Module 6 – REFURBISHMENT OF DISTRICT HEATING SYSTEMS

Professional Intensive Training Course Version

SHaKE – Sharing Heat and Knowledge on Energy Communities
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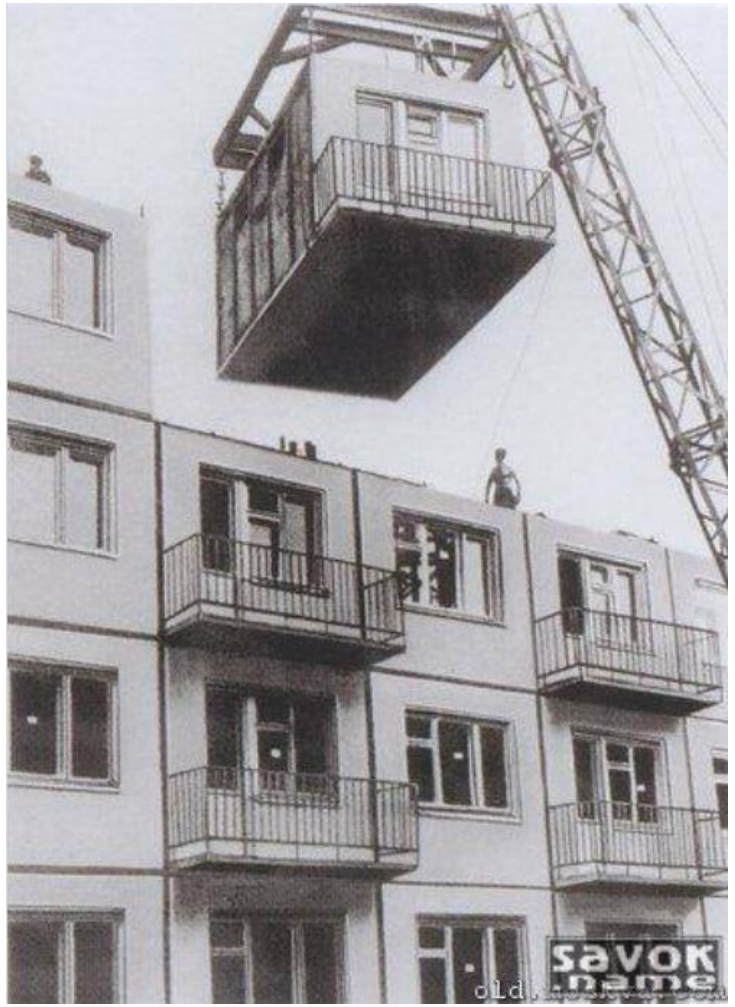
THE ROLE OF DISTRICT HEATING SYSTEMS

- District heating is meant to be an urban energy concept.
- It minimises emissions in the densely populated areas of cities.
- It can provide more efficient system control due to large scale.
- In some countries it was used for heat supply for housing estates.
- More efficient system control and maintenance
- It facilitates the integration of renewable energies such as geothermal that would be difficult at individual scale

Source: https://dunaujvarosmesel.hu/2023/02/03/vakolokanal-helyett-toronydaru/

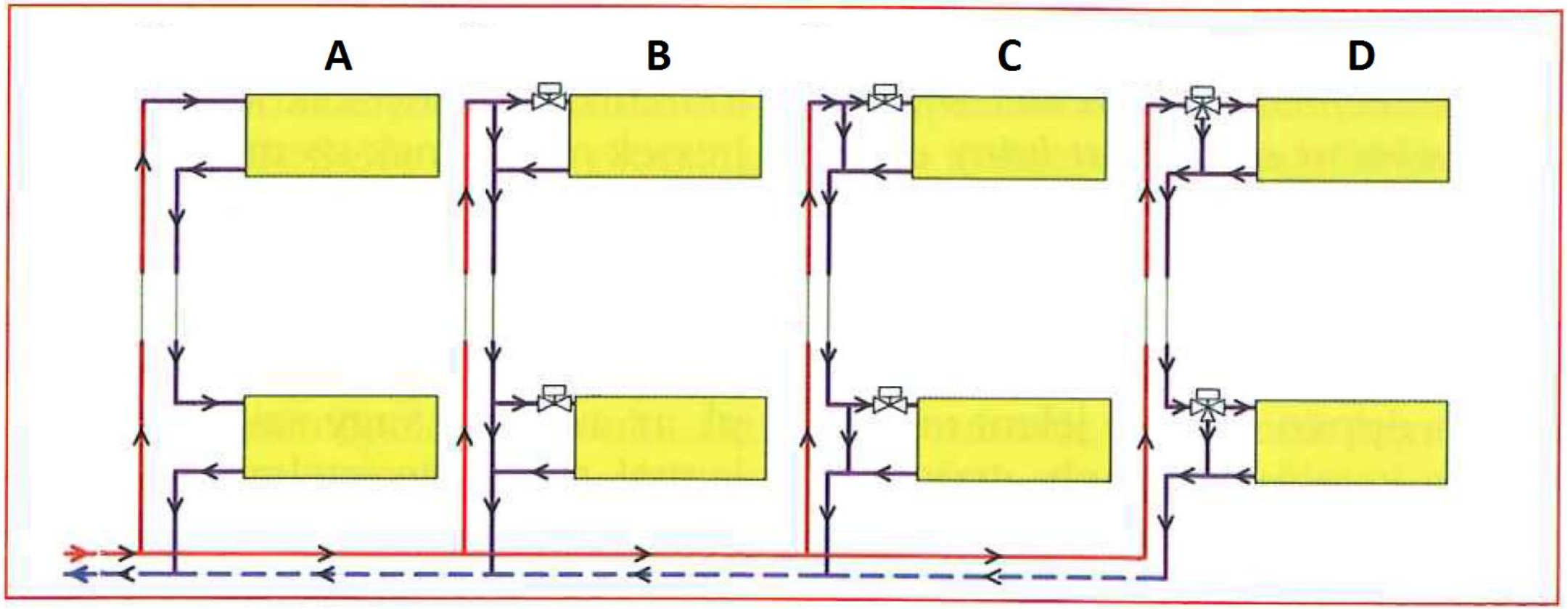
HISTORICAL CONTEXT IN EASTERN EUROPE

- Several systems were installed in the age of very cheap energy.
- Efficiency did not play a significant role in the design process.
- Low-efficiency systems have been around for decades.
- Renovation is necessary in many cases. Conscious design is required, as large-scale renovations are carried out rarely.
- Hungary: Single-pipe heating was compulsory for dwellings built with insulated technologies.



https://dunaujvarosmesel.hu/2023/02/03/vakolokanal-helyett-toronydaru/

SINGLE PIPE SYSTEM REFURBISHMENT



A. Single-pipe, flow-through heating

B. Single-pipe, bypassed radiator

C. Single-pipe, shifted bypass with one-way valve

D. Single-pipe, shifted bypass with three-way valve

Source: Kepka György: Panelkorszerűsítés gyakorlati szemmel II., Magyar Installateur, 2014/10.

REFURBISHMENT OF DHC IN HOUSING ESTATES

COMPACT, MODULAR SUBSTATIONS

- In 2nd generation district heating systems substation were installed in situ.
- In 3rd generation DH prefabricated components are used, also for substations.
- Substations are available in various performance levels prefabricated with all necessary elements equipped, sich as:
  - Flat-plate heat exchangers
  - Variable frequency pumps
  - Performance adjustment valves
  - Expansion vessels.

Source: www.szovaterm.hu

TECHNICAL CONSIDERATIONS IN THE TRANSITION

Building-Level Adaptations

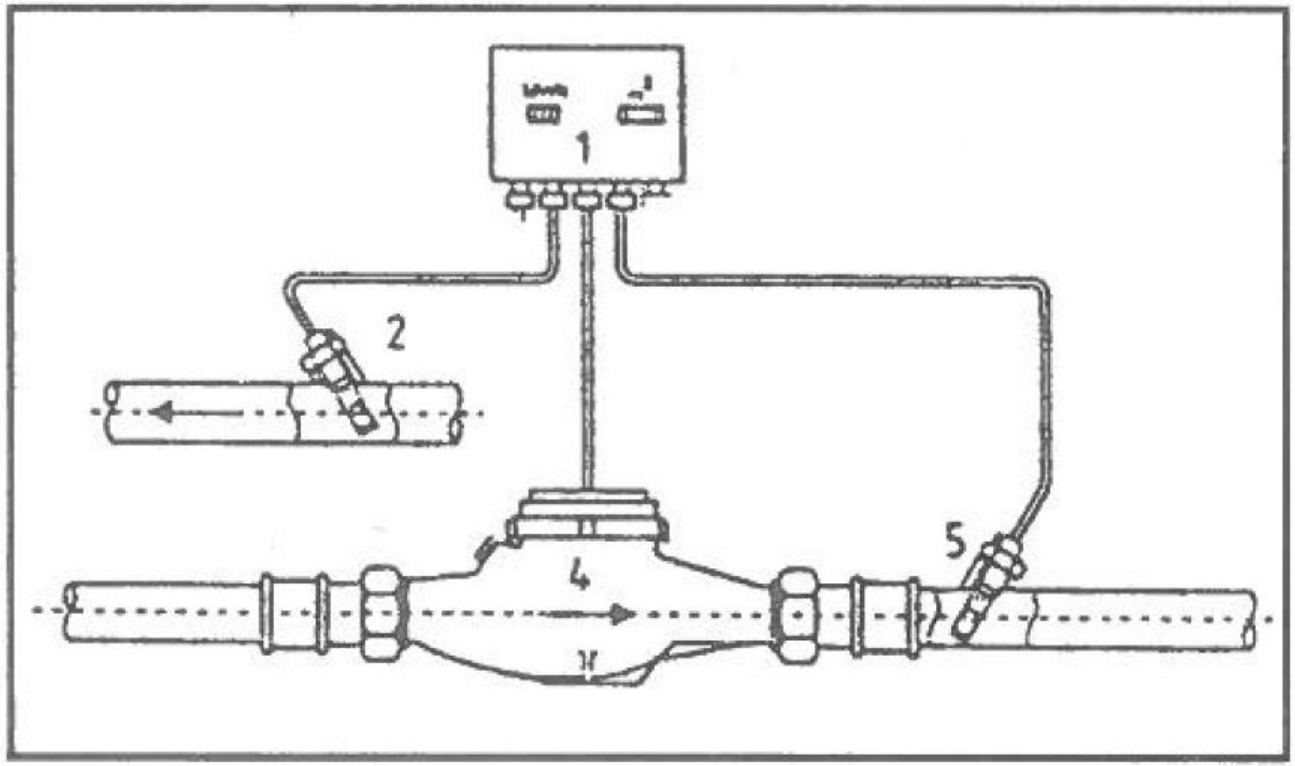
- Ensuring radiators or underfloor heating systems work efficiently at lower inlet temperatures
- Improving thermal envelopes (windows, walls, roofs)
- Installing substation heat exchangers that operate well at lower ΔT
- Domestic hot water (DHW) preparation:
  - Requires booster heaters (e.g., electric or heat pump-based)
  - Avoiding Legionella risk (use point-of-use or pasteurization strategies)

https://www.atamate.com/atamate-news/apartment-innovations-1-fifth-generation-heat-networks

MEASURING AND BILLING HEAT CONSUMPTION

Heat consumption meters

- Processing computer
- Supply thermometer
- Flow sensor
- Return thermometer



- Central heat consumption measurement for buildings
- Division of heating cost among consumers

Source: Forrás: Horváth Gábor: A hőfogyasztásmérés elmélete és gyakorlata. Sontex. Budapest, 2008.

REFURBISHMENT OF DISTRICT HEATING SYSTEMS

CASE STUDIES

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DH DEVELOPMENT: INVOLVING DOWNTOWN AREAS

London: Bunhill Heat and Power Network

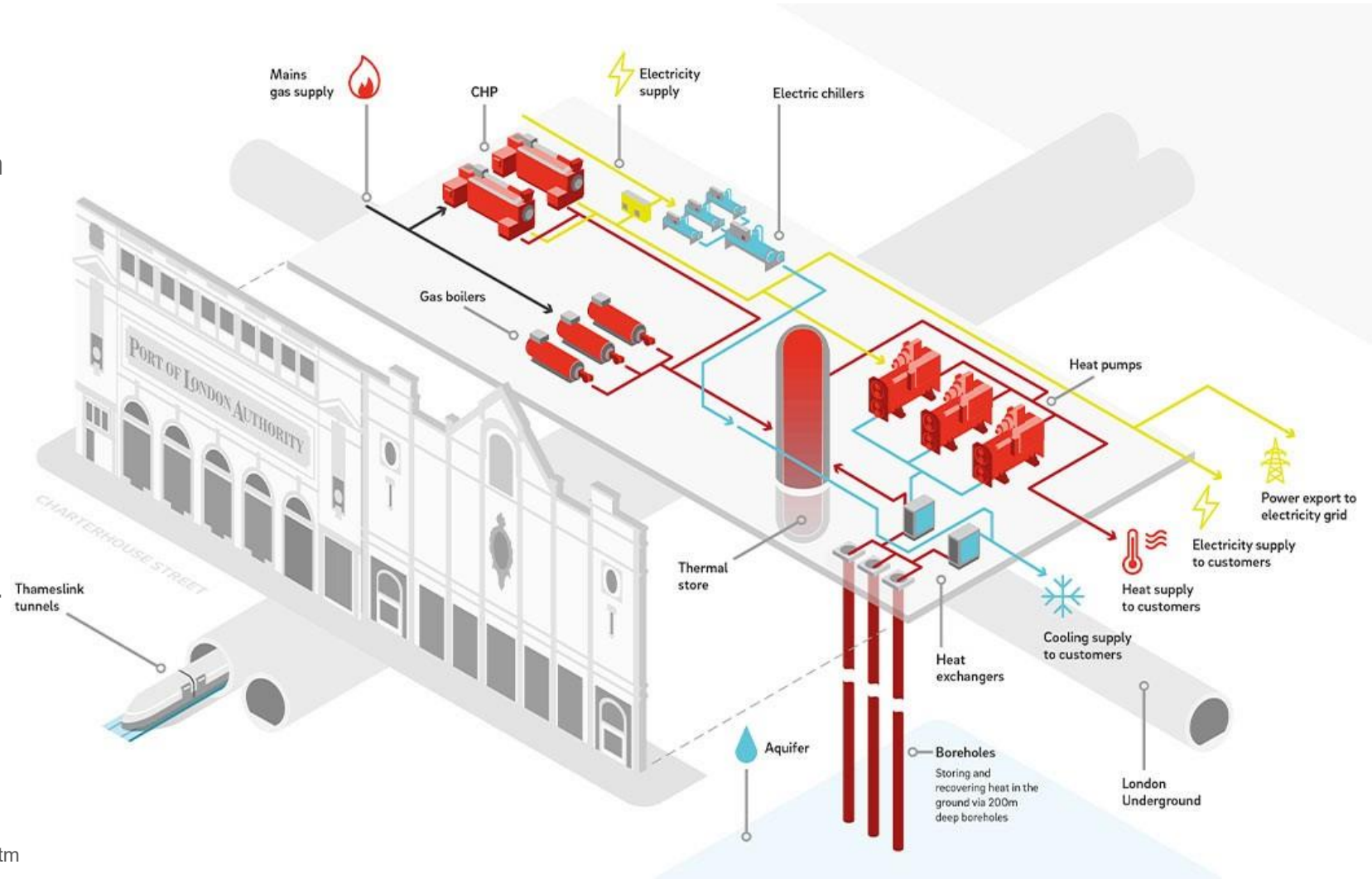
- The first project in the world to take waste heat from an underground train network (the London Underground) and use it to provide heat locally.
- Phase 1 was based on a gas-fired Combined Heat & Power (CHP) plant in Central Street; waste heat from electricity generation was captured for district heating.
- Phase 2 introduces a new energy centre located at a London Underground ventilation shaft (corner of Moreland Street & Central Street). It extracts waste heat from the Tube's ventilation system via a heat pump.

Source: www.islington.gov.uk, Bunhill Heat and Power Network.

DH DEVELOPMENT: INVOLVING DOWNTOWN AREAS

London: CITIGEN Project

- 4 MW heat pump will draw the natural warmth from the London Aquifer (on average 14°C), via 3 boreholes 200m below the surface, as well as recycling waste heat from power and chill generation, which would otherwise vent into the atmosphere.
- The heat pump will be equal to the demand of 2,300 UK homes or businesses. This is complemented by a further 2.8MW of new cooling capacity for customers across the business district.
- 320,000 litres thermal storage tank for flexibility of heat generation - peak shaving, allowing Citigen to use excess renewable energy on the grid to store heat.

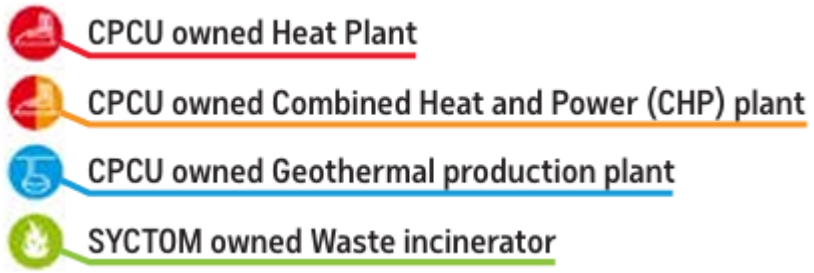


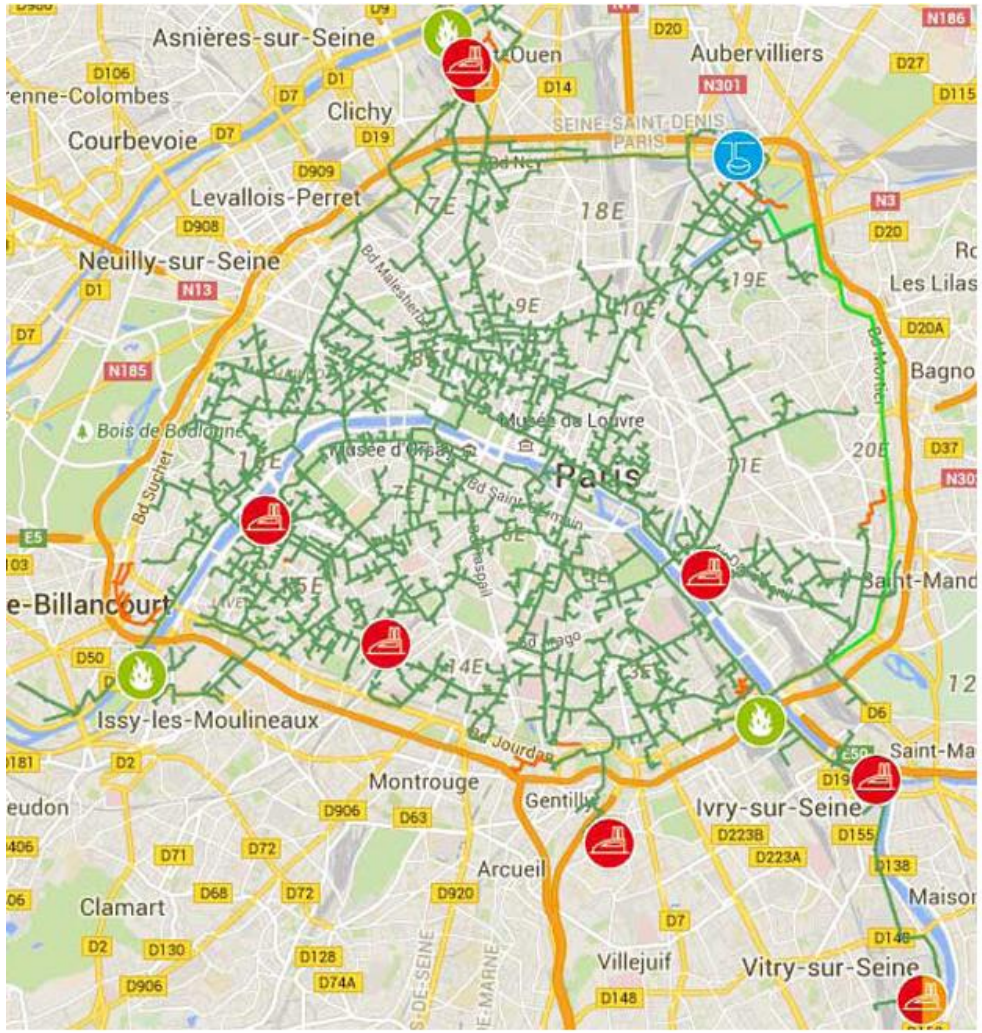
Source: https://www.eonenergy.com/business/why-eon/case-studies/citigen.html?utm

DH DEVELOPMENT: INVOLVING DOWNTOWN AREAS

Paris District Heating Development

- CPCU district heating network: ~ 5,500 GWh/year heat produced; network length ~ 475 km.
- CPCU serves ~ 500,000 households equivalent, includes 100% of hospitals, ~50 % social housing, ~50 % publicly-owned buildings.





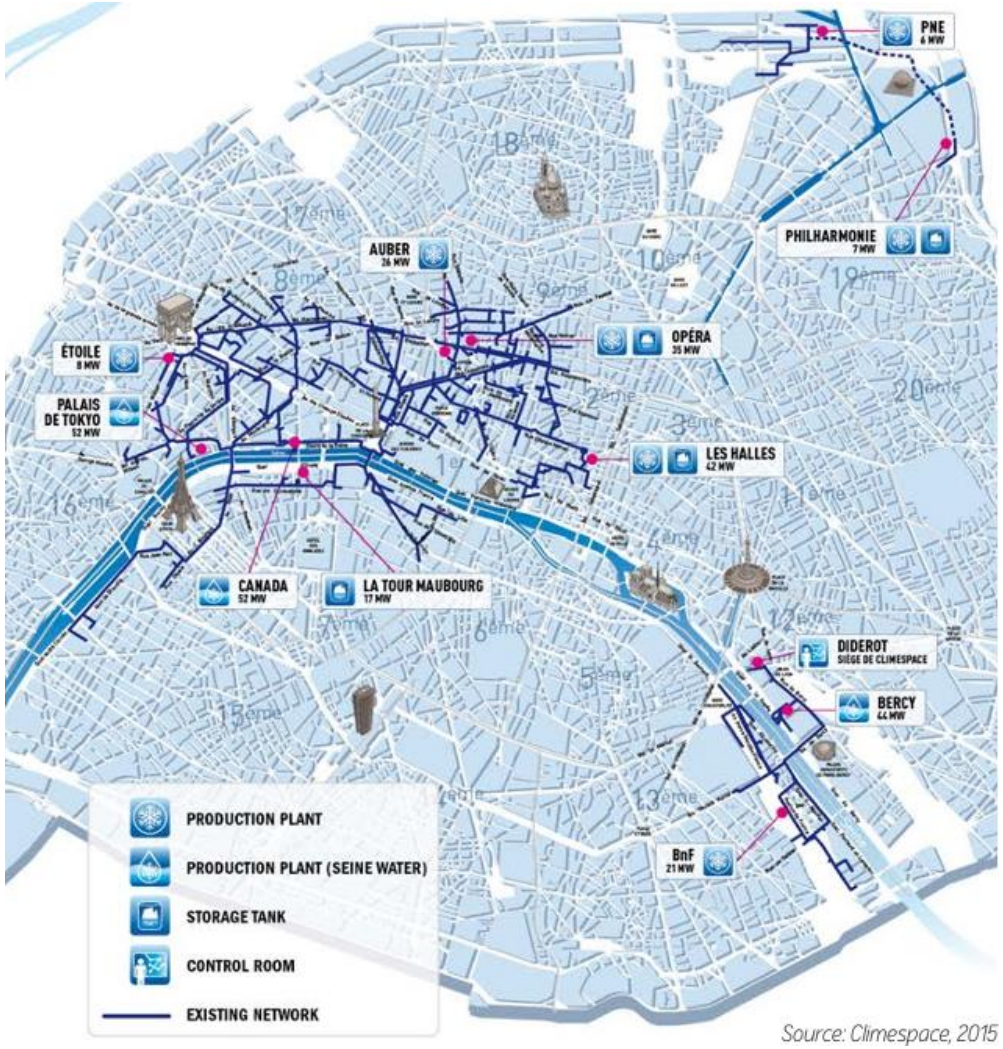
Source: CPCU, 2015

Source: https://urban-leds.org/wp-content/uploads/2019/resources/case_studies/ICLEI_cs_Paris-case-study.pdf

DH DEVELOPMENT: INVOLVING DOWNTOWN AREAS

Paris: Climespace District Cooling

- Climespace district cooling: ~ 330 MW cooling capacity, ~ 412 GWh/year. ~ 71 km cooling network.



Source: Climespace, 2015

Source: https://urban-leds.org/wp-content/uploads/2019/resources/case_studies/ICLEI_cs_Paris-case-study.pdf

Thank you!

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