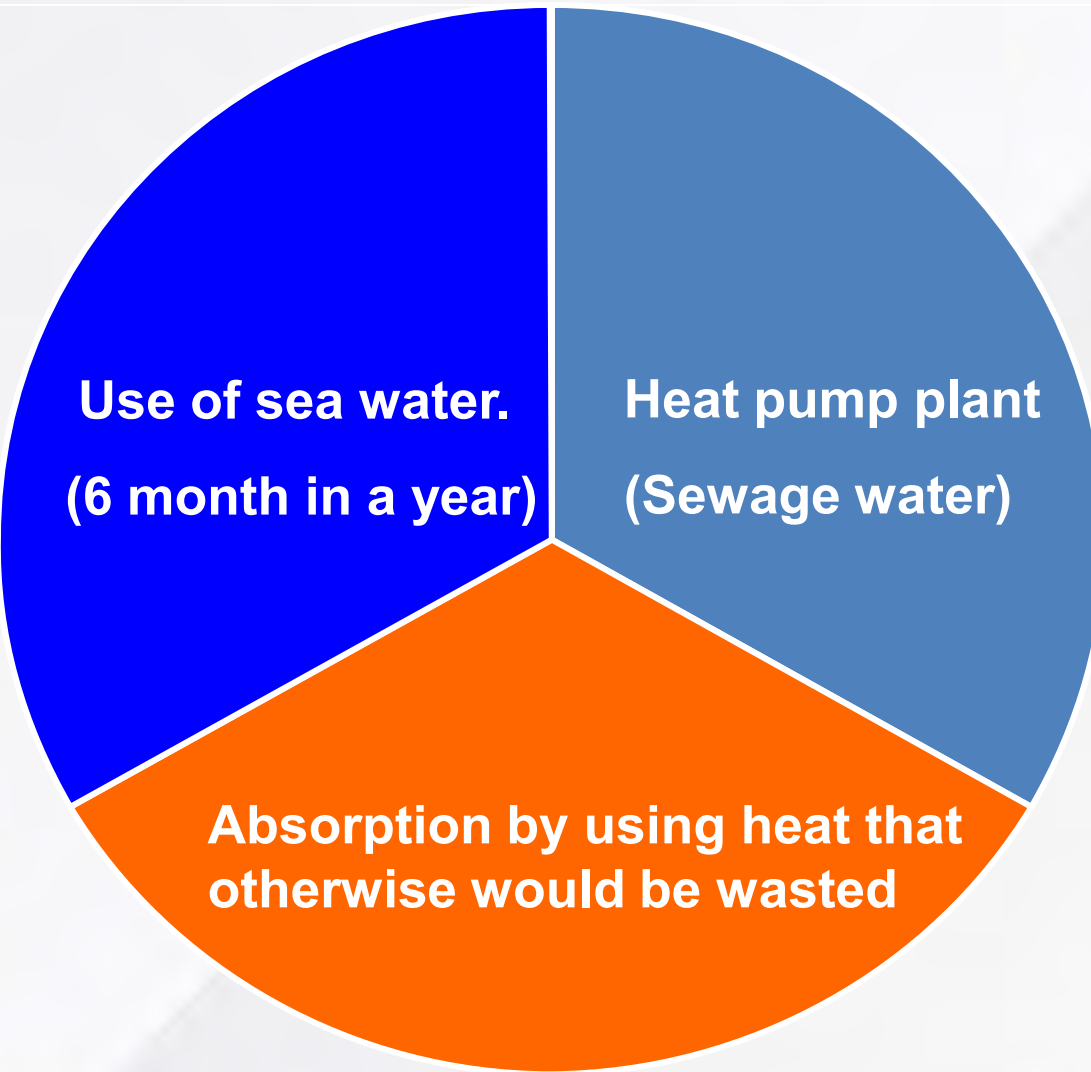


Current DC situation in Helsinki

- Connected cooling load: 80 MW
- Number of connections: 115
- Total length of the district cooling network: 32 km
- Yearly energy sales: 60 000 MWh
- Yearly turnover 9,5 M€ and profit 2 M€
- Growth of business is really rapid.
- 4. largest cooling system in Europe
- Target is to be the third largest in Europe next year



Yearly district cooling production



- Heat Pump
- Absorption
- Free cooling

More than 80 % of production is based on resources that otherwise would be wasted or unused

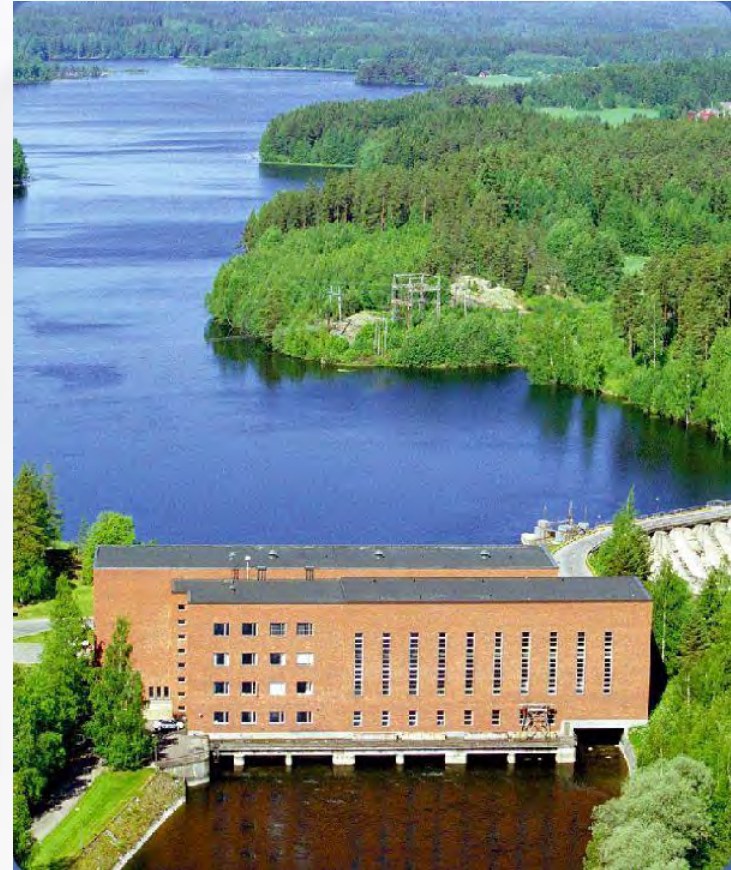
Versatile energy sources

Versatile, responsibility

Three dimensions in balance

In Helsinki Energy we keep three dimensions in balance:

- The sufficiency and reliable transmission of energy
- The environmentally benign operations to reduce climate change
- The moderate and competitive price of energy.



Mankala hydropower plant

Environmentally beneficial heating solution

- The production of district heat in CHP plants is efficient and economical. Compared with separate production, fuel savings amount to over 30%. Cogeneration is also beneficial to the environment. Thanks to district heating, the chimney stacks of individual buildings have disappeared from the city and the air quality in Helsinki has improved considerably.
- Helsinki Energy has been working persistently to minimise emissions. Carbon dioxide emissions from energy production are 35% lower in cogeneration than in separate production. The improvement of air quality has been advanced by the introduction of desulphurisation plants to coal-fired power plants in the 1980s and 1990s and by the increasing share of natural gas in the range of fuels used.



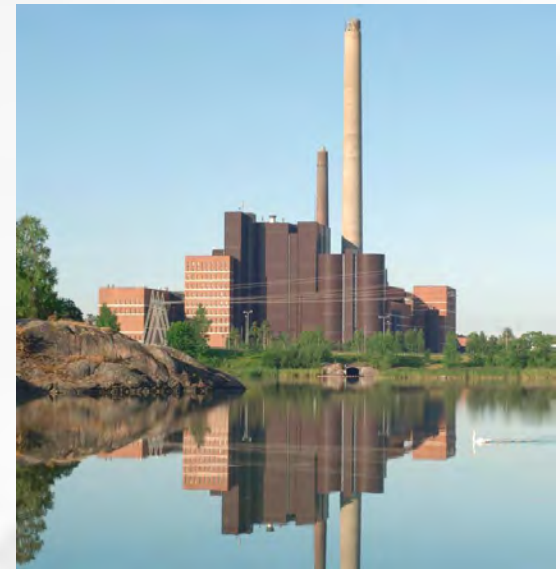
”Kioto” situation without CHP benefits

The carbon dioxide emissions of Helsinki Energy was year 1990 (Kioto basic) 3 404 ktn and year 3 240 ktn. Emissions 2008 was 5% under the level of 1990.

At the same time delivered energy increased 153%. From year 1990 to 2008 Helsinki Energy connected 4 800 new DH-customers with annual energy use 1 700 GWh to its network. The CO₂ emissions of those would be 500 ktn in separate heating.

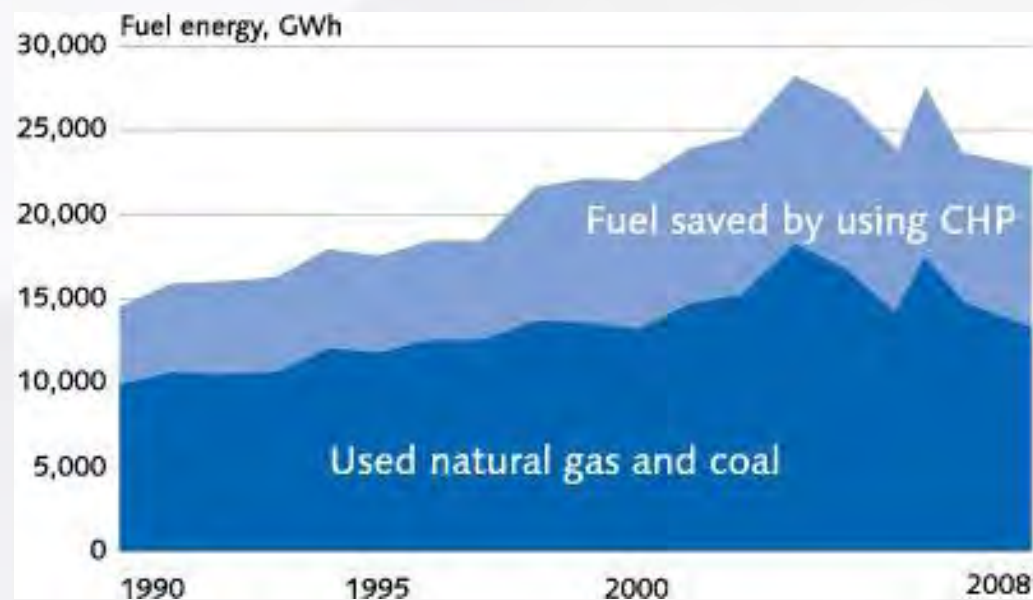
The DC has totally built up during this period the savings of CO₂ with district cooling was 2008 40 ktn. If we calculate all these together are the CO₂ savings of Helsinki DHC /CHP from 1990 22% (705 ktn).

CO₂ savings from CHP are 2 700 ktn annually.

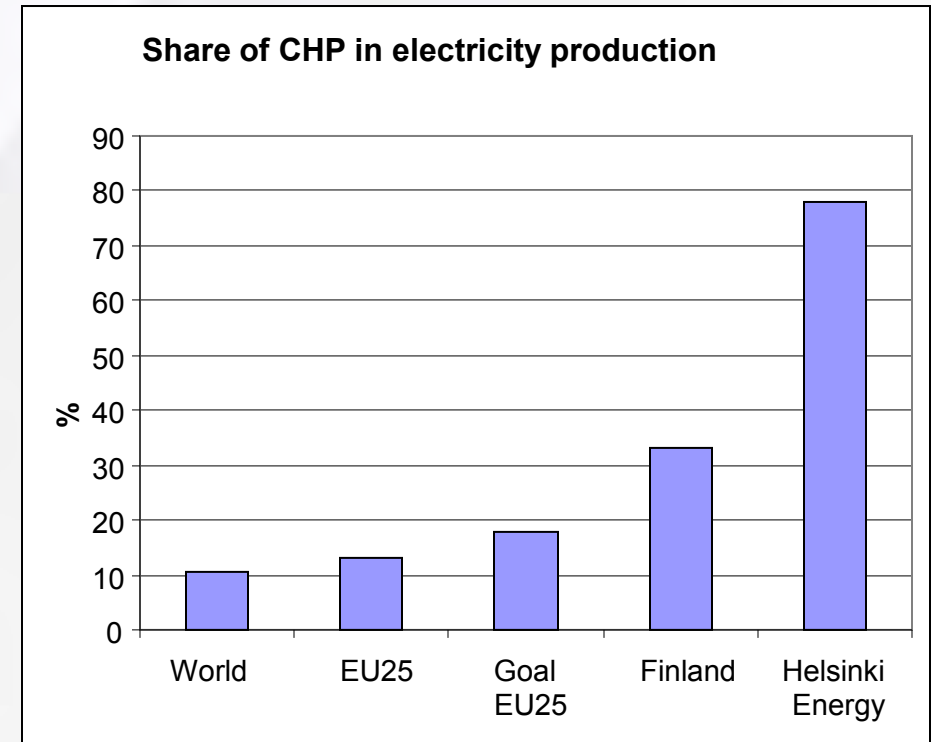
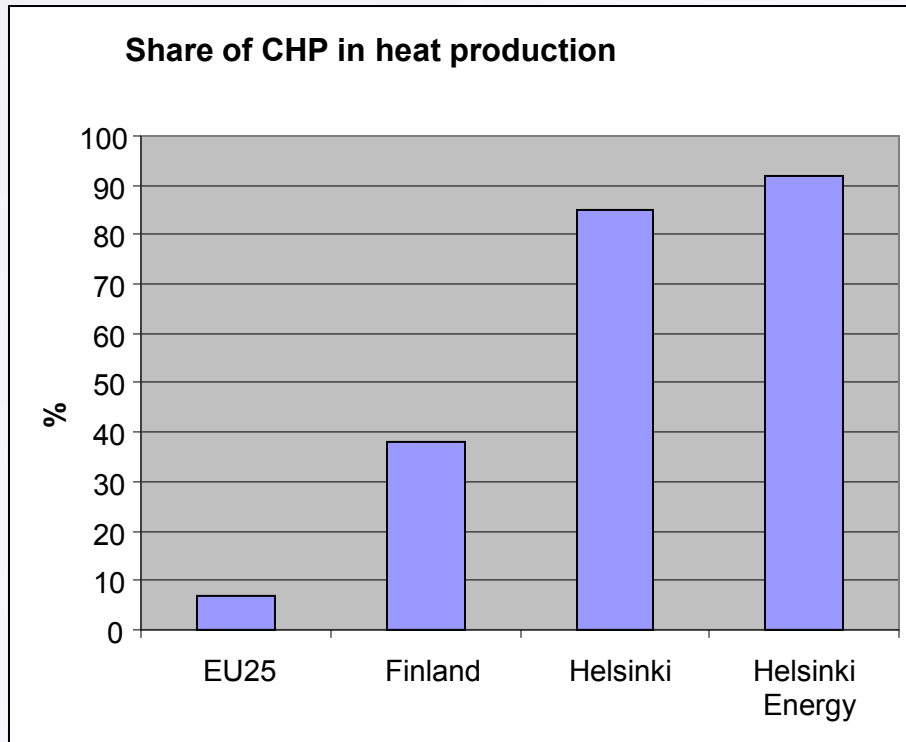


Eco-efficient city energy by co-generation

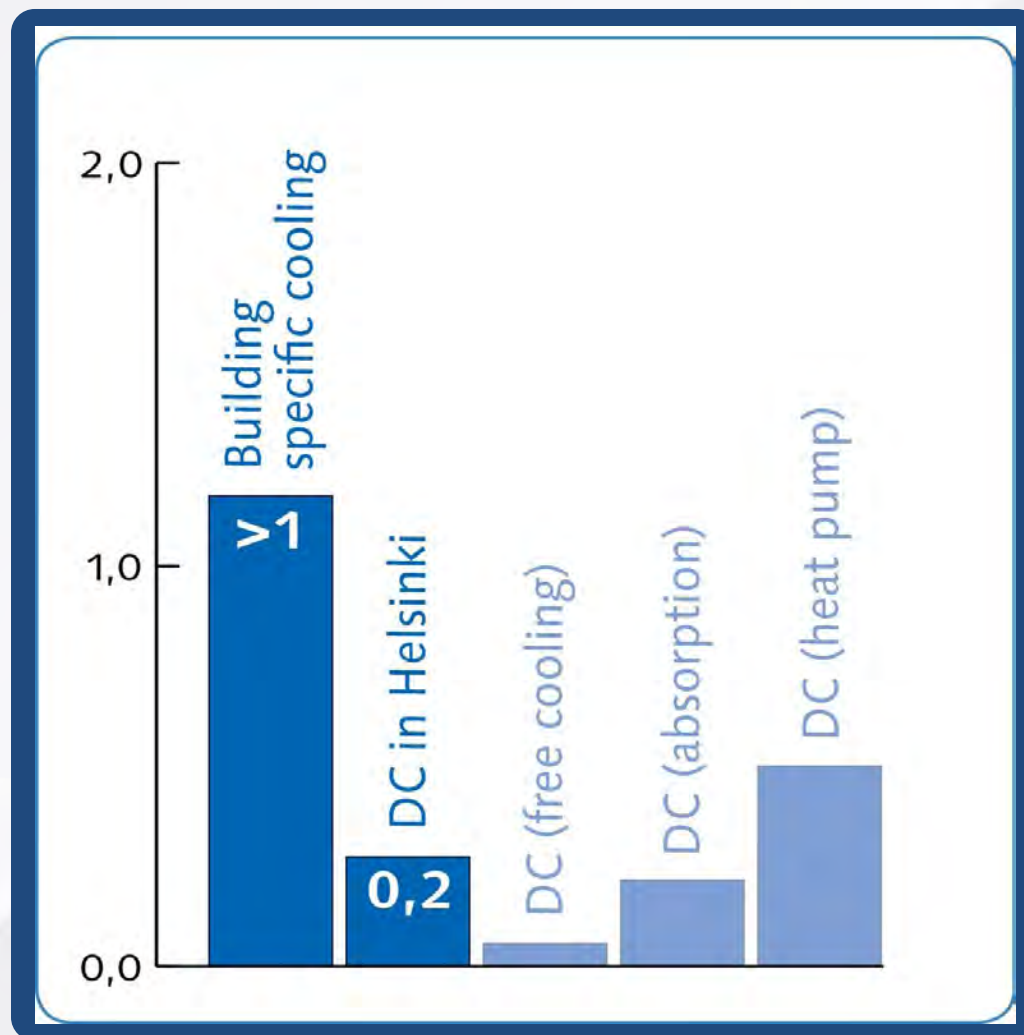
In addition to CHP, we also use trigeneration, which means that district cooling is also produced in the same process with heat and electricity. Helsinki Energy has trigeneration in its Salmisaari power plant.



Share of CHP in production



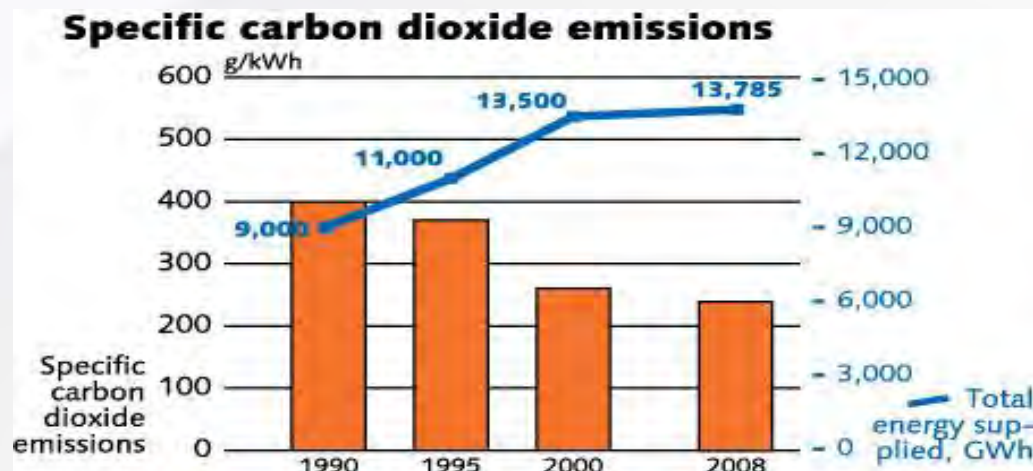
Efficiency for cooling solutions



Eco-efficient city energy by co-generation

Helsinki Energy produces electricity, district heat and district cooling by CHP in its power plants located in Helsinki. When electricity and heat are produced in a single process, fewer raw materials are required than in separate production. CHP production's fuel efficiency is more than 90%.

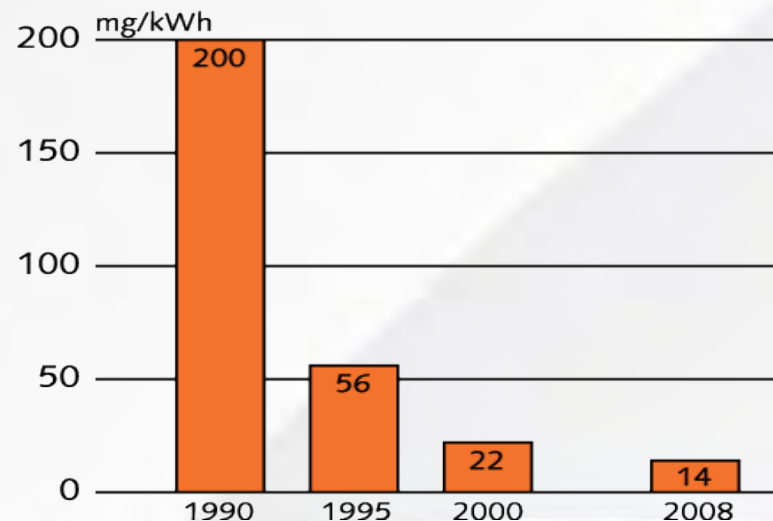
In CHP plants, the energy contained in the fuel can be utilised almost totally, which means high efficiency. At the same time, overall emissions are also substantially reduced. With CHP, each year Helsinki saves an amount of energy corresponding to the annual heat requirement of 270 000 detached houses.



Emissions at their lowest for decades

- The permitted emission limits, determined on the basis of specific emissions, first entered into force at the start of 2008 as monthly limits. Some difficulties with the emission limits were experienced, mainly at separate peak-load and reserve heating plants.
- Microparticle emissions totalled approx. 160 tonnes in 2008. In the 2000s, emissions have varied between 160 and 720 tonnes per year. Microparticle emissions collapsed at the beginning of the 1990s.
- In addition to climate protection, the local air quality must also be taken into account in new energy solutions. The common project of the Finnish Meteorological Institute, the University of Helsinki, the Ministry of Transport and Communications, and Helsinki Energy on investigating the quantity, quality and origin of microparticles in the city air started in the operating year 2008. The Kumpula measurement station has produced real-time information since last autumn. The results also show that the flue gases from power plants and heating plants are kept under sufficient control.

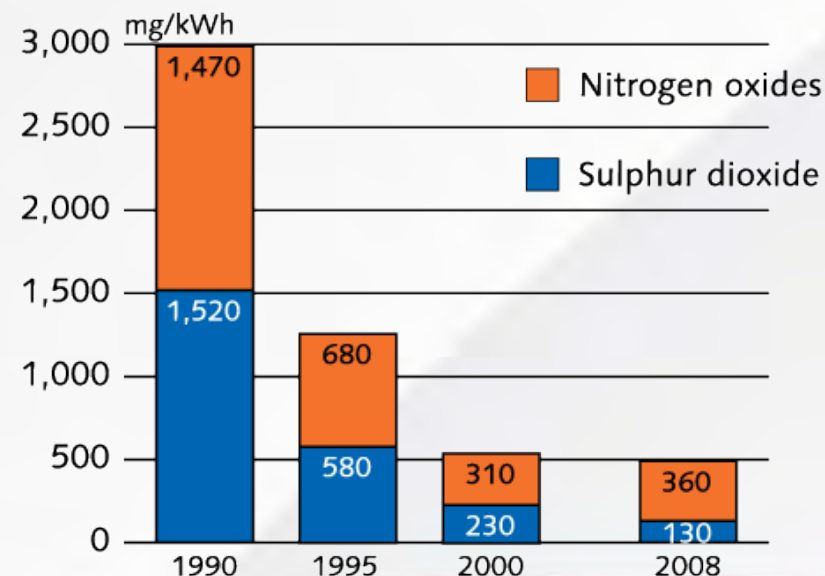
Particle emissions



Emissions at their lowest for decades

- Helsinki Energy's emissions continued to decrease in 2008. Coal consumption decreased by a third from 2007, the use of natural gas increased by approx. 9%, and the use of oil fell below 2% of total energy.
- Carbon dioxide emissions decreased by 16% and were smallest for decades. The specific emissions of carbon dioxide of the energy sold declined by about 17% and totalled approx. 240 g CO₂/kWh.
- In the 2000s, the specific emission of carbon dioxide from energy sold by Helsinki Energy has varied between 240 and 330 g CO₂/kWh. In the international reference year 1990, carbon dioxide specific emissions were about 400 g CO₂/kWh.
- Acidifying emissions of sulphur dioxide and nitrogen oxides decreased in 2008 by weight compared to 2007, sulphur dioxide by about 50% and nitrogen oxides by about 11%.

Acidifying emissions



Emissions at their lowest for decades

By-products of combustion

- Combustion by-products include bottom ash and fly ash generated in a combustion process as well as solid desulphurisation product from a desulphurisation process. These can be employed for improving the quality of cement and asphalt and in earth-moving. Utilisation of combustion by-products was in 2008 complicated by the quality of the ash. In the operating year 2008, combustion by-products were pre-registered according to the EU Chemicals Regulation (REACH).

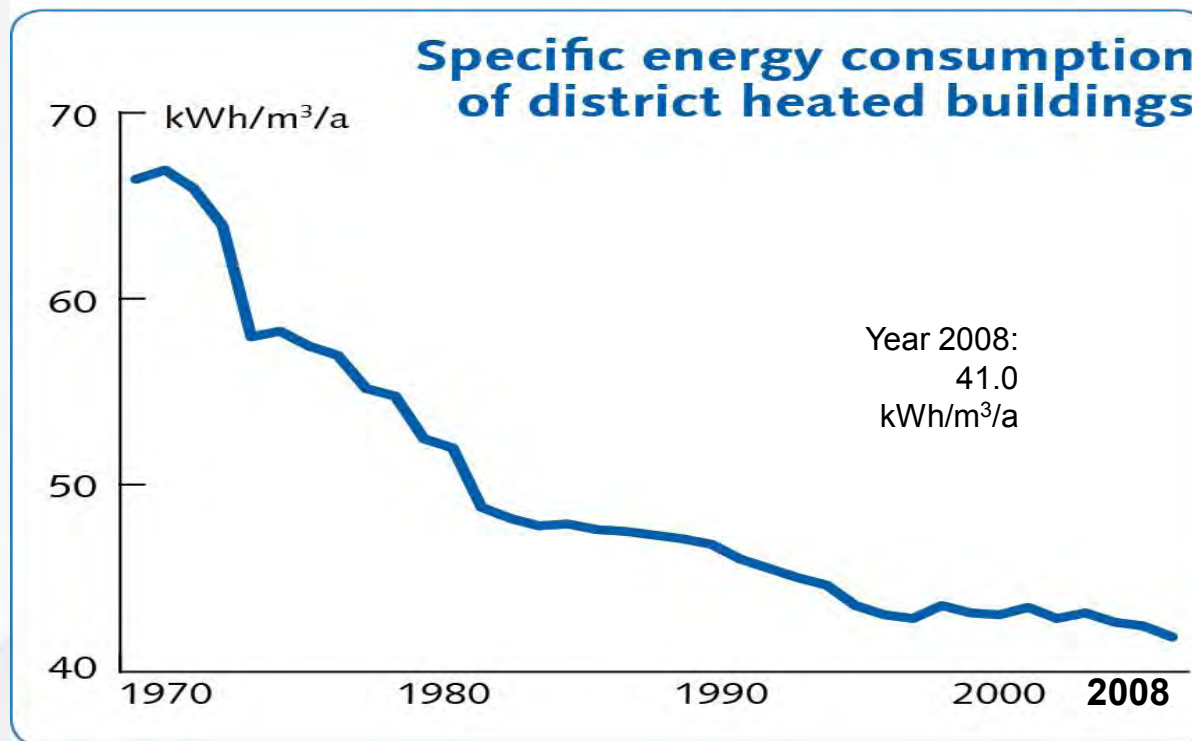


Efficient, award-winning energy use throughout the chain

- The Ministry of Trade and Industry has created an agreement model in cooperation with the energy sector as an incentive for energy companies to act in accordance with the national Energy and Climate Strategy. Helsinki Energy received an energy conservation award in 2006, applying to all of the agreement sectors: district heating, electricity transmission and distribution, and the power plant sector.
- The reasons for granting the award included the fact that Helsinki Energy actively implements the agreement with respect to its customers and within its own organisation. At Helsinki Energy, energy efficiency agreements are part of the environmental management system. Utilisation of new technology was also emphasised.

How is energy conservation carried out in practice?

- In a diverse production of megawatts, it is in the common interest to produce electricity and heat while economising on the use of the energy sources. Efficiency and the reduction of losses in district heating and in electricity transmission and distribution are equally important. As a consumer, every one of us consumes megawatts; as an energy company, we cannot decide where or how much electricity, heat and cooling are used, but we can give advice on the most sensible way of consuming them. (The statistic is outside temperature harmonised).



2008

Present DH services for customers

- Guidance and information
 - energy efficiency
 - Heating equipments
 - O&M
- Customer connection process
 - Design cooperation with customers
 - Substation quality control
- Customer management process
 - Monitoring consumption
 - Consumption reports and forecasts
 - Identifying deviation and defects
 - Guidance and recommendations
- Life cycle services
 - Substation renewal guidance and dimensioning
 - Renovation guidance
- Customer and interest group events
 - Annual seminars
 - After sales events
 - Promoting energy efficiency with interest groups
- Energy certificates
 - net service for building owners



Development of DH services

- Expanding remote reading
 - Improved reporting and billing
 - Improved knowledge of consumption characteristics
 - Improved guidance
- Developing guidance
 - More individual and accurate information
 - Energy efficiency instructions
 - Producing and distributing energy efficiency material
- Promoting energy efficiency
 - Closer cooperation with customers
 - Closer work with other interest groups
 - Publicity and articles concerning energy efficiency
- R&D
 - Energy efficiency solutions and methods
 - Building renovation solutions and methods
 - Low energy and passive building solutions
- Energy efficiency projects with customers:
 - HVAC renovations
 - energy efficiency renovation
 - regional energy efficiency plans
 - low energy building projects
 - installing additional metering devices in buildings
 - utilizing cordless sensor technology for indoor climate evaluation

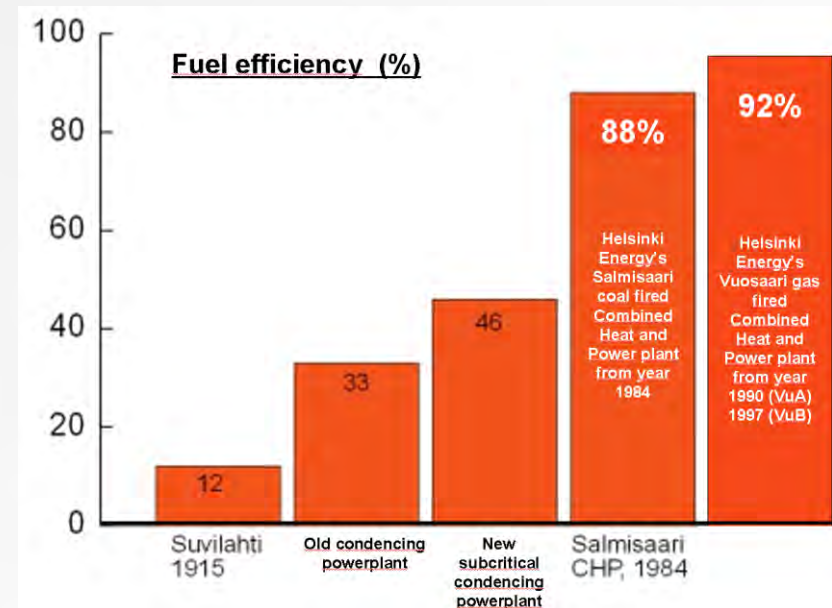
Advice on sensible energy use

Advice on sensible energy use

Helsinki Energy actively promotes sensible energy use. The Energy Advisory Centre for households has served our customers for over 30 years. Feedback reporting on electricity consumption has been available for our customers for ten years, and a property-specific consumption reporting facility in district heating has been in use for twenty years.

Combined heat and power production saves primary energy

Co-generation, or CHP, and district heating constitute a system with exemplary eco-efficiency. The efficiency of CHP at Helsinki Energy exceeds 90%, which is among the highest in the world. If electricity and heat were to be produced separately in a decentralised way, the fuel costs and emissions would be at least 40% higher.



Energy conservation in power plants and offices

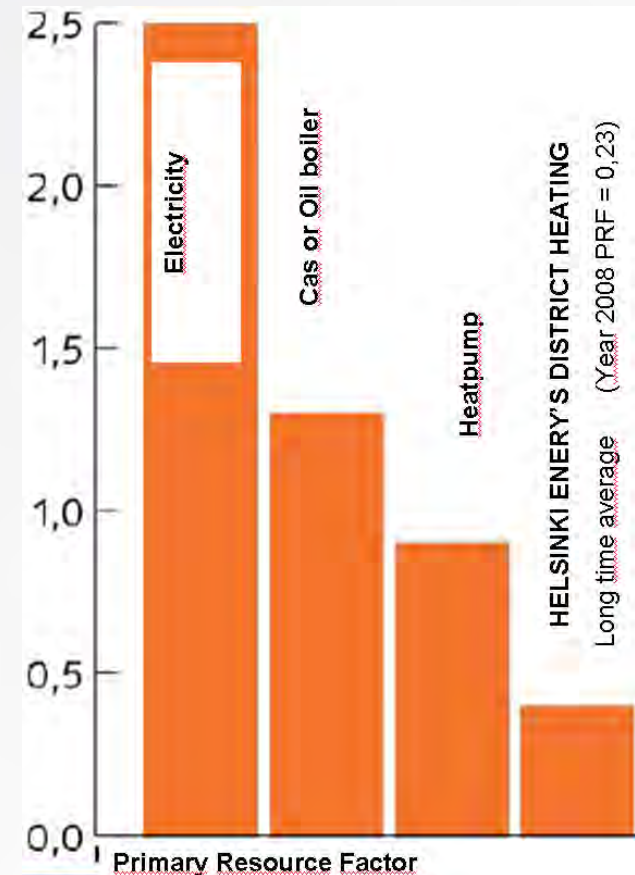
Power plants have carried out energy analyses, and dozens of energy-saving projects have been implemented on the basis of these analyses. All Helsinki Energy's places of business are covered by the Green Office scheme.

Energy efficiency agreements in 2008–2016

Helsinki Energy was among the first companies to join the energy efficiency agreements. These are part of the system promoting energy conservation in accordance with the EU Energy Services Directive, developed together with the Ministry of Employment and the Economy.

Helsinki Energy has joined both the energy production and the energy services action plans. The agreements have been drawn up for the years 2008–2016. Helen Sähköverkko Oy, which is responsible for the electricity distribution services in the Helsinki region, is participating in the action plans for electricity distribution.

In accordance with the agreement, Helsinki Energy develops and introduces new services that promote energy conservation by its customers. The services provided by the Energy Advisory Centre for sensible use of energy comply with the activities endorsed by the new Energy Services Directive.



Helsinki Energy development projects

- Competitive products and cost-effective production processes are an essential and integral part of Helsinki Energy operations. Helsinki Energy aims to identify the needs of its customers – people, industrial, energy and commercial enterprises, local authorities, and real estates using electricity, district heat, district cooling and related energy services – so that our products and services will meet them as far as possible.
- Helsinki Energy has long traditions in the development of energy production. Combined heat and power (CHP) generation and extensive introduction of district heating in Helsinki were eco-efficient decisions in their time, carrying far into the future.
- Expansion of district cooling in Helsinki and its production in a single process with electricity and district heat are examples of today's eco-efficiency. District cooling is a sustainable solution, which has been received well in Helsinki.
- We produce district heat and cooling in the Katri Vala heating and cooling plant. District heat is recovered from the waste heat of waste water; in the summer district heat is produced from the return water of district cooling. The production of district cooling uses sea water and, in the summer, surplus heat energy from district heating. It is the largest plant in the world to produce heat and cooling in a single process.
- Helsinki Energy is a responsible partner also in climate issues. Innovations increasing the mitigation of climate change are important to us, and we are involved in a great number of development projects. In addition to low-emission CHP, our diverse production structure includes generation with nuclear power and emission-free renewable energy sources. Their use will be expanded according to our development programme.

Climate challenges and renewable energy sources

August 2009

- The security of energy supply in Finland is based on several production forms, including the fossil fuels natural gas, coal and oil, the renewable wood, hydro and wind power, and nuclear power.
- Helsinki Energy together with major European energy companies has set a target of carbon dioxide neutral production by 2050. The methods to be adopted for the Helsinki Energy development strategy are based on the targets that the EU, Finland and Helsinki have prescribed and proposed for the mitigation of climate change.
- The development steps in the next few decades include continuing our eco-efficient trigeneration (producing electricity, district heat and district cooling in the same process at the highest efficiency rate in the world), a substantial increase in wind power, a feasibility study on a multifuel power plant, participation in nuclear power production, expansion of district heating along with urban development, and meeting the growing need for cooling in Helsinki with district cooling. Energy efficiency is observed in all operations.
- Permanent decisions that reduce energy consumption play a key role in the mitigation of climate change.
- Helsinki Energiy is actively involved in the development of new technology and a shareholder in CLEEN Oy, established by enterprises and research institutes. The use of various fuels includes a research project on the origin of fine particulates, conducted in collaboration with the Finnish Meteorological Institute, the University of Helsinki and Helsinki Energy.

Climate challenges and renewable energy sources

Targets of renewable energy

Finland's most significant renewable energy forms are wood and wood-based fuels, and hydropower. In its programme, the EU aims to raise the share of renewable energy in Europe to 20% by 2020. The target set for Finland is to increase the share of renewables by 9.5 percentage points to 38%. The energy policies of the City of Helsinki aim to increase the share of renewable energy to 20% (Helsingin Energia's share was six per cent in 2008).

Eco-efficient cogeneration

Combined heat and power generation and district heating have been developed in Helsinki to an internationally esteemed level. In 2008, Helsinki Energy won the Regional Champion Award by the Committee of the Regions as a world leader in energy efficiency. The efficiency rate of more than 90% in our trigeneration was also awarded full marks in an impartial country-specific review by the International Energy Agency IEA. Fuel energy can be utilised almost completely and, as a result, the total emissions of power plants are reduced significantly compared with separate heat and power generation. District cooling is also eco-efficient and has substantially lower emissions than alternative cooling solutions. Safeguarding the operating preconditions of trigeneration is important in terms of global climate protection and local air quality.

Energy efficiency in consumption and production

In addition to increasing the share of renewable energy sources, energy efficiency must be enhanced in both consumption and production in order to reach the set targets. Helsinki Energy is involved in action plans to promote energy saving in accordance with the EU Energy Services Directive. With the agreements, drawn up for 2008–2016, Helsinki Energy has committed itself not only to improve its own energy efficiency, but also to develop and introduce new services that promote the energy saving by customers.

Customer relations

- The policy is to fulfill and exceed the requirements and goals of the Fair District Heat quality label and the national voluntary Energy Efficiency Agreement.
- The primary goals are to:
 - Improve awareness of energy efficiency
 - Improve healthy indoor climate
 - Reduce primary energy consumption and CO2 emissions
- Promote energy efficiency measures
 - Produce comprehensive customer services
- Annual customer surveys are carried out among old and recently connected customers since 1998
- Participation in national DH surveys in three years intervals
- Interest group surveys carried out in three years intervals
- Customer feed back system for systematic feed back management
- More than 50% of Balanced Score Card meters directly or partially customer related
- End user studies carried out in order to improve customer knowledge

Communications and marketing

- Annual customer and interest group events
- National and local campaigns
- Customer journals
- Media co-operation
- Co-operation with neighborhood associations
- Seminars and work shops
- Development projects with customers and interest groups
- Articles in technical and scientific journals
- Web site information
- Printed material



DH marketing goals

- Connecting all profitable buildings to DH
- Keeping all existing customers
- Maximal utilising of DH in buildings
- Further improving the DH image
- Strengthening the awareness of DH as an environmentally benign solution
- Strengthening the position of DH as a future solutions
- Further strengthening the customer trust and confidence in DH

Participations and involvements in activities

Memberships of professional bodies

- The Finnish HPAC Association; The Finnish Association of Graduate Engineers TEK
- The Finnish Association of Heating Engineers

Memberships of Special Commissions and Task Forces

- The Finnish Energy Industry
- The Finnish District Heating Association
 - membership of the board, all committees and task forces
- Finnish Heating, Piping and Air-Condition Association
- The Finnish Foreign Trade Association
- CEN /Technical Committees
- Nordvärme /Member of the presidency
- Basec (Baltic area sustainable energy cities)
- EcoHeatCool project, Intelligent Energy Europe /steering committee
- IEA International CHP/CHC collaborative steering committee
- EHP (Euroheat & Power
 - Member of the Consumer Installation Committee
 - Member of the District Cooling Committee
 - Member of the TF Eco-Labeling
 - Member of Board of Directors
 - Member of Technology Platform directing Board.
 - Member of Business Committee
 - Member of the Euroheat Committee
 - Member of Tariff Committee
 - Member of the Energy Efficiency Committee



Fair and award-winning district heating

- Helsinki Energy's district heating operations have been developed in a purposeful and customer-oriented manner. In 2007, HelenDistrictHeat received Excellence Finland's valued five-star Recognised for Excellence Award in the category of operational units of enterprises. This recognition was the direct result of the company's persistent development of operational processes.
- Helsinki Energy has also been awarded a Fair District Heating Quality Label. The Fair District Heating Quality Label has been designed to increase the transparency and openness of energy and district heating company operations.



Fair and award-winning district heating

- **European Parliament Award**

Helsinki Energy's eco-efficient cogeneration received the highest number of votes and therefore won the European Regional Champion Award in the category of Energy Champion by the European Parliament's Committee of the Regions

- **United Nations recognition to the City of Helsinki** of its dedication, leadership and commitment to the enhancement of the quality of the urban environment.

- **Management System Certificate ISO 14001**



Cogeneration also recognised in the country review of the International Energy Agency IEA

- In addition to the European Parliament, Helsinki Energy was also acknowledged this year by the International Energy Agency IEA. This international independent energy organisation has published a country review of Finland's district heat and cooling production. The IEA report awarded Finland with the highest possible number of points and commends Helsinki Energy as an outstanding example. In Helsinki, district heat, district cooling and electricity are produced on a large scale in a single process.
- One of the easiest and most attractive strategies for improving energy supply efficiency and reducing greenhouse gas emissions is to invest in highly efficient combined heat and power (CHP) and district heating and cooling (DHC) systems. Interest in promoting these technologies is not new many countries have adopted CHP/DHC goals and supporting policies.

Cogeneration also recognised in the country review of the International Energy Agency IEA

- IEA Report:

Case Study 2. Helsinki Energy

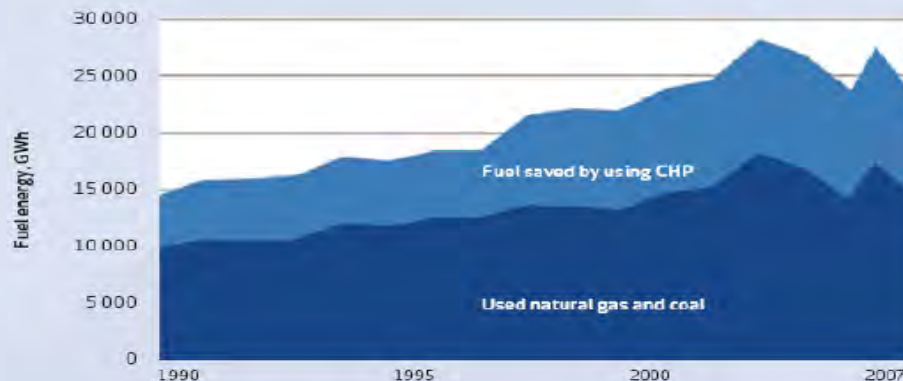
Helsinki Energy's DHC and CHP infrastructure consists of four CHP-plants: two main combined cycle plants with natural gas in the suburb Vuosaari, and CHP plants with coal in the city centres Hanasaari and Salmisaari. DH also needs heat-only boilers for peaking and reserve. The capacity is high and the usage time is normally very short. The share of CHP heat is annually over 92%. The company has also added a combined heat pump plant (90 MW heat from cleaned salvage water and 60 MW cooling) to the infrastructure since 2007. The infrastructure as a whole includes, therefore, combined heating, cooling and electricity – three systems at a large scale.

By the end of 2007, Helsinki Energy had DH sales of 6 410 GWh; in addition to this, 25 GWh were supplied to the neighbouring cities of Espoo and Vantaa.

Figure 5 highlights the estimated fuel savings that the company has seen as a result of generating heat from CHP.

FIGURE 5:
**FUEL USED BY CONVENTIONAL
AND CHP GENERATION**

SOURCE: HELSINGIN ENERGIA, 2008. 12

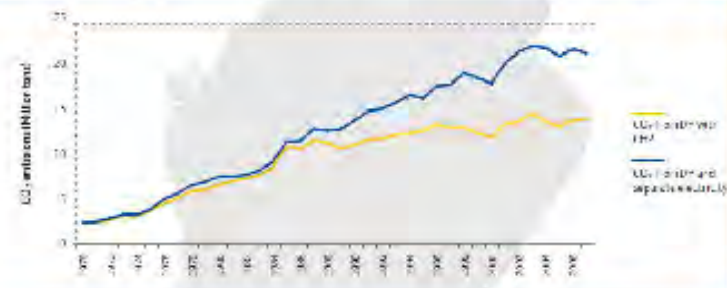


Finland is a World Leader in CHP/DHC

Fuel Use Has Decreased



CO₂ Emissions Have Decreased



- In 2007, CHP produced 74% of heat needed for DH, and 29% of the country's electricity
- CHP's share of thermal electricity production was 65% in 2007
- Government involvement has been limited - but strategic
- Large biomass CHP use
- District cooling on the rise

Case Study: Helsinki

- One of the world's leading CHP/DHC cities
- 4 CHP plants using natural gas and coal
- Annual share of CHP heat at over 90%
- Also uses innovative combined heat pump plant to provide a cooling load of 53 MW
- The combination of CHP/DHC in Helsinki estimated to reduce CO₂ emissions by 2.7 MT annually

