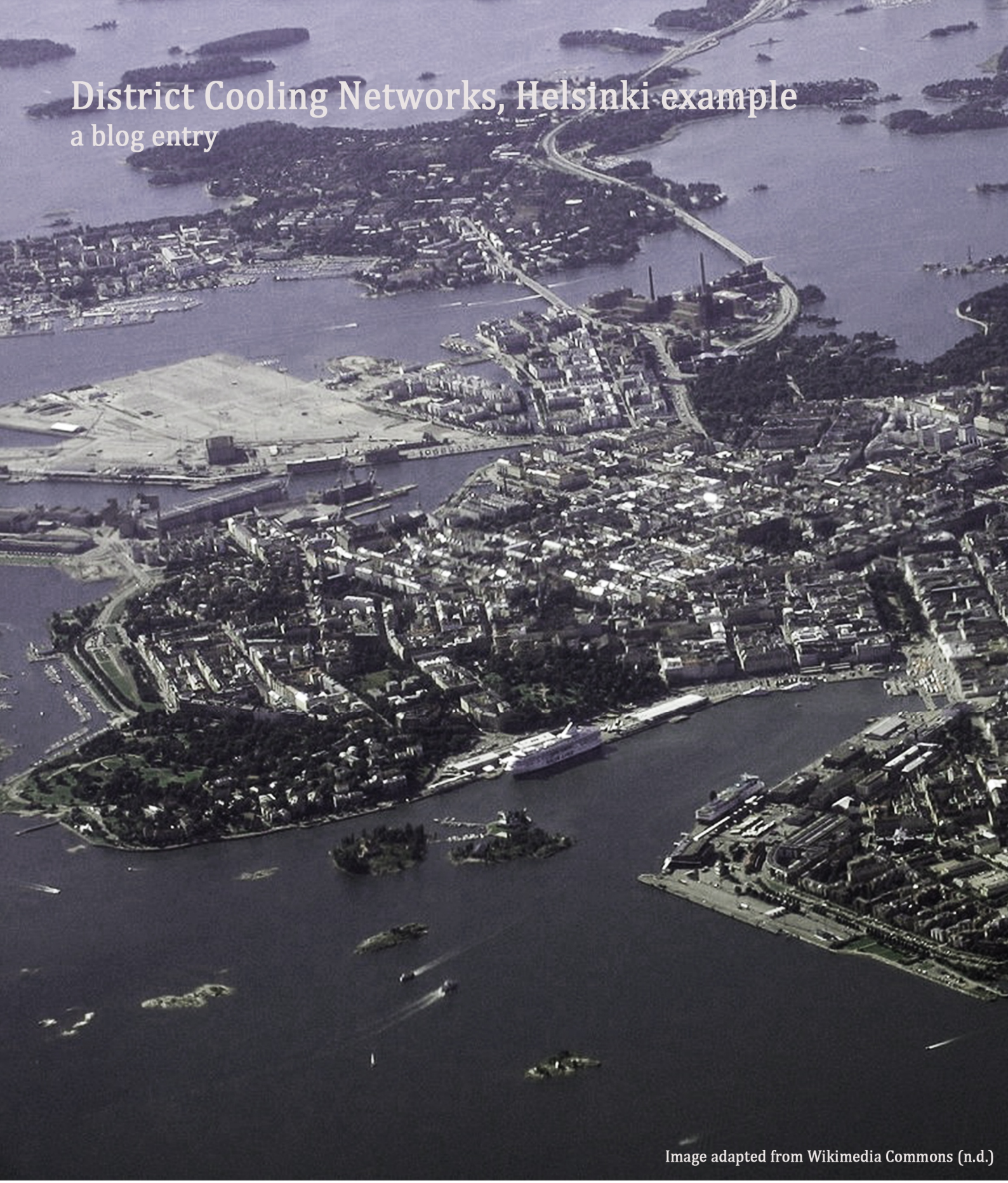
District Cooling Networks, Helsinki example

a blog entry



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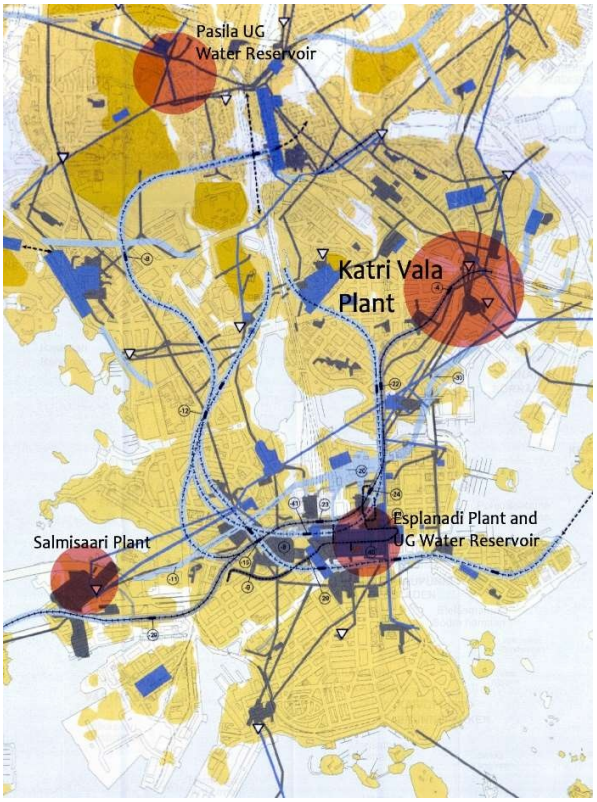
Who has the coolest cooling? Helsinkiläinen! [1]

What is the first image that presents itself in your mind when you think about Helsinki? It definitely does not involve warm colors but rather blacks and whites with occasional snowflakes. So who would have thought that Helsinki, one of the world's coldest capitals, would need cooling, when we feel we barely need it in Hamburg? Apparently, it does! Not only there is a district cooling network in Helsinki, but it is also a state-of-the-art system that deserves being talked about. Just take a look at the underground map of Helsinki below, and you will see the hidden infrastructure which provides cooling water to the city.



Helsinki underground map [2]

Helsinki city has ambitious goals when it comes to climate change and carbon emissions even though they don't have the hottest summers. And yes, there is an increasing demand for cooling in Helsinki because humans' comfort conditions are evolving, and climate change and urban sprawl are contributing factors. City of Helsinki plans to reduce CO_2 emissions around %80 by 2035 [3]. One of the many ways to achieve this is to use energy efficient systems such as district cooling. And with the

[1] Helsinkiläinen: person living in or originating from Helsinki. For reference, see end page.

existing district heating network, it is even easier to implement a district cooling network since both systems are integrated to each other [4].

The cooling production system is mainly composed of three plants and two underground water reservoirs. Water reservoirs are used as storage units when cooling demand is low during nighttime. When cooling demand increases during daytime, the chilled water is pumped to city [5]. Of the three cooling plants, two of them are located underground. You may ask yourself, what is it with all these underground facilities? First of all, it is much less expensive when plants and reservoirs are as near to the served areas as possible, but laying them on ground level would mean taking up precious urban area. Secondly, land ownership rarely becomes a problem underground. Moreover, construction activities do not obstruct urban life as it would on ground level, and maintenance is much easier [6].

There are various methods used to produce chilled water. In Helsinki, chilled water is produced by free cooling, absorption chillers, and heat pumps. Free cooling from the sea is by far the most favorable one, since it requires almost no energy, but unfortunately it can be used only when Baltic sea water is below 8°C between November and May [7]. Free cooling was first used in Helsinki when Katri Vala plant started operating in 2006.

Katri Vala plant, named after the famous Finnish poet, is a co-generation plant and provides both chilled and hot water simultaneously to the city through five heat pumps with a 70MW capacity of cooling. It is using excess heat from sewage, data centers and return waters of both cooling and heating systems. During winter it can provide cooling to a portion of the city center and during summer, it provides cooling to the whole city center. Similarly, during winter it can provide heating water to city whereas during summer it provides only hot tap water to the city. It is one of the largest heating and cooling plants in the world, but what makes it impressive is that 80% of production is based on energy that would otherwise be wasted [8]. Maybe it is past time that we start talking more about circular economy in energy too.

Other plants have their methods for producing cold water too. Salmisaari plant is the oldest one and produces cold water through absorption chillers, it is also a power plant. On the other hand, Esplanade plant is the newest one, started operating in 2018 and produces chilled water with heat pumps, also using waste heat from the city [9].

Taking a glimpse at the past, district cooling has started functioning not long ago in Helsinki, the first demo was performed in 1995. After its success, the system was being improved. In the beginning residentials were not included due to hardships with customer contracts; however, today some residentials are also benefiting from it [10]. Due to its costly nature, district cooling systems are not usually spread through the city but rather concentrated in certain areas. This is why new development areas are planned with connections to the district heating and cooling systems.

With all that said, what is waiting for Helsinki in the future? There is a fact that none can avoid, cooling demand is increasing. It is expected to increase somewhere around 15% by 2030 and most of it will be from office uses [11]. In 2014, market share of district cooling was only around %10, and it is expected to rise to %30 by 2030 [12].

Energy demand for cooling is only 1% of the overall energy demand of end-users [13], so what is all the fuss about? But city of Helsinki is using opportunities to cut carbon emissions as much as they can. And it is also profitable for them. District cooling and heating systems are operated by Helen energy which is owned by city of Helsinki. The profit range of the company is around %10, and energy

market is not regulated in Finland. Even though it was supposed to be privatized, that never went through [14]. And the network is expanding.

So, if you are planning to take a trip to Helsinki, just remember that there is so much more going on below ground than meets the eye. And if you ever run out of options of fun things to do in Helsinki, which is very likely the case, try to take a moment to think about the massive infrastructures that surround us, which we barely even notice anymore. Just at that moment, you can appreciate them for the comfort they provide us, or just curse them for destroying our planet. But maybe, just maybe, there is good in every evil and there is evil in every good... And now let yourself drift away, take a sip from your half-cold Finlandia vodka and keep waiting for the shy sun while looking at blacks and whites with occasional snowflakes.

References

Cover image adapted from: Wikimedia Commons. (n.d.). Helsinki aerial. Retrieved July 16, 2020, from https://commons.wikimedia.org/wiki/File:Helsinki_aerial.jpg

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