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Article

Making the case for **district cooling**

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Today, around 10% of the world's electricity production is used for air conditioning. According to international studies, the demand for cooling of commercial and residential buildings will grow exponentially in the years to come, especially in high-income countries and emerging economies in India, China and South America.

Calculations from the Netherland Environmental Agency estimates that the energy demand for cooling will rise by 72% in the period from 2000-2100. This development will increase pressure on CO_2 emissions, if today's prevailing decentral cooling technologies continue to be used.

New solutions are needed to meet the increasing demand for air conditioning without compromising the environment and bringing the power supply system down. The development towards new solutions is accelerated by recent legislation on phase-out of traditional refrigerants, notably in Europe and the US, forcing building owners to replace existing air conditioning systems with new low-GWP systems.

Among these trends, district cooling is emerging as one of the most sustainable solutions to meet the growing demand for indoor cooling. As cooling demand surges worldwide, district cooling is increasingly recognized as a climate-resilient, resource-efficient, low-carbon and affordable solution.

How does district cooling work?
District cooling systems are much like district heating systems that have become widespread in metropolitan areas in many countries. In a district cooling system, chilled water is supplied from a central cooling utility to commercial and residential buildings through pipelines.

The cold water for the district cooling is supplied by free, natural cold water resources – sea, lakes, rivers or underground reservoirs – or produced from waste heat from power generation or industries, or via central electric chillers.

Perspiration perspectives

World energy demand, Exajoules

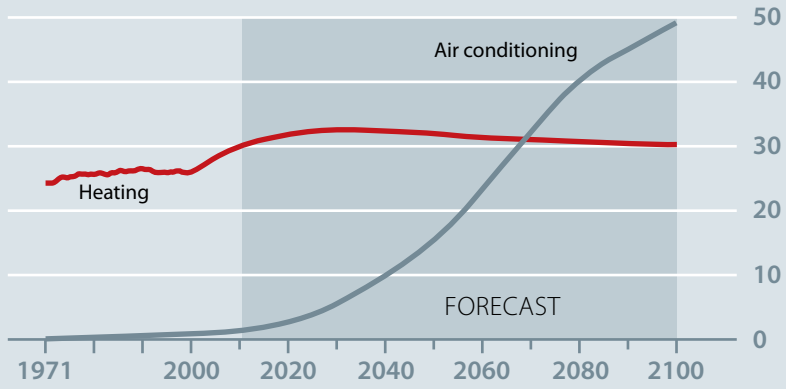
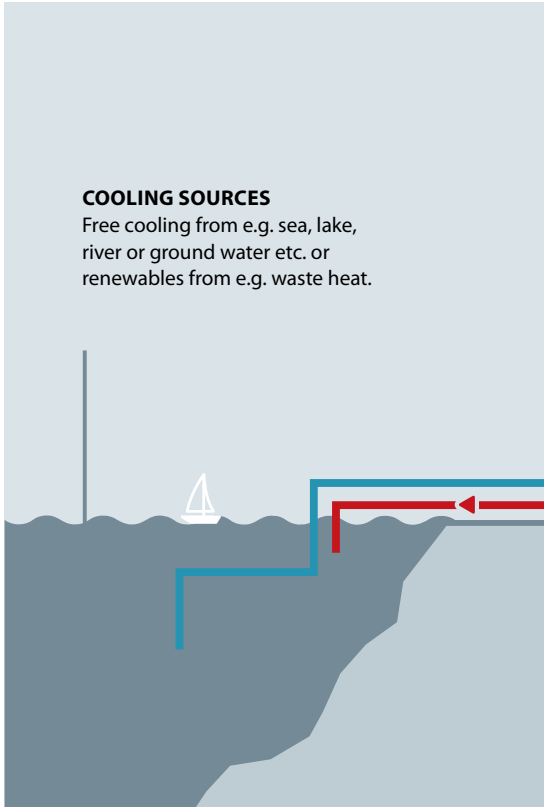


Figure 1:
Projected development in global demand for heating and cooling until 2100.
Source: PBL Netherlands Environmental Assessment Agency



The district heating cold tower stores cooling to balance peak demand. Furthermore, the storage of chilled water reduces pressure on the electricity grid, since cold water can be produced during off-peak hours, for instance during the night. The cold tower also ensures uninterrupted supply of cooling if for some reason the energy production system is down.

District cooling doubles the energy efficiency

Existing district cooling systems in cities like Paris, Dubai, Helsinki, Copenhagen and Port Louis have proved that district cooling can be more than twice as efficient as traditional, decentralized systems.

In Dubai, for instance, 70% of electricity is consumed by air conditioners, and in order to meet the cooling demand, the city has developed one of the world's largest district cooling networks. By 2030, 40% of the city's cooling demand will be met by district cooling, using 50% less electricity than traditional decentral AC units.

Paris is another city that has recently invested in establishing a comprehensive district cooling system with 70 km of pipelines in different districts of the city. Using water from the Seine River, more than 500 buildings are now supplied with space cooling.

District cooling advantages **for local authorities**

- High energy efficiency
- Reduced pressure on power grid
- Low carbon footprint
- Improved control and management
- Preserved architectural heritage

District cooling advantages **for building**

- Reliability of supplies
- High indoor comfort
- Space freed up (roof and basement)
- Less noise and use of chemicals
- Preserved architectural heritage

Figure 3: French Climespace has listed the advantages of the Paris district cooling network for local authorities, building owners and end-users.

A couple of years into operation of the Paris network, the energy efficiency of the district cooling system has been calculated to be 50% higher compared to a similar cooling capacity supplied by stand-alone units.

Reducing pressure on the power grid

Powering air conditioning systems with electricity or fossil fuels has been compared to cutting butter with a chainsaw. The high energy sources with high temperatures can be used much more effectively to produce electricity or other forms of mechanical work, whereas cooling – and heating for that matter – can be provided more efficiently by using low-temperature energy sources.
In many countries in hot climate zones, the increasing use of high-quality energy for air conditioning will stretch the already strained electricity grid beyond its limits. With district cooling, however, these cities will be able to fulfil the demand wih low-grade waste heat, free cooling sources or renewables.

Limiting the use of refrigerants with high global warming potential

F-gas regulation in Europe and SNAP regulation in the US ban or phase out refrigerants with high global warming potential. District cooling presents an attractive option to control and reduce consumption of environmentally damaging refrigerants typically used in decentral air conditioning systems. District cooling is a climate friendly solution as it feeds on local, natural resources, e.g. sea water, or is powered by renewables or waste heat from power and industrial production.

How district cooling **works**

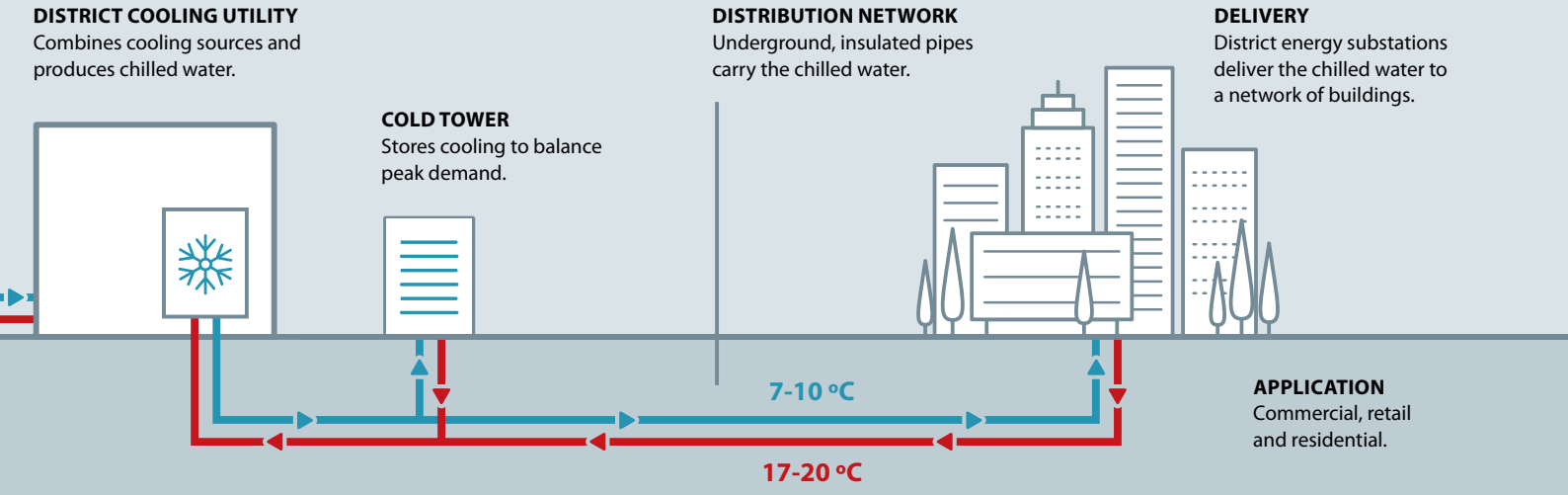


Figure 2:
Outline of district cooling system using free cooling from e.g. the sea or waste heat from power plant.

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While district cooling is still a relatively new technology, it is built on the vast experience acquired in the district heating field. A quick survey of existing and projected district cooling systems gives a clear indication of the potential of the new technology to become a backbone of energy systems in the not so far future.

The energy efficiency of district cooling speaks for itself. District cooling systems are stable and reliable and have proved to be 5-10 times more efficient than conventional stand-alone machine cooling systems.

At the same time, district cooling is an environmentally friendly solution relying on local, natural energy sources such as sea water, surplus heat form power and industrial production or from renewable energy sources. This saves high-quality energy, notably electricity, for other applications and reduces pressure on the strained urban power grids around the world.

The many advantages make district cooling a perfect technology to achieve permanent wins in the quest for high indoor comfort and in the fight against climate change.

Danfoss is a leading player in the movement towards more efficient, cleaner and more reliable energy systems and constantly innovates products and solutions for district cooling.

Check out the district cooling site to get a quick overview of solutions and benefits
heating.danfoss.com

Find more information on Danfoss heating/cooling products and applications on our homepage
heating.danfoss.com

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