# HEAT NETWORK EFFICIENCY SCHEME

Department for Energy Security & Net Zero

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# Welcome

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Please also turn off webcams to improve video quality

Ask questions using the Q&A functionality

HEAT NETWORK
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# Agenda

| Session | Speaker |
|---|---|
| **Introduction to the Heat Network Optimisation Guidance** (10 minutes) | Alex Trebowicz - Department for Energy Security & Net Zero |
| **Greening energy networks and preparing for change** (10 minutes) | Huw Blackwell - Anthesis |
| **Heat Network Optimisation Guidance and how to deliver a successful optimisation study** (20 minutes) | Tom Naughton - FairHeat |
| **HNES Monitoring and Reporting requirements** (10 minutes) | Louise Singleton - Gemserv |
| **Q&A** (10 minutes) | Gemserv |

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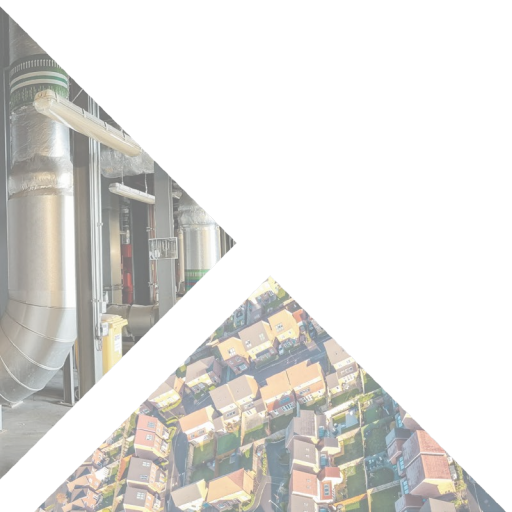
# Introduction to the Heat Network Optimisation Guidance

Alex Trebowicz

Department for Energy Security and Net Zero



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# Greening energy networks and preparing for change

Huw Blackwell

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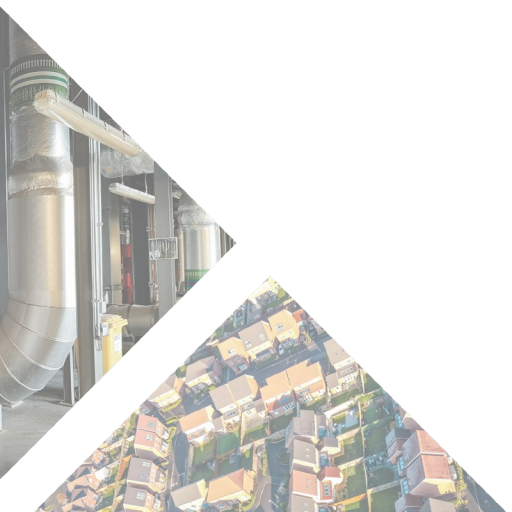

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# BEIS GREENING ENERGY NETWORKS GUIDANCE

BEIS

September 2023

Anthesis

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# 01 GEN Project

# BEIS GEN PROJECT

- Greening Energy Networks (GEN) project
- Funded by government with support from industrial partners.
- Report undertaken by Anthesis with support from 1Energy and Fairheat.
- Reviewed 6 existing networks across England to determine most commercially viable routes for decarbonisation vs an individual heat pump counterfactual
- Summary findings are presented here, to help system owners and operators make decisions about their future decarbonisation pathway considering their context

Department for Business, Energy & Industrial Strategy

Heat Networks Industry Council

Anthesis

1ENERGY

FairHeat

# 02 Decarbonising systems

# FOUR PATHWAYS TO DECARBONISATION

**1. Gas based – Methane (Bio-gas) or Hydrogen**

Limited commercial availability and cost of the latter makes it a highly unlikely solution, especially away from proposed Hydrogen Hubs and in the near term to achieve any net zero targets (e.g. before 2035). This cannot be relied upon as a decarbonization strategy in the housing sector as large-scale supply to housing may never materialize owing to adverse economics. **No project taken forward within GEN.**

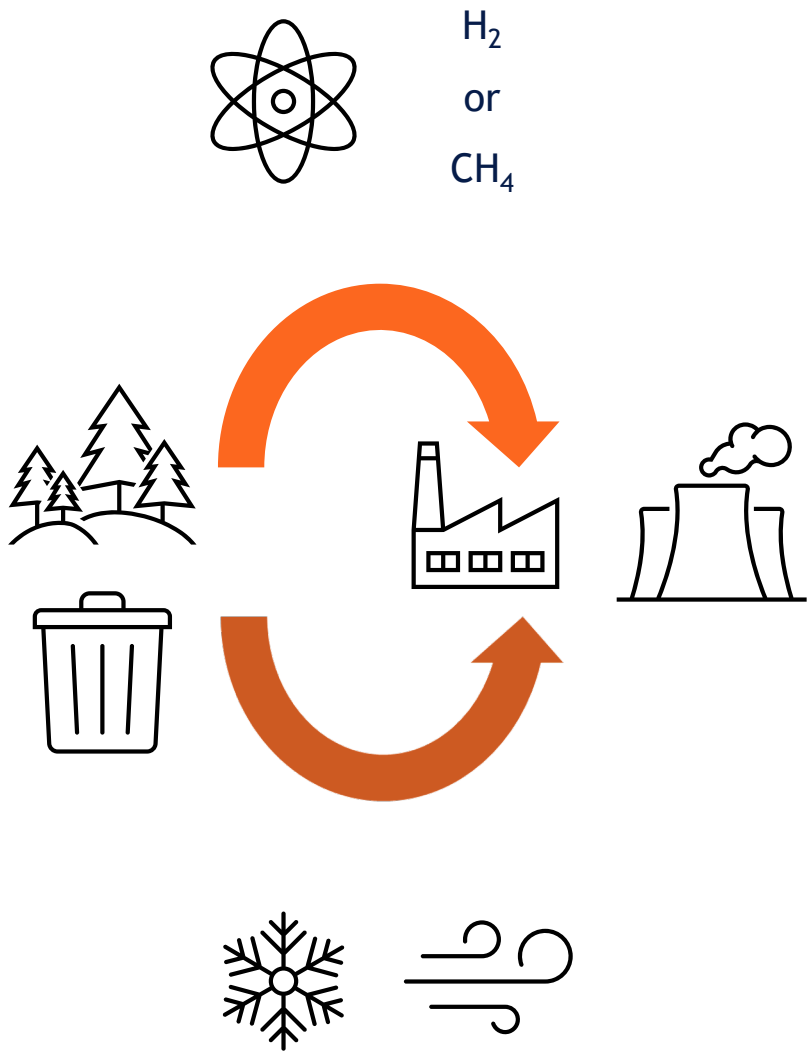
**2. Waste heat (EfW, heat from cooling)**

**3. Biofuels (Wood, Bio-oil)**

Medium term challenges around future of combustion, availability of solid fuels, carbon factors and decarbonising these. Where available these can already be commercially viable solutions. Heat from EfW also offer the opportunity to substantially decouple supply price from commodity markets. **An option on 4 projects within GEN.**

**4. Heat pumps**

Associated challenges with Electrical peak loads, electricity sourcing, design approaches for F-gas safety, design operating temperatures, local electrical infrastructure constraints, financing, and long-term grid carbon factors. Emerging micro-climatic risks. Probably the future fall-back for many systems. **Proposed for 2 projects within GEN.**



# 03 Focus on Heat Pumps

# CHALLENGES IN MOVING TO HEAT PUMPS IN EXISTING SYSTEMS

| Technology | Benchmark cost (£/kW) | Benchmark size | Benchmark Weight |
|---|---|---|---|
| 1 MW Gas boiler | £42-52,000 @ £42-52/kW | 40 $m^2$ 1m tall | 5,000 kg |
| 1 MW ASHP | £400,000 @ £400/kW | 80 $m^2$ 2m tall | 9,500 kg |

The following applies at both communal and district scale

1. Air source system may become space limited in deployment, and have other associated novel technical challenges and risks (e.g. cold pluming, ice formation, H&S, fire strategy integration)
2. Large carbon improvements come from deployment of first heat pump in a system meeting only part of the demand e.g. 30% peak.
3. **Heat pump COP is king.** However cost-effective improvements to this over Air Source systems can be a challenge e.g. water or ground based systems may not be economic for the operational efficiency gains
4. High temperature heat pumps may be preferential to wholesale terminal equipment replacement
5. **Reduction in operating temperatures always beneficial.** Often substantive opportunity to improve existing systems. Recommend ongoing reductions as part of replacement of terminal systems at end of economic life.

# 04 Relevance to Policy

# POLICY ALIGNMENT

1. **Commercial cases for decarbonisation exist** where there is existing waste heat systems e.g. EfW, or heat from cooling
2. **Heat pump systems appear a sensible decarbonisation fallback** but may not always be technically feasible. **Be aware of novel risks** for these systems, which substantially differ from traditional fossil boiler approaches. Currently there appears to be **additional costs** for these in comparison to other decarbonisation approaches or 'business as usual'.
3. **Lowering of heating system temperatures is technically beneficial** regardless of primary heating supply. Many improvement **projects already have a business case**, especially for systems at 'end of economic life.'
4. **Current government schemes** (e.g. HNES, HNOO) aim to **facilitate reducing of communal or district heating system temperatures**, and encourage knowledge and experience sharing between consultants, contractors and asset operators.
5. **Additional schemes** (HNDU, Green Heat Network Fund, BHIVE), aim to **facilitate the commercial decarbonisation of communal systems** via District heating

# THANK YOU

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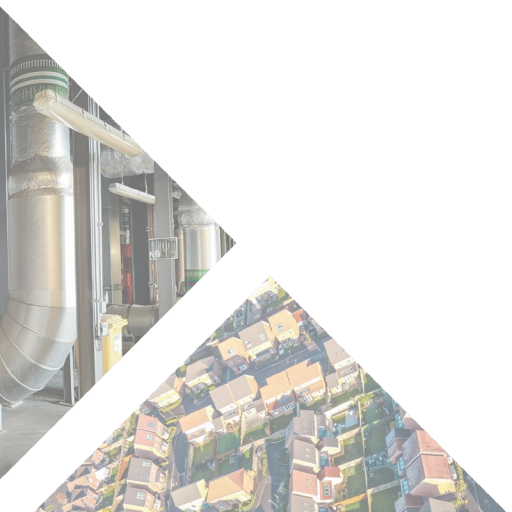
# Heat Network Optimisation Guidance and how to deliver a successful optimisation study

Tom Naughton

FairHeat



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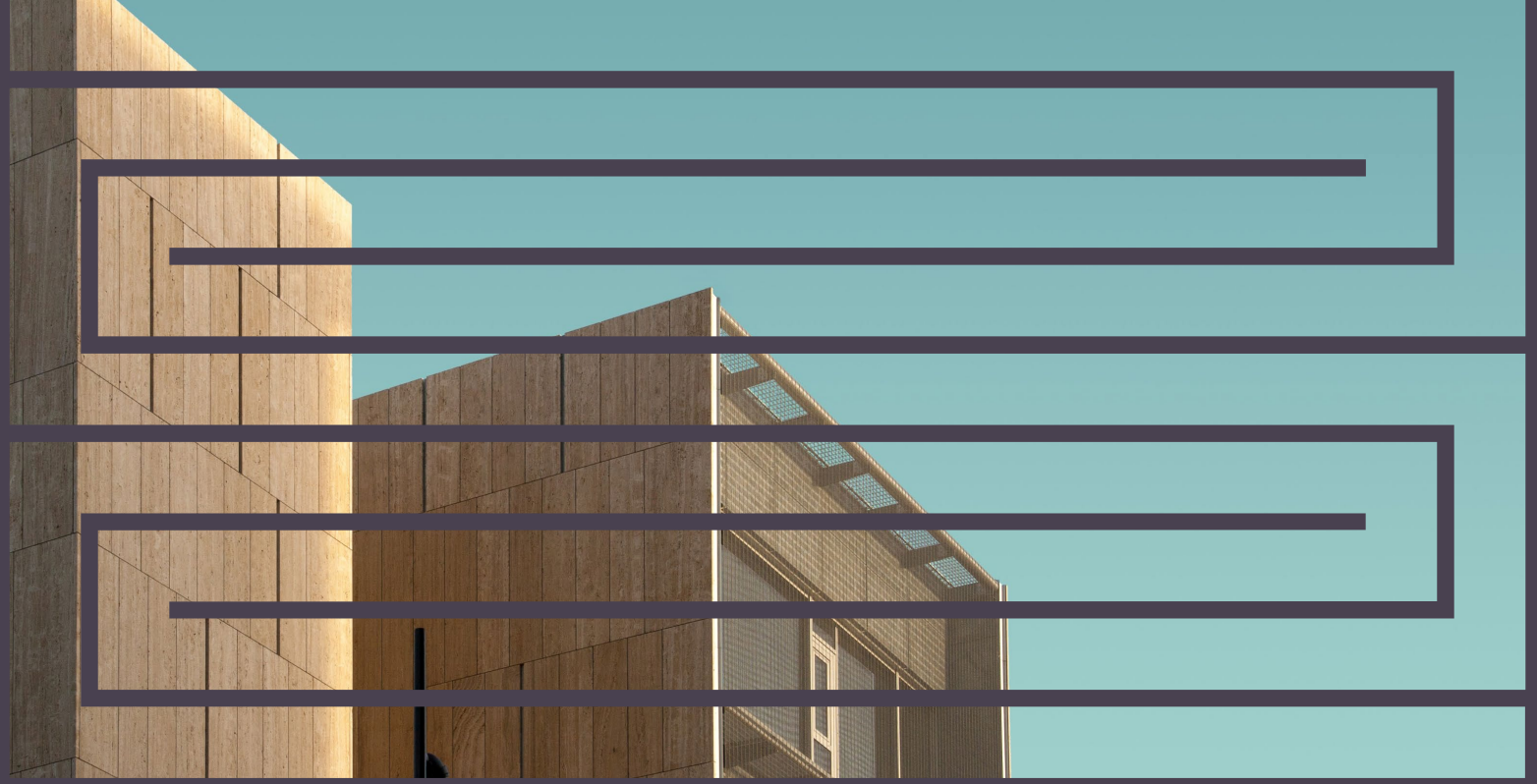

# Heat Network Optimisation Guidance

06 September 2023

FAIRHEAT

# Introduction

**Thomas Naughton** MCIBSE CEng

- Associate & Head of Operations at FairHeat
- tom.naughton@fairheat.com
- www.fairheat.com

FAIRHEAT

# Why FairHeat?

- FairHeat have established a standard methodology for Optimisation Studies
- Business structured around Quality Assurance of heat networks
- Based on 8 years of experience with over 150 operational heat networks
- Access to huge amount of performance data
- More recently:
  - Heat Network Optimisation Opportunities (HNOO) – 10 studies
  - Heat Network Efficiency Scheme (HNES) Demonstrator – 22 studies
  - Currently working on HNOO2 and HNES projects

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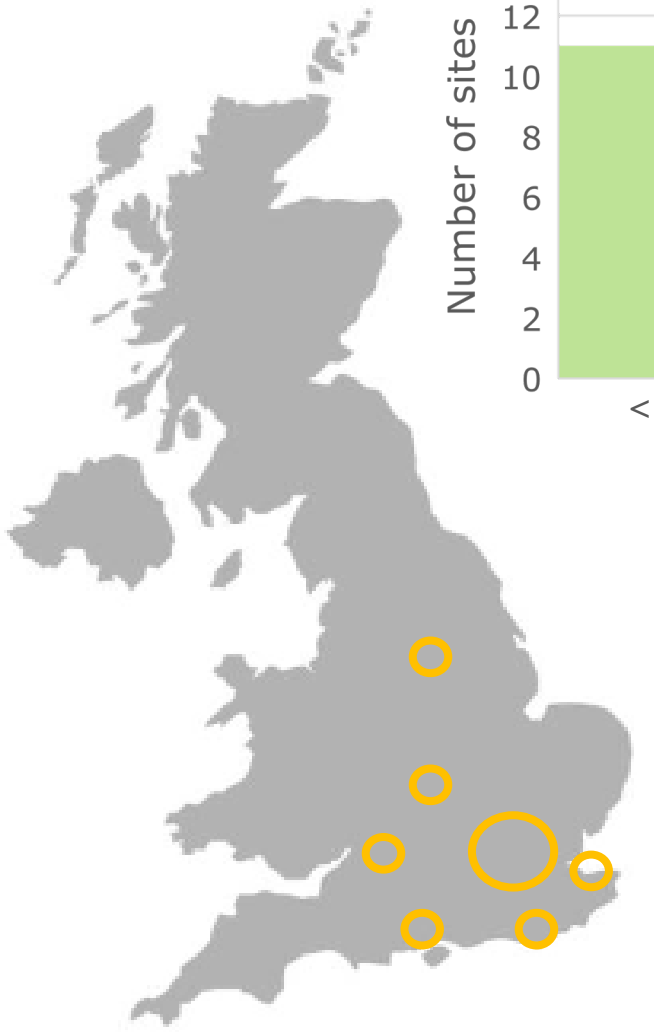
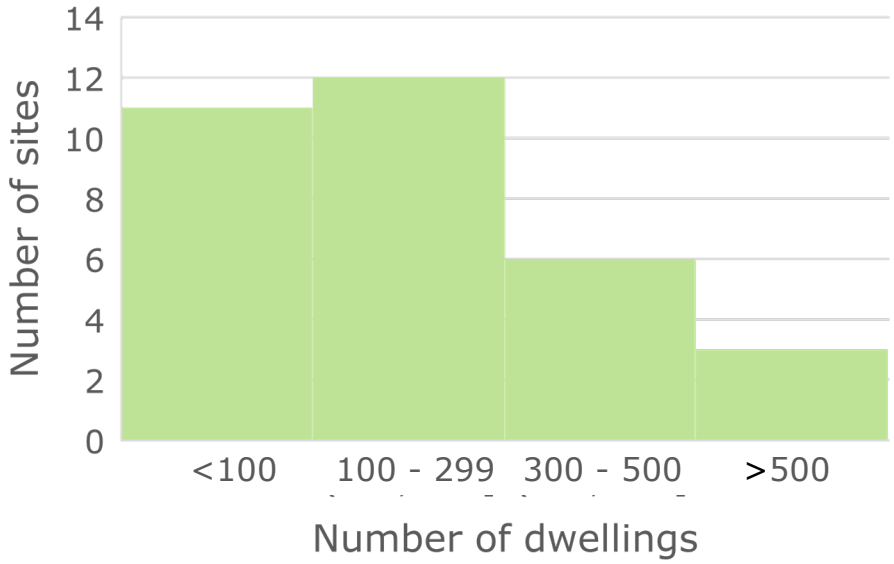
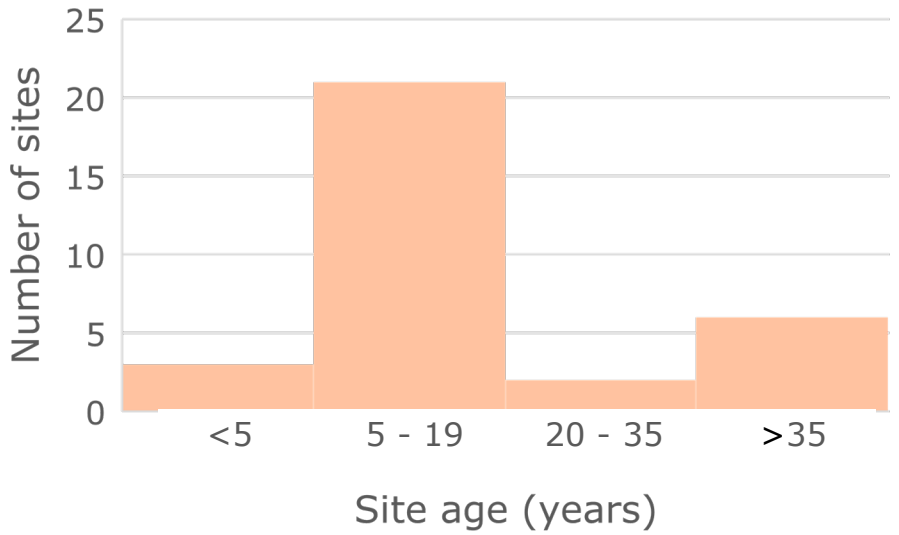
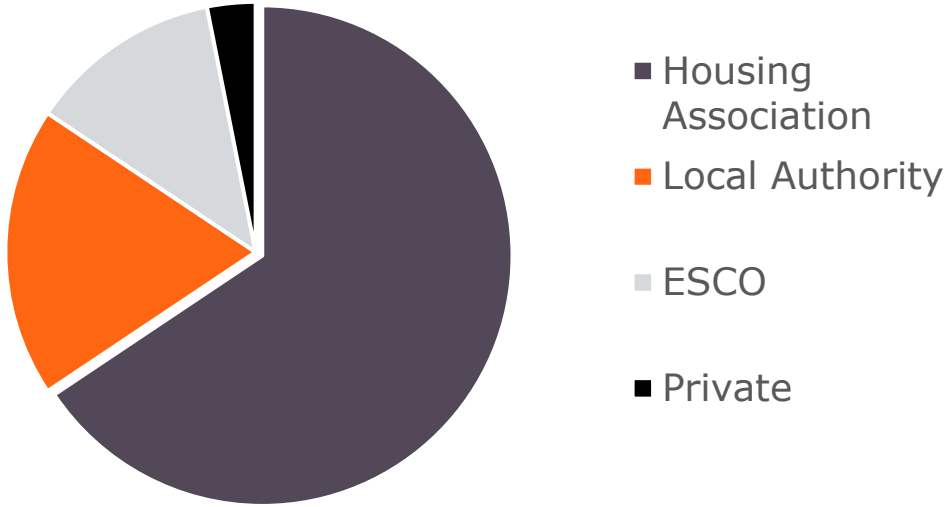
# FairHeat - HNOO & HNES Demonstrator





# Regulation context

Heat Network Regulations coming in 2025

Heat Networks Technical Assurance Scheme (HNTAS) sets minimum technical standards

Legal obligations introduced on heat network operators

HNOG complements the Heat Networks Technical Assurance Scheme (HNTAS)

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# Purpose and audience

- ✓ Dissemination of common issues and methods for optimising heat network performance
- ✓ Establishes key principles and methods
- ✓ Guidance material for upskilling sector
- ✓ Standardised set of processes and approaches

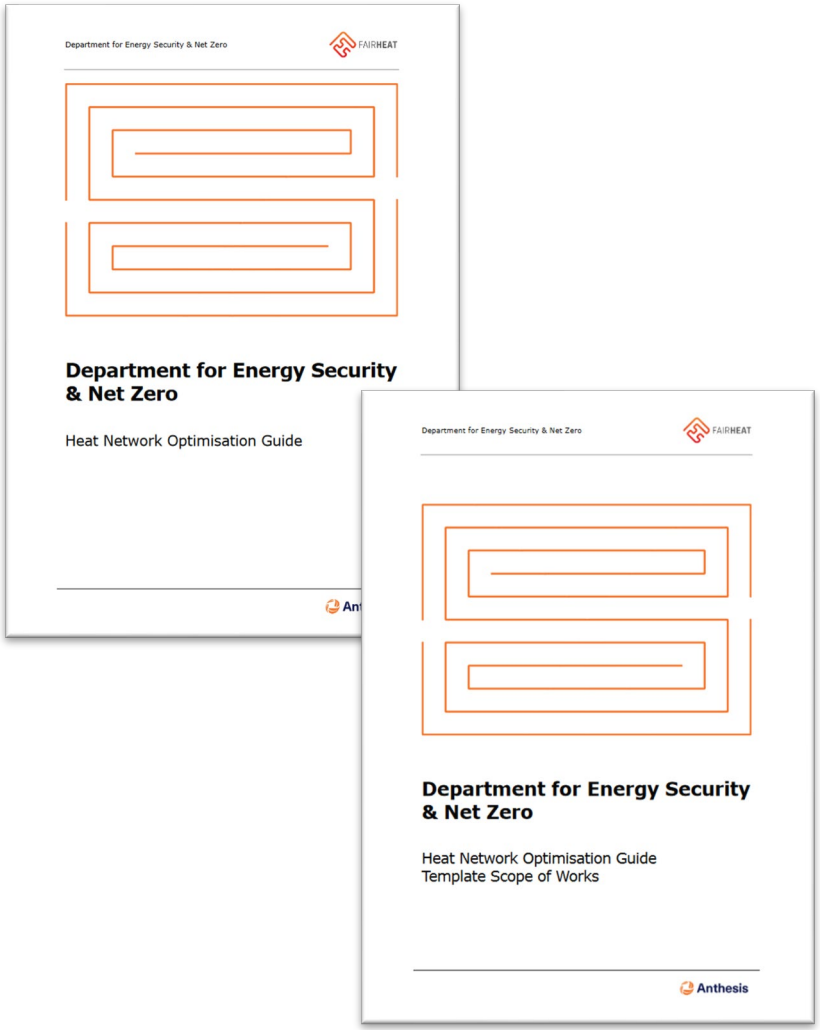
Provides guidance and support to

Heat network operators (non-technical)

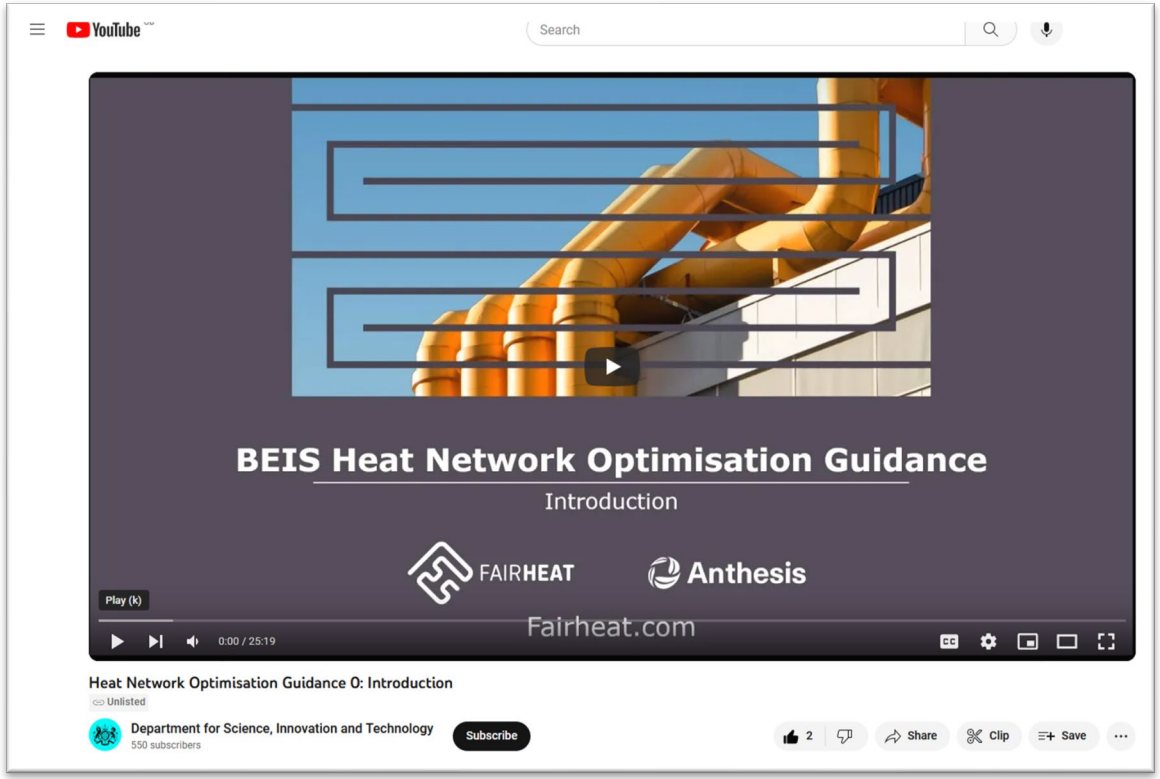
Heat network specialists/engineers (technical)

# Heat Networks Optimisation Guidance (HNOG)

## Guidance notes + template scope of works

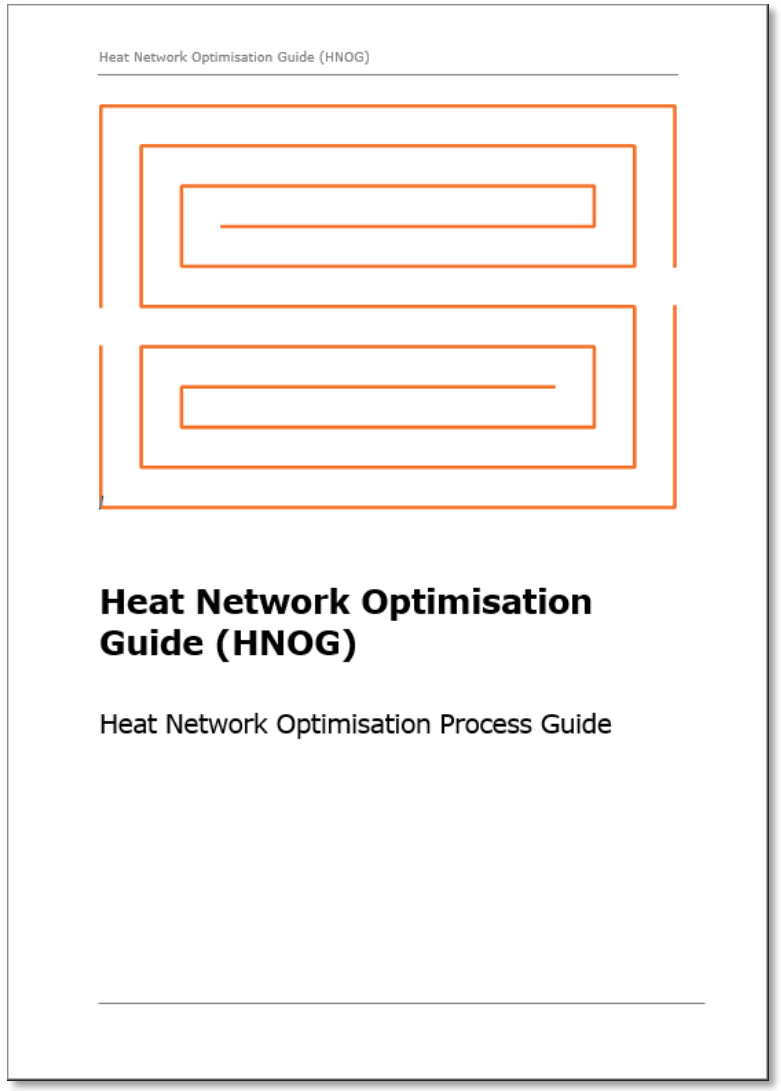



## Videos



# HNOG Process Guide

- Developed for engineers undertaking Optimisation Studies
- Outlines overview of key principles for improving heat network performance
- Establishes standardised processes and outputs
- Provides guidance on:
  - Determining heat network performance
  - Undertaking site audits
  - Performance analysis
  - Determining interventions
  - Developing business case for client

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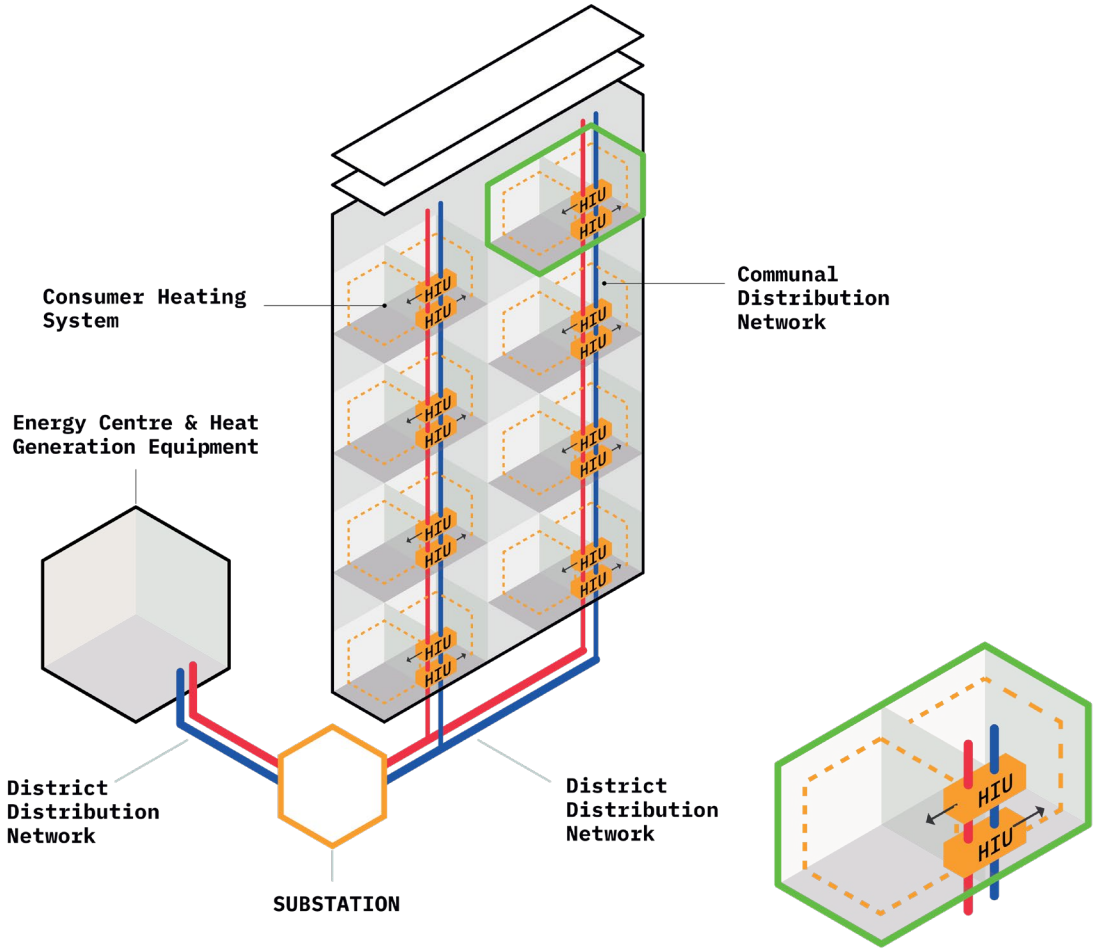
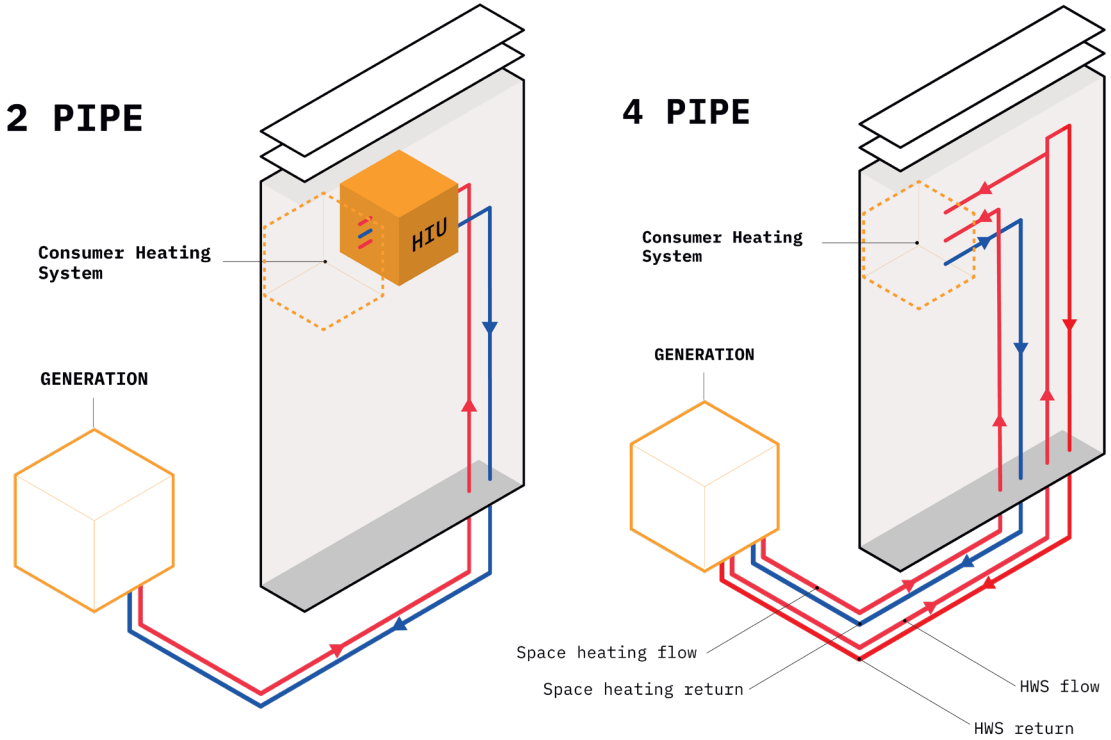
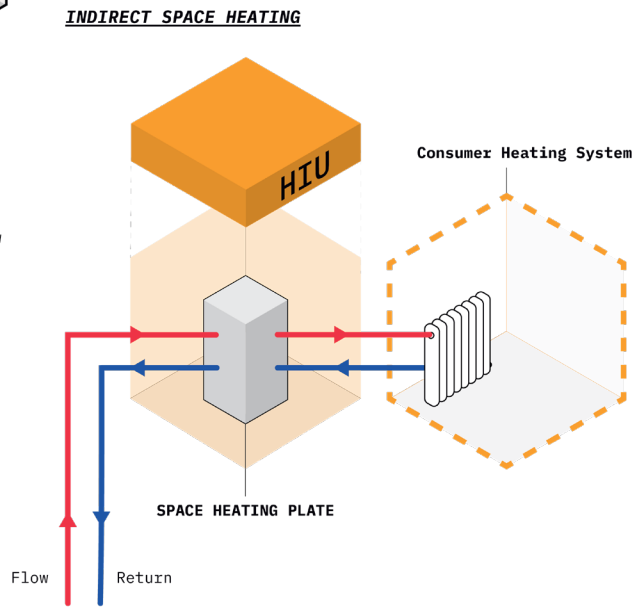
# Key principles

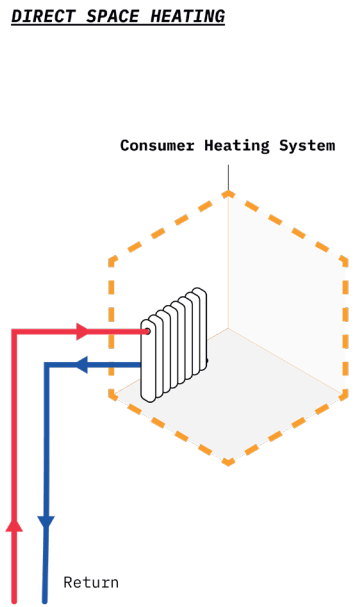
- Commonly used terminology
- Different heat network typologies
- Heat network optimisation principles
- Process for implementing heat network improvements



# Different heat network typologies and equipment

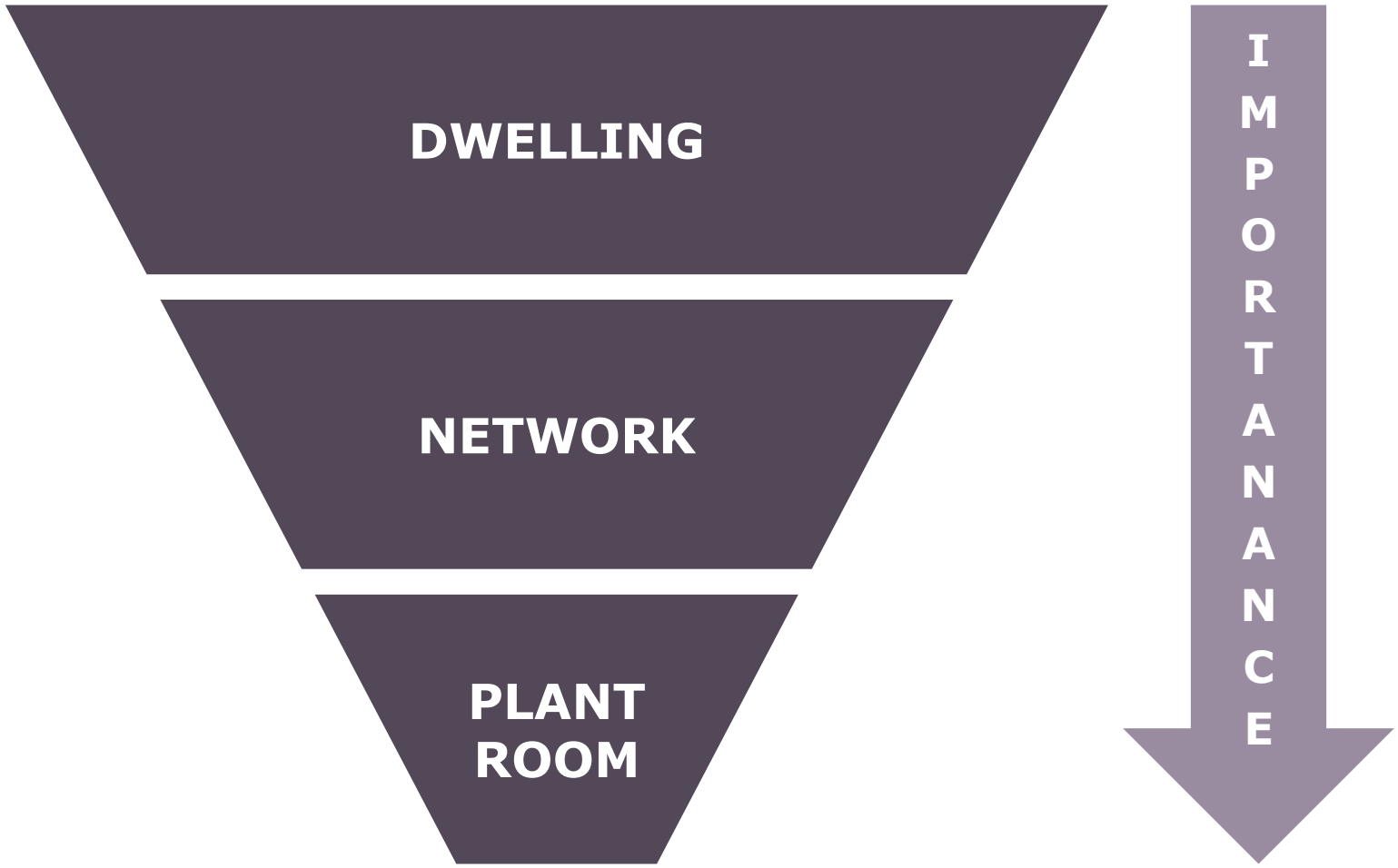


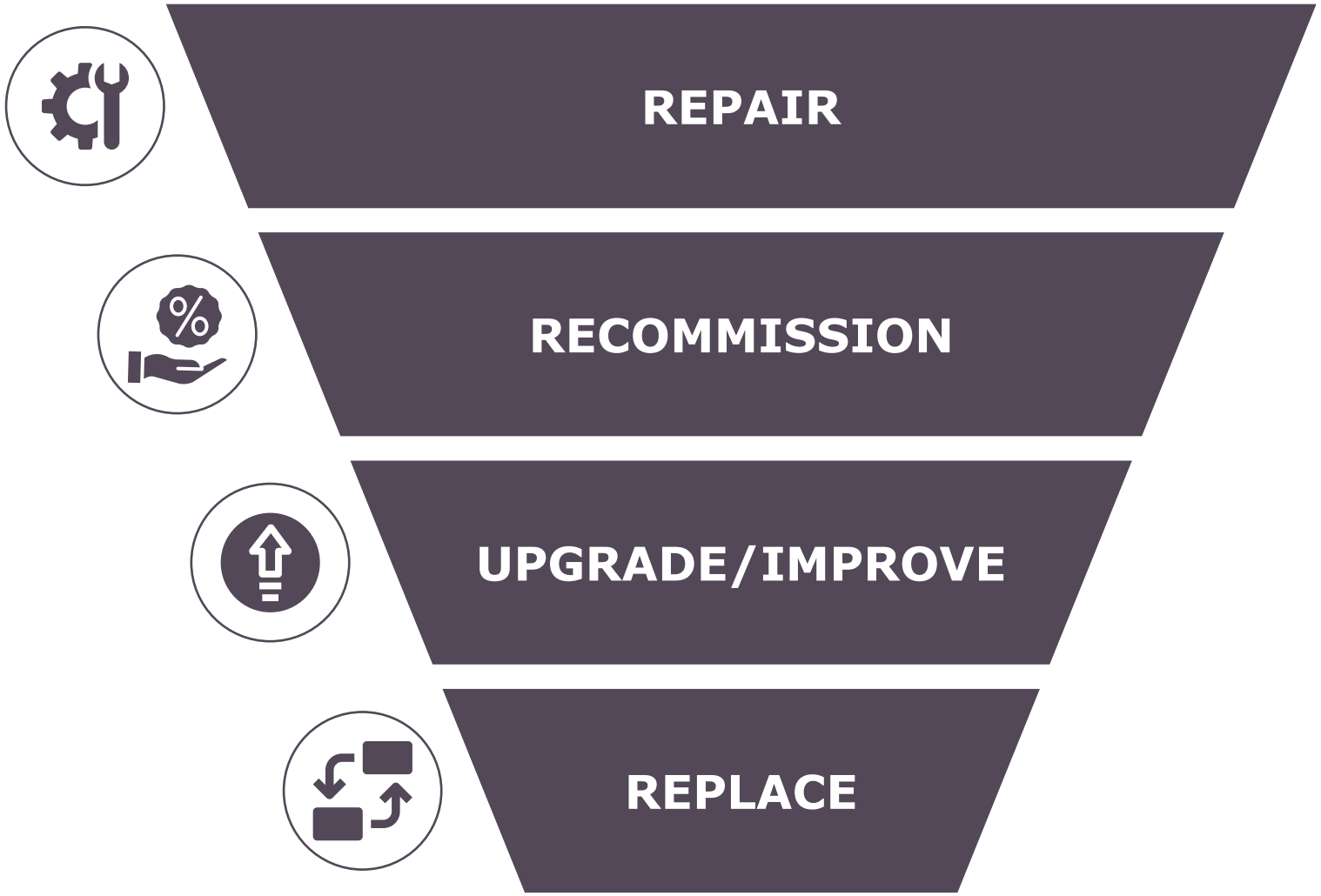



# Improvement process

# Optimisation Hierarchy



# Approach to improvement

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# Core stage details

| Pre-project | | Phase 1: Initial investigation | | | | Phase 2: Techno-economic options appraisal | | | Phase 3: Implementation plan | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0. Define project | 1. Information & data collection | 2. Pre-audit analysis | 3. Site audit | 4. Technical review | 5. Detailed technical analysis | 6. Determine potential interventions | 7. Cost benefit analysis | 8. Costing of interventions | 9. Final business case |
| Stage outcome | Understand Client aims & agree project scope | All relevant information on heat network identified | Initial understanding of system issues and potential causes | Sufficient understanding of system to complete optimisation assessment | Gain qualitative understanding of system issues | Quantitative assessment of performance against KPIs completed | Optimisation opportunities developed and modelled | Initial business case for optimisation opportunities completed | Detailed costing of interventions to inform final business case | Final business case for optimisation opportunities completed |
| Core tasks | Initial engagement<br>Understand heat network typology and issues | Issue & return RFI<br>Collect M&B and O&M data | Analyse all information returned from RFI<br>Interview Client to understand issues from Client perspective<br>Data gap analysis | Organise site visit and dwelling access<br>Undertake site audit<br>Measurements of key parameters (e.g. temperatures)<br>Meeting and discussing performance with end users | Review of information site audit and pre-audit analysis<br>Develop hypotheses regarding probably causes of performance issues<br>Presentation of findings<br>Discuss queries with manufacturers | Undertake root cause analysis<br>Heat loss modelling<br>Pump energy modelling<br>Analysis of reliability and financial KPIs | Selection and design assessment of interventions<br>Heat loss modelling<br>Pump energy modelling<br>Analysis of reliability and financial KPIs | Financial modelling of work packages<br>Produce business case | Develop high level scope of works<br>Engage with contractor and equipment suppliers to cost for works<br>Undertake pilot of works if appropriate to assist with costing & confirming impact of interventions | Financial modelling of work packages<br>Produce delivery plan<br>Update business case |
| Information exchanges | High level summary of issues<br>Scope and quote | Heat network documentation<br>Heat meter data<br>BMS data<br>O&M logs | Queries raised during analysis | Requirements to ensure successful site audit<br>RAMS | Findings of site audit | | Client feedback on intervention options | Client inputs into financial model | Information for costing<br>Data collected during and following pilot (if conducted) | Client inputs into financial model |
| Key outputs | Defined project scope<br>Engagement to undertake optimisation study | RFI register & gap analysis | Draft system issue list<br>Data gap analysis results | Completed site audit checklists | Initial investigation report<br>Presentation of findings<br>Decision on next steps | Heat loss model<br>KPI analysis | Work package selection<br>Heat loss model<br>KPI analysis | Techno-economic options appraisal report<br>Presentation of findings<br>Decision on next steps | High level scope of works<br>Detailed interventions cost planPost-pilot report | Implementation plan<br>Presentation of findings<br>Decision on next steps |

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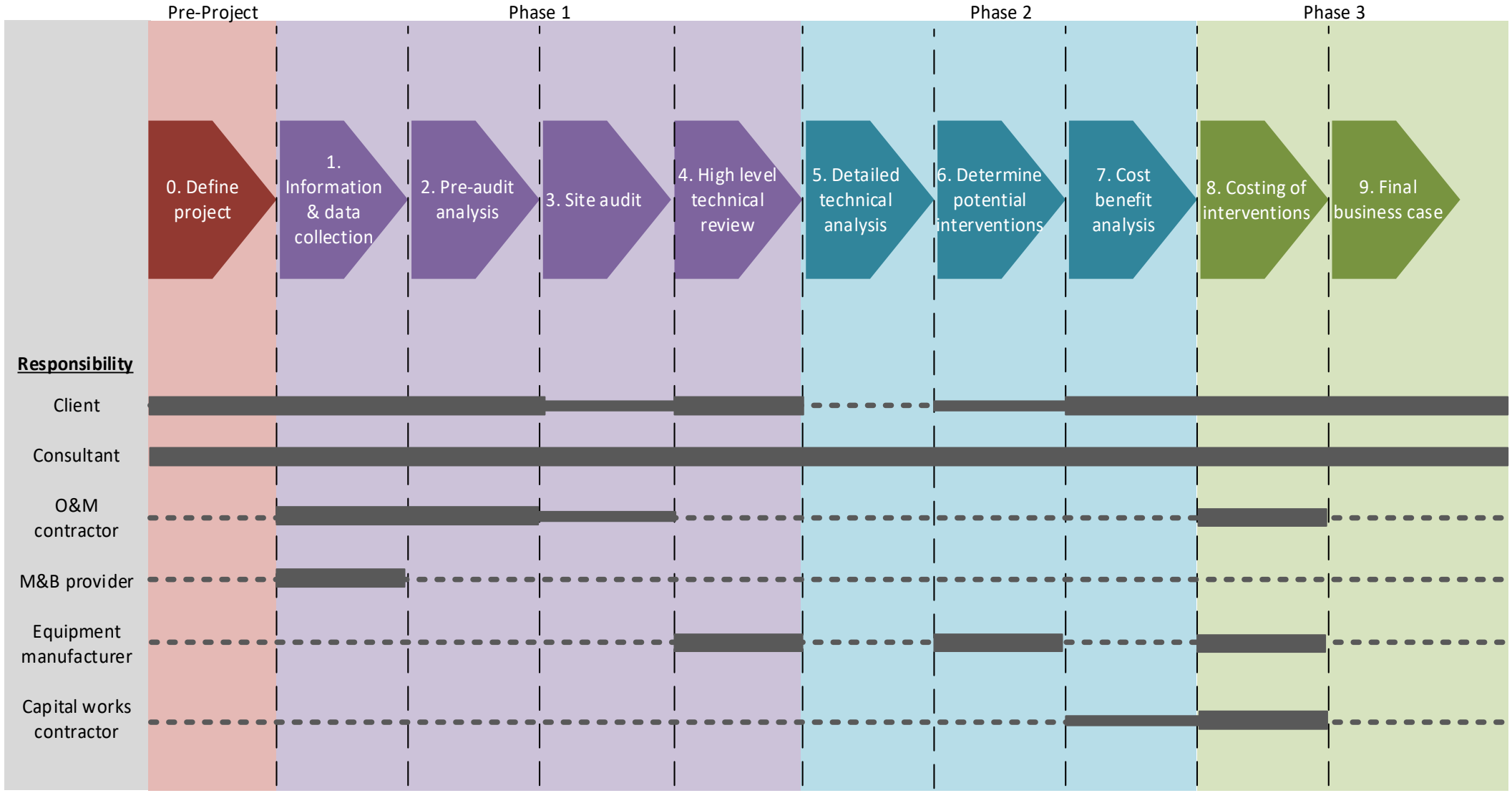
# Standardised process

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# Required knowledge and expertise

- Required to ensure quality of study
- Will support heat network operators to ensure qualified engineers with minimum experience are specified
- Reflects complexity of heat network optimisation issues
- Minimum standards to be introduced for through the Heat Network Technical Assurance Scheme (HNTAS)

| Project Role | Project Activities | Minimum Experience | Minimum Qualifications |
|---|---|---|---|
| Study Engineer | Leads on site audit and responsible for managing the technical and financial analysis of the optimisation study | 2+ years operational experience in heat network sector | Either<br>Level 6 qualification (England, Wales and Northern Ireland) in engineering related discipline<br>or<br>Level 10 (Scottish Credit and Qualifications Framework) in engineering related discipline<br>or<br>Professionally registered as an Engineering Technician (EngTech) with the Engineering Council |
| Study Lead | Accountable for the technical quality of report, conclusions and recommendations | 5+ years operational experience in heat network sector | Either<br>Level 7 qualification (England, Wales and Northern Ireland) in engineering related discipline<br>or<br>Level 11 (Scottish Credit and Qualifications Framework) in engineering related discipline<br>or<br>Professionally registered as a Chartered Engineer (CEng) with the Engineering Council |

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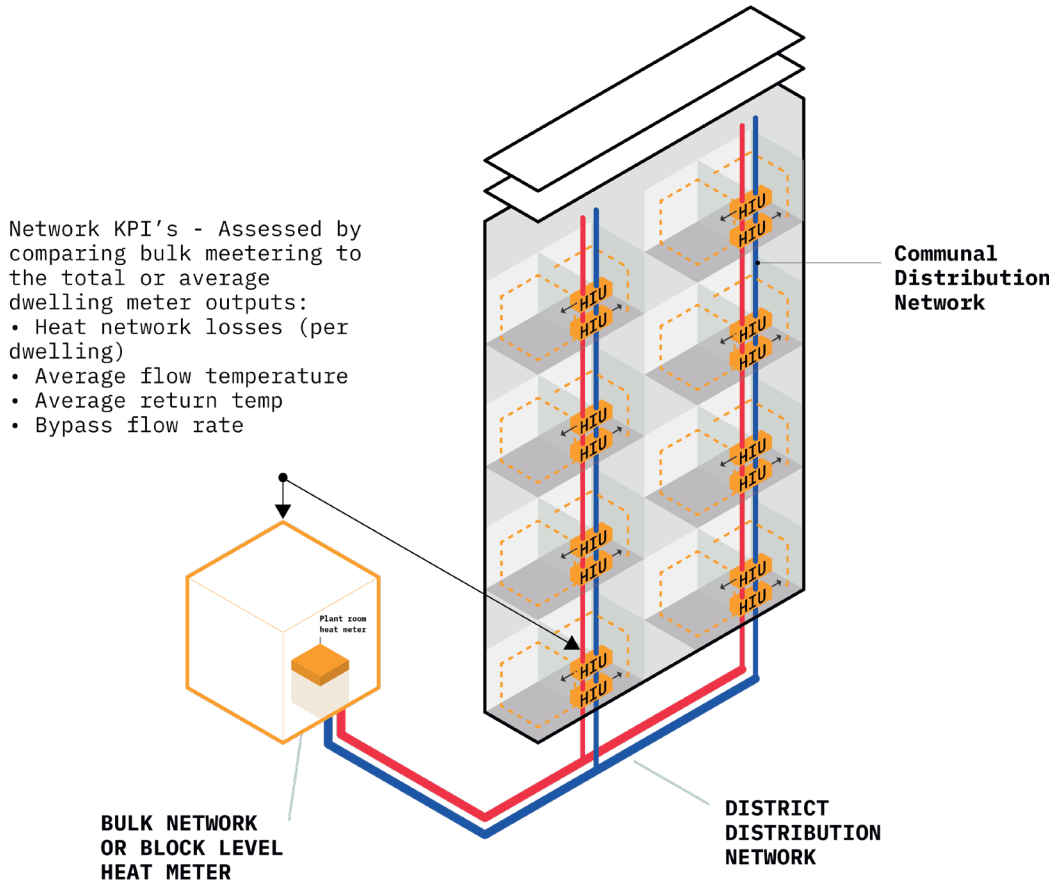
# Determining performance

- Key performance indicators (KPIs)
  - Energy centre
  - Network
  - Dwelling
  - Others
- Calculation methodology



# Site audits

- Health and Safety
- Information required
- Equipment required
- Key site activities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# Technical analysis

- Analysing heat meter data
- Heat loss modelling
- Pump energy
- Presenting data

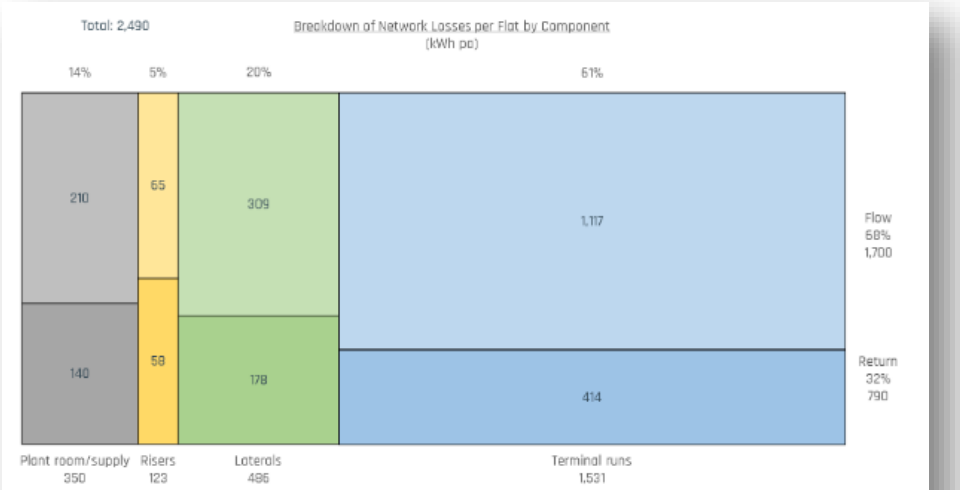



*Figure 21: Example Mekko chart presenting outputs of a pre-project heat loss model*

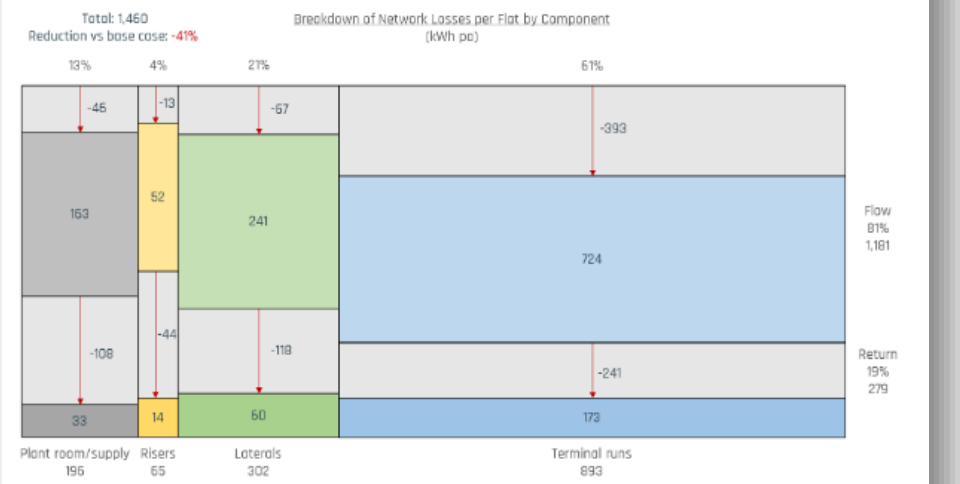
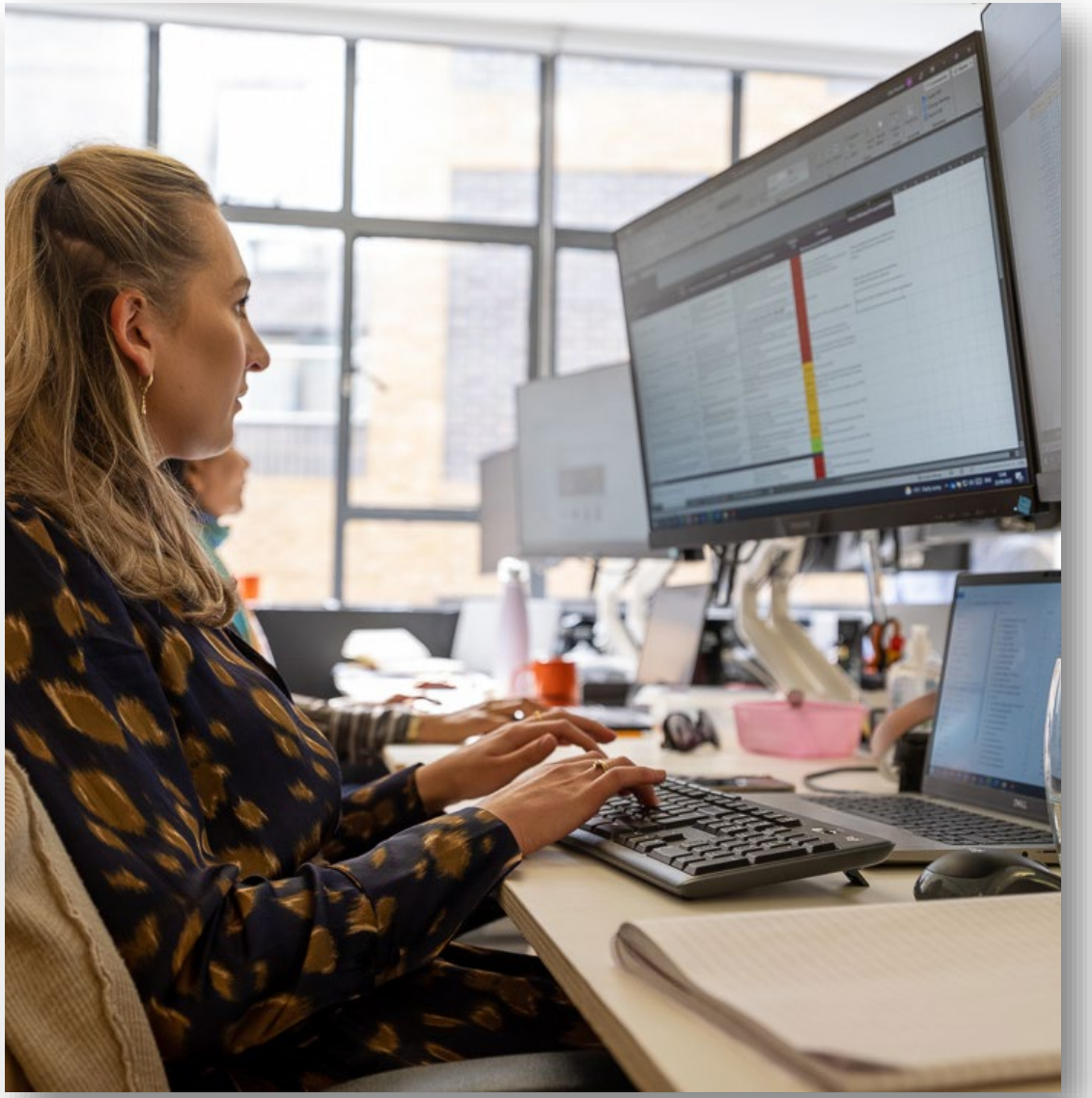



*Figure 22: Example Mekko chart showing possible reduction in heat losses as a result of optimisation works*

# Determining and modelling interventions

- Root cause analysis
- Dependency of interventions
- Modelling impact on system



# Business case

- Analysis techniques
- Typical inputs and interpreting outputs
- Key risk items
- Delivery plan

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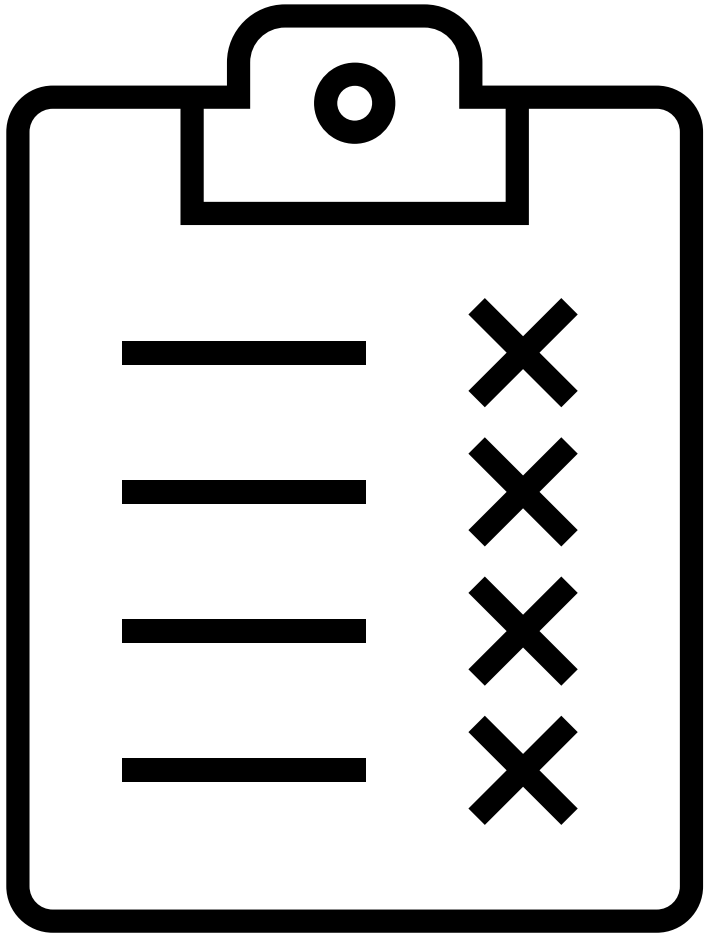
# Typical failure states

- 16 common reasons for failure
- Produced from analysis of past projects
- For each key failure type:
  - Frequency
  - Impact
  - Cost
  - Ability to optimise on an operating system



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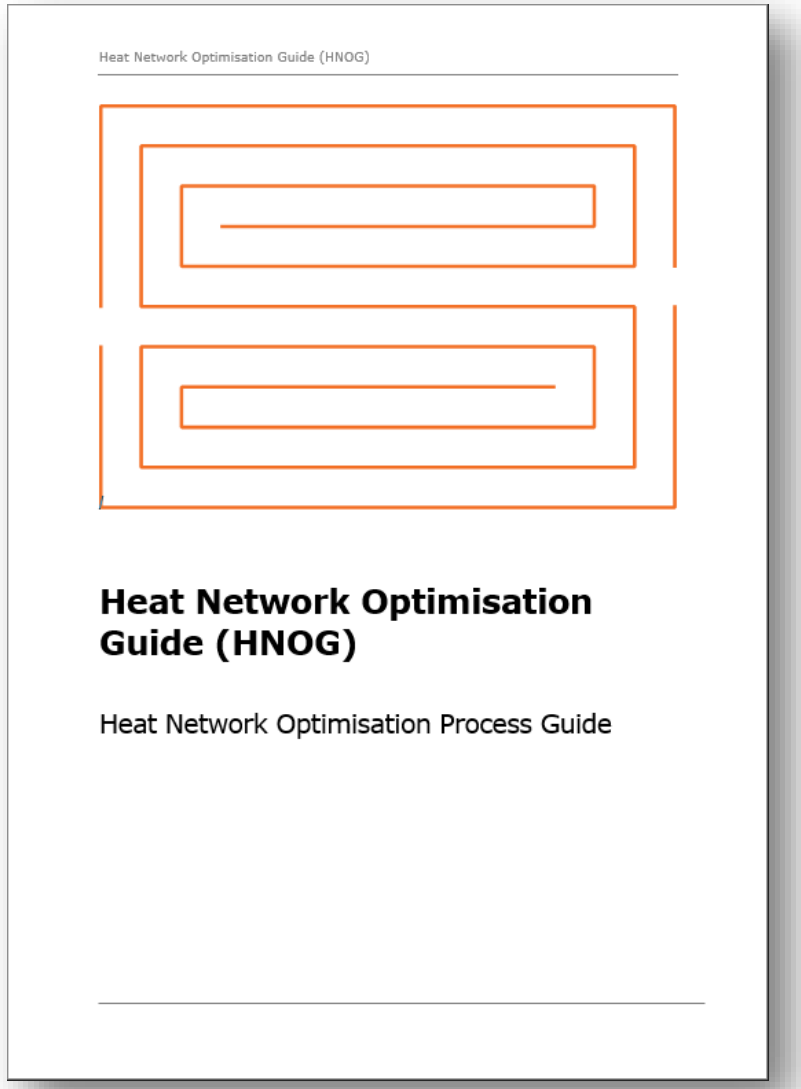
# HNOG Template Scope of Works

- Separate document
- Aimed at heat network operators that would want to engage specialists to undertake Optimisation Studies
- Contains:
  - Example scope for each Study Phase
  - Standardised methodology and analysis
  - Clear outputs and deliverables at each stage
  - Minimum knowledge and experience to conduct study

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# HNOG Videos

- Series of 8 videos aimed at Heat Network Operators
- Accessible! Non-technical approach to technical content
- Help to inform operators about heat network basics and methodology for approaching poor performance
- Provides guidance on key issues that affect heat network performance
- Helps operators understand what to ask specialists and contractors

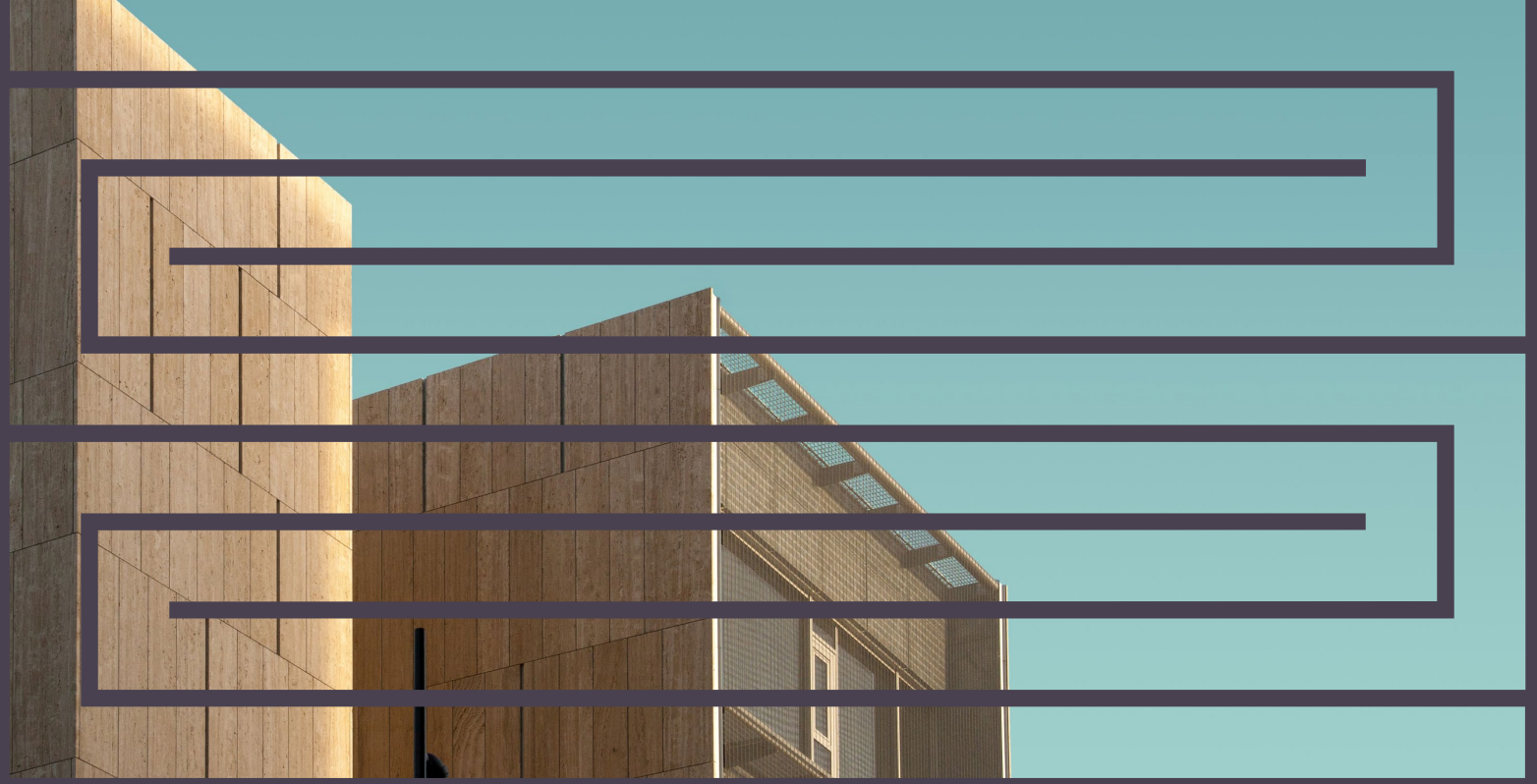
# Video subjects

- Video 0: Introduction
- Video 1: Bypasses and controlling network flows
- Video 2: Water quality
- Video 3: Return temperatures
- Video 4: Flow temperatures
- Video 5: Complexity
- Video 6: Insulation
- Video 7: Plant room efficiency









# Thank you for listening

www.fairheat.com | info@fairheat.com

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# HNES Monitoring and Reporting requirements

Louise Singleton

HNES Programme Manager

Department for Energy Security & Net Zero

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# Monitoring and Reporting requirements

- A condition of grant funding is regularly submitting Monitoring and Reporting (M&R) returns
- M&R returns are essential to track whether grant funding will be spent and also to ensure the Aims of HNES are being met
- Additional written guidance on M&R is provided to successful projects.

| Revenue M&R Returns |
| --- |
| • Required from grant award until sign off of Optimisation Study<br>• Monthly returns covering:<br>  • Project progress updates<br>  • Risks and issues<br>  • Budget drawdown<br>• Final return to include:<br>  • Optimisation Study Outputs Annex |

| Capital M&R Returns |
| --- |
| • Required from grant award until 24 months after commissioning date<br>• Monthly returns covering:<br>  • Project progress updates<br>  • Risks and issues<br>  • Budget drawdown<br>• Quarterly returns covering:<br>  • Progress against benefits and KPIs for each of the previous 3 months |

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# Q&A

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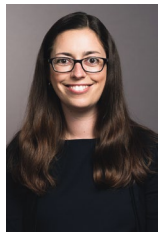
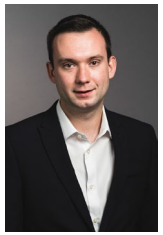
# Where to find help and support

If you have a general enquiry about HNES, want to be added to our mailing list, or would like an application form, please email hnes@gemserv.com

To discuss your project in more detail with one of our Relationship Managers, please email hnes.support@gemserv.com


Louise Singleton


Samantha Shea


Sam Hales


Rosie Knight


Neil Smillie


Billy Cliffen


Chris Forster


Elin Pain

DESNZ has published eight heat network optimisation guidance videos, which can be accessed on the gov.uk website

Further detail on the scheme can be found in our HNES Guidance for Applicants document

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# Follow our new social media accounts

Heat Network Efficiency Scheme (HNES)

@HNEScheme

## Join our mailing list

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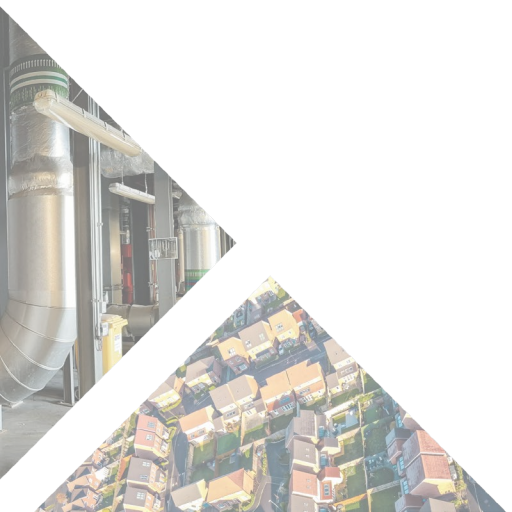

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