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www.cir-strategy.com/events

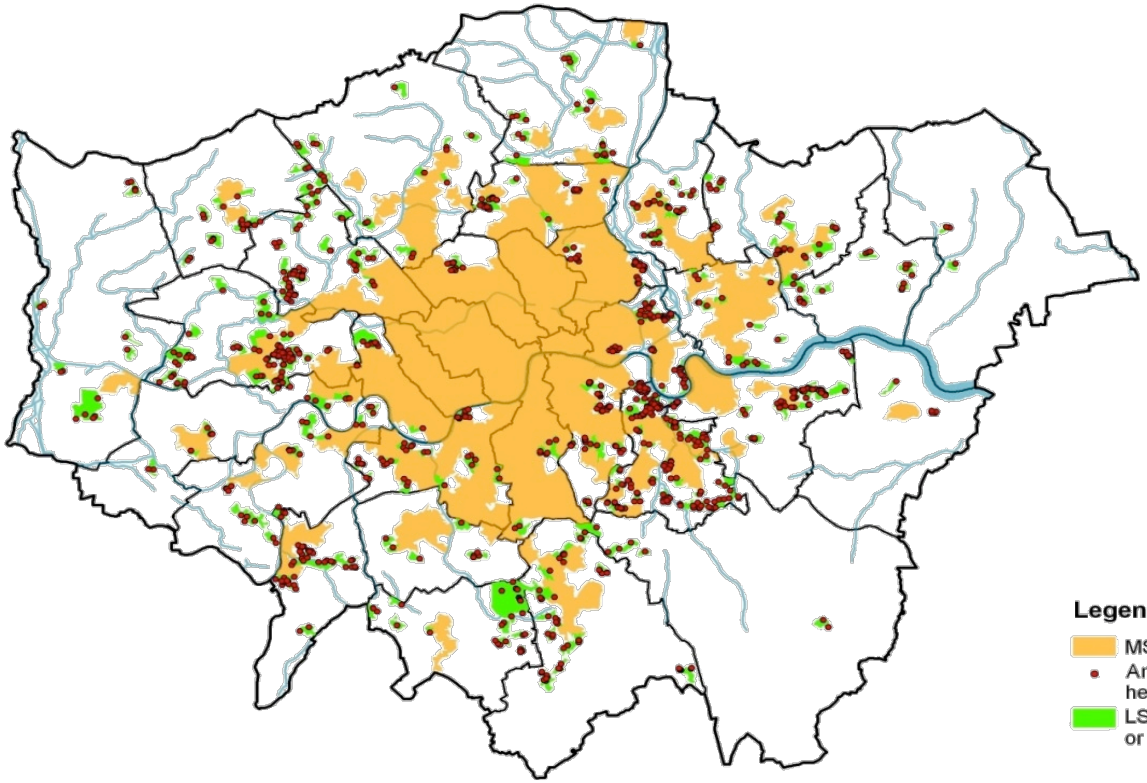
The role of heat networks in future energy scenarios

Introduction

Heat networks:

1. Potential
2. Energy system functions
3. 4th generation heat networks
4. Possible transition

Heat networks – technical potential



N

0 2.5 5 10 km

Legend

- MSOAs above minimum heat demand density threshold
- Anchor heat loads within LSOAs above minimum heat demand density threshold
- LSOAs above minimum heat demand density threshold, containing or adjacent to such containing anchor heat load(s)

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Future heat networks

Seasonal storage

Diurnal storage

System balancing

Energy sharing

Integrating renewables

Integrating heat pumps

Waste heat capture

Large scale heat capture

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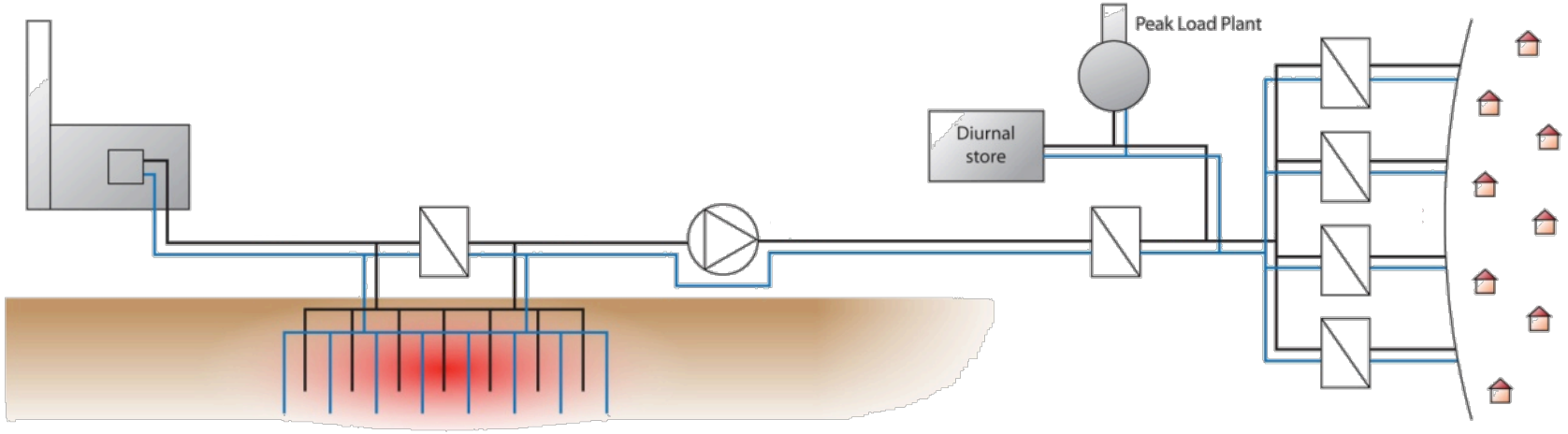
Seasonal storage



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Diurnal storage

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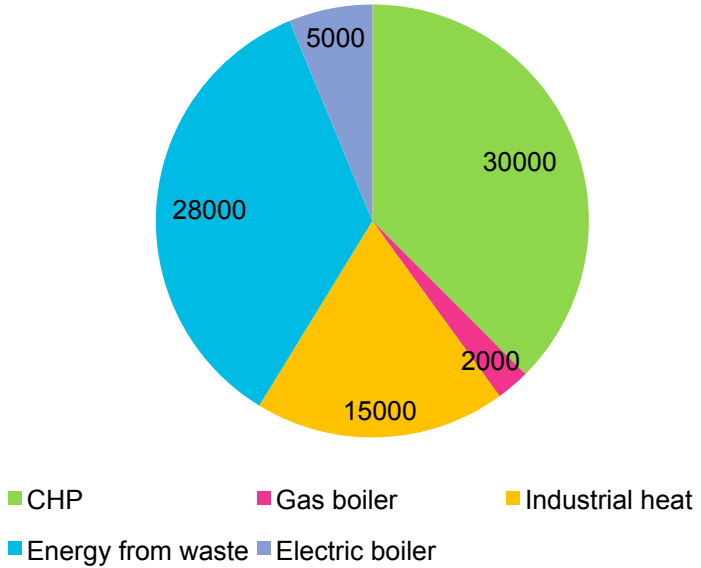
System balancing

- Danish district heating plants use large electric boilers for:
  - Using excess, low cost wind power
  - Selling grid regulation services
- Skagen DH plant
  - 4no. 4.7MWe gas fired CHP units
  - 11MW electric boiler
  - 4no gas boilers
  - 4,150m3 thermal store (250MWh)
  - 2,500 connections

Skagen DH heat generation (MWh/yr)



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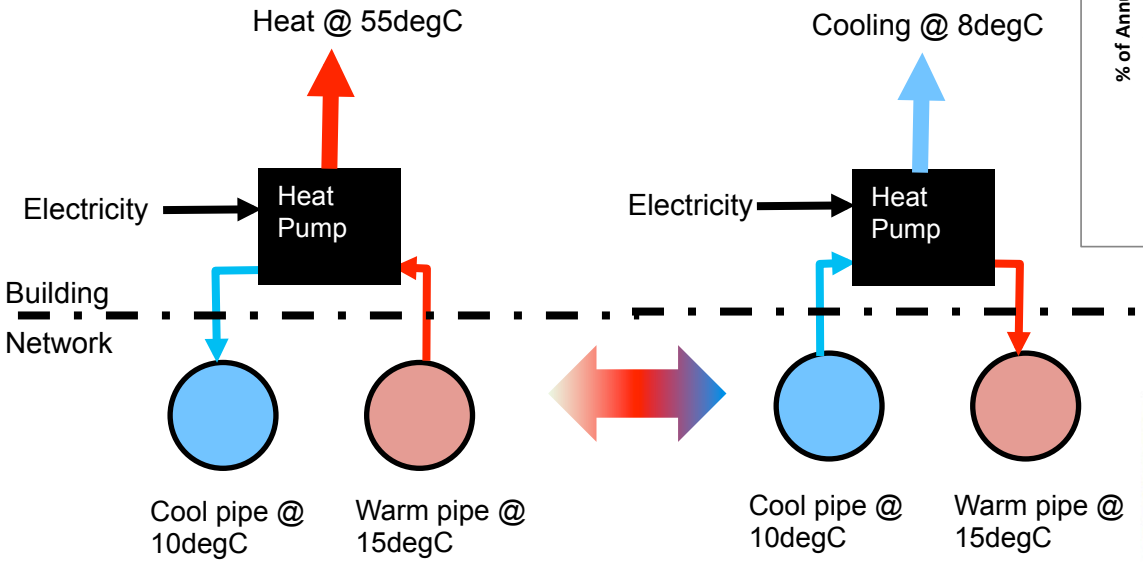
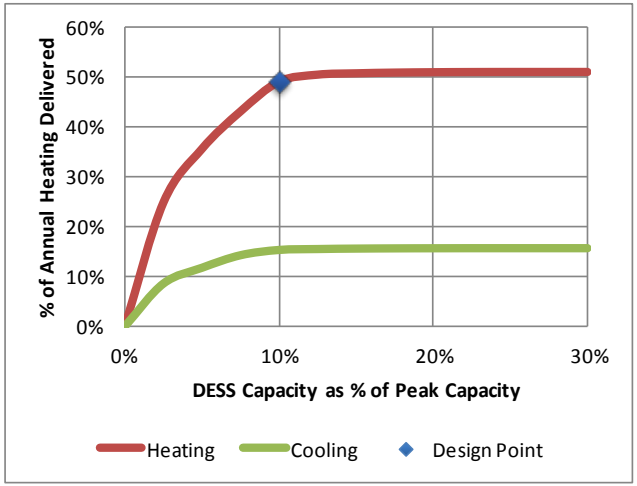
Bach, P (2011) Wind Power and District Heating: New business opportunity for CHP systems: sale of balancing services: http://pfbach.dk/firma_pfb/forgotten_flexibility_of_chp_2011_03_23.pdf

http://www.emd.dk/desire/skagen/Skagen_UK.html

Energy sharing





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Building in heating mode

Building in cooling mode

Waste heat capture

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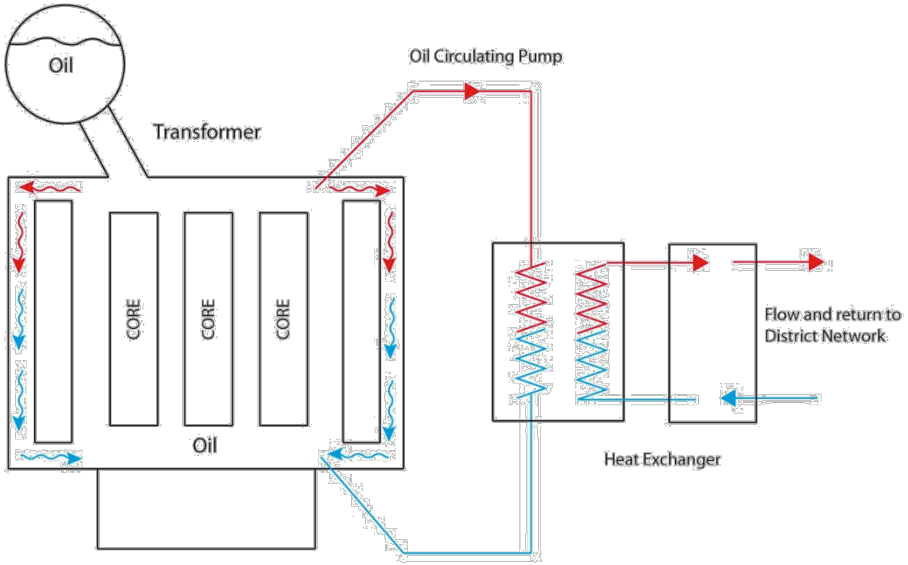

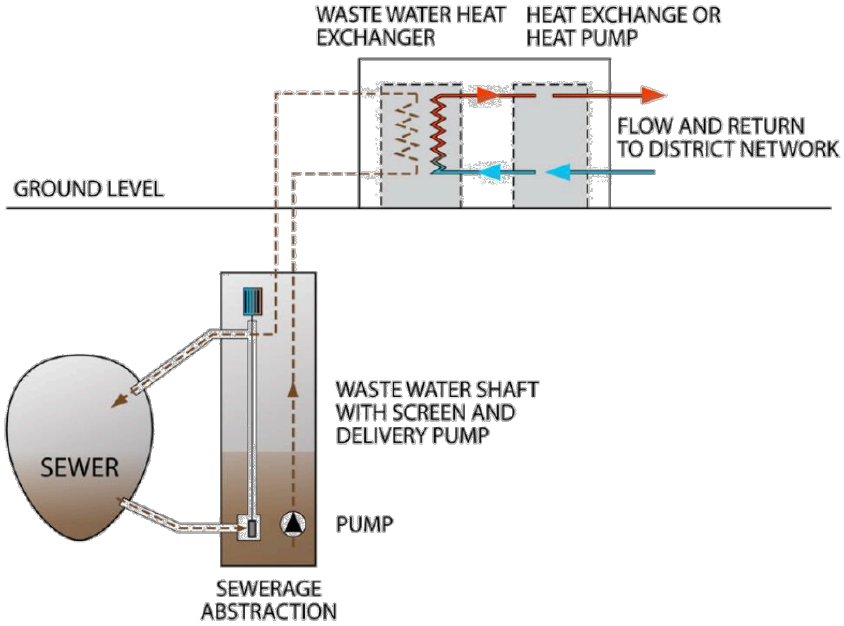

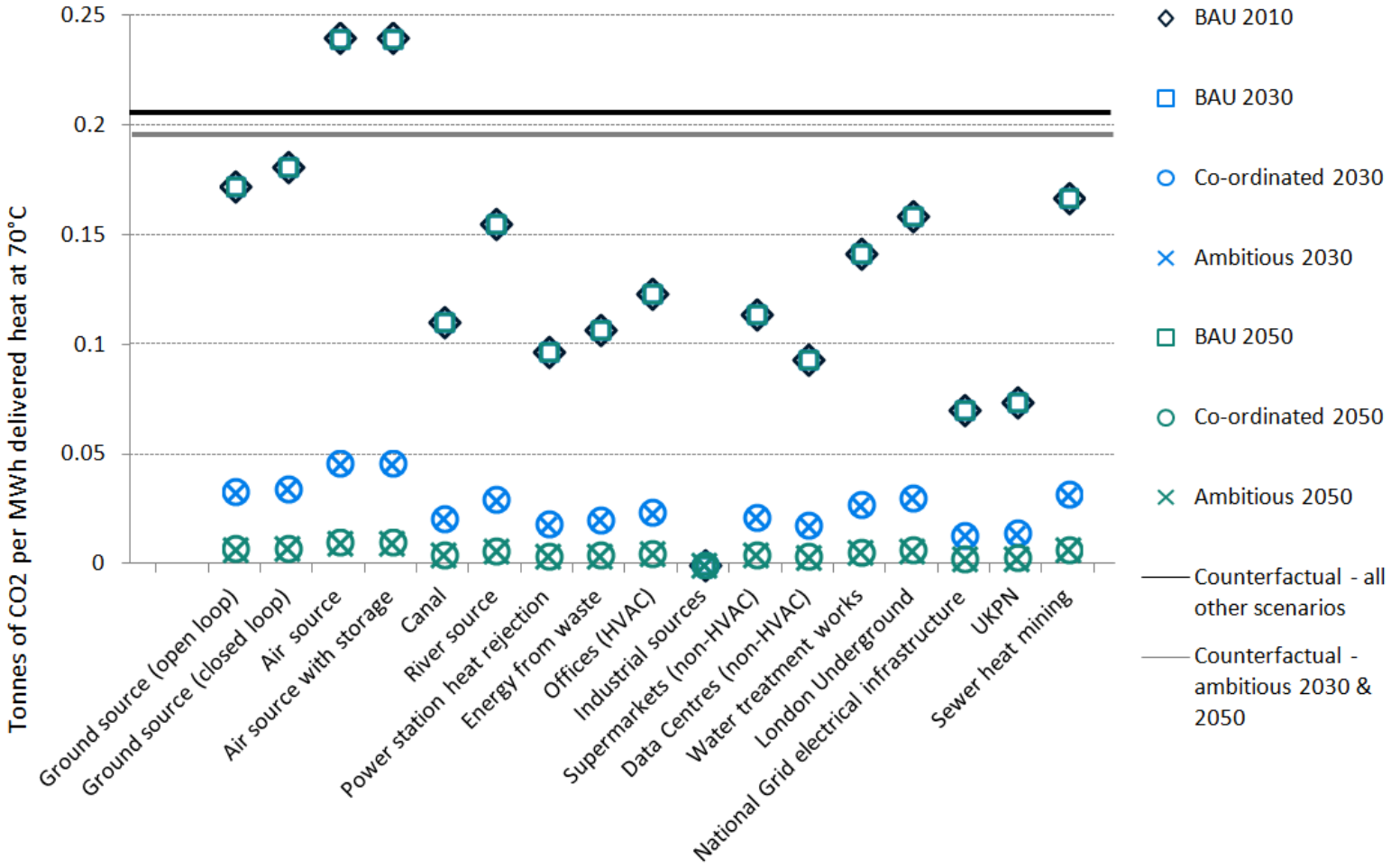

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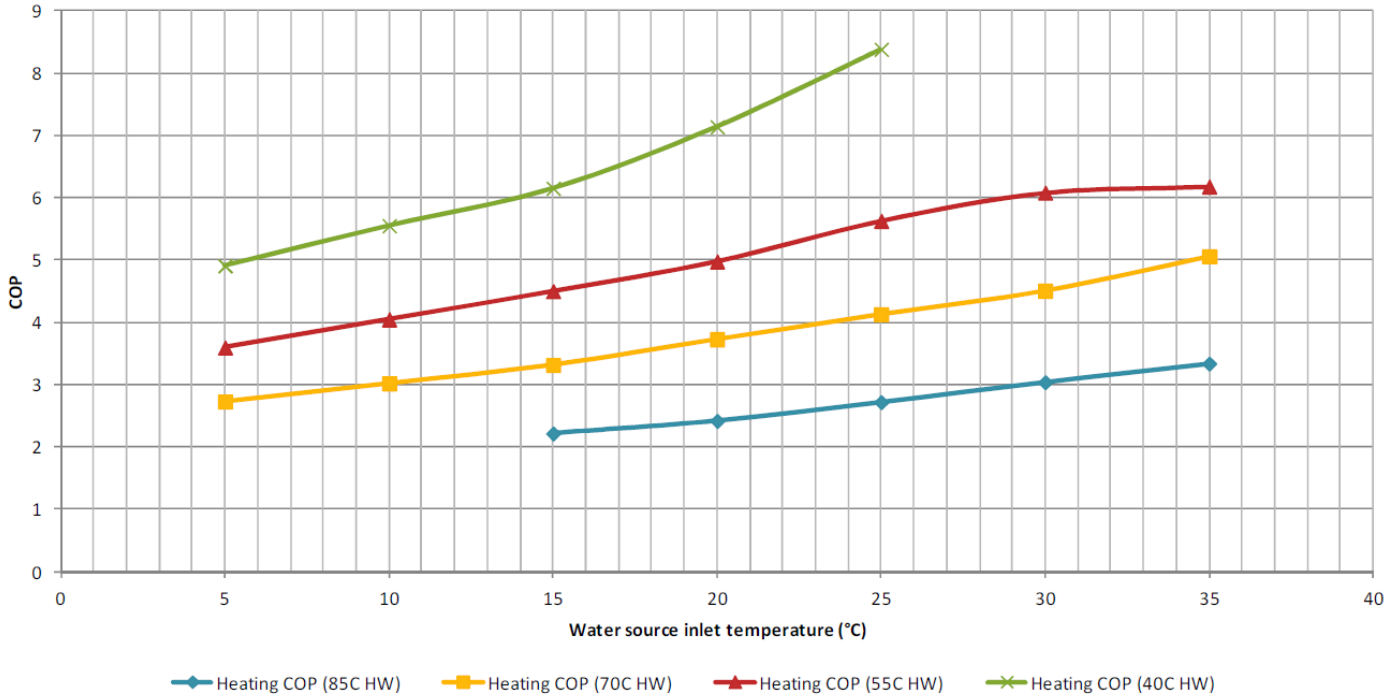
Carbon intensity of waste heat supply

Integrating heat pumps/renewables



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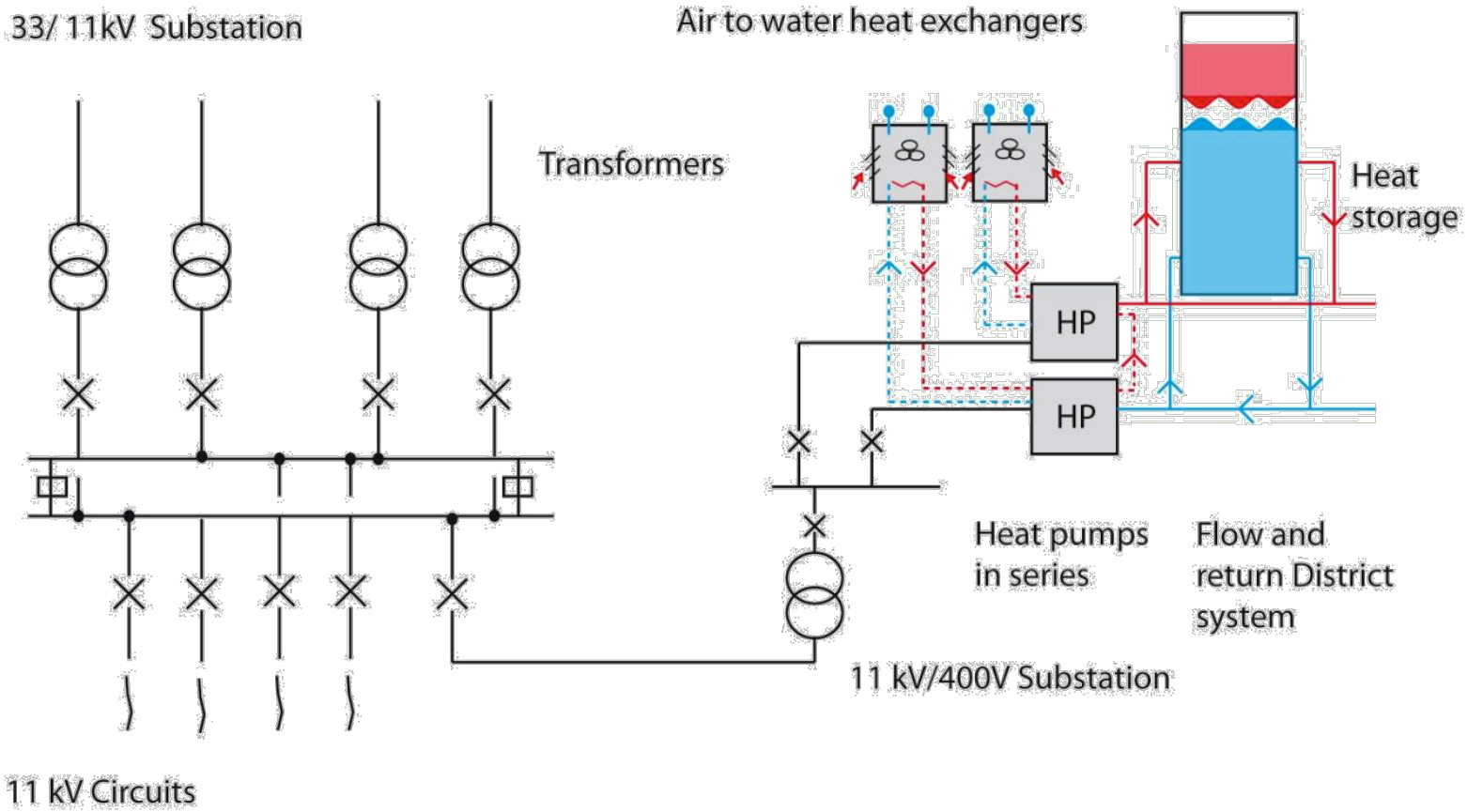
Integrating heat pumps



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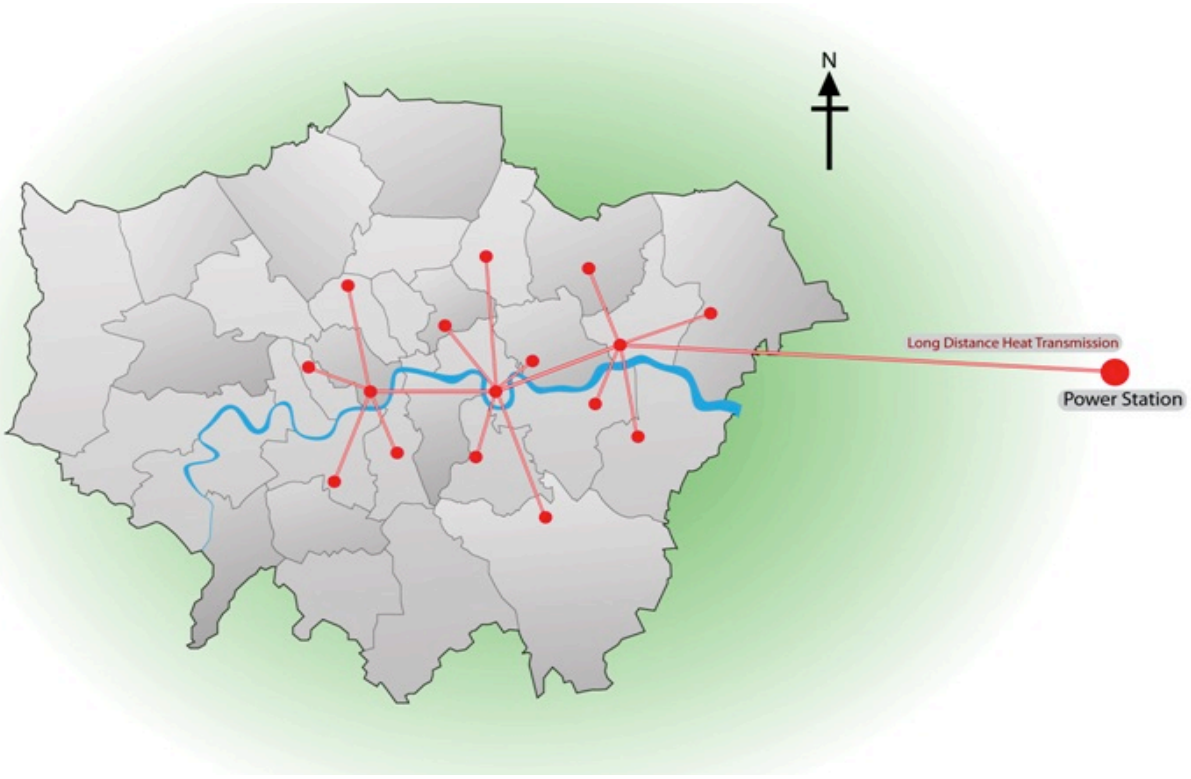
Large scale heat capture



4th generation opportunities – reduced temperature operation

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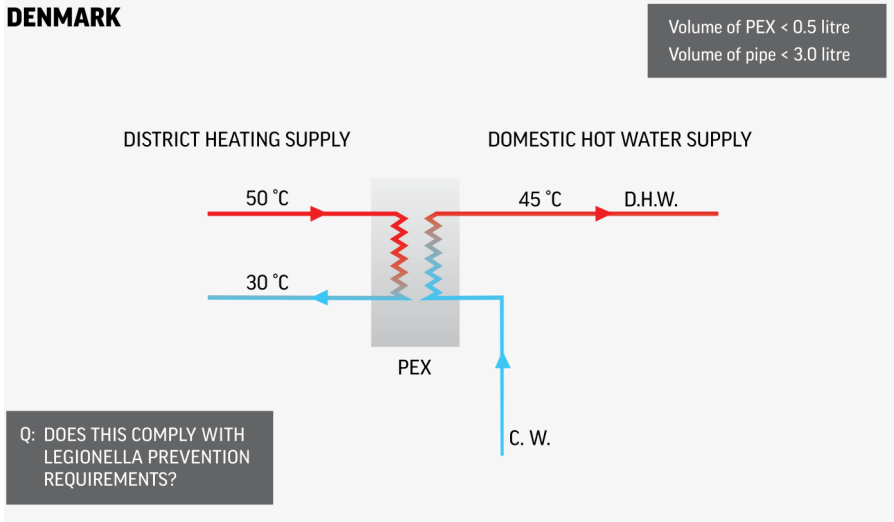
- Reduced network cost
- Reduce network losses
- Reduce overheating in corridors / risers
- Supply hot water at 50degC not 65degC (Danish systems use 45degC)
- Improve central plant efficiencies
  - Heat recovery
  - Heat pump COP



Growth and transition

Establish schemes

- Connecting buildings together via heat networks to form the nucleus of DE schemes
- Relatively small scale systems

New connections

- Growth in scheme size and heat network extent as further buildings are connected

Load diversity

- Connecting more diverse heat loads with different demand profiles
- Enhancing carbon reduction and economic performance

Inter-connection

- Interconnection between smaller schemes

Low carbon sources

- Connection of these larger schemes to larger sources of low/zero carbon heat
- Use of renewable fuels and waste heat

Zero carbon transition

- In time, longer distance transmission of heat from low carbon power stations
- Use of DE systems for energy storage and demand management

Conclusions

- Significant opportunities for heat networks in dense urban areas
  - Technical potential is high
  - Economic potential function of heat demand, network cost, heat cost
- Heat networks can provide multiple wider energy system services
- Value of energy system services needs to be considered
- Integrated energy system planning required
- Transition to zero carbon is supply constrained

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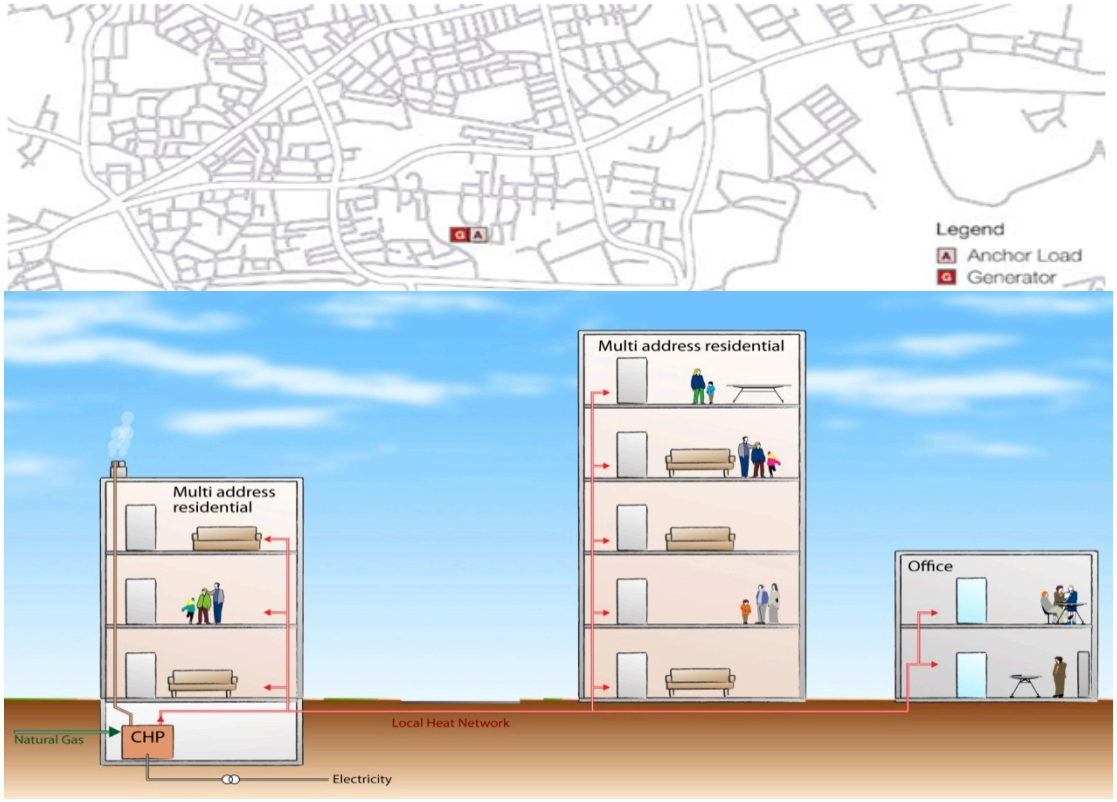
Type 1 heat network



- 0.3-3MWe
- CHP units in buildings
- ~3,000 residential units or equivalent

- Examples:
- Barkantine Heat and Power
- King's Cross

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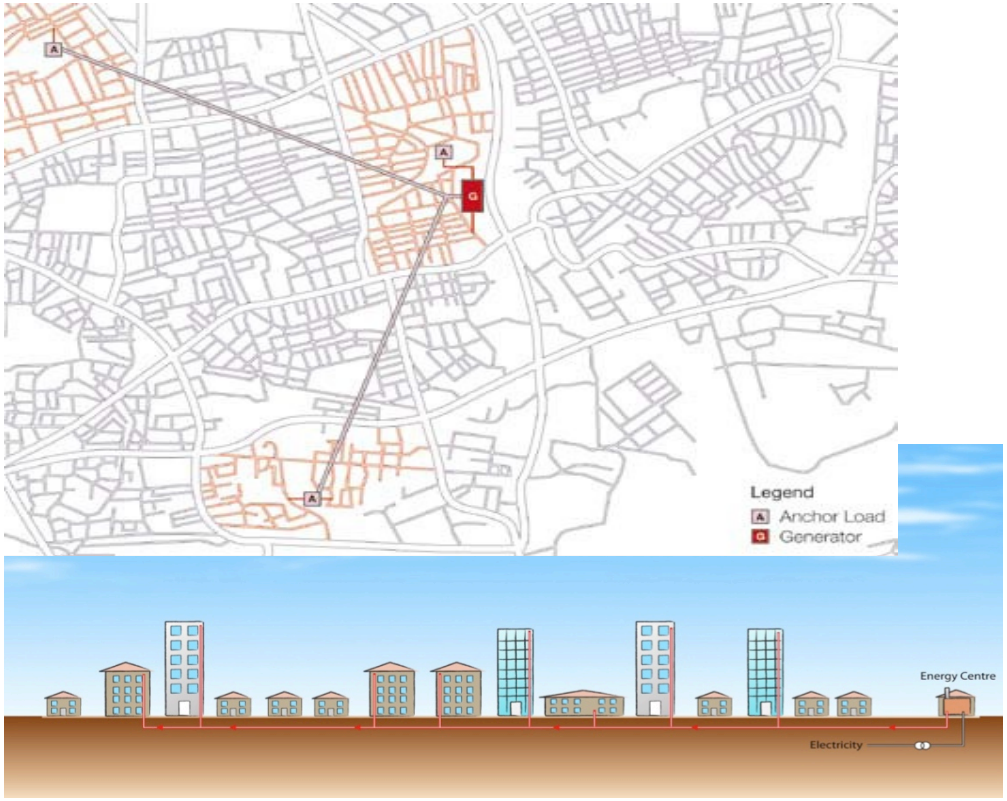
Type 2 heat network



- 3-40MWe
- Dedicated energy centre
- 3,000-20,000 residential units or equivalent

- Examples:
- Olympic Park
- Citigen

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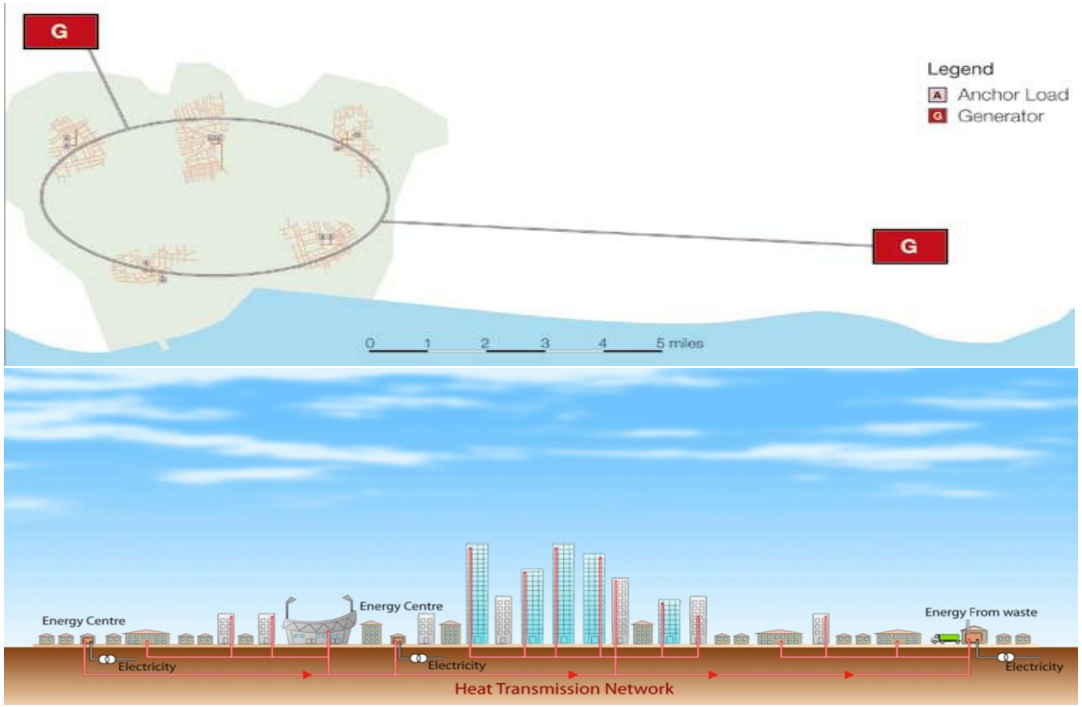
Type 3 heat network



- >40MWe
- Multiple heat sources
- Long distance transmission network
- ~100,000 residential units or equivalent

- Examples:
- London Thames Gateway Heat Network

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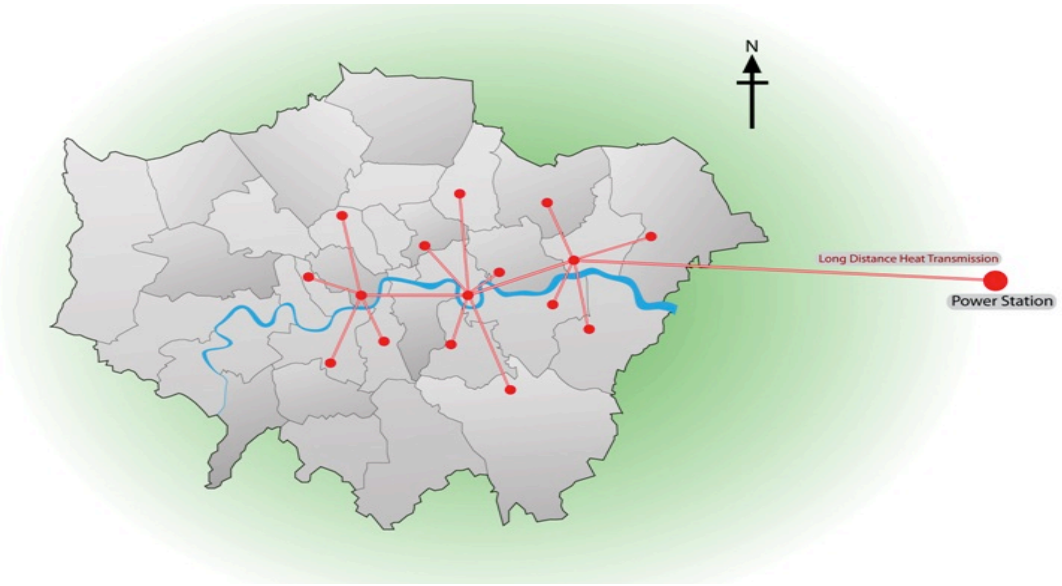
Type 4 heat networks



- >250MWth
- Zero carbon heat source
- Very long distance transmission network
- Links multiple Type 2 and Type 3 systems

- Examples:
- Vienna
- Link to Thames Estuary CCS cluster

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