Engineering progress
Enhancing lives

Low carbon district heating workshop

17th November, London

Slido code **#DHREHAU**

Free WiFi:

Network: Building Centre Events

Password: Event1931

Agenda

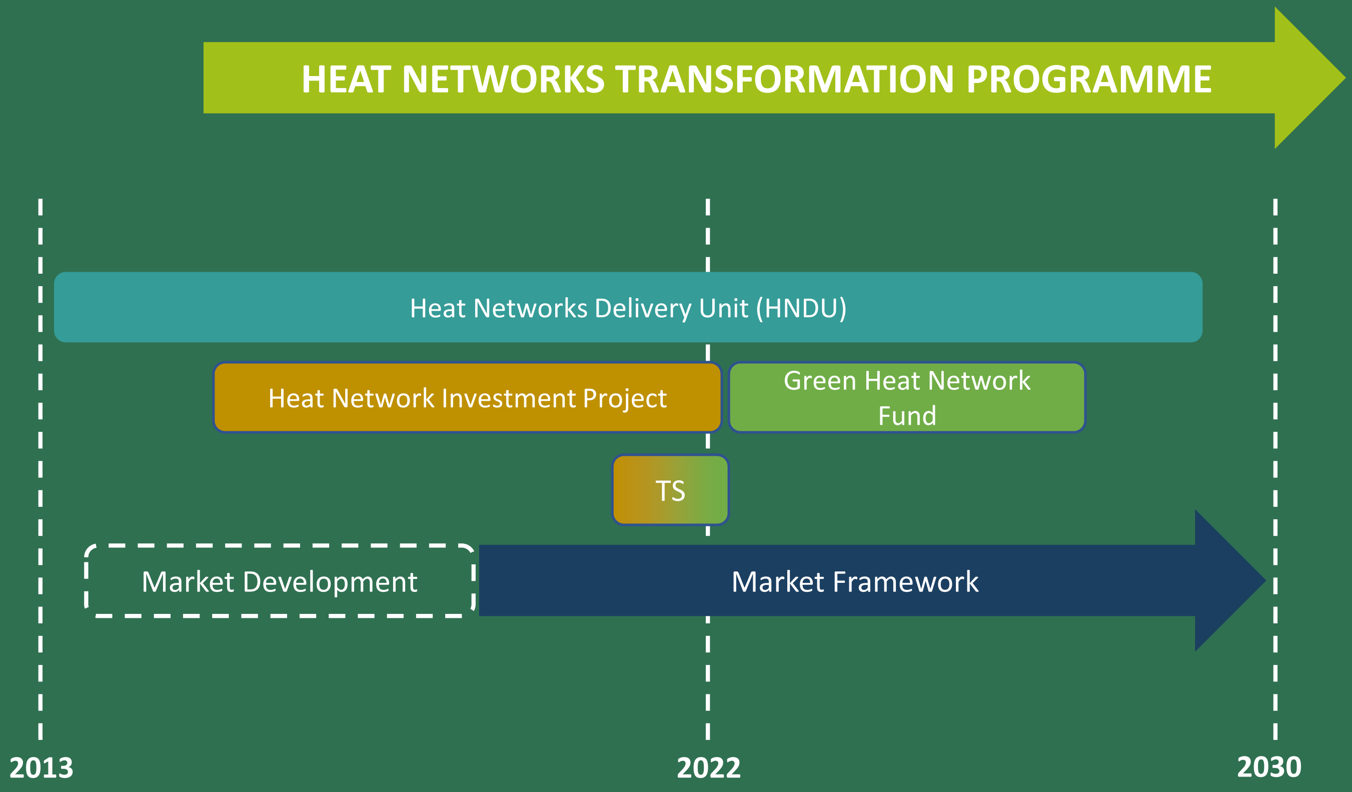
Triple Point
HEAT NETWORKS
INVESTMENT MANAGEMENT

Introduction to the Green Heat Network Fund

Ken Hunnisett

Triple Point
HEAT NETWORKS
INVESTMENT MANAGEMENT

- HNDU supports early stages of project development
- GHNF three-year programme to 2025
- Market Framework includes Regulation and Zoning.



Strong Foundations to Build On

A Blend of Complementary Specialisms

Triple Point Heat Networks Investment Management - through the GHNF - will not only seek to decarbonise heat networks, but also build on the progress made by the HNIP in developing a resilient market.

Triple Point HEAT NETWORKS INVESTMENT MANAGEMENT

- HNIP was launched prior to the UK's commitment to Net Zero.
- The aim of HNIP was to create the conditions for a self-sustaining heat network market
- The sector has continued to make great progress despite the challenges of COVID and BREXIT
- GHNF scheme design reflects the evolving political and social imperative and the ambition to decarbonise is even greater.

Triple Point
HEAT NETWORKS
INVESTMENT MANAGEMENT

Annual heat delivered
735GWh

Network trench length
150km

85,000 Homes to be connected

Total CAPEX of active projects **£877m**

Total offers made to the value of
£303m

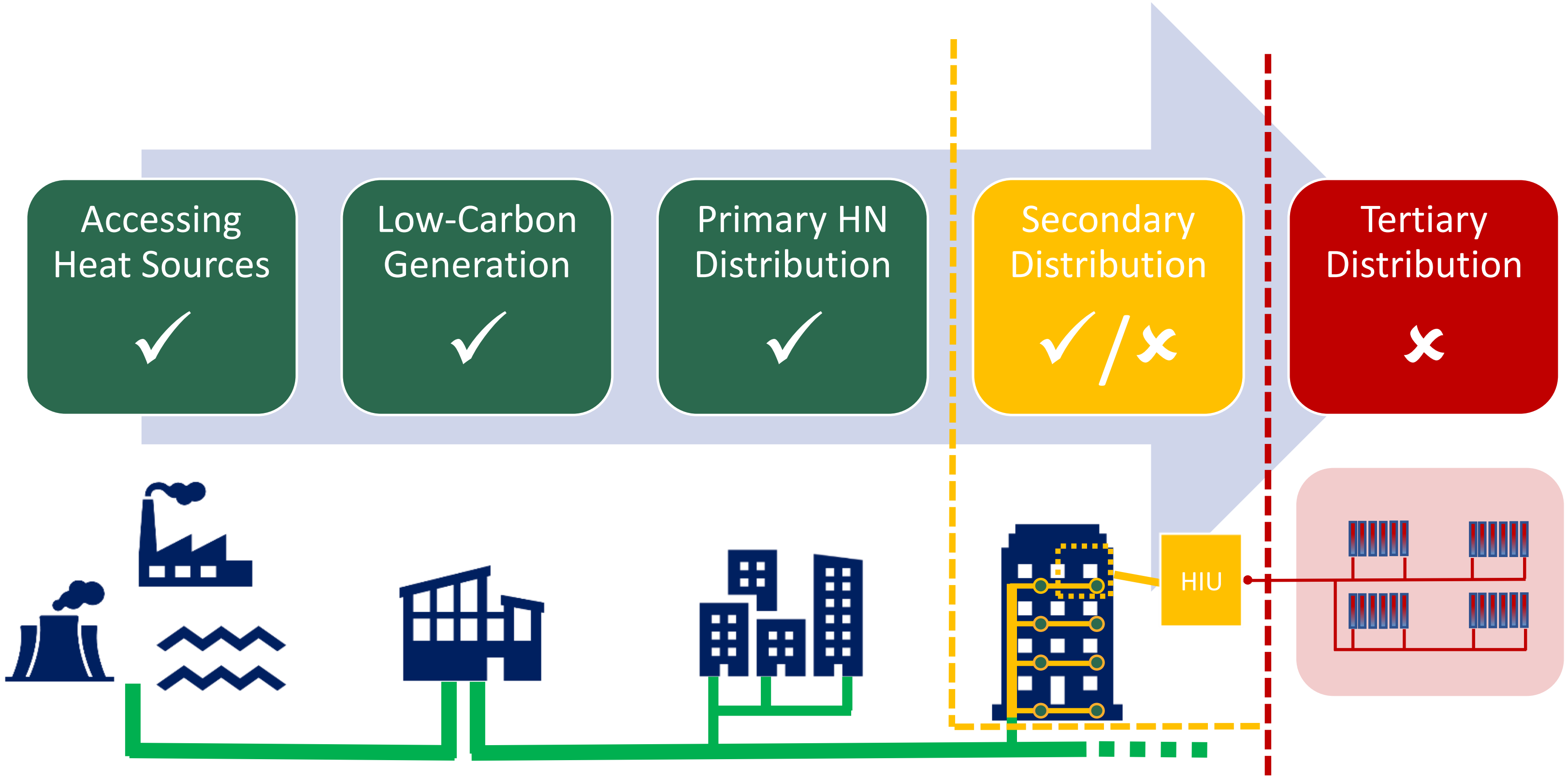
More than **80,000 tonnes** carbon saved per year

Triple Point
HEAT NETWORKS
INVESTMENT MANAGEMENT

£288m of grant funding available over 3 funding years to support

- New low carbon networks and decarbonisation and expansion of existing networks
- Eligible projects in England
- Public, private and third sector organisations
- Commercialisation and Construction, or Construction only

GHNF Applications should be submitted by the organisation responsible for the development of the heat network



- Applicants are able to self-assess their project against **four** initial pass/fail gated metrics

Carbon Intensity
100gCO2e/kWh thermal energy delivered

Customer Detriment
Protecting domestic and micro-business end users

Social IRR
3.5% or greater over 40-year period

Minimum Thermal Demand
2GWh/year (100 dwellings if rural)

Triple Point HEAT NETWORKS INVESTMENT MANAGEMENT

- All of the metrics are calculated and appraised within the application form itself once the applicant has entered all required inputs

Capped Award
4.5 pence/kWh of grant per kWh delivered over 15 years*

%

Maximum Award
Up to, but not including, 50% of CAPEX + Commercialisation costs

*Subject to review

Award Range (pp/kWh)	
<1.5	Projects are likely to be among the highest scoring applications in any given round and are most likely to be funded
1.5-3.5	Projects that are typical of the core range of support levels expected
3.5-4.5	Projects with significant financial challenges to overcome and which are less likely to be funded.
>4.5	Not eligible

Triple Point HEAT NETWORKS INVESTMENT MANAGEMENT

Applicants must commit to the GHNF Market Transformation Commitments

Projects commitments will enable growth within the supply chain, help to address the heat network sector skills gap and allow the sector to share in learnings and innovation across a portfolio of projects

Infrastructure

Fair and open procurements

Engaging local communities and supply chains

Adding to a reliable and resilient energy system

Skills

Identify opportunities to address the sector skills gap

Fair and open recruitment

Stimulating new jobs in the UK and training opportunities

Innovation

Identify ways for projects to enable investments in research and development

Sharing of learnings and innovations with the wider market

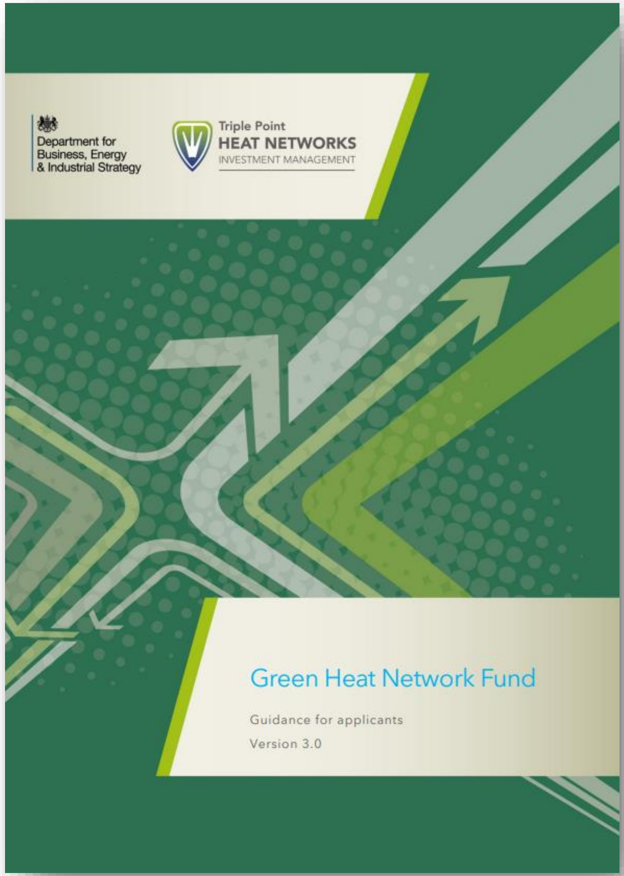
Triple Point
HEAT NETWORKS
INVESTMENT MANAGEMENT

- Read the Application Guidance
- Engage with Relationship Managers early. Email enquiries@tp-heatnetworks.org to request a call
- Attend our events and Webinars


Lauren Bright


Amy Fry


Libby Carr



Triple Point
HEAT NETWORKS
INVESTMENT MANAGEMENT

Triple Point HEAT NETWORKS INVESTMENT MANAGEMENT

Supporting investment into heat network projects using a range of potential funding providers

- PCR-compliant procurement platform – **Dynamic Purchasing System** with a potential value of £150m
- Open to **public sector** heat network owners/developers in **England & Wales**
- Both **asset finance** and **equity investment/equity investment-related services** available for procurement
- Separate from the Heat Network Investment Project (HNIP) and designed to **work alongside HNIP and Green Heat Network Fund**
- Runs to **March 2023** but option for BEIS to **extend for up to 2 years**
- BHIVE **can be used to finance a new heat network**, **expand an existing** heat network or **to sell** part or all of an existing operational network

Triple Point
HEAT NETWORKS
INVESTMENT MANAGEMENT

Our team are available to you now through all existing channels and at:

enquiries@tp-heatnetworks.org

www.tp-heatnetworks.org

Guidance and fund materials can be downloaded from gov.uk website

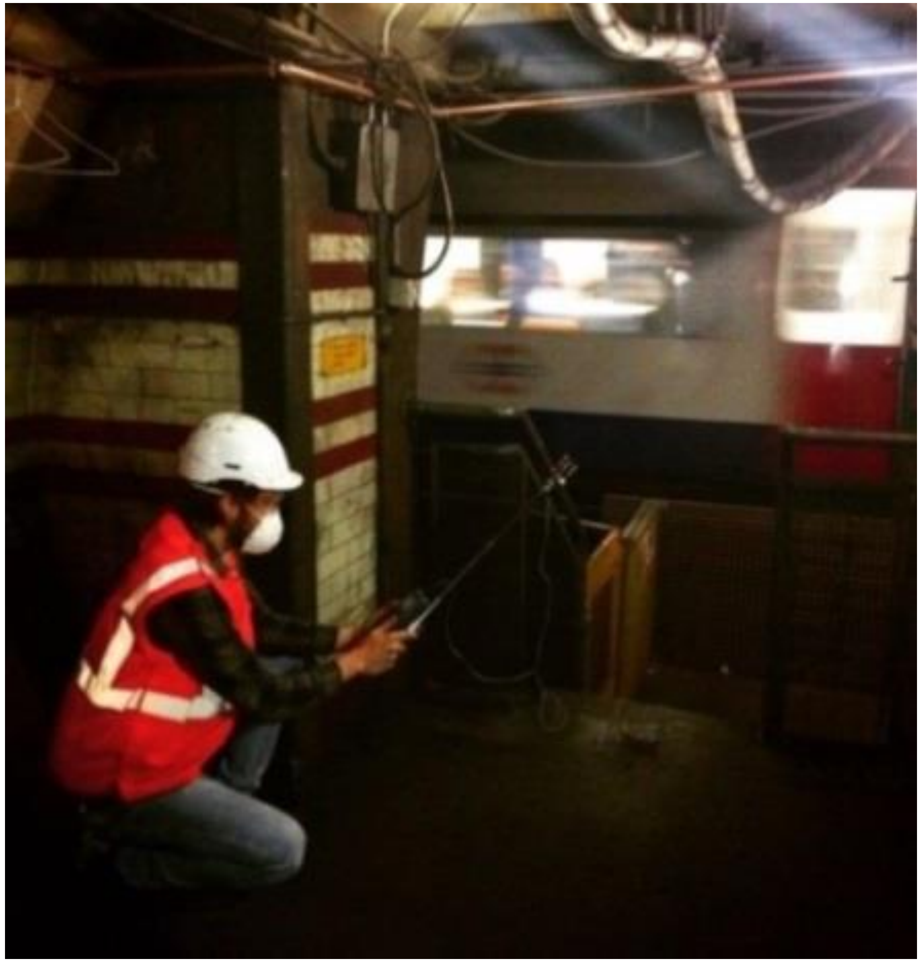
https://www.gov.uk/government/publications/green-heat-network-fund-ghnf

Waste heat potential for heat networks

Dr Akos Revesz
CEng MCIBSE
17/11/2022

EST 1892 LSBU

A bit of history...



LoT-NET

BEIS Waste heat Research

greenSCIES
Green Smart Community Integrated Energy Systems

INDUSTRIAL STRATEGY

UK Research and Innovation

How can heat networks best facilitate waste heat utilisation?

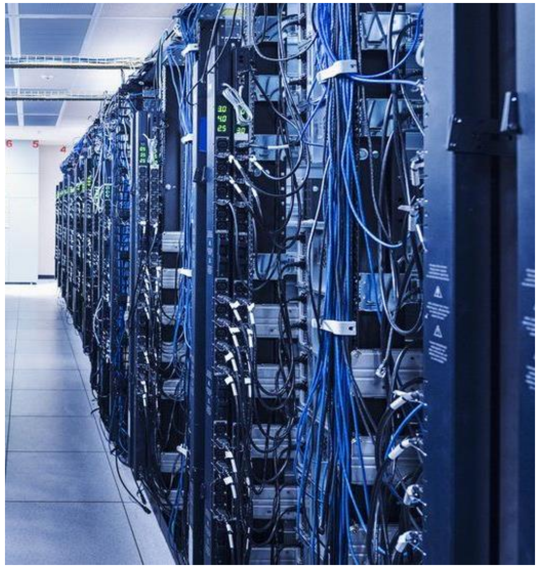
Categorisation of waste heat sources

High grade

- High temperature
- Large quantity
- Typically constant
- Often further away from demand

- Lower temperature
- Smaller quantity
- Sometimes intermittent
- Closer to demand

Low grade



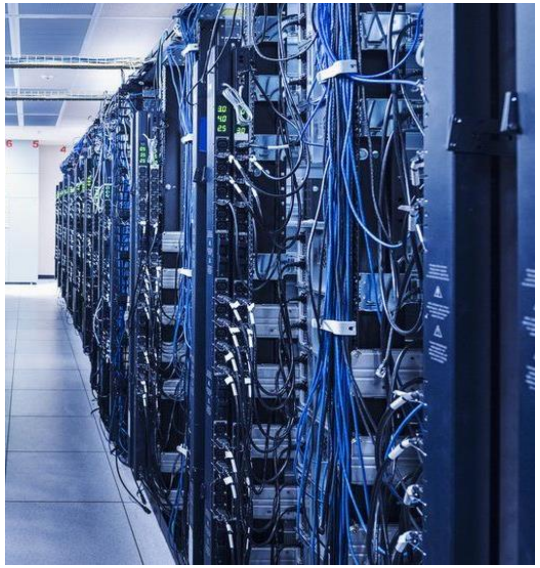
Categorisation of waste heat sources

Industrial – high grade

- High temperature
- Large scale
- Often constant
- Often further away from demand

- Low temperature
- Smaller scale
- Sometimes intermittent
- Closer to demand

Commercial – low grade



Low grade waste heat

- The low-grade opportunities are predominately based in cooling plants, e.g. supermarket refrigeration cycles, data centre cooling, etc.
- A total of **574 TWh/yr** of potential thermal energy (heat) output from the low temperature waste heat sources (EWNI)
- Requires a heat pump to step up the temperature
- Type of heat recovery system varies with heat rejection medium and depends on the cooling plant and preferences of the heat provider

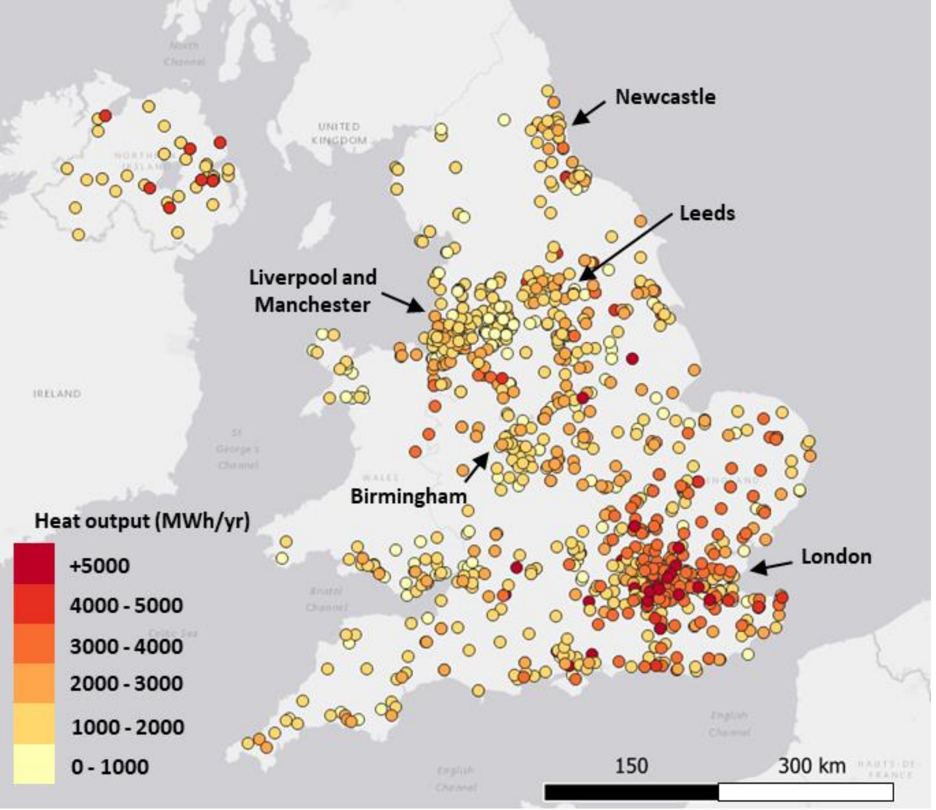
Examples of low great waste heat opportunities

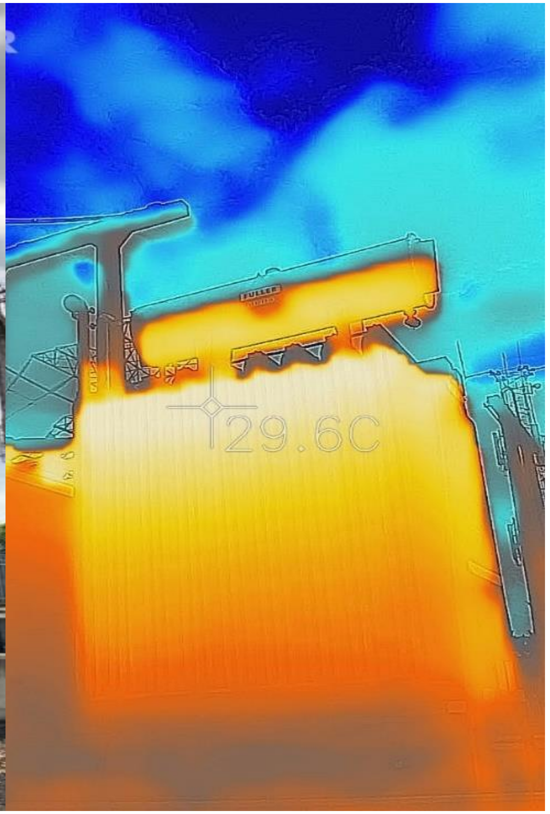
Waste heat source	Number of heat sources > 250kW	Waste heat recovery site/medium	Waste heat temperature(s) (°C)	Total thermal energy (heat) output ($TWh.a^{-1}$)
Data centres	475	IT server exhaust air	30 to 40°C	16.2
		Chilled water heat rejection	10 to 20°C	
Electrical substations	394	Transformer cooling system	40 to 70°C	4
Wastewater	985	Final WWTP effluent	12 to 23°C Average 17.6°C	22.5
Mine water	18584	Water	12 to 40°C	520
Supermarkets	4853	Condenser heat rejection	21 to 27°C	7.8
		Desuperheater	53°C	
Cold stores	306	Condenser heat rejection	15 to 30°C	3.6
		Desuperheater	60 to 90°C	
Underground railway tunnels	65	Ventilation shaft air	11.5°C to 28°C	0.29

Data collected by LSBU's Heating and Cooling Group as part of the BEIS Waste Heat Research (LSBU, ARUP 2021) (Paper under review: Davies et.al. 2022)

Waste heat maps (example)

Electrical Substations | Waste heat temperature: ~ 40-70°C | Total thermal energy output: 4 TWh



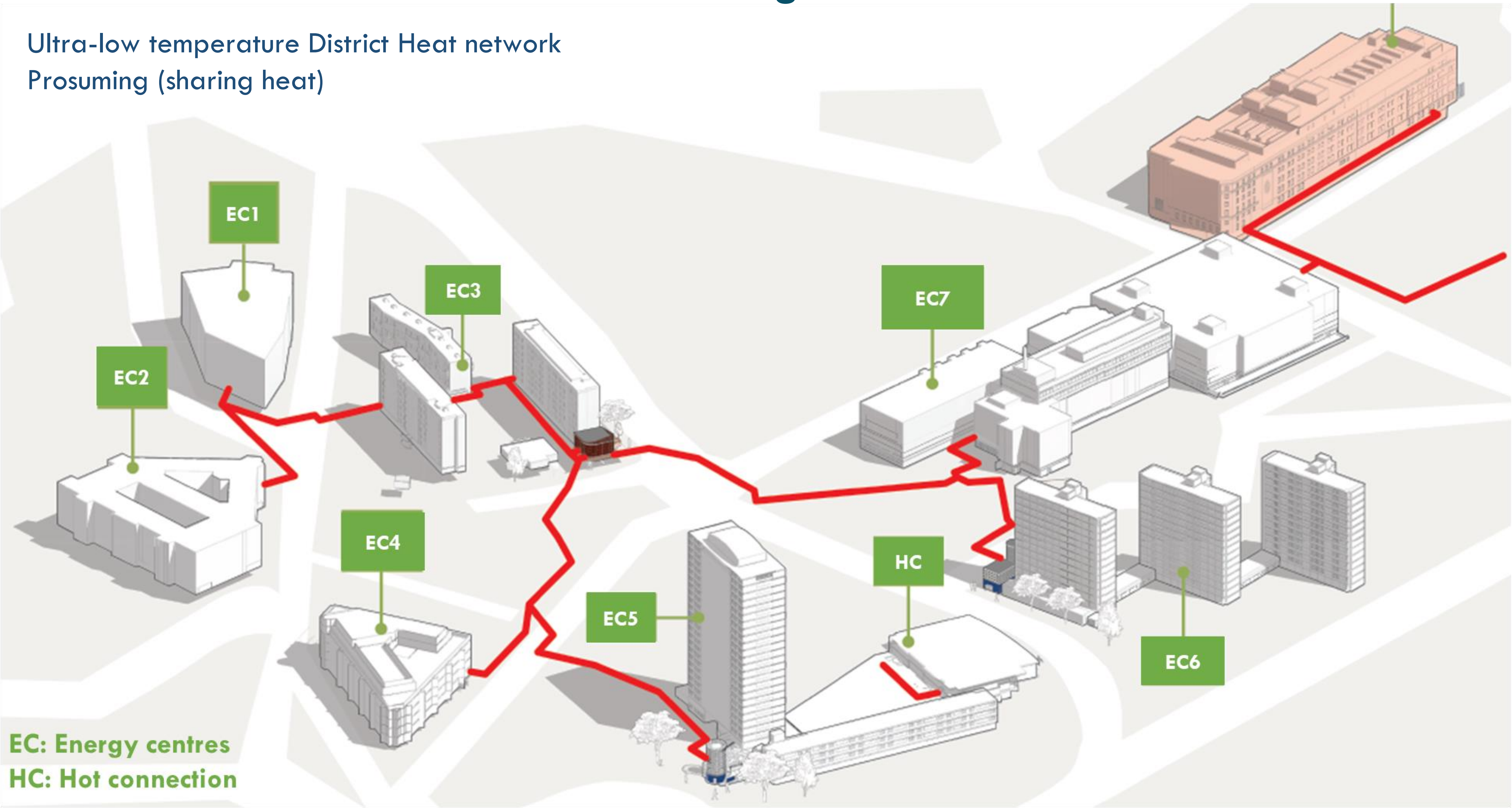


Geographic spread of waste heat does not align with demand everywhere, but there are significant areas of overlap in some cases!

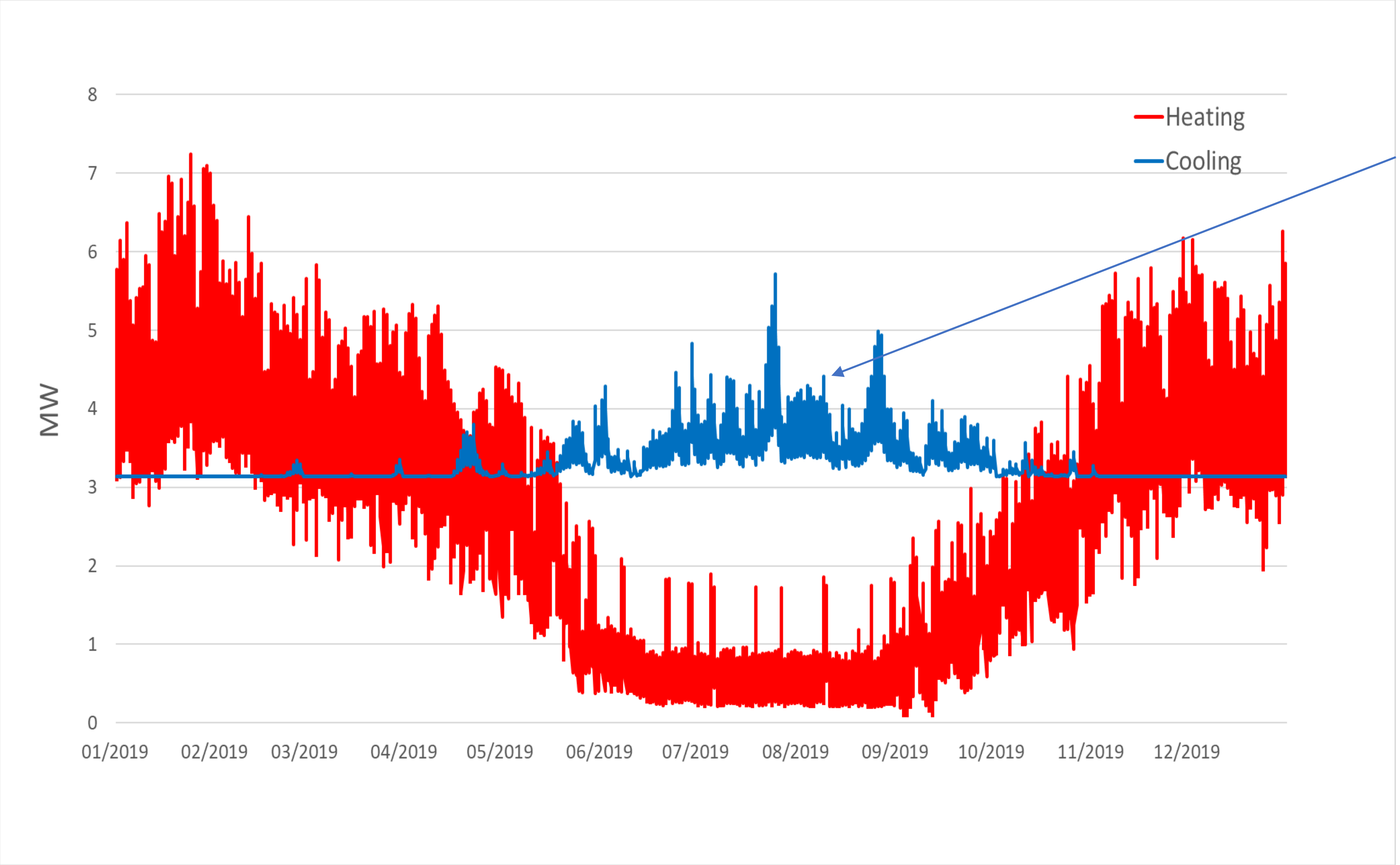
Case study: Low grade waste heat from a data centre
Project GreenSCIES

GreenSCIES – New River Scheme in Islington

- Ultra-low temperature District Heat network
- Prosuming (sharing heat)



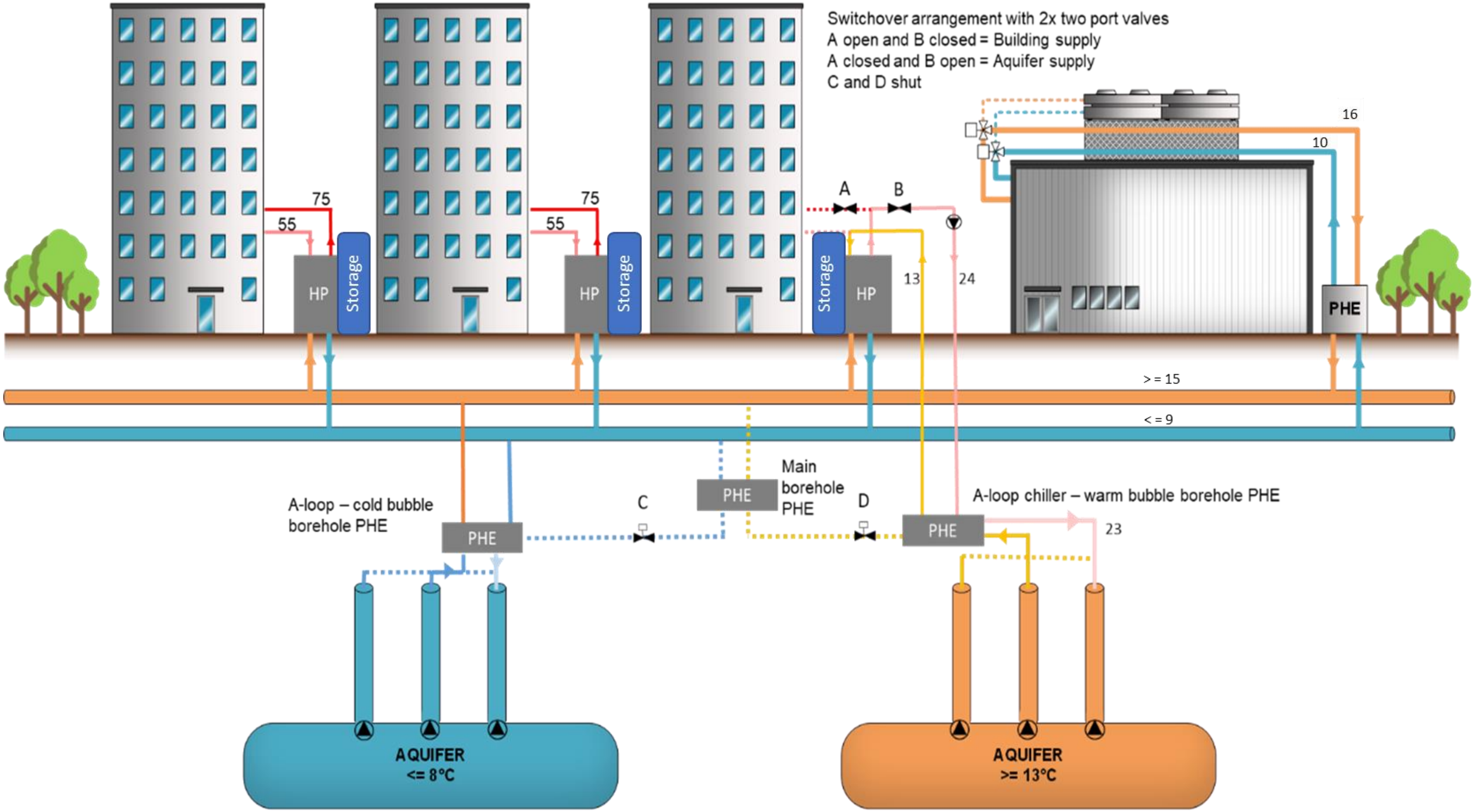
Combined heating cooling demand



The data centre has approximately 3MW of constant cooling demand across the year (topped up with some of the buildings cooling demand in the summer period)

Balancing heating and cooling load was important to achieve cost and carbon benefits

Waste heat recovery from chiller plant


Switchover arrangement with 2x two port valves
A open and B closed = Building supply
A closed and B open = Aquifer supply
C and D shut
75
55
HP
Storage
75
55
HP
Storage
A
B
Storage
HP
13
24
16
10
PHE
> = 15
< = 9
Main
borehole
PHE
PHE
A-loop – cold bubble
borehole PHE
PHE
C
D
A-loop chiller – warm bubble borehole PHE
PHE
23
AQUIFER
<= 8°C
AQUIFER
>= 13°C

Some learnings from the Islington scheme

REVENUE & CARBON

- Significant carbon savings
- Cost effectiveness is key!
- **Flexibility**: Picking the cheapest price periods
- **Prosuming**: Cooling as the by-product of heating
- **Storage** is a key element to save costs and carbon

BENEFITS FOR THE WASTE HEAT PRODUCER

- Lower emissions
- **Helps businesses meet their net zero targets**
- Improved cooling plant efficiency
- Improved energy metrics (e.g. PUE for data centres)
- Lower exposure to carbon prices
- Less chiller maintenance

CHALLENGES & RISKS

- Heat offtake capacity - now and in the future
- Supply resilience and security considerations
- Demarcations of ownership and operation
- Technical & commercial interfaces – design, construction, operation phases
- **Early stakeholder engagement is key!**

BARRIERS

- High spark gaps (policy costs make elect expensive!)
- High lifetime costs (loss of RHI)
- **Lack of technical and commercial knowledge** around waste heat utilisation in DHNs!
- Need more successful demonstrators

Thank you for joining

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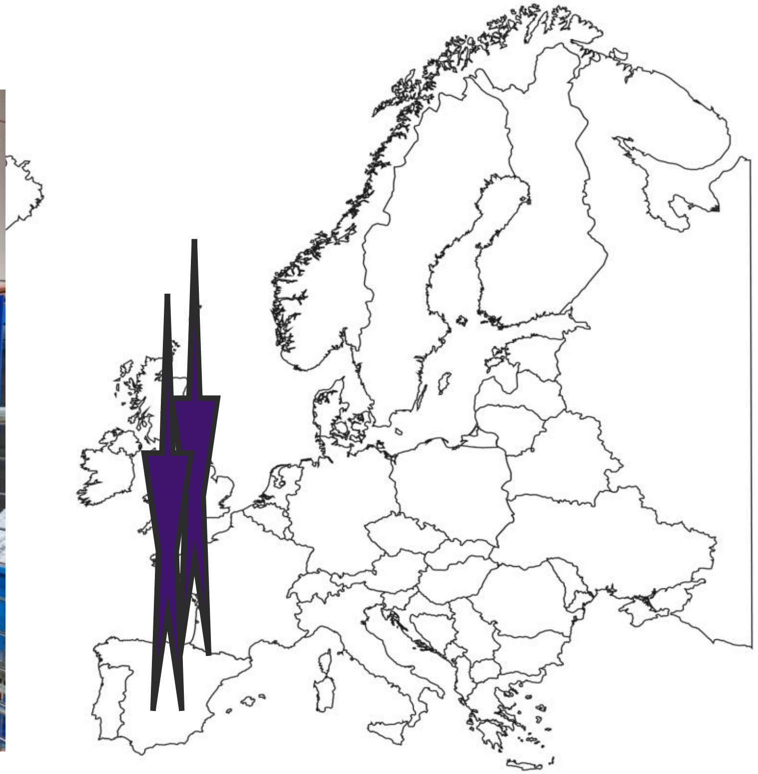
CLADE
LEADING THE TRANSFORMATION IN
GREEN HEATING AND COOLING
22 APRIL 2021 //

INTRODUCTION TO CLADE //



TODAY //

- The climate emergency is extremely acute and urgent
- District heating is a key technology for decarbonising cities
- Heat pumps are the only viable (climatically, technically and commercially) technology
- There has to be a robust commercial model – selling heat is not enough
- We must not create a climate damaging legacy by using chemical refrigerants
- Natural refrigerant heat pumps support all these requirements

REFRIGERANTS //

HFC	HFO	Naturals

F-gas contributes ~3% to global emissions, more than aviation

PFAS and TFA pollution is already above the safe limits for humanity

CLADE

WHY NATURAL REFRIGERANTS

	Low GWP	Toxic	Environmental Hazard	High temp	Flammable	High efficiency	Notes
CO2	✓	✗	✗	✓	✗	✓	Low return temperature required
Hydrocarbon	✓	✗	✗	✗	✓	✓	Special safety systems required
Ammonia	✓	✓	✓	✓	✓	✓	Special approvals required
HFO	✗	✓	✓	✗	✓	✗	Too many compressors in large systems
HFC	✗	✓	✓	✗	✗	✗	Failed to work, being phased out

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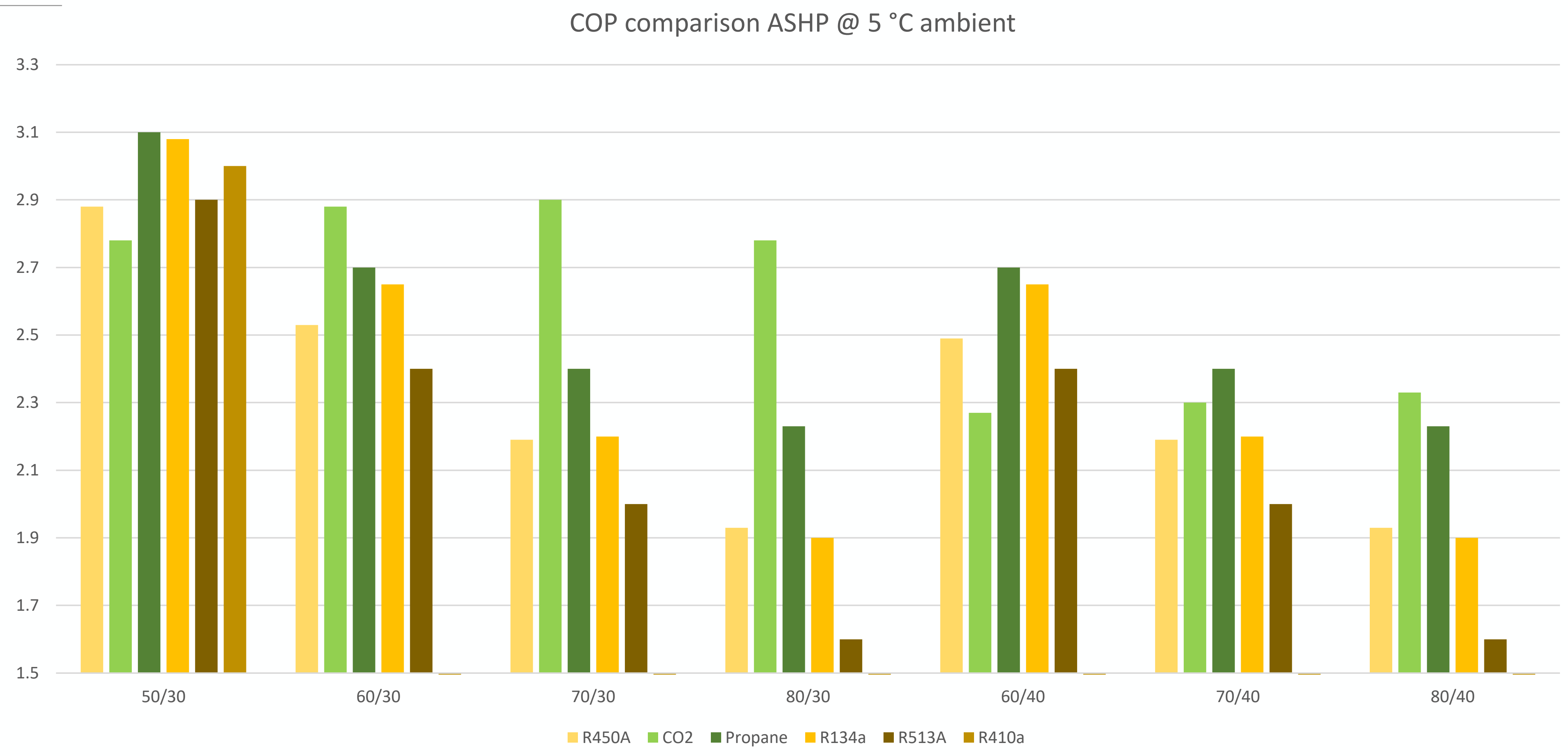
MOVE TO NATURAL REFRIGERANTS IS WELL UNDERWAY //

- Gas suppliers shift business model to recovery and disposal
- Carbon reporting includes the reporting of F-gas loss
- Environmental lobby increases pressure in EU
- Manufacturing increasing globally – CO2 identified as the most important refrigerant for the future
- Price

Gas	Relative price
CO2	1
R32	409%
R1270	502%
R290	502%
R134A	548%
R410A	635%
R407C	833%
R407A	885%
R407F	1004%
R448A	1024%
R449A	1024%
R404A	1302%
R513A	1650%
R404AR	1687%
R452A	1766%



"An R32-based ASHP won't deliver 51 °C at lower than 4 °C ambient temperature, therefore is not suitable to meet the demand in many geographical locations."

- Perform better
- Lower impact
- Will not become islanded assets
- Total cost of ownership is lower

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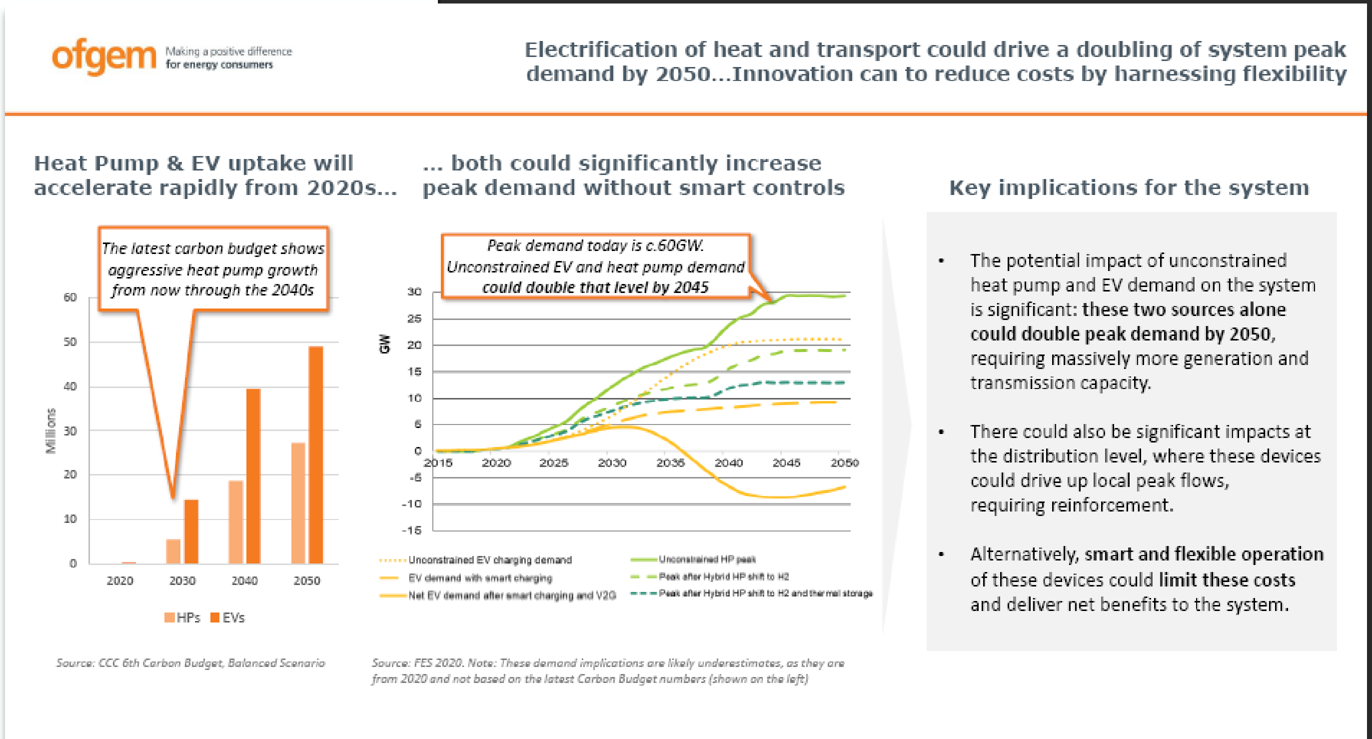
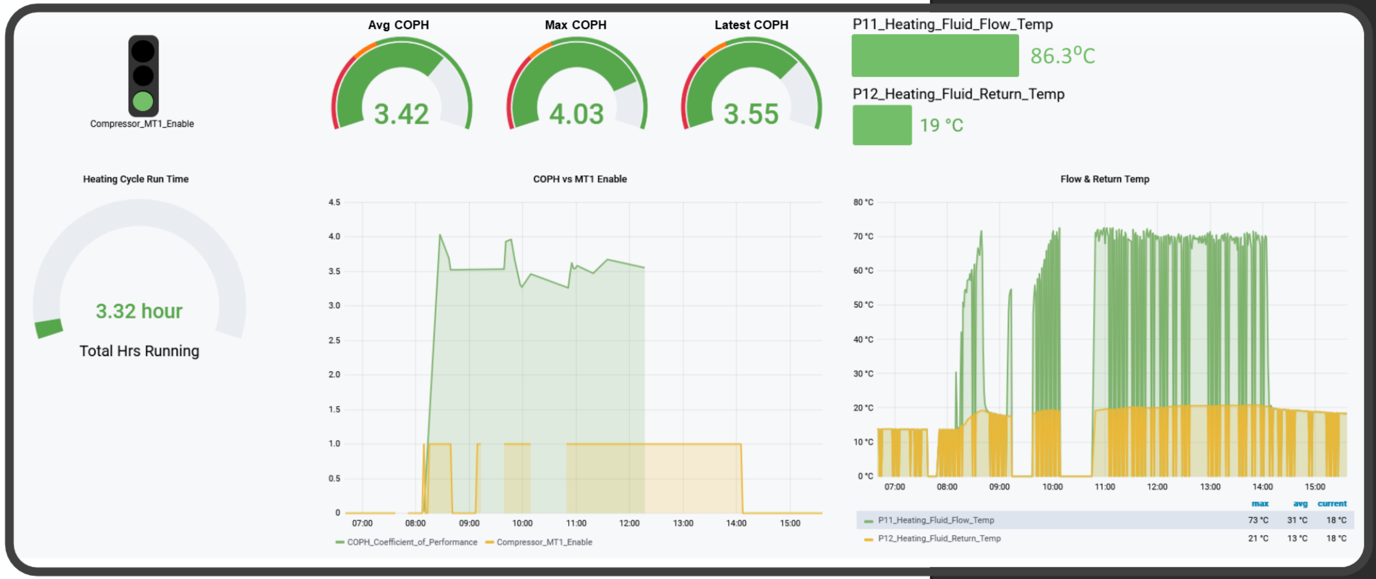
GRID FLEXIBILITY //



HEAT PUMPS + THERMAL STORAGE + FLEX = ££££

LIVE COP CALCULATION //



Demonstrating world leading IIOT application of analytics Clade have a live COP calculation available for connected heat pumps.

This near-real time technology enables end users to analyse performance in detail, generating insights that lead to operation efficiency improvements.

CLADE

HEAT SOURCE //

CLADE

CLADE OAK RANGE //

100-500kW of heating capacity, full Siemens PLC controls with Clade Cloud integration

Removable panels for access to individual evaporator expansion devices.

Supplied with one fan per evaporator coil section, reducing noise levels and enabling advanced defrost adaptive control, whilst simplifying the overall control process.

Integrated electrical control panel to work seamlessly alongside client selected BMS system.

Compressor inverter drive to control compressor speed, enabling smoother running in low load conditions, whilst minimising electrical input.

Condenser plates - transferring heat from refrigerant to water.

Plug and Play - Close coupled V block evaporator up to 250KW, eradicates the requirement for on-site inter connections between the heat pump and heat source.

Specialist Compressors provide a greater operating temperature range and increased COP.

Low noise, weather proof housing ensures low noise levels, as expected by local Environmental Health Authorities.

Full mechanical service integration, incorporating VSD pumps for simplified installation.

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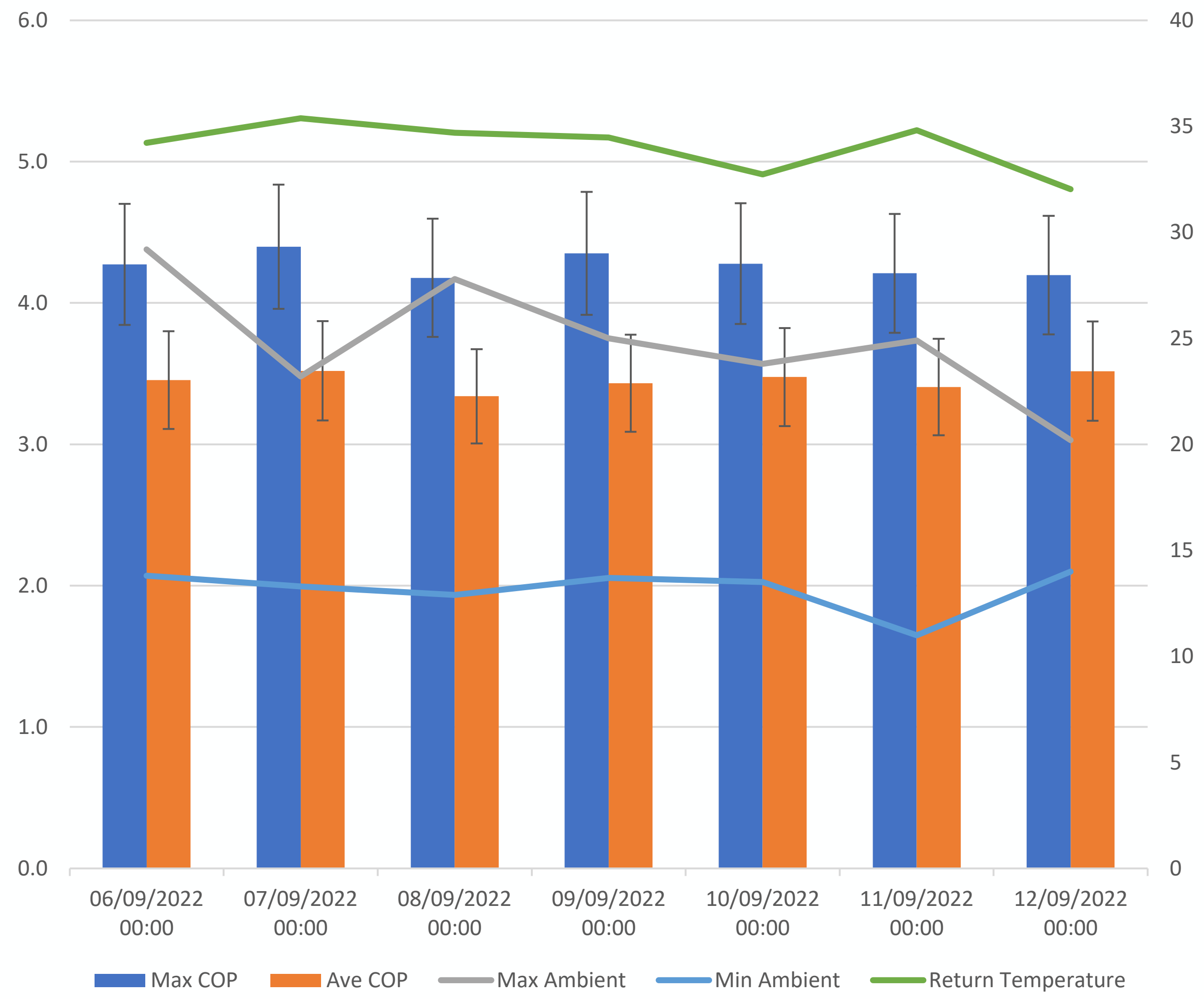
OAK CASE STUDY //



This heat pump provides heat for a leisure centre.

COP varies considerably over the day as the demand and environmental conditions change.

This heat pump has a flow temp of 65C, the return is slightly above where it should be because of the control on the system.

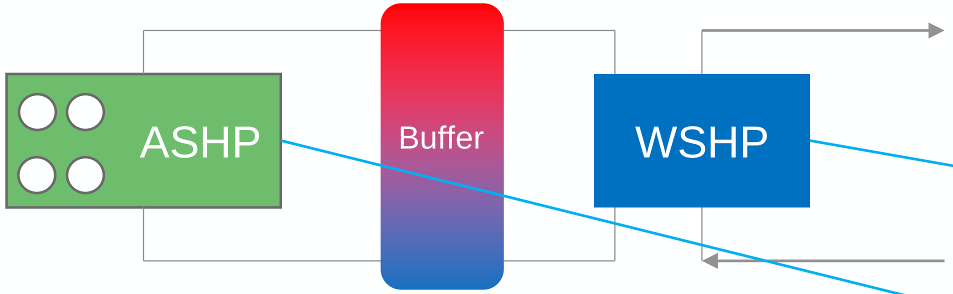
CLADE

CLADE LARCH CASCADE RANGE //

For some installations a straight boiler replacement is required at normal boiler temperatures of around 80/70C flow and return.

Heat pumps are amazing and can achieve this but require two stages to do so. Clade use two hydrocarbon refrigerants, r290 and r600a in an ASHP and WSHP respectively.

These are in fact versions of our Aspen and Willow heat pumps with buffer tanks between to make operation as efficient as it can be.



The low temperature air source heat pump generates 45C water with a small delta T

The high temperature water source heat pump generates 80C and can accept 70C in the return

Intermediate thermal stores act to smooth operation of each HP by stopping feedback loops, these can also be used to time generation for efficiency

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LARCH CASE STUDY //

This is an example installation to demonstrate the characteristics of a cascade heat pump system. In this instance the system is designed to deliver the full duty of 560KW at 80/70ºC. In other systems the cascade may only supply part of the duty.

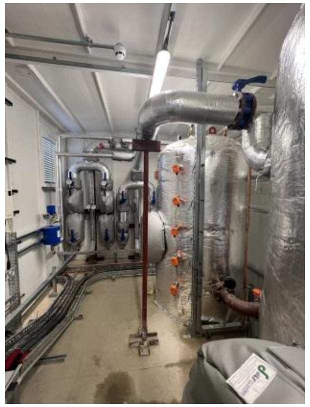
The advantage of this arrangement is the direct replacement of boiler technology without affecting the wider heating system.

The disadvantage is the increased electrical load (two sets of compressors) which will require a larger supply and the space taken. The complexity of the system can also increase the operational and maintenance costs.

The system consists of two ASHP and two WSHPs sized to match each other. Intermediate buffers smooth the operation by disconnecting the two heat pumps.

- 2 x 280kw r600a high temperature WSHP with a COP of 3.89
- 2 x 160kw r290 low temperature ASHP with COP of 2.81

System **COP of 2.1** (=280/(72+57)

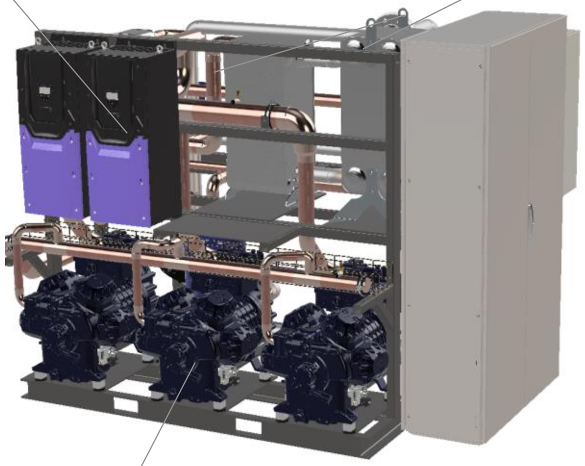


CLADE WILLOW RANGE //

Up to 500 KW of heating capacity for water source heat pump applications

Inverter controlled compressors for maximum control and a turn down ratio of 30% of lead compressor capacity

Heat exchangers specifically selected for the application temperatures to ensure maximum efficiency



Available in acoustic housing or bare rack as required.

Temperatures up to 80 DegC, can be used with Clade Aspen in a cascade arrangement.

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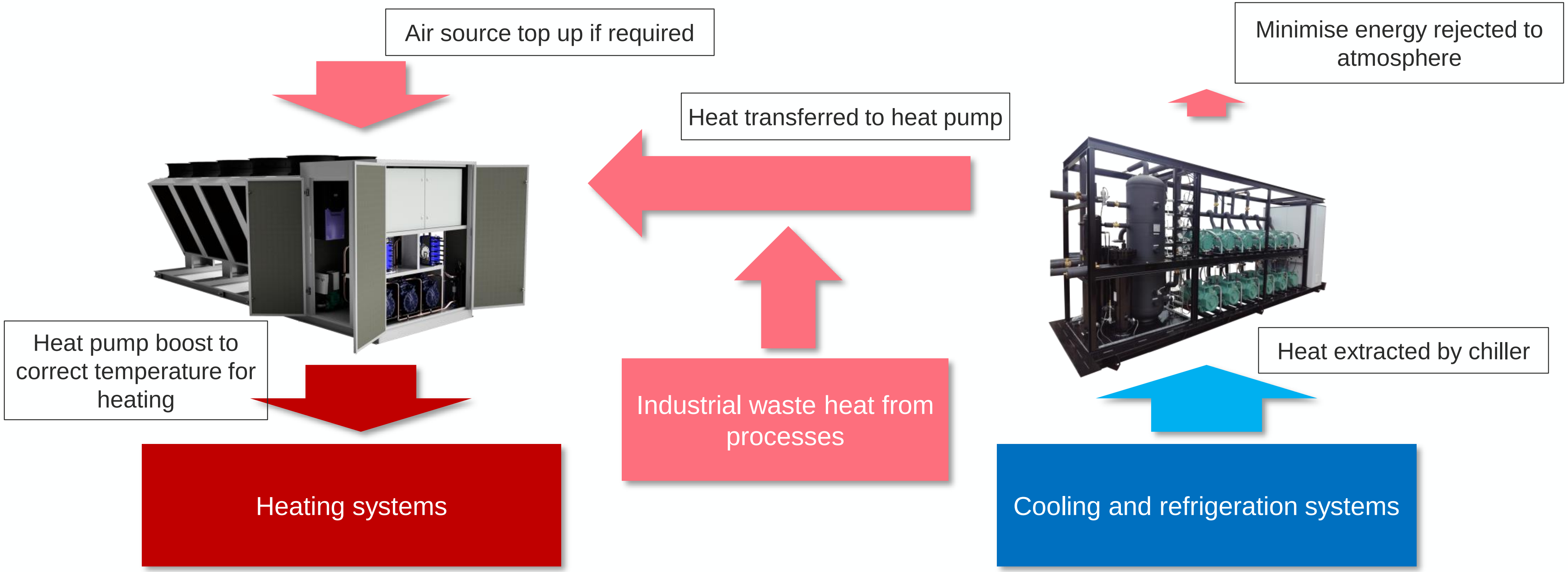
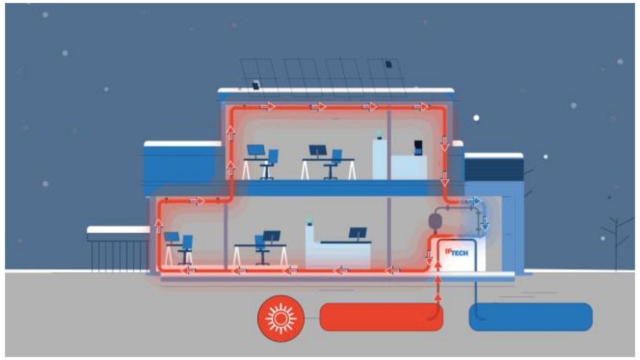
HEAT RECLAIM AND INTEGRATION WITH COOLING INCREASES EFFICIENCY SIGNIFICANTLY //



Rejected heat or heat from the cooling system is used to boost the heat pump, even allowing for seasonal variations this improves COP to over 4.5

ATES: unique performance

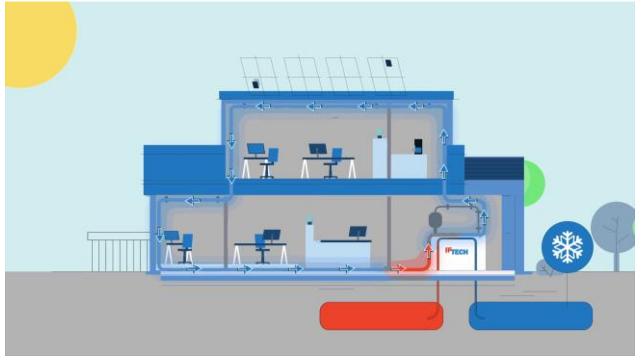
Highest efficiency of all available HVAC technologies on the market today.



1 electrical energy

4.5 groundside energy

Heating demand building



1 electrical energy

24 groundside energy

Cooling demand building

IF TECH Underground Thermal Energy Storage

Wandsworth Riverside Quarter

LOCATION:
London, UK

CLIENT :
Frasers Property

PROJECT:
Newly built neighbourhood with mixture of residential apartments, commercial spaces and sport facilities.

VALUECREATION:
- CO_2-reduction = 450 ton/y

DETAILS:
- Heating power: 1.80 MW
- Cooling power: 2.75 MW

HEAT PUMP AFTERCARE //

The skills to optimise, operate and maintain systems are vital to long term commercial success

SUMMARY POINTS //

- Heat pumps are a very flexible technology
- Full life engineering support is critical
- Natural refrigerants are the only choice
- Think systems not components

CLADE

THANK YOU //

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Coffee break

Engineering progress
Enhancing lives

White paper on Heat Network Pipework

Alexandra Leedham

Technical Team Leader – District Heating

REHAU -
Your specialist DH partner

Specialist sales & technical teams based in the UK

Only UK manufacturer of PE-Xa district heating pipe

Largest UK stock of DH pipework

REHAU polymer district heating pipes

RAUTHERMEX

PE-Xa pipe with bonded PU foam

25-160mm = 3MW*

RAUVITHERM

PE-Xa pipe with PEX foam (non-bonded)

25-160mm = 3MW*

PP-R with PU foam (bonded)

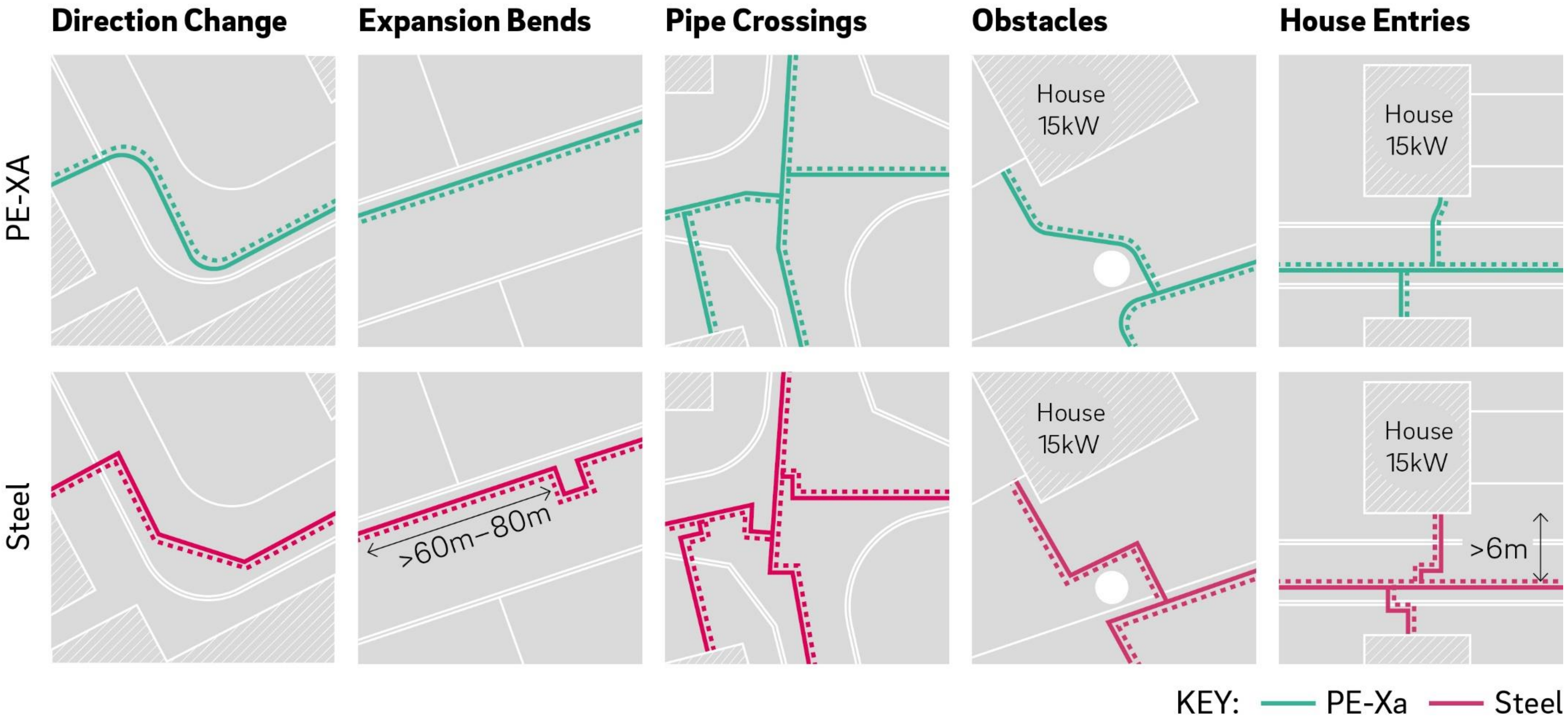
160-315**mm = 13 MW*

**Based on Δ30K*
*** Larger sizes available on request*

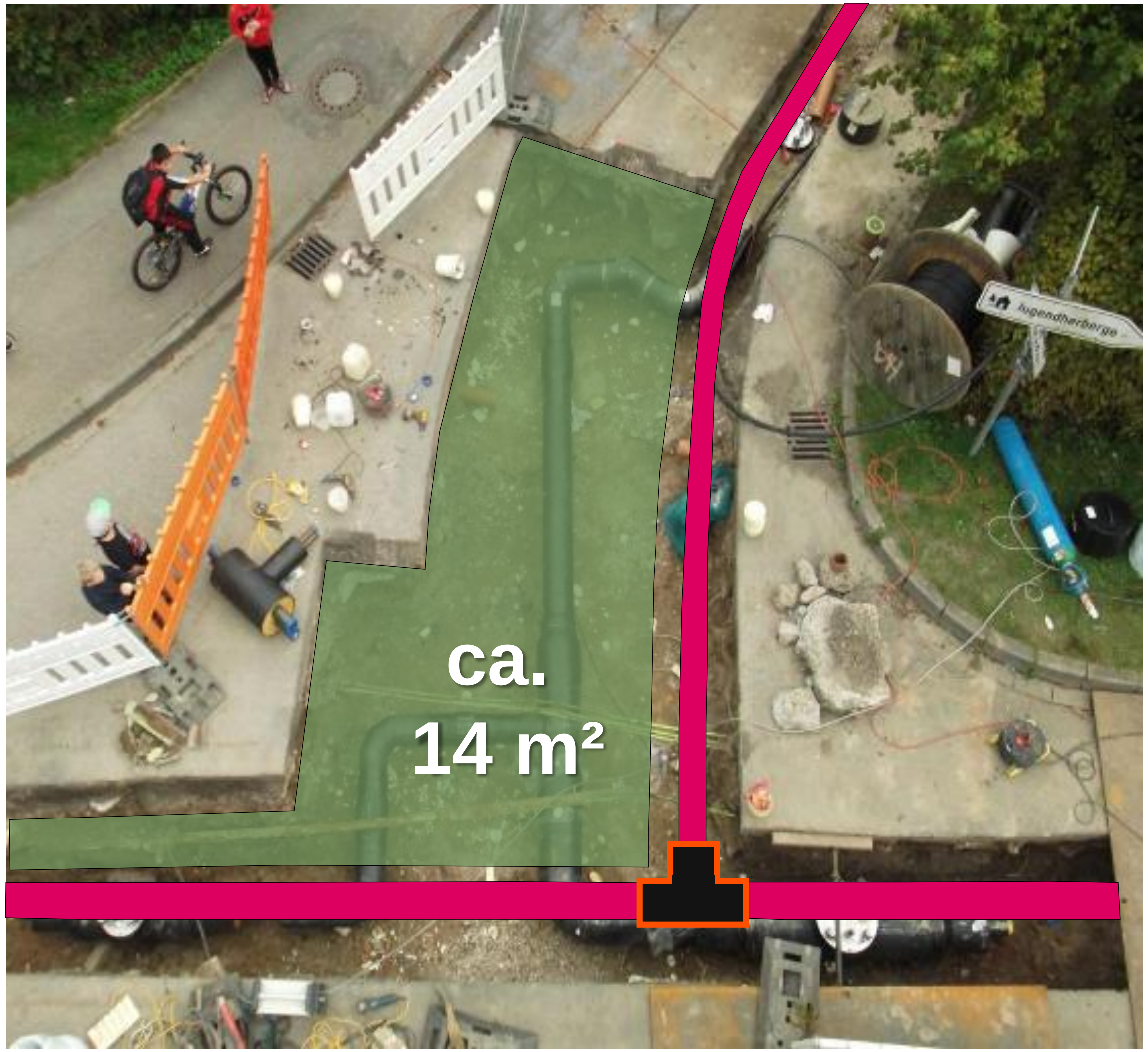
Why did we write a white paper?

1. DH route considerations
2. Carbon emissions from freight
3. Heat losses & shrouds
4. Pipe sizing
5. Summary of 4th generation pipe materials

Steel vs PE-Xa - route considerations



Steel vs PE-Xa – space required on site

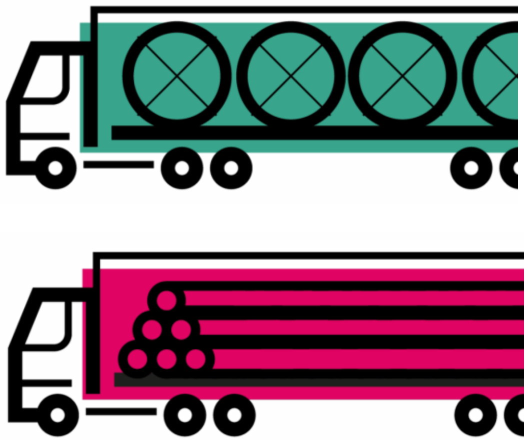


Steel vs PE-Xa – carbon emissions from freight

Carbon emissions for vehicle for lorry journey from London to Manchester.

Emissions calculated using **www.carboncare.org** calculator according to EN 16258.

	Example 1: 1,500m of DN25	**Example 2: 1,000m of DN100**
PE-Xa	43kg CO_2e	97kg CO_2e
Steel	131kg CO_2e	181kg CO_2e
% carbon saving	**67%**	**46%**



Heat losses in DH pipework

2x UNO 25 = 8.19 W/m DUO 25 = 5.81 W/m

Heat loss reduction with DUO → 29%

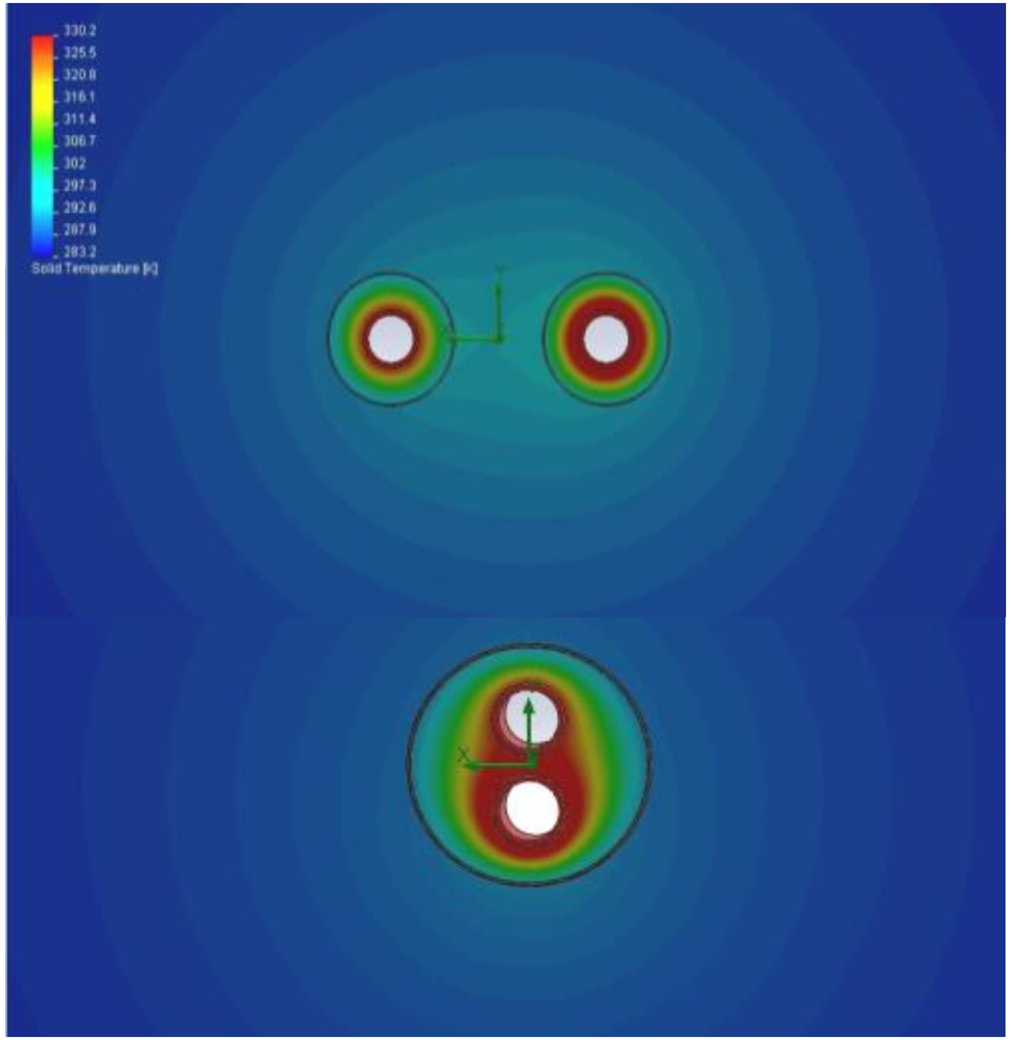
2x UNO 40 = 12.42 W/m DUO 40 = 8.60 W/m

Heat loss reduction with DUO → 31%

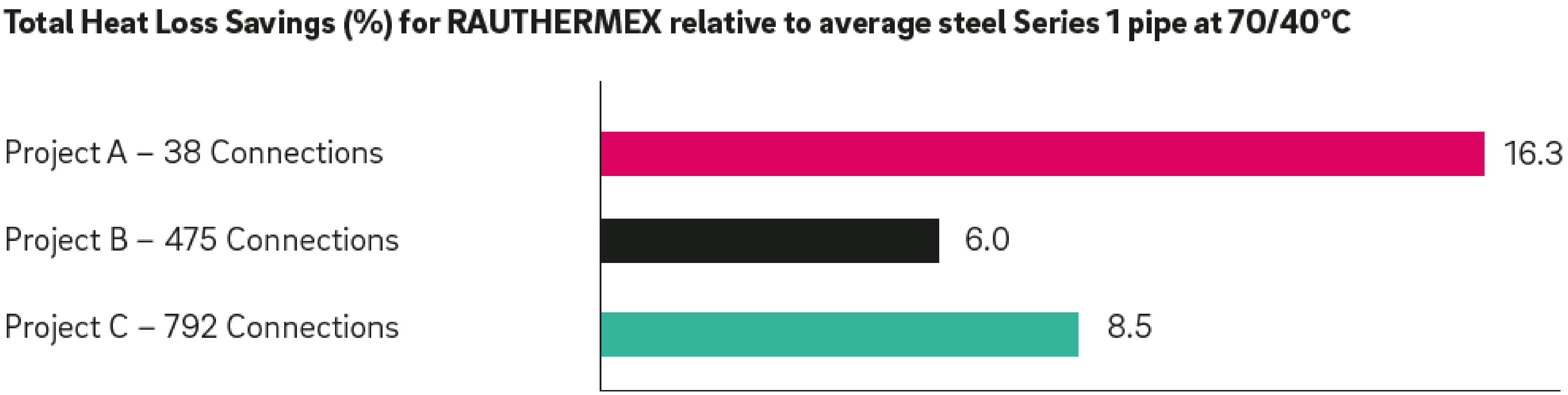
2x UNO 63 = 14.58 W/m DUO 63 = 9.59 W/m

Heat loss reduction with DUO → 34%

Data taken at 70/40°C using RAUTHERMEX pipe.



Design heat loss comparison



Parameters:
- Using average heat losses across range of minimum 3 x Series 1 steel pipes
- Soil depth 0.8m at 10°C
- Does not include additional pipework needed for steel expansion loops
- Calculation is based on new pipes

Shroud comparison


MFPA Leipzig GmbH

Certificate
No. PBS 5.2/17-139-3a_eng

This confirms that the object

REHAU RAUTHERMEX Clip-Sockets System
in the versions T-, I- and L-Socket, size 76-126
in combination with the pipe system RAUTHERMEX

of the customer

REHAU AG + Co
Ytterbium 4
91058 Erlangen

according to the results of the testing centre

Gesellschaft für Materialforschung und
Prüfungsanstalt für das Bauwesen Leipzig mbH
(MFPA Leipzig GmbH)
Hans-Weigel-Straße 2b
04319 Leipzig

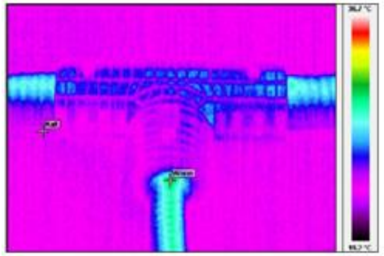
carried out in accordance with the provisions of the technical rule

DIN EN 489:2009-07 Section 5.2 - Water permeability

The test was carried out with increased requirements with a pipe bend of up to 20 °. The detailed test results are shown in the test reports No. PB 5.2/17-139-2 of 29 August 2017 and No. PB 5.2/17-139-3 of 26 October 2017.

Leipzig, 26 October 2017

Dr.-Ing. U. Hornig
Dipl.-Ing. M. Maske



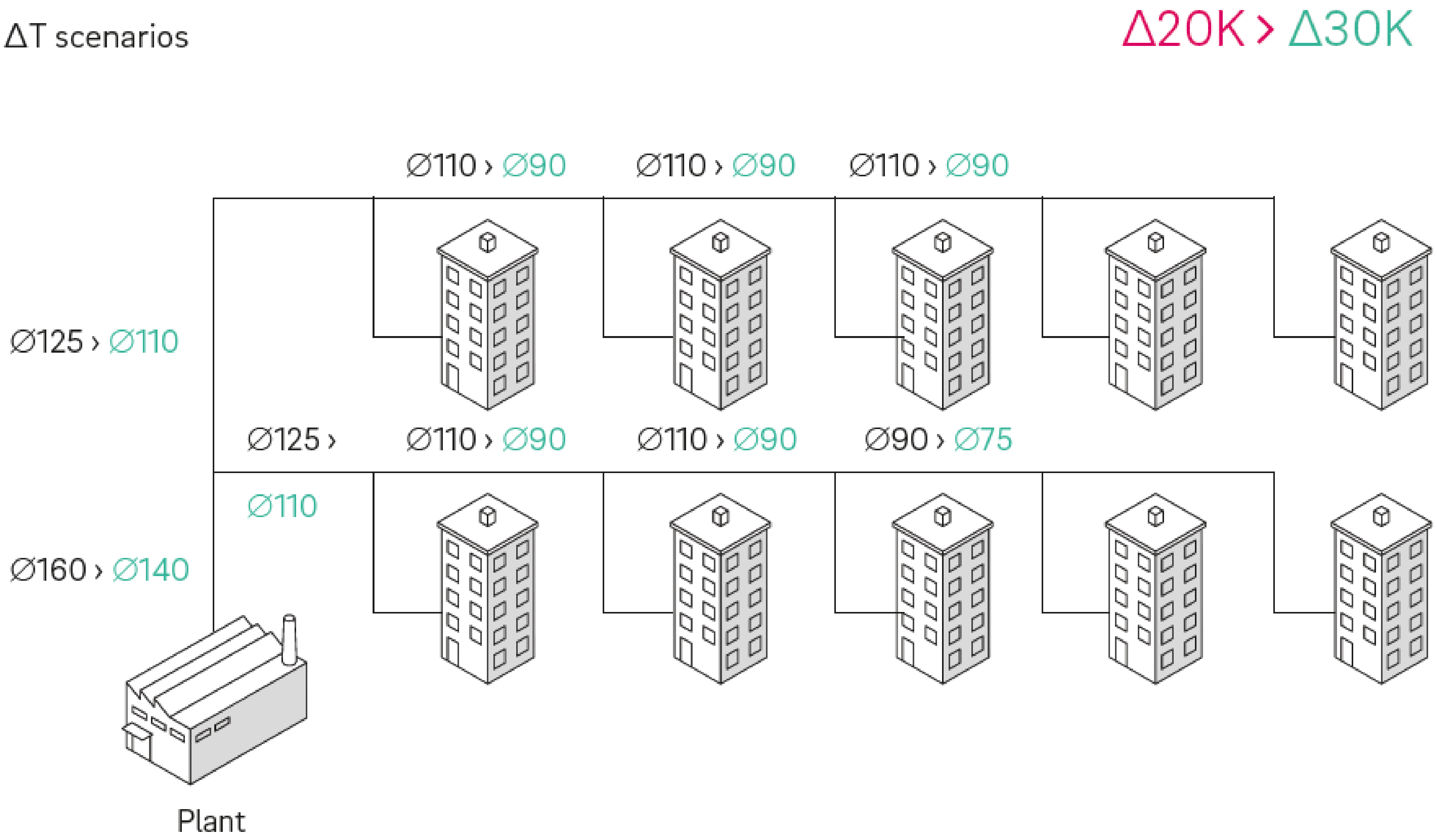
Clip shrouds

- T, L and I versions
- No hot works
- Up to 20° angle of pipe insertion
- Uses PU foam
- Externally tested to 0.3 bar watertightness

Heat shrink

- Only I-shrouds for steel / PP-R
- T, L and I shrouds for PE-Xa pipe version
- Requires hot works on site
- Uses high performance PU foam

Heat network pipe sizing



CAPEX savings from increasing ΔK

CAPEX required

Flow / return temperature (°C)		Network material cost (£)	% Cost saving to 80/60°C or Δ20K network
Δ20K	80/60 60/40	£226K	
Δ30K	70/40 65/35	£174K	23%
Δ40K	70/30	£142K	37%

OPEX savings from increasing ΔK

Operating costs

Flow / return temperature (°C)		Total heat losses (kW)	Saving on additional electricity demand @ 0.30 £/kWh HP COP 3	% saving to 80/60°C network
ΔK20K	80/60 60/40	36.63 kW 24.42 kW	£10,695 /a	33%
Δ30K	70/40 65/35	24.48 kW 21.76 kW	£10,641 /a £13,026 /a	33% 41%
Δ40K	70/30	16.26 kW	£17,844 /a	56%

4^{th} Generation Network - Pipe Material Comparison

	Steel	PP-R	PE-Xa
Max pipe size	>DN1000	DN350 (400mm)	DN130 (160mm)
Pipe lifespan at 4G temps	>50 years	>50 years	>50 years
Coils / sticks	Sticks	Sticks	Coils / sticks
Complexity of install	Specialist steel welder	Civil contractor	Civil or mechanical contractor
Expansion loops needed	Yes	No	No
Leak detection required	Yes	No	No

Engineering progress
Enhancing lives

Thank you for your attention

alexandra.leedham@rehau.com

Presentation

Challenges in designing Secondary Heat Networks in Residential Buildings

AECOM Building Engineering

Contents

Who we are

We are the world's trusted multidisciplinary infrastructure consulting firm.

Our vision is to lead the industry in delivering infrastructure assets, buildings and environments which create resilient, sustainable, net-zero communities and cities.

– whether by reducing emissions, creating social value or diversifying our senior leadership and workforce.

We understand both the urgency of the challenges facing our society and our responsibility to respond in an impactful and enduring way. With this consciousness, we're leading the change toward a more sustainable and equitable future, partnering with those who want to make a positive difference in the world.

We're listening to our clients and the communities we serve to improve lives and livelihoods, and to create sustainable legacies for generations to come. Thinking without limits is what keeps us at the vanguard. Ideas have no borders, and this ethos is embedded in our culture. The full scope of our global capabilities is available to anyone who needs it, wherever they are based.

We're trusted advisors — planners, designers, engineers, scientists, consultants and program and construction managers — delivering professional services spanning, transportation, buildings, water, the environment and new energy. Working throughout the project lifecycle, we're one team driven by a common purpose to deliver a better world.

Building Services Engineering

Vishal Bhowmik
Principal Mechanical Engineer
BULDING SERVICES ENGINEERING

Antonis Thrasyvoulou
Principal Mechanical Engineer
BULDING SERVICES ENGINEERING

- MID + HIGH DENSITY RESIDENTIAL MEP DESIGN
- 28+ YEARS OF COMBINED EXPERIENCE
- PM + MECHANICAL LEADS

- ENERGY CENTRE AND HEATING NETWORK DESIGN
- BOILER & HEAT PUMP PLANTROOMS
- 4^{TH} & 5^{TH} GENERATION HEAT NETWORKS

Mid to High Density Residential

Gascoigne West Phase 1
BEFIRST | LONDON

Gascoigne West Phase 2
BEFIRST | LONDON

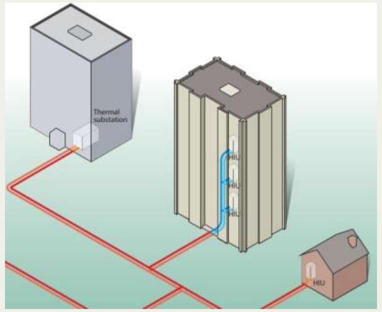
Lots Road
HUTCHISON WHAMPOA | LONDON

Eastwick and Sweetwater
BALFOUR BEATTY | LONDON

Milton Road
HARROW COUNCIL | LONDON

Byron Quarter
HARROW COUNCIL | LONDON

Heat Losses



GOAL | STRATEGY | CHALLENGES

Restrict heat losses

- Less than 876kWh / dwelling / year; i.e. 100 W/Dwelling)
- 550kWh / dwelling / year best practise; i.e. 50W/Dwelling)

Reduce LTHW temperatures

- >70ºC → <60ºC

DHW Generation temperatures

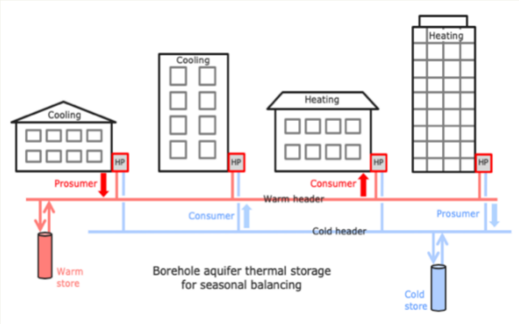
<u>TMV Selection / Operation</u>

- Minimum temperature (Shut off) >52ºC (or >55ºC ?)
- Minimum Delta T = 10ºC

Hydraulic Separation

- Inevitable Temperature Degradation
- Is it really needed?
- High / Low pressure loops

Heat Losses



GOAL

Restrict heat losses

- Less than 876kWh / dwelling / year; i.e. 100 W/Dwelling)
- 550kWh / dwelling / year best practise; i.e. 50W/Dwelling)

STRATEGY

Introduce Ambient Loop

- <30ºC

CHALLENGES

- **Capital Cost & Maintenance Cost**
- **Is there a cooling demand on site?**
- **Embodied Carbon Higher / Lifecycle lower**
- **Limited manufacturer availability**
- **Future connection to DH networks, may require local heat rejection plant**

Heat Losses

GOAL

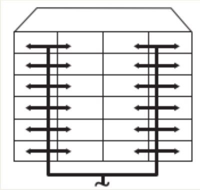
STRATEGY

CHALLENGES

Restrict heat losses

- Less than 876kWh / dwelling / year; i.e. 100 W/Dwelling)
- 550kWh / dwelling / year best practise; i.e. 50W/Dwelling)

- **Minimise pipework length**
- **Minimise pipework Size**
- **Increase Insulation**

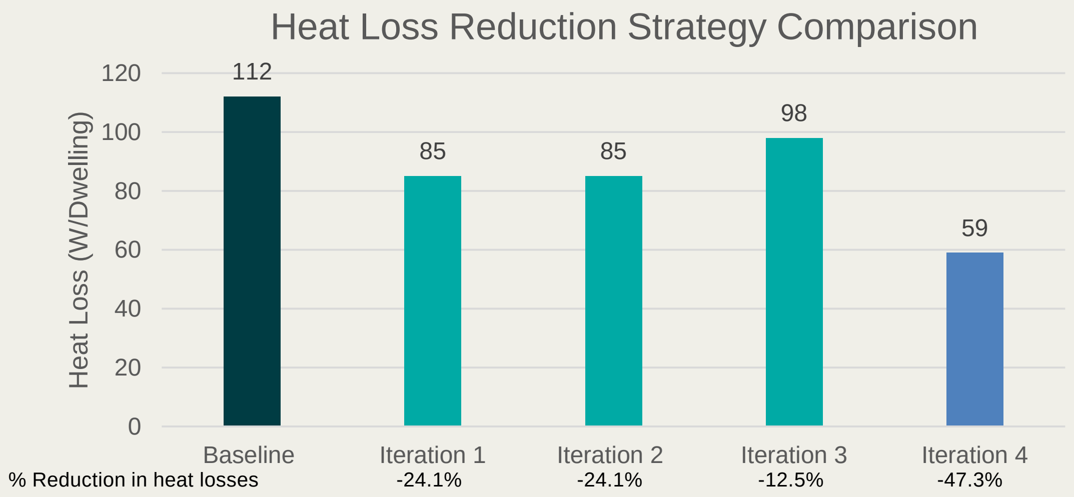


- **Riser Space allowance requirement**
- **Coordination with architecture**
- **MEP Involvement in early design**
- **Increase cost**

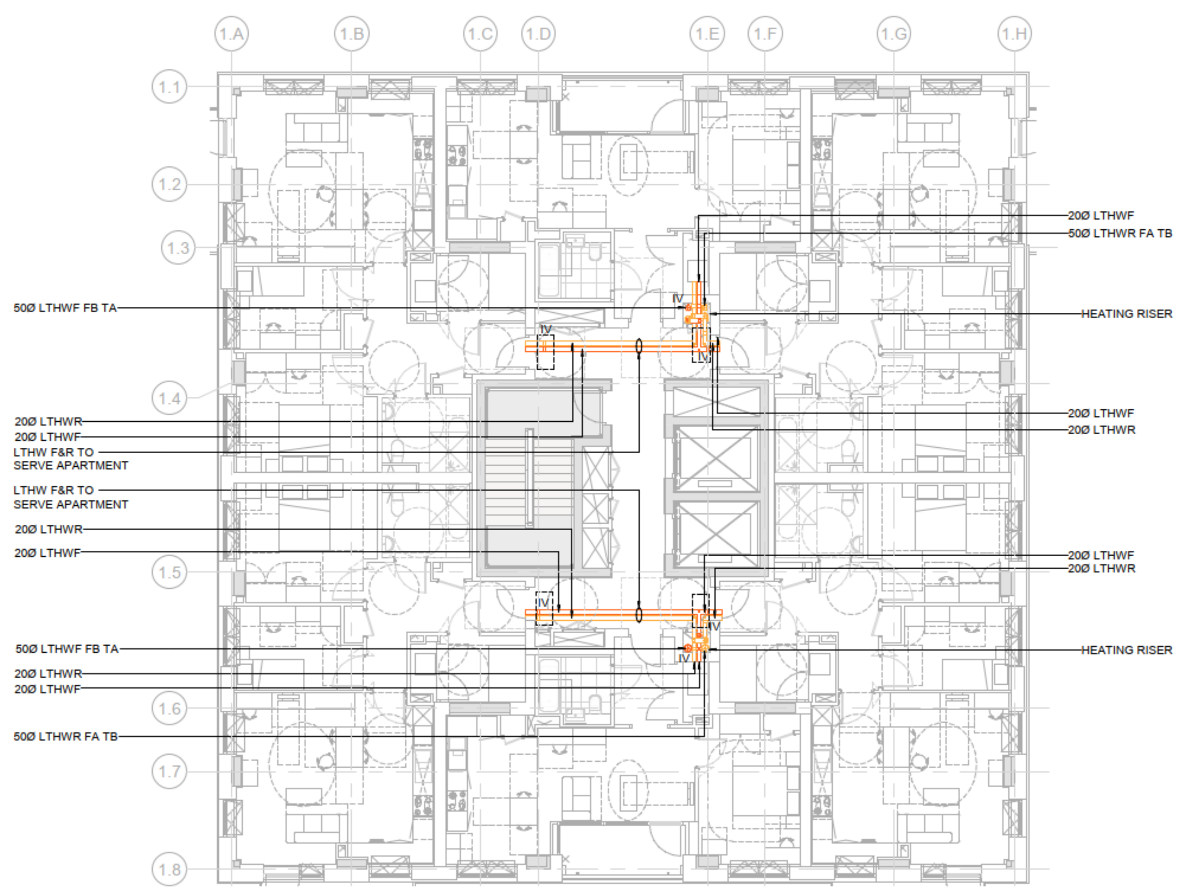
Heat Losses

Sample Development

- Type – Residential
- Number of Buildings - 5
- Number of Apartments – 386

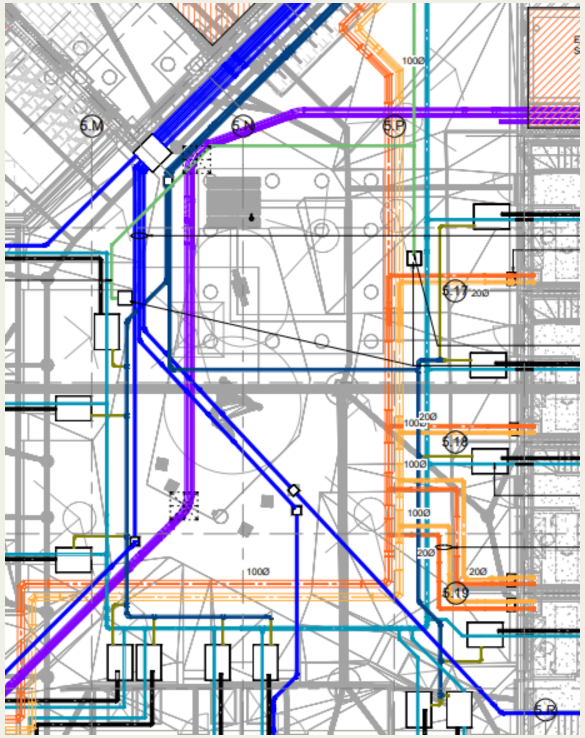


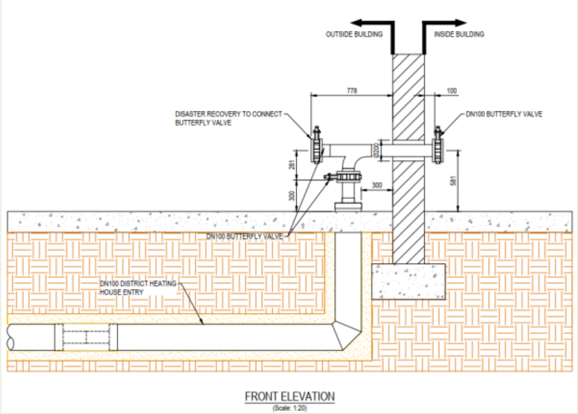
Iteration	% Loss to Annual Average Demand	Heat Loss (W) / Apartment
Baseline Scenario – Flow 70°C / Return 40°C, Ins. Thickness 25mm	29.70%	112
Iteration 1 – Flow 70°C / Return 40°C, Ins Thickness 50mm	22.60%	85
Iteration 2 - Flow 60°C / Return 30°, Ins. Thickness 25mm	22.50%	85
Iteration 3 - Flow 70°C / Return 40°, Ins. Thickness 25mm, 20% reduction in lateral pipe length (HIU Closer to corridor)	26.10%	98
Iteration 4 - Flow 60°C / Return 30°, Ins. Thickness 50mm, 20% reduction in lateral pipe length (HIU Closer to corridor)	15.80%	59



Other Design Considerations

- Avoid buried pipework below slab
- Pipework Design Life Vs. Operating temperature and pressure
- Site coordination / congested below ground services
- Avoid for requirement for air Venting
- Disaster Recovery design





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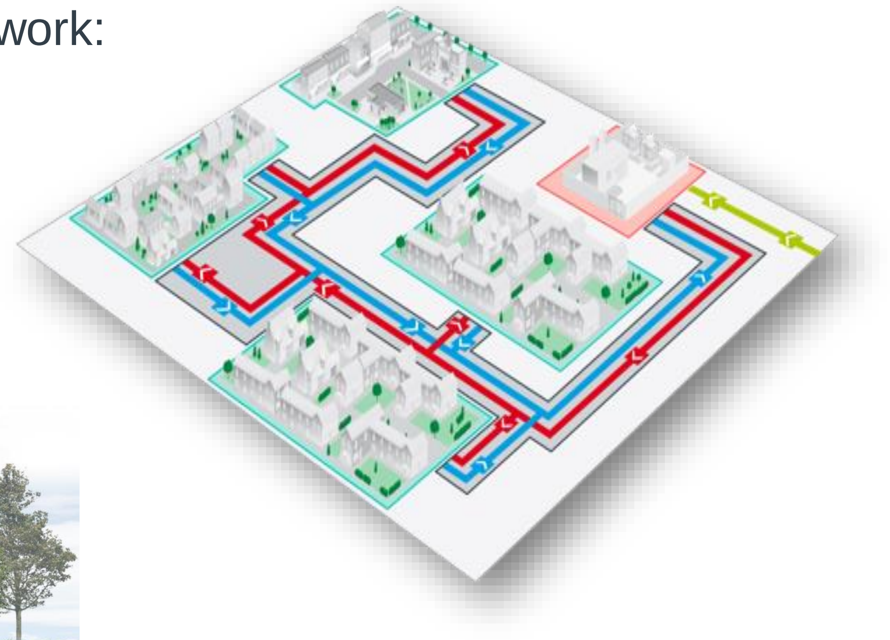
Designing Network Heat Pump Solutions for Low Density Housing

Presented by: Robert Temlett

17/11/2022

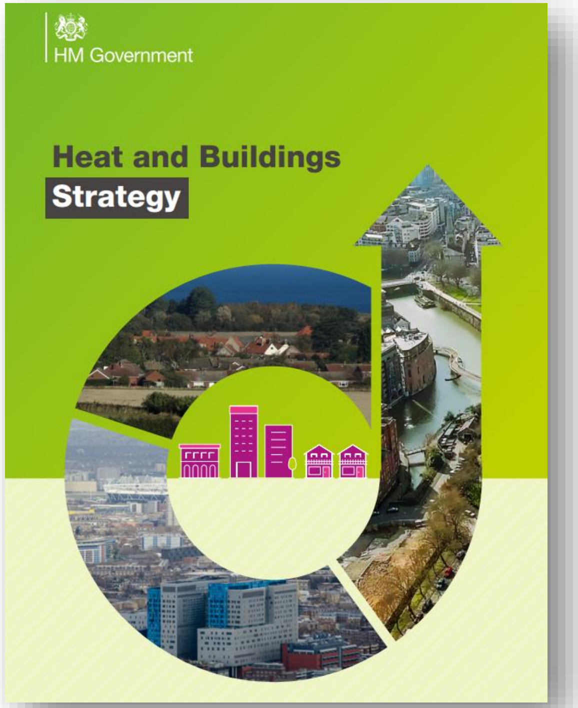
Agenda

- Why are we implementing District Heating in Low Density Housing.
- How are we implementing it.
- Design challenges of a low density network:
  - Heat network losses.
  - Temperature drop in the network.
  - Differential pressure in the network.



Why are we implementing District Heating in Low Density Housing

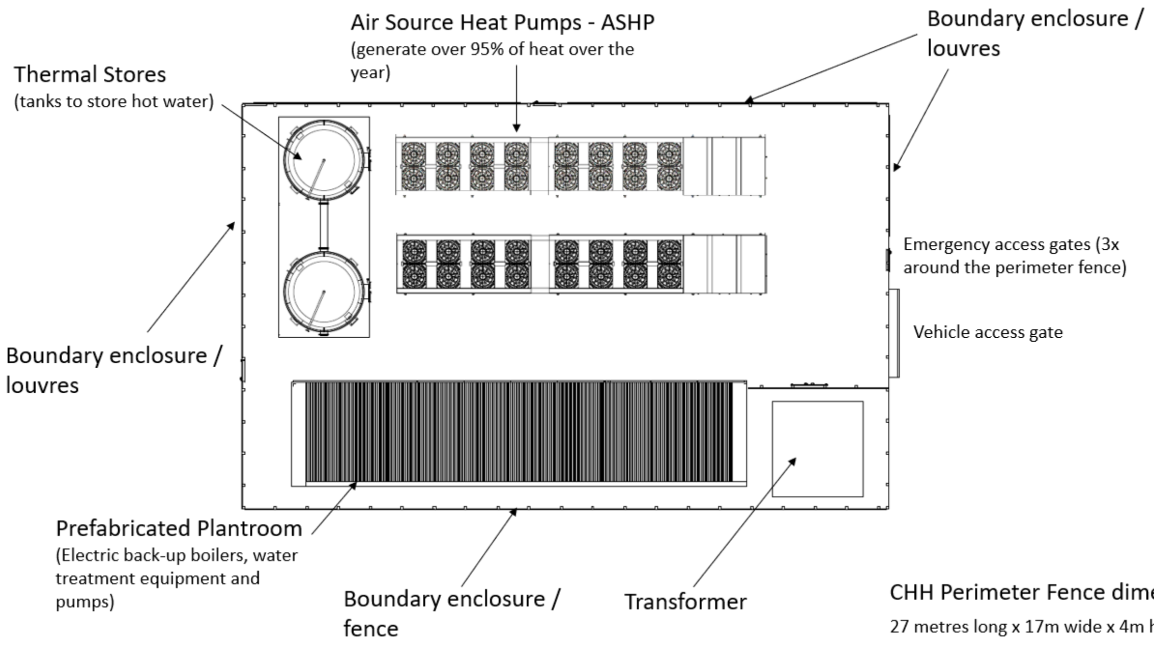
- Phasing out of natural gas connections in new build beyond 2025 (Future Home Standards).
- District heating in low density developments provides a new opportunity for BUUK (Metropolitan's umbrella company) to construct long-term assets which provide heat from sustainable sources.
- Provides developers with a robust option to replace gas connections with heat network connections.
- Significant carbon savings estimated at greater than 70% compared to a gas combi boiler.
- Future Net Zero heat solution as the electricity grid decarbonises so does the district heating network.



How are we implementing it

- Centralised Energy Centre (Community Heat Hub)
- Providing greater than 95% of annual heat demand from heat pumps.

What does the Community Heat Hub (CHH) contain?



CHH Perimeter Fence dimensions:
27 metres long x 17m wide x 4m high

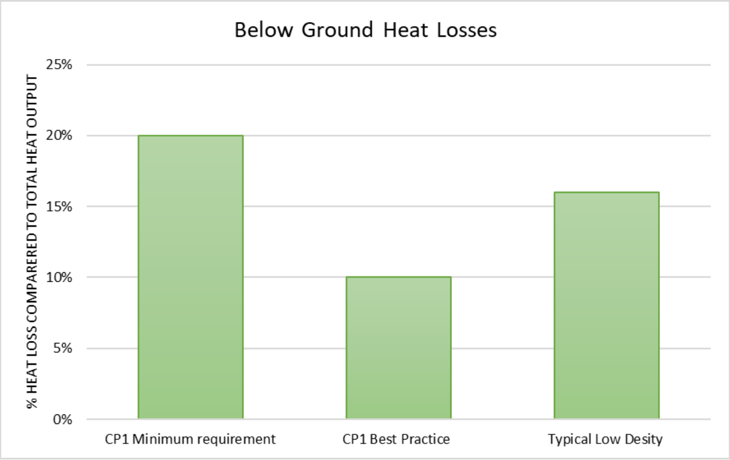
How are we implementing it

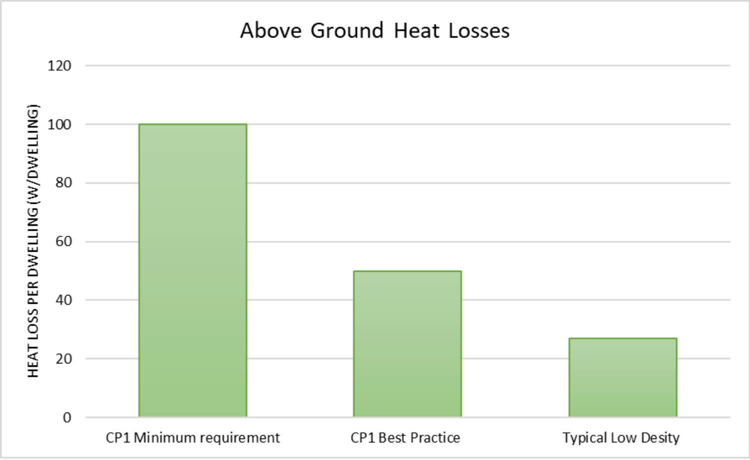
- Pre-insulated plastic pipe network.
- Disaster Recovery Valves and isolation valves at key locations.
- HIU selection for low network operating temperatures.

Design Challenges

Heat Network Losses

- Calculated below ground heat network losses are typically 16%-18%.
- Calculated above ground losses are typically 3-5%.
- Low density network losses are proportioned differently from guidance in CIBSE CP1.
- Achieving approximately 20% total heat network losses is achievable for low density networks.
- Designing for low network temperatures is fundamental in achieving 20% network losses.



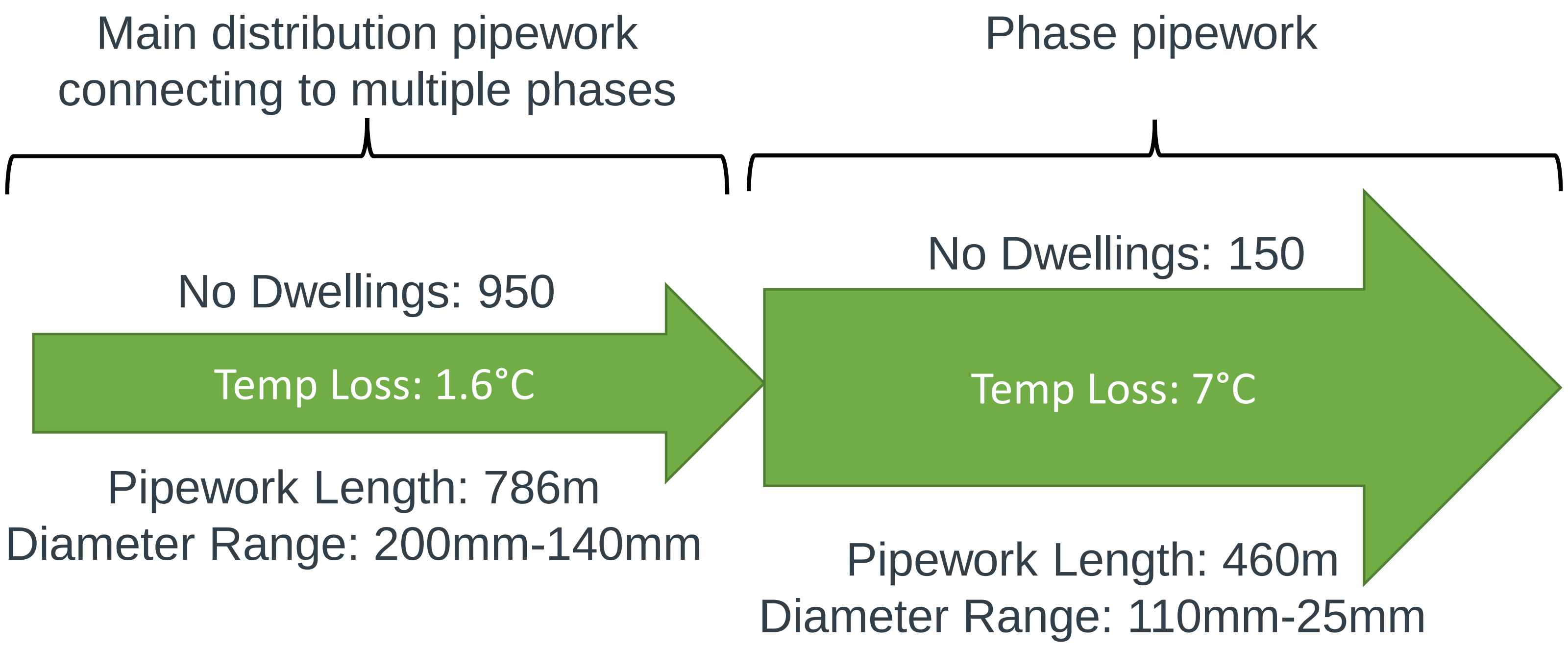


metropolitan

Design Challenges

Temperature drop in the network

- During low load conditions, the final flow temperature that reaches the index HIU can be below the minimum required temperature for the HIU to deliver design loads.
- Highest temperature drop occurs in smaller diameter pipework in a cluster of properties (phase layout).



Design Challenges

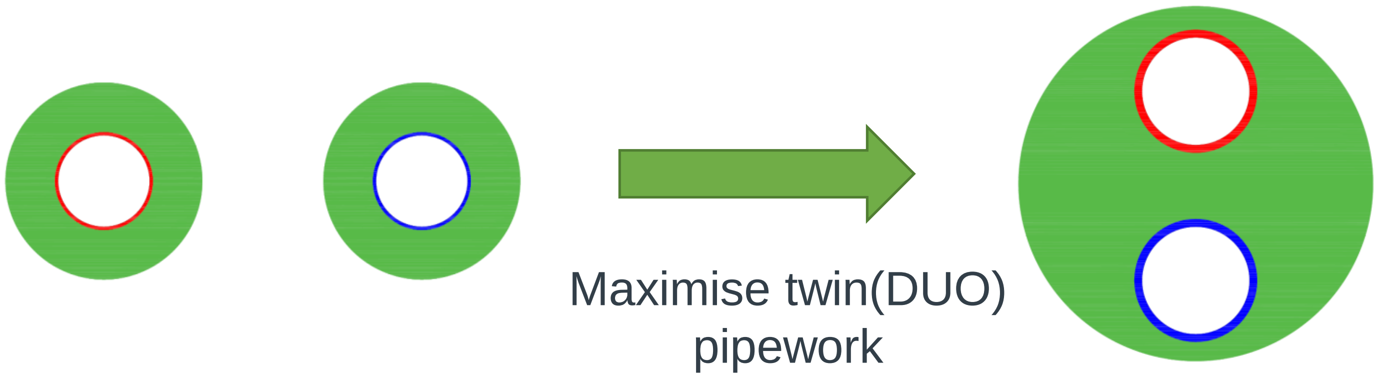
- **Temperature drop in the network**
- Temperature drop can be reduced and managed by:

  •Optimising pipework sizing within phases (reduce diameter where possible).

  •Optimise pipework layout within phases.

  •Increase flow temperature during low load conditions.

  •Increase thermal insulation (although this will have CAPEX increases).



Design Challenges

Differential pressure in the network

- Due to the network length the differential pressure at energy centre can be relatively high during peak load conditions.
- HIUs can only work against a certain differential pressure, typically a maximum of 6 bar, therefore properties closer to the energy centre can be at risk.

Ways to mitigate against differential pressure

- Place the energy centre central to the development.
- Increase diameter of main distribution pipework (balancing exercise between pressure and temperature drop).
- Install pumping stations along the main distribution pipework.
- Install differential pressure control valves at branches off the main distribution pipework.
- Install additional pipework to supply properties close to the energy centre separately.

Thank you for listening