



HSY

Intelligent Urban Heating  
and Cooling Solutions:

# Going Underground for Renewable Energy

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District Heating and Cooling -  
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# Helsinki Metropolitan Area

The Arctic Circle

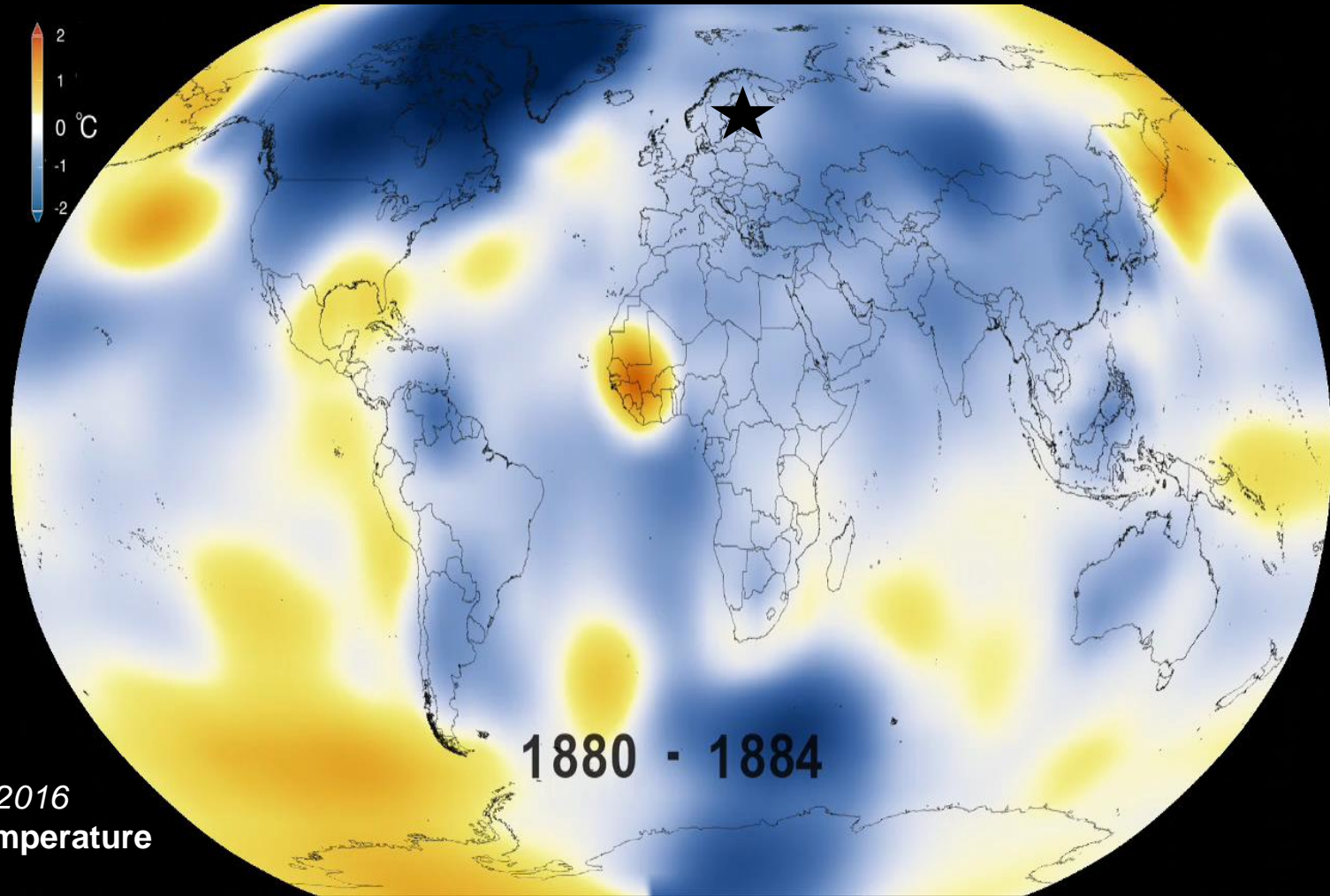
Finland

Helsinki

	Helsinki City 2016	Helsinki Metropolitan Area (4 cities)
Population	0.64 mill	1.14 mill
Population density: inhabitants/km2	2,934 Inner city 16,000	1,479

# Finland has become warmer,

100 years of global warming



**Finland 2016  
Mean temperature**

- Whole year 6.6°C
- Warmest month July, +17.8°C
- Coldest month January, -8.8°C

*Source: NASA and the National Oceanic and Atmospheric Administration (NOAA).*

# Common strategy for the mitigation of climate change



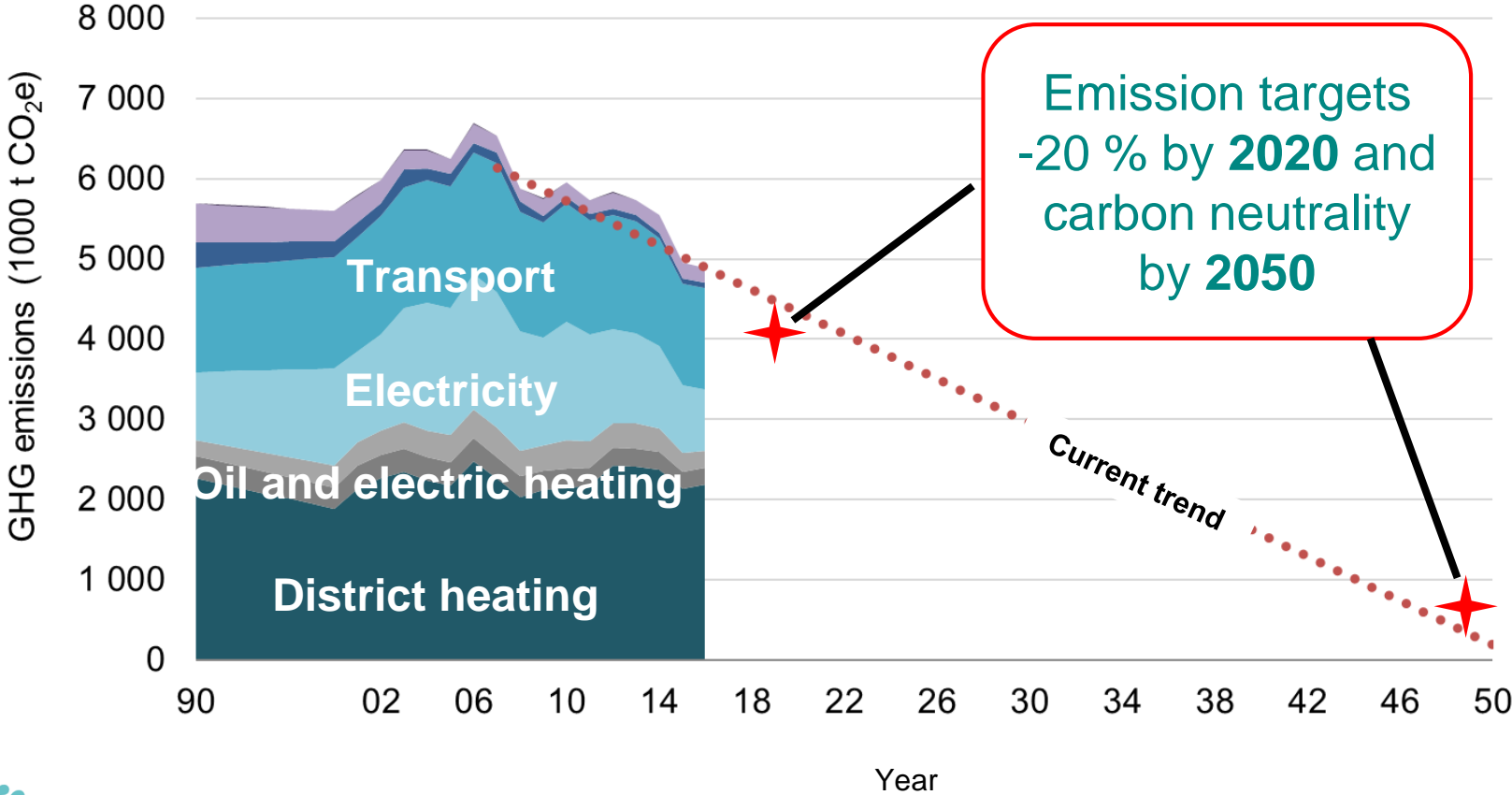
## Helsinki Metropolitan Area Climate Strategy 2030

- Traffic
- Land use
- Buildings
- Procurement
- Consumption and waste
- Energy production  
distribution and consumption

The measures on which the cities can have an impact through their own decision.

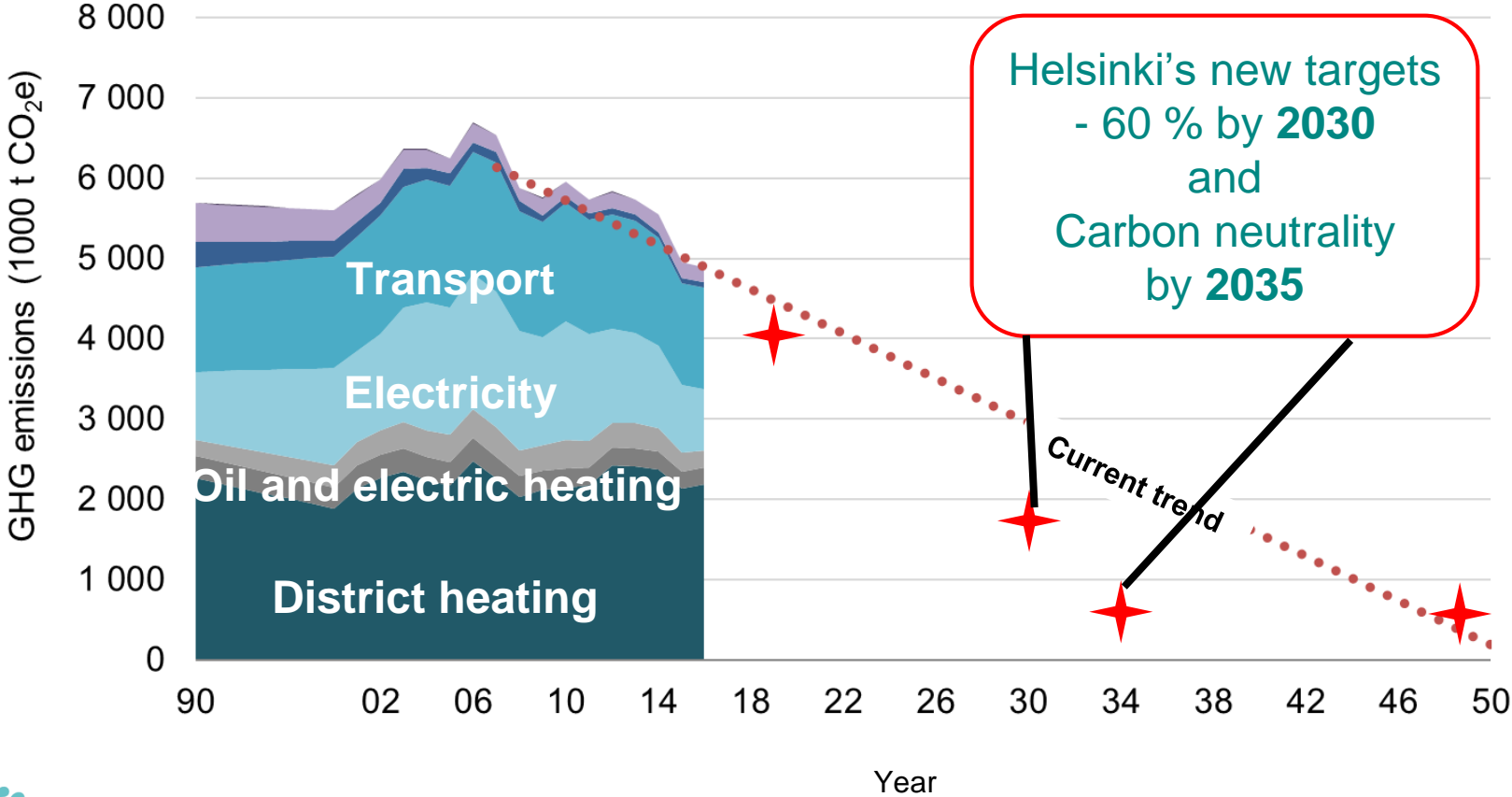
130 measures

# Carbon emissions are declining in the Helsinki Metropolitan Area



Source: HSY

# Carbon emissions are declining in the Helsinki Metropolitan Area



# Heating is the main source of carbon emissions



The Esplanade Park



# The energy company Helen Ltd's goals

A background image of a rainy street scene. Several people are walking away from the camera on a wet sidewalk, holding black umbrellas. The street is lined with trees and a building is visible on the left. The overall atmosphere is overcast and rainy.

Helen Ltd owned by the City of Helsinki:

- Carbon emissions - 20% 1990-2020
- Share from energy from renewable sources 20% in 2020
- Carbon neutral 2050

**Origin of district heat:** mainly fossil fuel, heat pumps 7 %

**Origin of district cooling:** heat pumps 79 %, sea water 10 % by 2016



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How?

Urban Energy Future and  
Renewable Energy Sources

# The future challenges – Finland's Climate Scenario by 2050

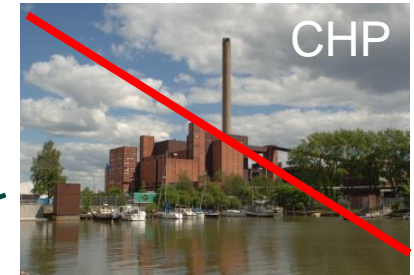
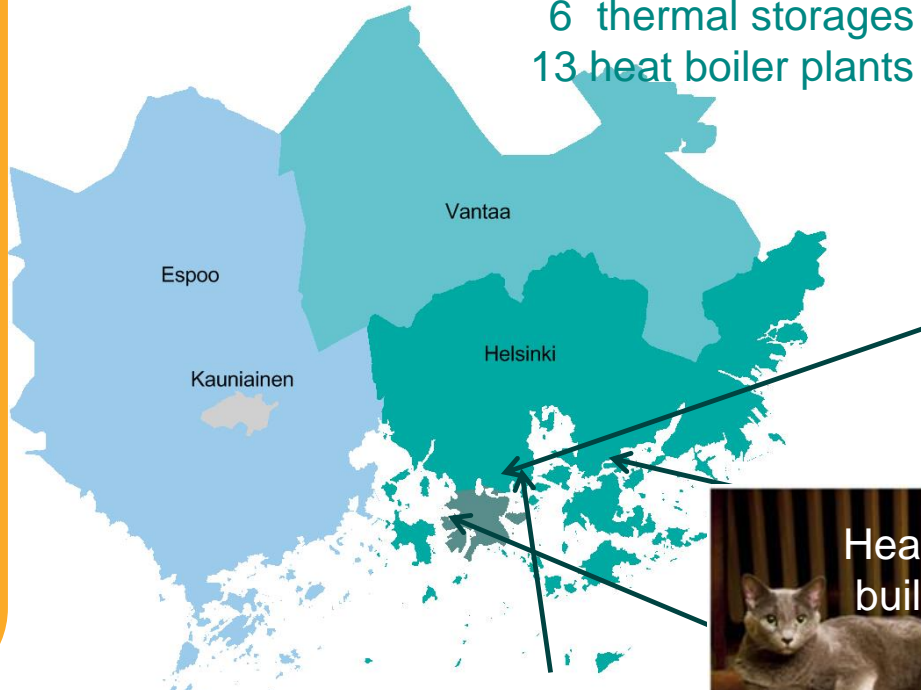
Demand  
for heating  
decreases  
– 17 %

Demand for  
cooling  
increases by  
+ 35 %

# District Heating -Decentralised Heat

District heating network  
1300 km in Helsinki

5 CHP plants  
2 heat pump plants  
1 waste to energy plant  
6 thermal storages  
13 heat boiler plants



# The world's largest heat pump plant: Katri Vala



**Above the heat pump**

park +33 m

Bomb shelter 20 m

The heat pump plant

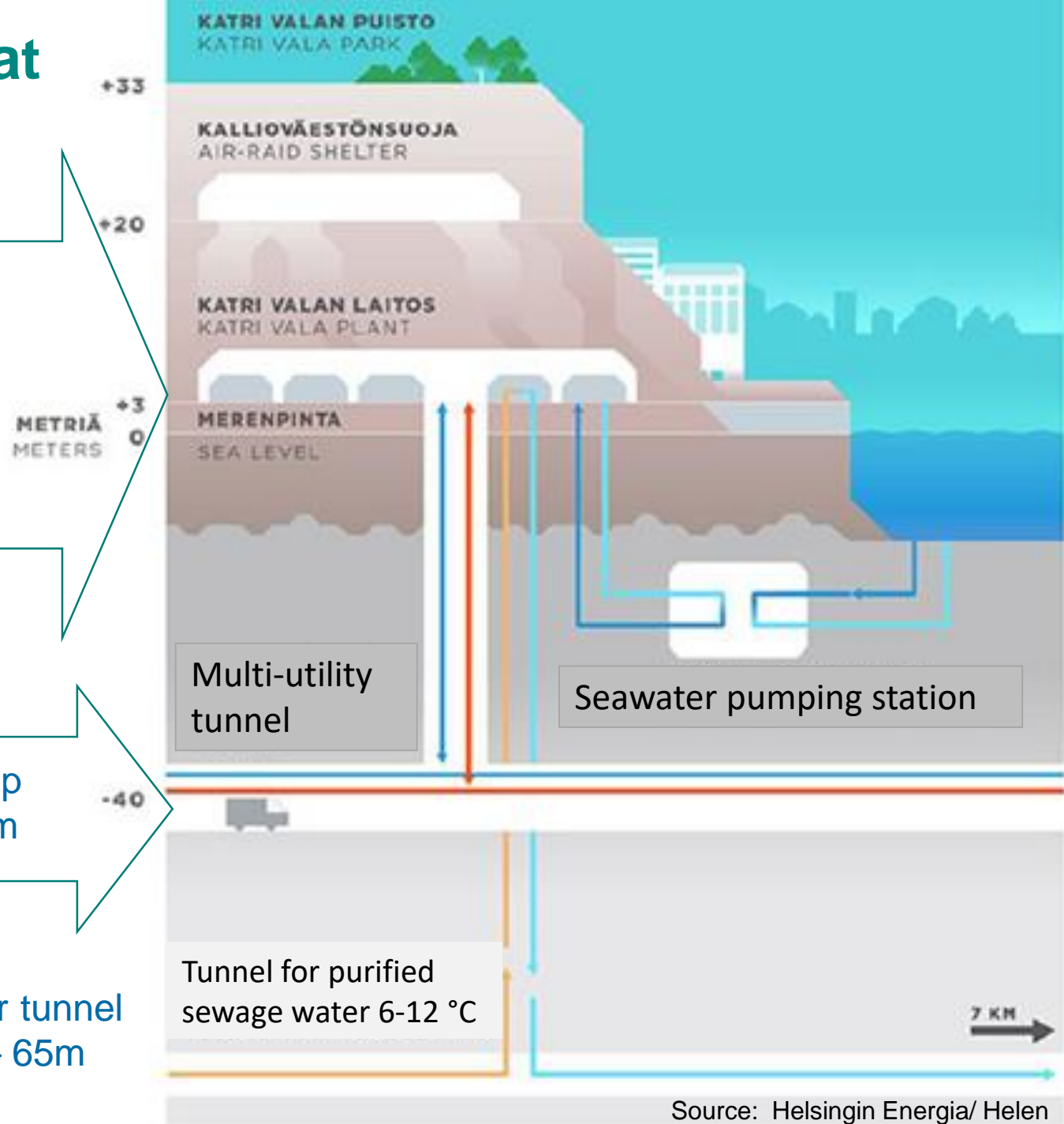
floor level + 3,5 m

# Katri Vala heat pump plant

Area 7 000 m<sup>2</sup>  
Volume 53 500 m<sup>3</sup>  
Floor level + 3,5 m  
5 heat pumps  
Heating 90 MW  
Cooling 60 MW

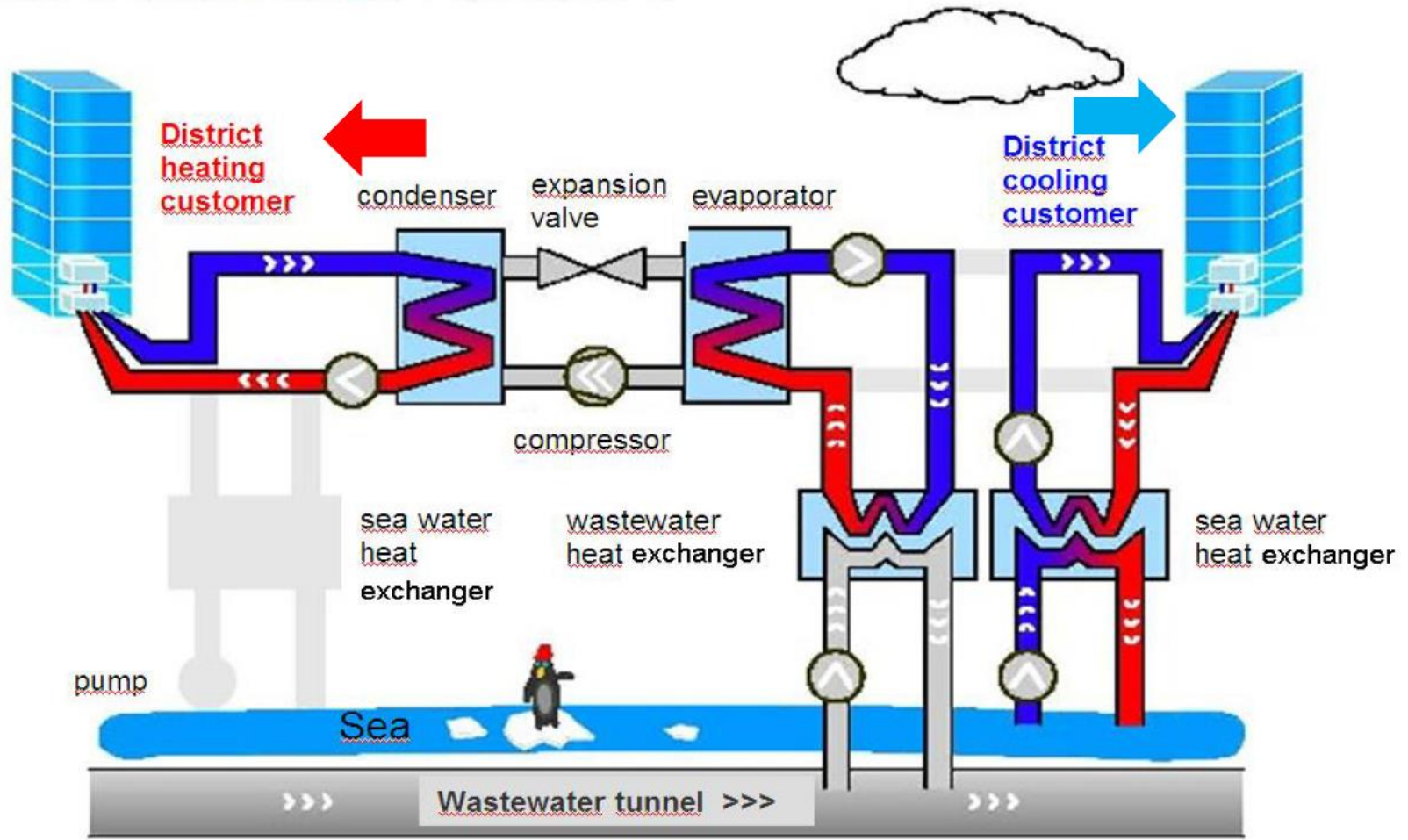
Below the heat pump  
Energy tunnel - 40 m

Cleaned wastewater tunnel  
- 65m



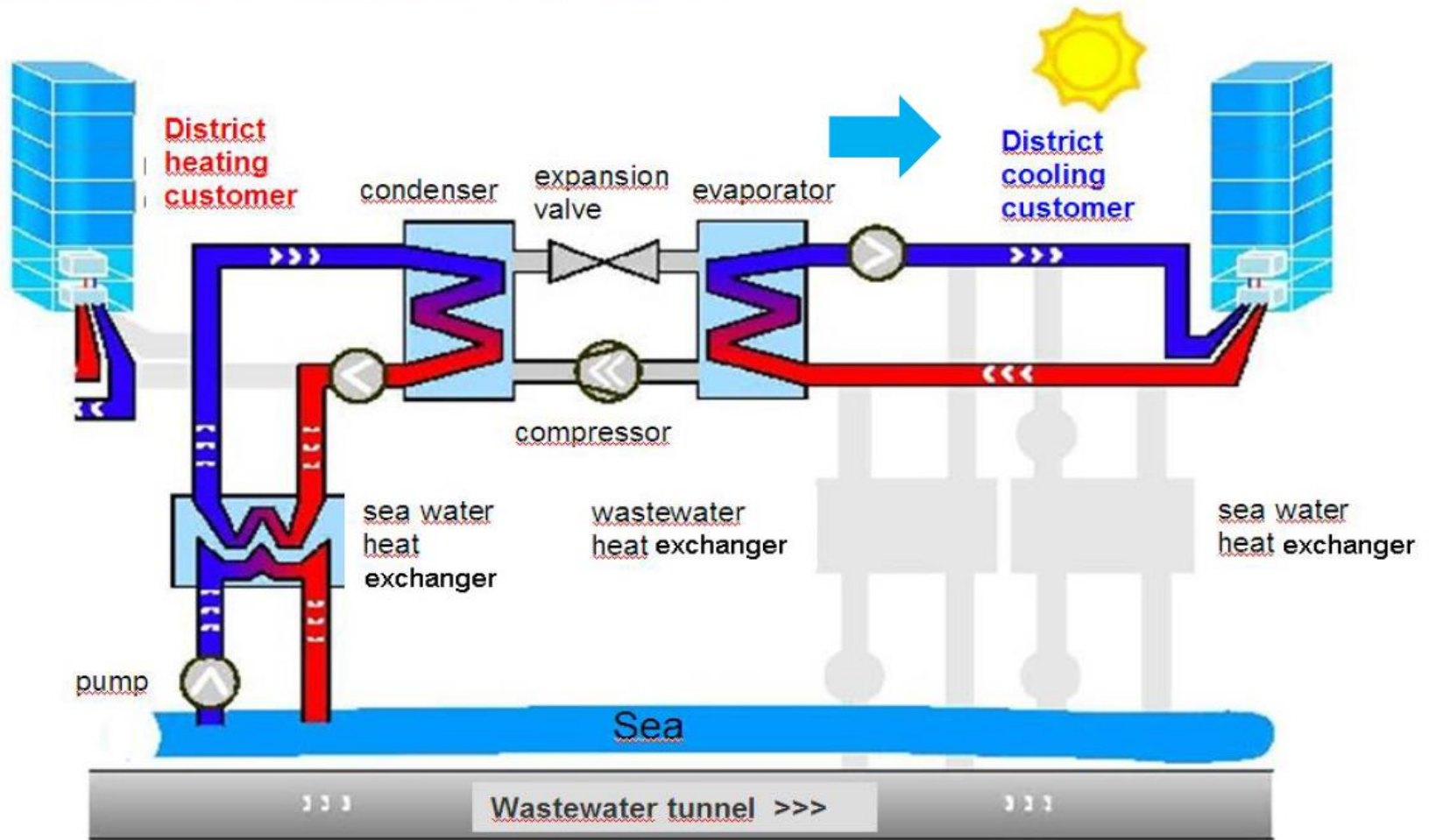
# District Heating in 90 MW

## Operation mode / Winter



# District Cooling in 60 MW, Katri Vala

## Operation mode / Summer




# The storage of District Cooling

**Storage** brings flexibility and extra reliability in the supply of cooling energy.



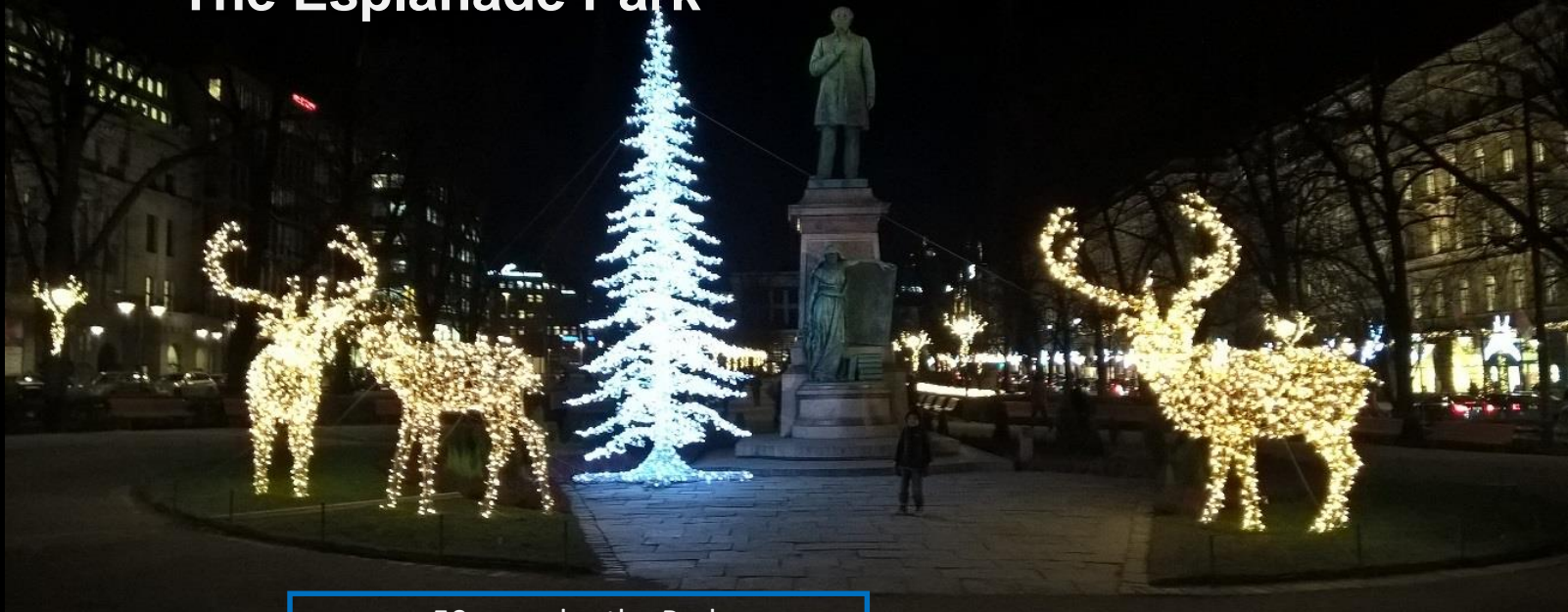
Esplanade Park cooling accumulator,  
26,000 m<sup>3</sup>, 35 MW



Pasila cooling accumulator  
11,500 m<sup>3</sup>, 20 MW

Source: Helsingin Energia/ Helen

# New heating and cooling plant The Esplanade Park



50 m under the Park  
The cooling lake – 100 m under the  
ground level

Air temperature +15 °C  
Water +10 °C

Cooling 55 MW

- new pumps 15 MW
- and storage 40 MW

Heating 22 MW

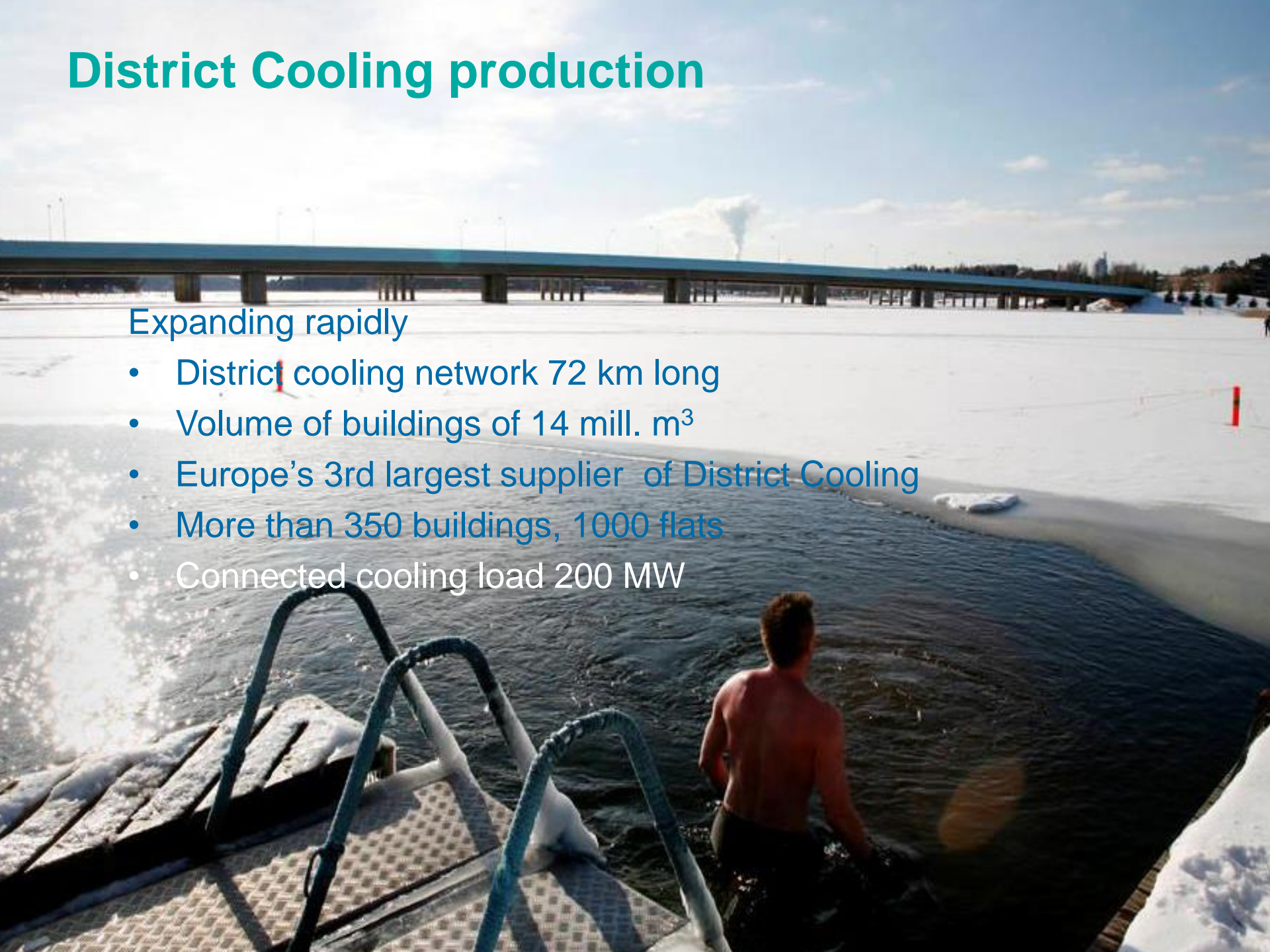
- Investment of 10 mill euro

Source: Helen Ltd 19.9.2017

# District Cooling production

Expanding rapidly

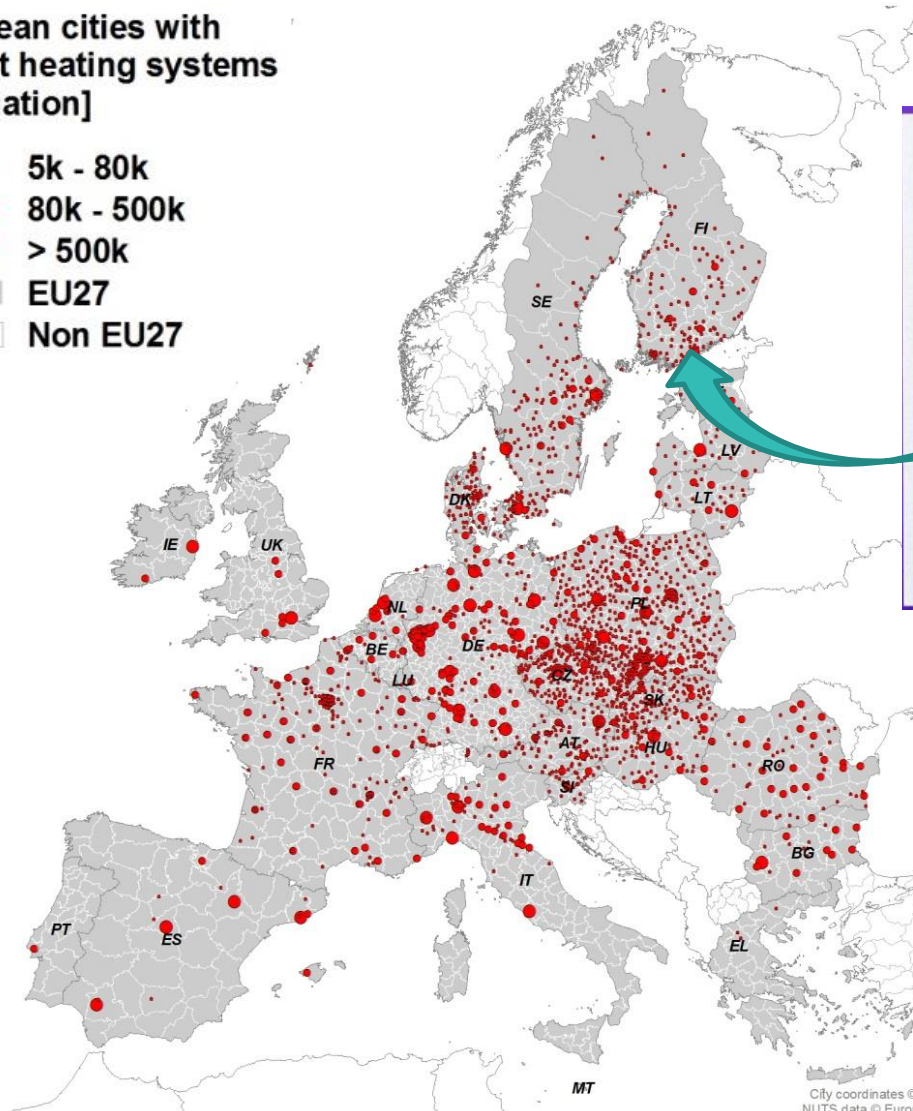
- District cooling network 72 km long
- Volume of buildings of 14 mill. m<sup>3</sup>
- Europe's 3rd largest supplier of District Cooling
- More than 350 buildings, 1000 flats
- Connected cooling load 200 MW



# Helsinki – The Winner of Global District Energy Climate Awards 2013

European cities with district heating systems [Population]

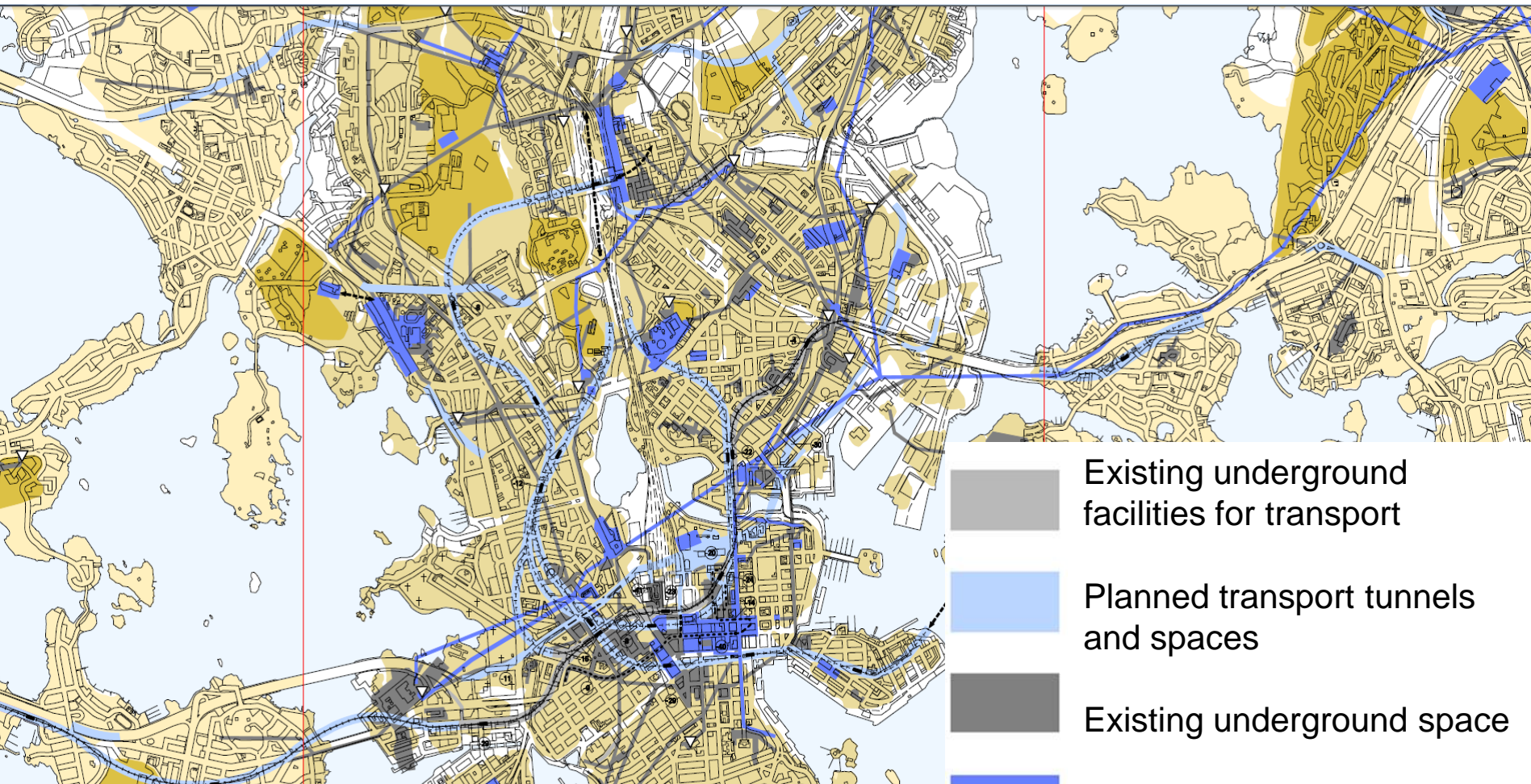
- 5k - 80k
- 80k - 500k
- > 500k
- EU27
- Non EU27



City coordinates © NUTS data © EuroGeographics for the administrative boundaries

Source: Helsingin Energia/ Helen

# Planning Tools: The Underground Masterplan in Helsinki



- Existing underground facilities for transport
- Planned transport tunnels and spaces
- Existing underground space
- Planned underground space
- Rock, which is suitable for underground building

# How to promote tools for climate change mitigation?



# Conclusions

- The technologies to achieve low carbon urban energy are already available.
- Large scale systemic changes require political decisions and measurable goals.
- Strong leadership needed on climate change.



All emissions are local - Cities must take lead on climate change!



*Gracias!*  
*Thank you!*

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