

SHOWCASE OF DISTRICT COOLING SYSTEMS IN EUROPE - Stockholm

Starting in Sweden in the early 1990's, District Cooling (DC) has had a rapid development. Today, District Cooling production in Sweden has grown to the same size as the production of the much older product wind power. But there is a very important difference: Unlike wind power, District Cooling has been successfully established without any subsidies! The cooling business in Stockholm is run by the energy corporation Fortum and alone accounts for about half of the national supply. 7 000 000 square meters of commercial area in the Swedish Capital are supplied with District Cooling via the cooling distribution network, that is currently 76 kilometers long.



Figure 1 Stockholm City

DC operations in Stockholm started in 1994. The market responded positively - partly because of the political decision to phase out CFC and HCFC-based products that are extremely aggressive to the ozone layer. It may appear strange that large-scale District Cooling has had a flying start in northern Europe, where the need for cooling reasonably is less than on the southern Europe. One conceivable explanation is that property owners are used, since 50 years back, to buying heat from large District Heating systems.

When launching a new product, the paramount achievement is to create confidence among customers - actual and potential. Market success is founded on a couple of very clear advantages for District Cooling:

- new price products and services based on customer demand and willingness to pay
- District Cooling has been presented to - and appreciated by - customers as easy to operate, reliable, economical and environmentally friendly
- it is an uncomplicated and easily maintained product - property owners just purchase cooling instead of being responsible for complicated machinery
- over its total operating time, District Cooling has reached a reliability level exceeding 99.7 per cent



- advantage of economy with competitive market prices free from public interventions, long contract periods and reduced investments for customers. Individual contracts are based on alternative prices and are often combined with District Heating contracts.
- system flexibility makes it possible to adjust cooling capacity to varying demands without having to invest in over-dimensioned equipment.
- fast adjustments of delivery capacity facilitates keeping and/or acquiring tenants
- the environmental superiority is a good door-opener to customers and the media. During the decade of District Cooling's existence in Stockholm, emissions of CFC and HCFC have dropped by more than 60 metric tons. CO₂-emissions from conventional cooling is 280 g/kWh as compared to 60 g/kWh from Stockholm District Cooling
- noise is radically reduced when individual cooling equipment is removed and releases space in customer property. One brilliant example is the recent development project for commercial real estate in downtown Stockholm. By connecting to District Cooling and removing large cooling installations on the flat roofs, space was created for constructing the City's most central, attractive apartments as penthouses with an excellent view!
- public economy benefits from more efficient use of especially the electricity supply infrastructure. As shown above, there are great economic advantages in avoiding additional electricity supply for cooling, which is ensured by District Cooling.

When District Cooling in Stockholm was launched, strong demand was expected. Indeed, growth has been faster than expected, which led to a temporary stop in sales last year due to the lack of production capacity. Fortum has now resolved that situation by connecting two DC systems and building new production capacity.

One pleasing surprise is that the utilization period has turned out to be significantly longer than expected. Cooling is necessary not only because of warm weather, but to approximately 50 % due to the all year round need for process cooling of computers, refrigerating/freezing equipments etcetera.

In systems with summer electricity peaks, the electricity savings provided by District Cooling have full impact. The Stockholm example shows that also in systems with winter electricity peaks, District Cooling gives a sizable reduction.

Fortum presently sells 500 GWh of District Cooling per annum. If that cooling had been produced conventionally, it had required five times more electric energy. That is to say that District Cooling means an 80 % reduction of the electricity requirement for cooling.

The Stockholm scheme consists of today of different systems ranging from 3 MW to 228 MW. The largest system is today the DC system for the central parts of Stockholm. 228 MW of DC in customer connections is now integrated from earlier several smaller and temporary systems.

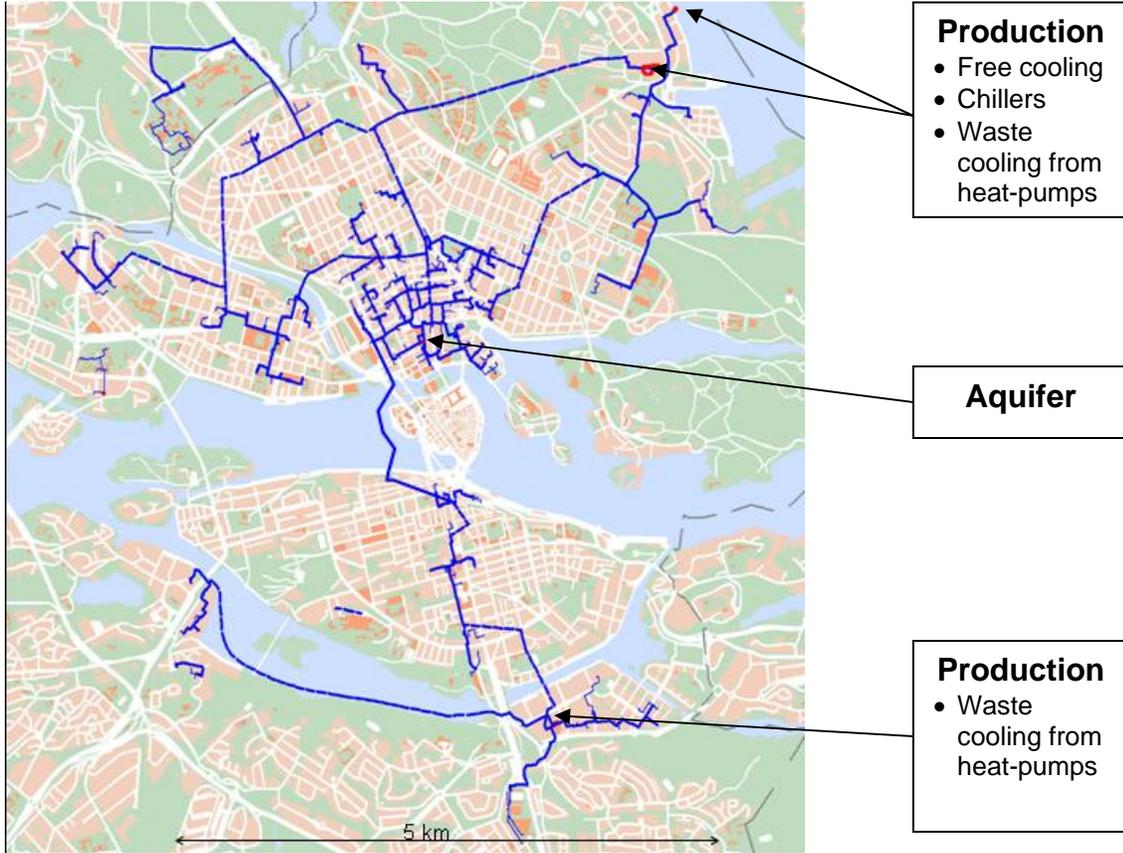


Figure 2.: The Stockholm City DC system

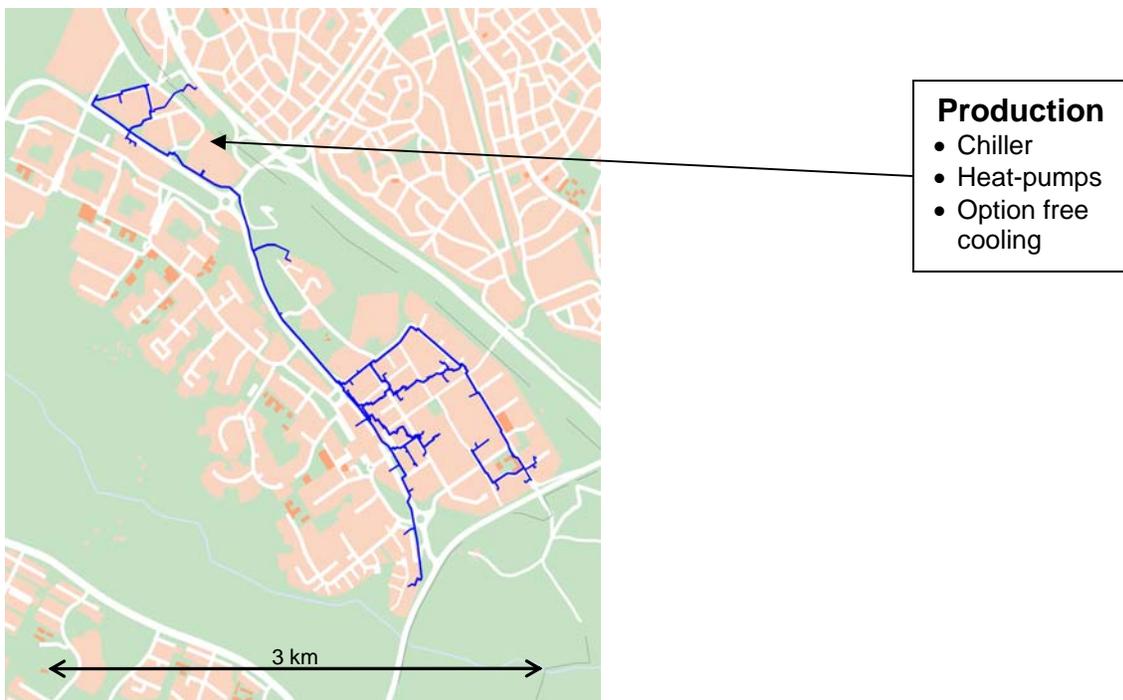


Figure 3: The second largest Stockholm system, the Kista system, designed for 50 MW
DATA DC systems in Stockholm:

Production capacity in:
 The Central net: 188 MW
 The Kista net: 41 MW
 Skärholmen Mall: 10 MW
 Infra City: 9 MW
 Danderyd Mall: 3MW
 Farsta Mall: 3 MW
 Älvsjö: 5 MW
 Mariberg: 4 MW
 Nacka Forum: 3,5 MW

- Number of customers exceeds 500.
- DC grid, pipe length: 76 km.
- Supplied commercial area 7 000 000 square meter.

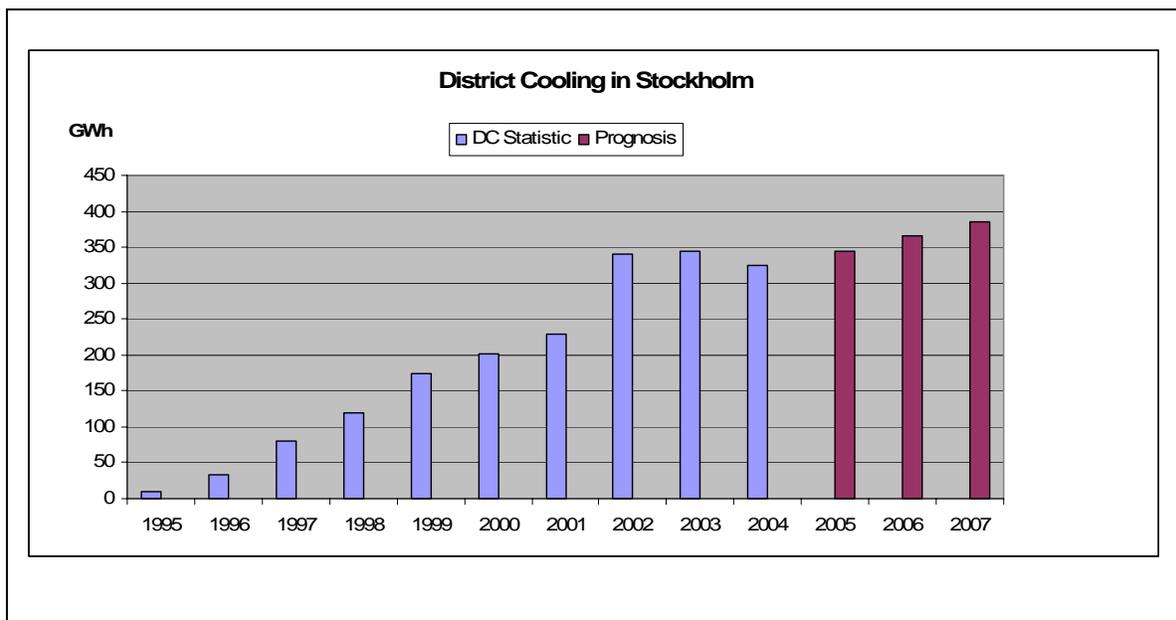


Figure 4: Development of the DC systems in Stockholm.