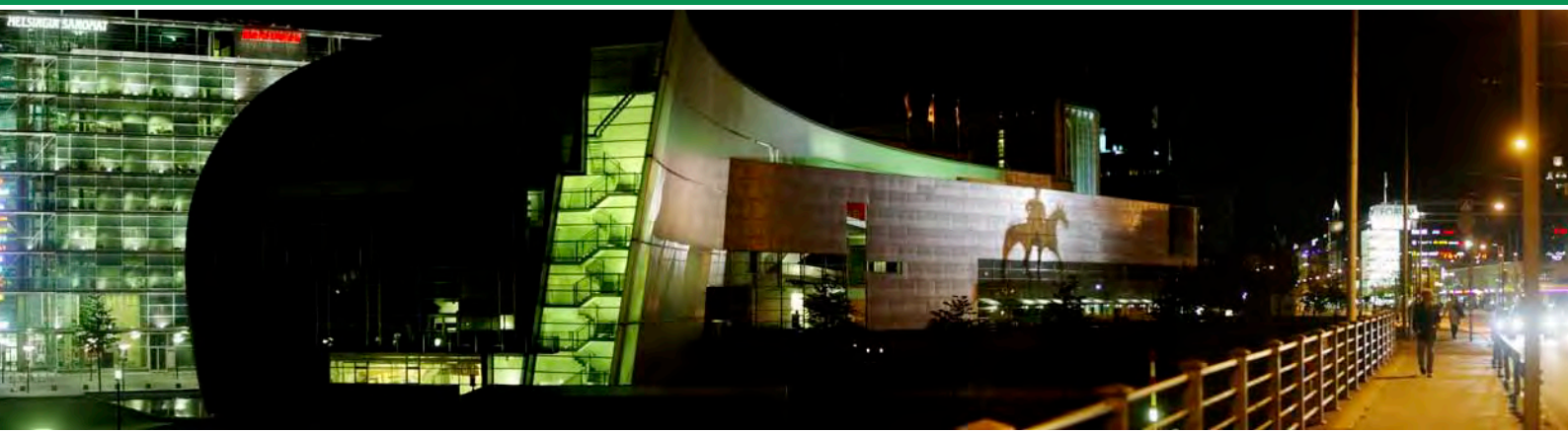
City of Helsinki

State of the Environment in the City of Helsinki: Theme Report 1/2008



Energy efficiency of Helsinki's building stock is improving

In January 2008 the Helsinki City Council approved a new energy policy guideline, according to which the energy efficiency of Helsinki's building stock will undergo significant development. The city decided to increase its share of renewable energy from 4% to 20% by 2020, to reduce its greenhouse gases by 20% by 2020 and to profile as an energy saving forerunner.

Nearly 90% of the Helsinki building stock is connected to the district heating system. Fuel oil and electrically heated buildings each account for approximately 6 % of the building stock. The 80–90 % energy efficiency for district heating, electricity and cooling production in Helsinki is one of the highest in the world. Helsinki's district heating production is based almost entirely on fossil fuels: coal and natural gas. Renewable energy has a 7% share of electricity production in the city of Helsinki. In order to increase the share of renewable energy production, Helsinki-owned energy company has decided to build two large offshore wind power parks with a wind power generating capacity of 500–1000 MW's.

During the period 1970-2007, the specific heat consumption of Helsinki building stock in the district heating system decreased by nearly a third, which is the result of both more effectively insulated new construction and improvements in the energy efficiency of existing buildings, such as window replacement, adjusting of the room temperature and the reduced use of warm water.

Energy efficiency of new residential buildings has improved

There are considerable differences in the energy consumption of district heated residential buildings built in different decades. The most poorly insulated buildings in the residential building stock were those completed during the period 1950–1975. Older, thicker-walled buildings built in the beginning of the 1900s are so well insulated that only buildings constructed in the 2000s have lower heat consumption. In 2006 the heat consumption of district heated building stock decreased substantially with the introduction of stricter building regulations.

Energy regulations for new buildings will most likely be further tightened in 2010 and 2012, thus bringing standards significantly closer to the low energy level. According to the Confederation of Finnish Construction Industries, efforts are being made to make low-energy construction the dominant form of new construction by the year 2015 and passive heating

Helsinki building stock by heating mode in 1990 and 2006.

	Year	District heating	Fuel oil or natural gas heating	Electrical heating	Wood or peat	Other or unknown	Geothermal heating	Total
Volume, m^2	1990	29818059	2759700	1697703	116561	715880	-	35107903
	2006	37367517	2400342	2482918	83788	1192707	18039	43545311
Percentage, %	1990	84,9	7,9	4,8	0,3	2,0	0,0	100
	2006	85,8	5,5	5,7	0,2	2,7	0,0	100

Weather-adjusted specific heating consumption of district heated building stock in Helsinki by sector 1970–2007 (kWh/m² represents the consumption per floor area).

Year	Residential buildings	Service and public buildings	Industrial buildings	Entire building stock	Residential buildings	Entire building stock
	kWh/m^2	kWh/m^2	kWh/m^2	kWh/m^2	kWh/m^3	kWh/m^3
1970	-	-	-	-	-	62
1980	-	-	-	-	-	50
1990	207	206	118	196	-	46
2006	191	206	93	185	50	42

construction by 2020. When this is realised, the heating need would be limited to the heating of household water.

Air conditioning problem in buildings must be solved

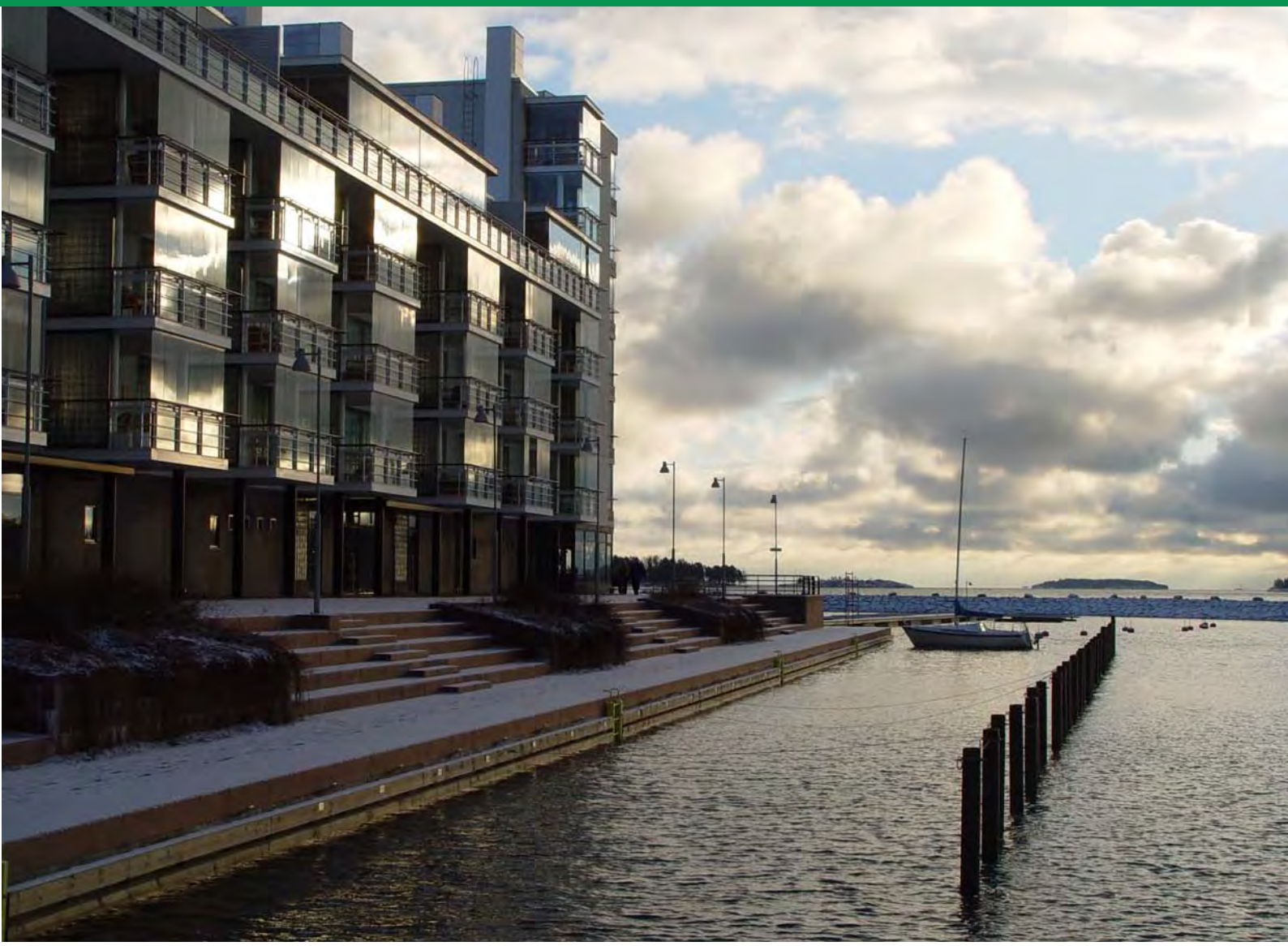
Mechanical cooling of buildings has recently become common in new construction. As the climate becomes warmer, the need for heating decreases and the need for cooling increases. Glassed-in balconies have also increased the need for cooling, as flats heat up in the summer. It has been estimated, that in worst case in the future as much as 20% of a building's electricity may be used for cooling in Helsinki. In new construction, however, the need for cooling can be minimised in such a way that cooling is achieved by, for example by better window design, sun shades and recirculating cool outdoor night air.

Even in older buildings, offices in particular, retrofitted air conditioning systems have become very common. Helsinki's energy company is meeting the challenge in the inner city by expanding the district cooling network, where 80% of energy need is covered with renewable or waste energy. Mechanical cooling could also be replaced in other ways, such as free cooling (cold water from the sea or borehole wells), using absorption heat pumps to advantage solar or district heating energy, or by solar electricity, which actually does work more efficiently on hot summer days. With the right utility solutions, cooler outdoor air can be used to cool buildings the whole year round. At present, high-power mechanical cooling plants are often installed and buildings are simultaneously heated and cooled, even in the winter.

In renovation construction energy efficiency and renewable energy are key issues

Efforts are being made to improve the energy efficiency of older buildings. State energy subsidies shared by municipalities have been granted for carrying out energy audits, implementing energy conservation measures and measures geared toward the implementation of renewable energy sources. In accordance with the national energy and climate strategy the amount of energy subsidies, interest rate subsidies and household deductions will be increased significantly in 2009. According to reports, older buildings can ideally achieve as much as a 30-40% savings in energy consumption with renovation construction. Energy consumption can be influenced by, for example, additional insulation, heat recovery from ventilation and window replacement.

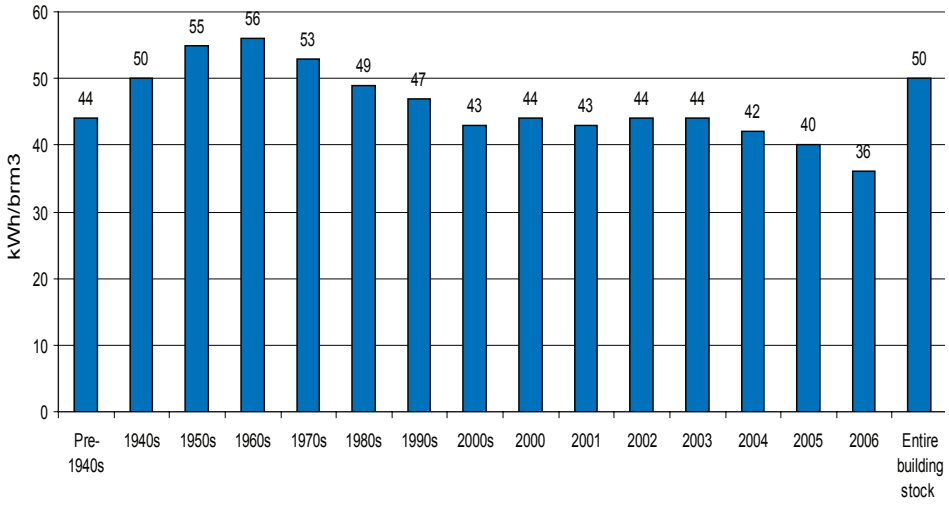
The energy efficiency of old and new buildings can be significantly influenced not only by the above-mentioned energy renovations, but also the use of renewable energy production, such as solar collectors. These can provide approximately 10–25% of a building's heating needs in Finland. Solar collectors are already economically profitable alternatives for residential use, particularly in fuel oil and electrically heated buildings, and their cost is expected to fall as they become more common. Rapid technological development of photovoltaic systems can make solar



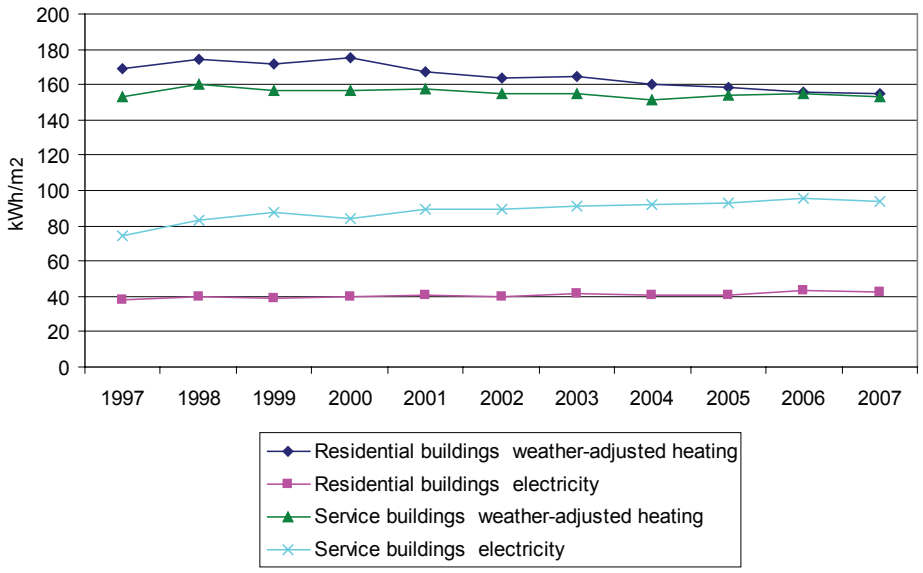
electricity economically competitive with power grids in the near future. Thus far, solar heating and photovoltaic systems have not been widely used in Helsinki except for the pilot residential area called Eko-Viikki, but the use is increasing in the near future.

Geothermal heat pumps could be used to achieve an energy saving of two-thirds compared with the heating by fuel oil or electrical heating. In Finland, however, geothermal heat pumps have been adopted at a much slower rate than in some other countries like Sweden. In 2006 there were only 95 geothermal heating systems in Helsinki, whereas there were some 17,000 buildings with fuel oil and electrical heating.

Air-to-air heat pumps have gained popularity, particularly in new buildings with electrical heating. These heat pumps can cost-effectively achieve an energy saving of approximately one-third. The problem with the air-to-air heat pumps is that even the newest models will not operate effectively when temperatures fall below minus 20–25°C, which is why they add to the peak consumption of the electricity on the coldest winter days, just as standard electrical heating does. Heat pumps can also be used to cool buildings, which increases energy consumption.



Weather-adjusted specific heating consumption of district heated residential building stock in Helsinki by decade – situation in 2007



Electricity and heat consumption of monitored properties owned by the City of Helsinki 1997–2007.

Rapid growth in electricity consumption

Helsinki's electricity consumption has shown rapid growth over a long period of time. Household electricity consumption has increased six-fold in Finland since 1970. After 1990, the per-household consumption of electricity in Helsinki has increased nearly 30%, which is a consequence of a growth in residential space per inhabitant and an increase in the use of appliances that consume a large quantity of electricity (electrical heating, computers and other home appliances, sauna baths in flats, cooling appliances etc.), even as the energy efficiency of these devices has increased. The increase in electricity consumption in Helsinki has been comparable to the rest of Finland. Helsinki households consume less electricity than Finns on average, which is due partly to the minimal use of electrical heating in Helsinki.

Electricity consumption of Helsinki's service sector workplaces has increased at an even faster rate than households during the period 1990–2006, by approximately 50%. This is due to a general increase in the number of services, the resulting rapid proliferation of office equipment in these businesses, and the usage habits of retrofitted cooling appliances. The removal of restrictions on business hours and improvements made to the utilisation capacity of public facilities has also increased electricity consumption.

The City of Helsinki serves as an example

Under the administration of Helsinki's Energy Savings Board, the City of Helsinki has been developing the energy efficiency of its building stock since 1974. Since the Energy Conservation Agreement of 1993, Helsinki has conducted energy audits on 80% of city-owned public service building stock and 50% of the recommendations made in these audits have been implemented. The specific heat consumption of buildings has decreased. In year 2007 there was a decrease in electricity consumption in the city-owned buildings after a long period of growth. According to a recent energy efficiency agreement, Helsinki aims to achieve a 9% saving in energy during the period 2008–2016 through the implementation of, for example, low-energy construction and energy renovations.

The City of Helsinki has initiated low-energy pilot projects at new and renovation construction sites in, for example, Käpylä, Viikinmäki and Viikki residential areas. Thus far, the City's pilot sites have been voluntary, and it has not specified any general energy requirements for City planning, among others.

The information presented in this theme report is based on the City of Helsinki Electronic Environmental Statistics, which can be found at www.helsinginymparistotilasto.fi. These pages will be published also in English by the end of 2008.

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