Session 3: Technical Innovation & Research

23 April 2024

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Chair

Lucy Sherburn
Senior Engineer

- Senior Engineer at FairHeat
- HNTAS project team member
- Experience in new build quality assurance – energy strategy, design, installation, and commissioning

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Agenda

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1. **Nina Dungworth:** Determining the value of reduction in oversizing of heat networks
2. **Laura Rashed:** Determining optimal insulation thicknesses for communal distribution pipework
3. **Jake Adamson** and **Sebastian Janssens:** Overview of Acceptance Testing for the Heat Network Technical Assurance Scheme
4. **Francessca James and Faizah Ahmed:** Minimum performance thresholds for Legacy Networks, including water quality
5. T**homas Lupton and Faye Bautista:** Standardised procedures – Heat Network Performance Improvement Plan and Standardised HIU Servicing Procedure

Determining the value of reduction in oversizing of heat networks

Nina Dungworth

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Speaker

Nina Dungworth
Consulting Engineer

- Consulting Engineer at FairHeat
- 2 years experience in the optimisation of existing heat networks and design and delivery of new build developments
- Worked on the stage 3 retrofit design for a 1950s heat network.
- Currently working with several developers to review the design, commissioning, installation and operation of their heat networks

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Introduction

- **Heat Networks Technical Assurance Scheme (HNTAS):** Scheme aims to ensure minimum standards of heat network performance are achieved.
- **Core principle:** Proportionate, with the effectiveness of the assurance process balanced against the cost of compliance.
- **Oversizing:** Heat networks in the UK have historically been subject to significant network pipework and peak load oversizing.
- **Savings**: The significance of CAPEX savings from correctly sizing pipework/equipment is not often understood.

Project aims

Determine the lower boundary of the savings which developers can expect to benefit from through HNTAS

Focus on two key areas of typical heat network oversizing:

1. Network pipework
2. Heat generation equipment

Contribute towards ensuring the TQA scheme is cost effective

Data analysed

EXISTING NETWORKS THAT HAVE BEEN THROUGH OPTIMISATION STUDIES

NEW BUILD SCHEMES THAT HAVE BEEN THROUGH A DESIGN REVIEW

- Low temperature hot water (LTHW)
- Two pipe heat networks
- Instantaneous dwelling hot water production
- No commercial connections
- Pipework material is medium grade steel (MGS)

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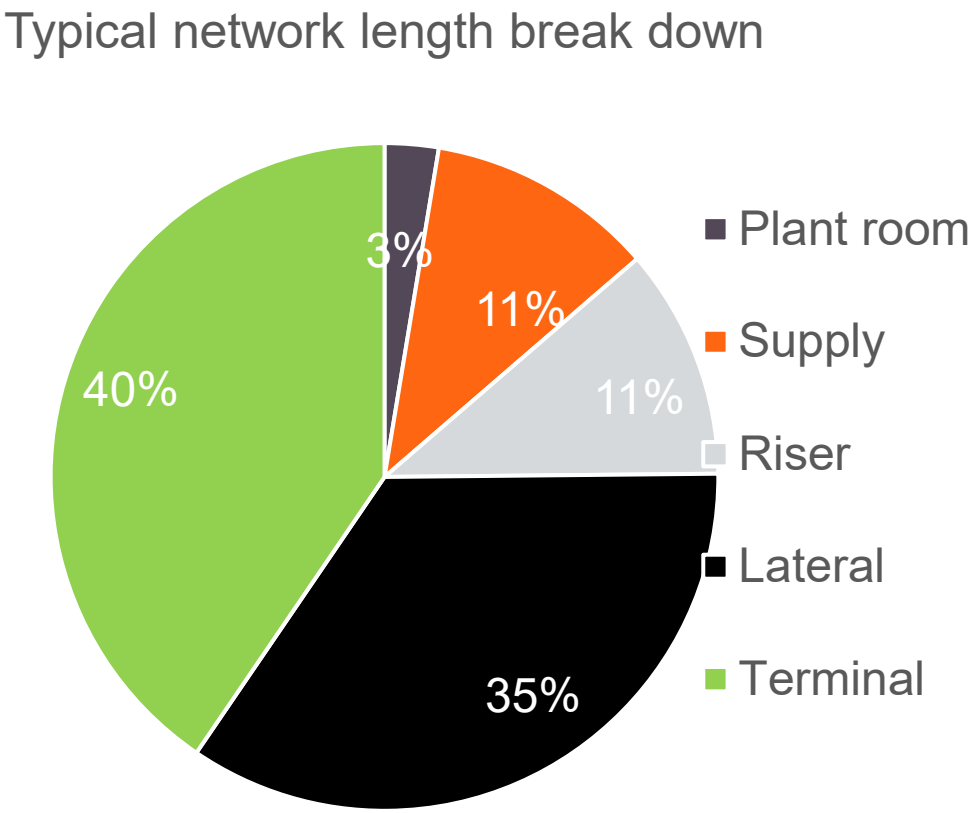
Network pipework oversizing

- Compared installed/design pipe sizing vs sizing following CP1 2020 methodology
- Average network length **23 m/dwelling**
- Results show that schemes have been typically oversized by **1 – 2 pipe sizes** across all areas of the network



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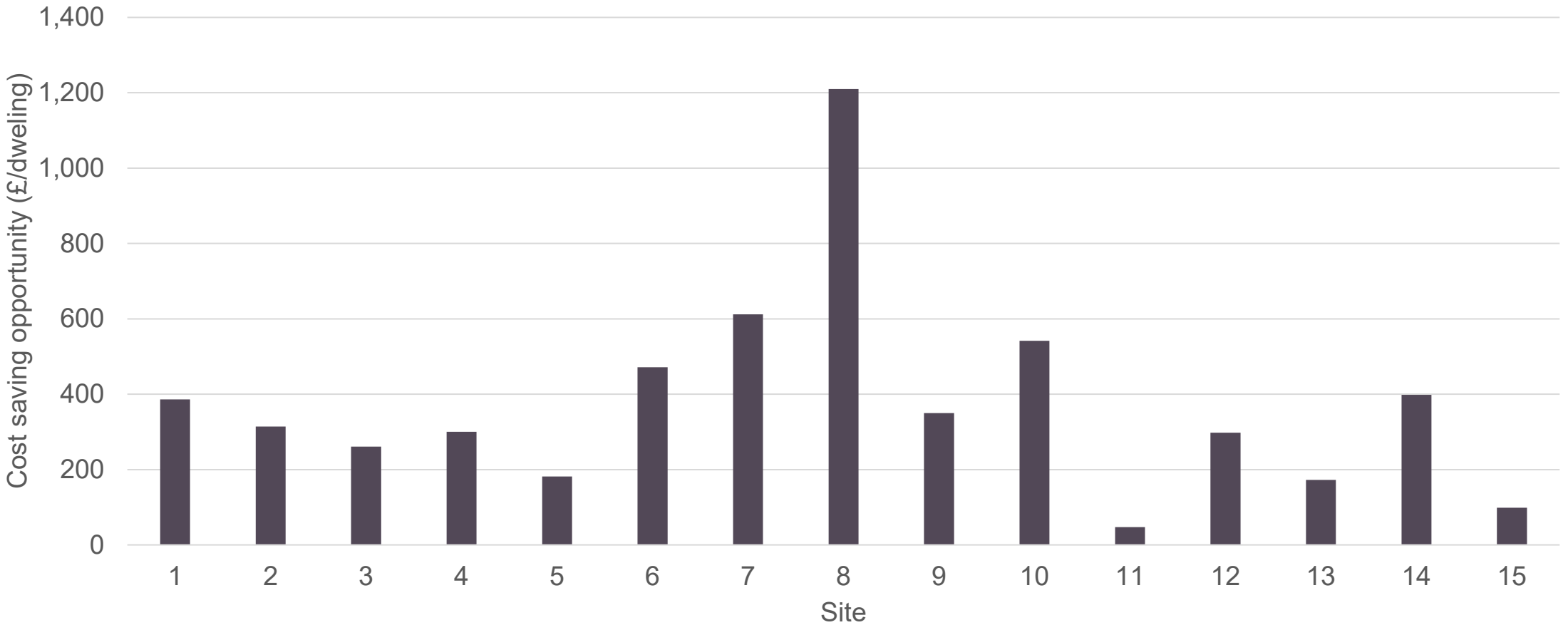
CAPEX saving opportunity: correctly sized network pipework



£ 380 /dwelling

Heat generation equipment oversizing

- Difference between the installed/design peak load and the peak load calculated following CP1 2020 methodology
- Redundancy has been discounted
- The opportunity to save on heat generation equipment CAPEX has been determined for 3no. energy strategies:

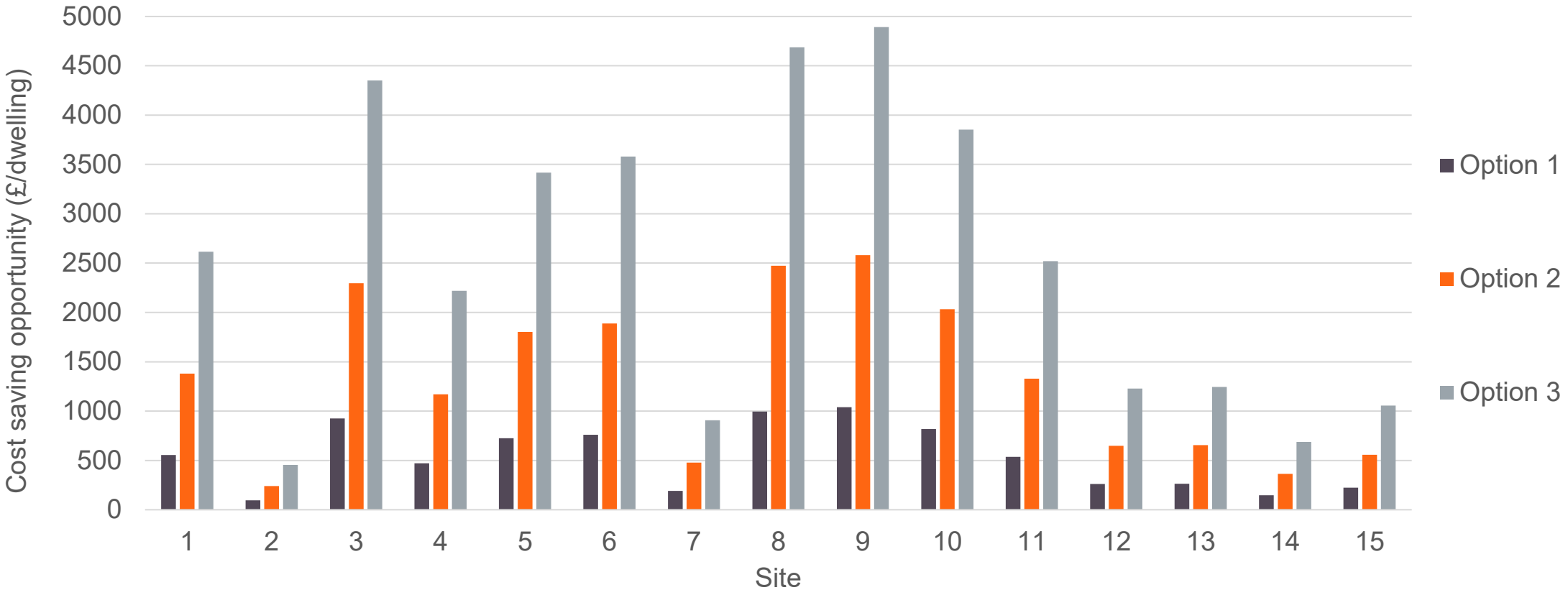
Option 1 – 100% gas boiler

Option 2 - 95% heat fraction ASHP & gas boiler top up scheme

Option 3 – 100% ASHP

CAPEX saving opportunity: correctly sized heat generation equipment

- Option 1 – 100% gas boiler **£ 530 /dwelling**
- Option 2 - 95% heat fraction ASHP & gas boiler **£ 1,300 /dwelling**
- Option 3 – 100% ASHP **£ 2,500 /dwelling**



Equipment servicing cost saving opportunity

- Heat network operator benefit
- Manufacturer servicing quote for gas boiler used as cost benchmark
- Discount rate **3.5%**
- Proactive maintenance only
- **NPV: £120 /dwelling** over a 25 year life span

Intangible benefits

- ✓ Reduced pipework coordination challenges
- ✓ Reduced energy centre footprint
- ✓ Reduced equipment weight
- ✓ Reduced utility connection size

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Conclusions and further work

- Expected savings are in the range of **c. £1,000 - £2,900 /dwelling**, for developers, depending on the scheme energy strategy.
- In reality the savings will be greater therefore this value can be taken as the minimum threshold of benefit to developers.
- Investigate and quantify the expected impact of a TQA process on aspects such as CAPEX and OPEX due to reduced plant room complexity.

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Determining optimal insulation thicknesses for communal distribution pipework

Laura Rashed

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Speaker

Laura Rashed
Graduate Engineer

- Graduate Engineer at FairHeat
- 2 years experience in the optimisation of existing heat networks and district heating design
- Worked on existing buildings to survey and propose works to optimise heating systems to enable the connection to new district heat networks

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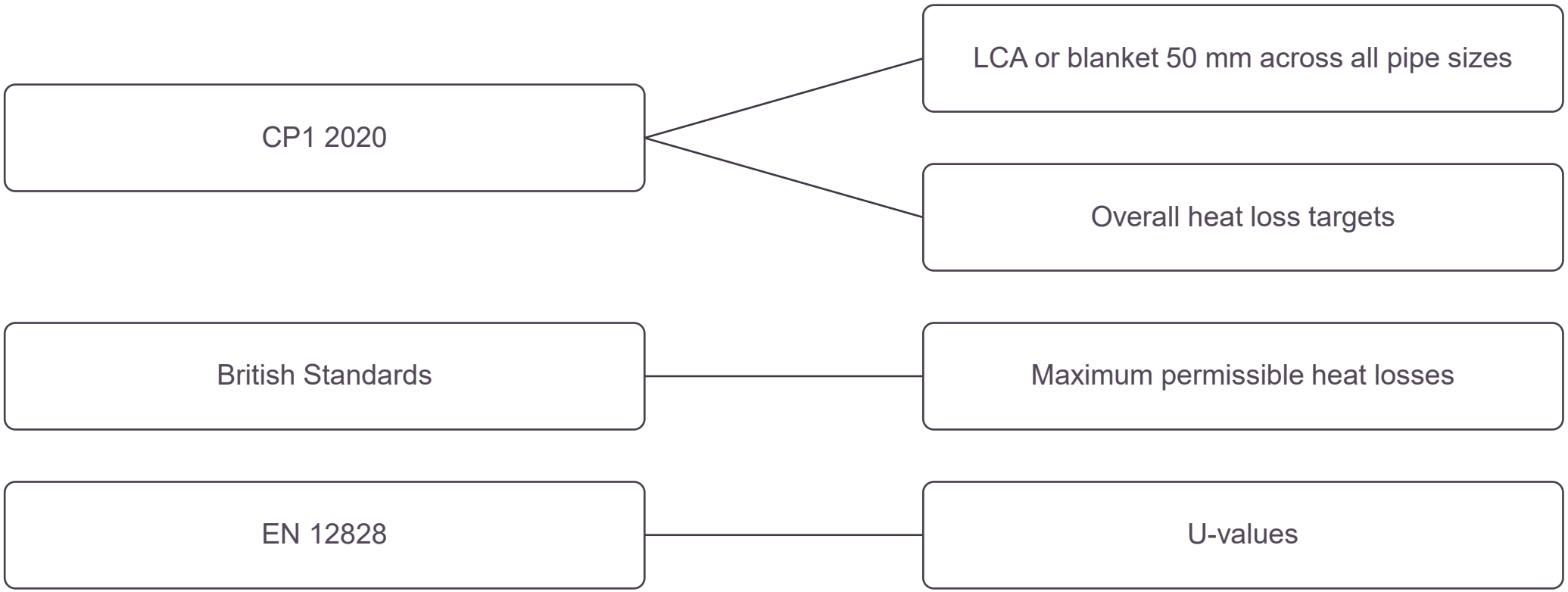
Current industry insulation standards



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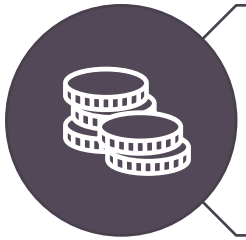
Objectives

Assess whether current insulation standards align with CP1 heat loss targets

Determine what insulation standards are required to meet CP1 best practice (550 kWh/dwelling/annum)



Undertake a life cycle cost assessment to determine optimum insulation standards

Propose recommendations on insulation thicknesses for the Heat Network Technical Assurance Scheme (HNTAS) and CP1

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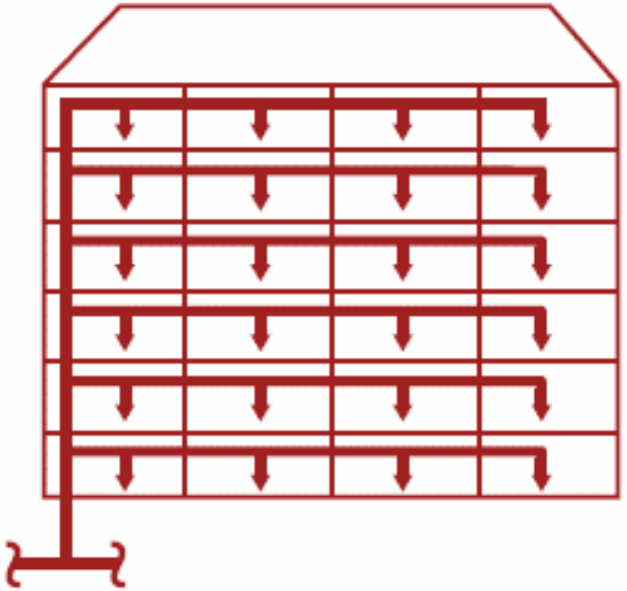
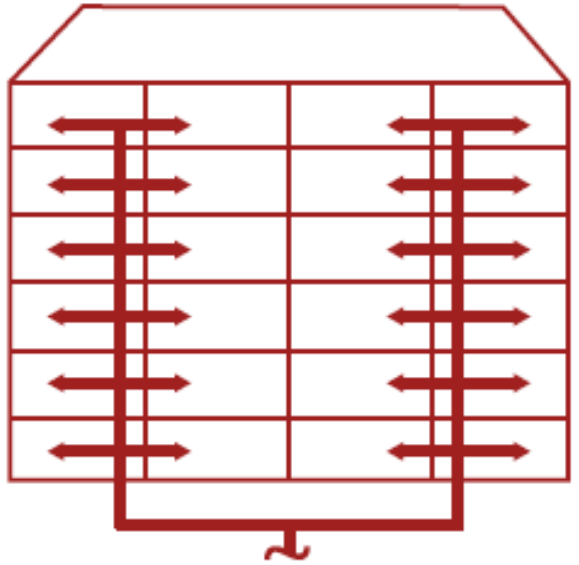
BESA reference building

Conventional arrangement



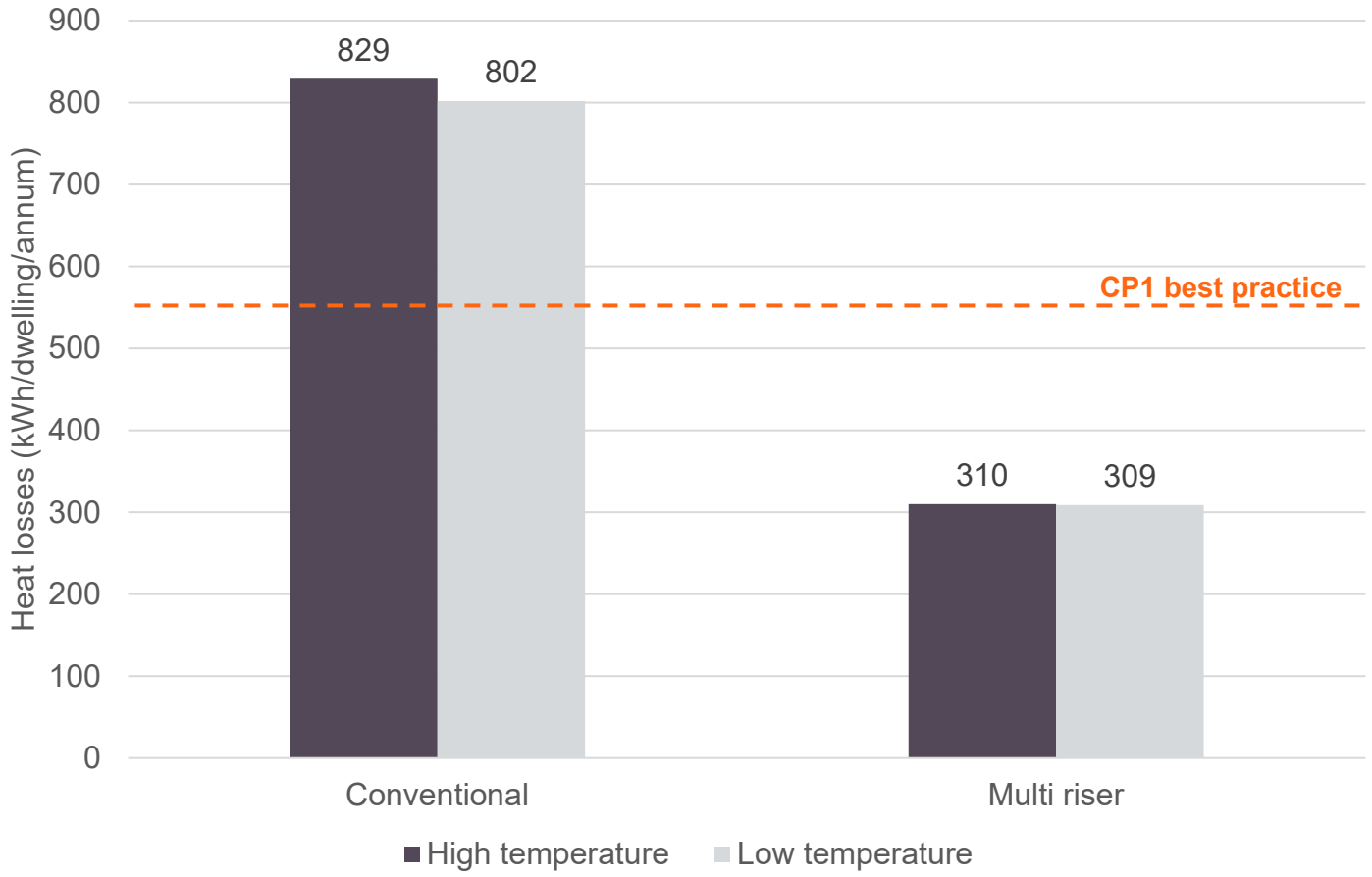
Multiple riser arrangement



Temperature profile
High temperature (70/30 °C)
Low temperature (55/33 °C)

Does BS 5422 align with CP1 heat loss targets?

Reference building heat losses with British Standards insulation standards applied

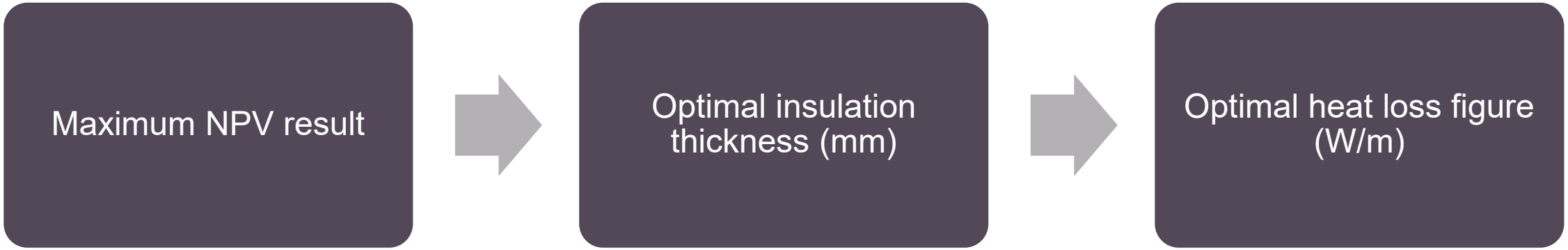


Lifecycle cost assessment: Methodology

- **Net Present Value (NPV) over 20 years** calculated for a meter of pipe across different pipe sizes and insulation thicknesses
- **Costs considered:**
  - Insulation supply
  - Heat losses (modelled using FairHeat's HLM)
- **Heat Loss Cost Calculation:**
  - Assumed **95% ASHP** with **SCOP of 2.7**
  - **5% Electric boiler** backup
- **NPV based on insulation lifespan** (as per CIBSE Guide M)
- **20% uplift** applied to total heat losses to account for:
  - Losses from ancillary equipment
  - Potential workmanship inefficiencies

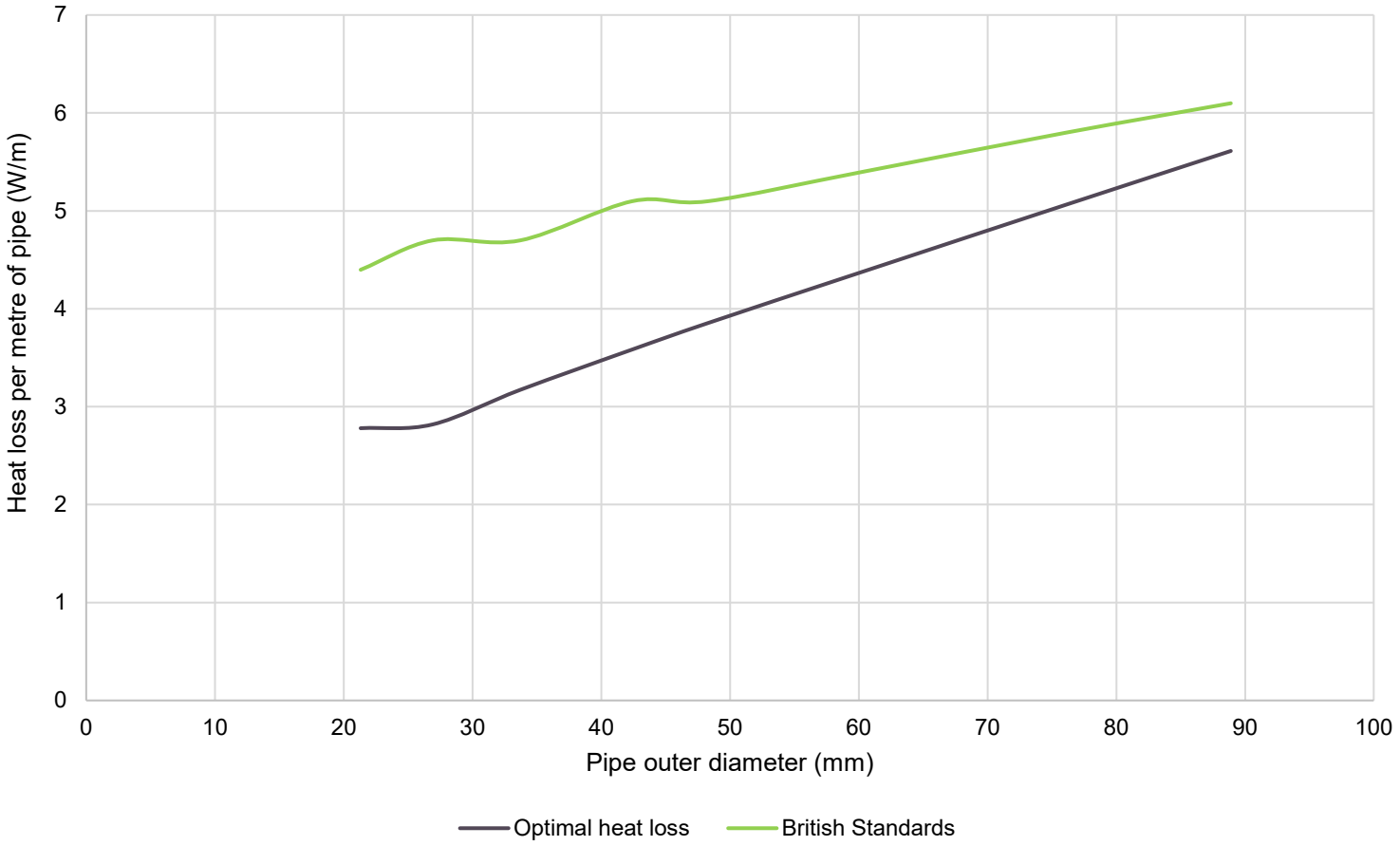
***Discount rate: 3.5%**
Costs provided by The Green Book

Lifecycle cost assessment: Methodology



Lifecycle cost assessment: Results

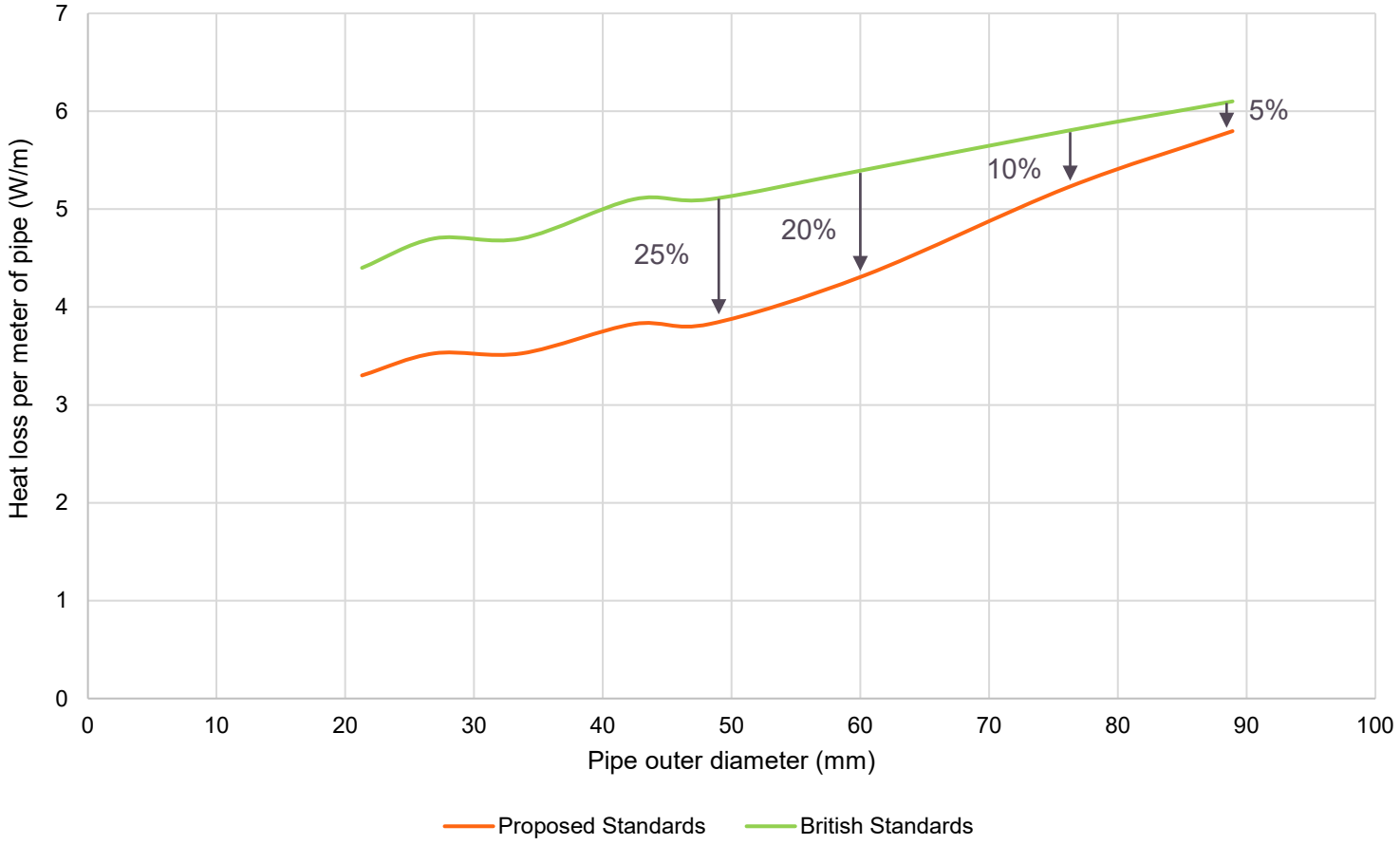
Maximum permissible heat losses (W/m) for optimal heat loss results and British Standards



Cost benefit to reducing the maximum permissib losses by up to 40%

Proposed standards

Maximum permissible heat losses (W/m) for proposed and British Standards



Reduce allowable losses by:

- 25% for pipe sizes up to 48.3 mm,
- 20% up to 60.3 mm,
- 10% up to 76.1 mm,
- 5% above 76.1 mm

Proposed standards: example

Modelled on the reference building at 55/33 °C

Pipe size	Minimum insulation thickness (mm)
DN20	20
DN25	30
DN32	30
DN40	35
DN50	35
DN65	45
DN80	55
DN100	70

Conventional layout = 788 kWh/dwelling/annum

Multi-riser = 314 kWh/dwelling/annum

Increase insulation thickness

Pipe size	*Required* insulation thickness (mm)
DN20	55
DN25	55
DN32	55
DN40	55
DN50	55
DN65	55
DN80	55
DN100	70

Conventional layout = 546 kWh/dwelling/annum

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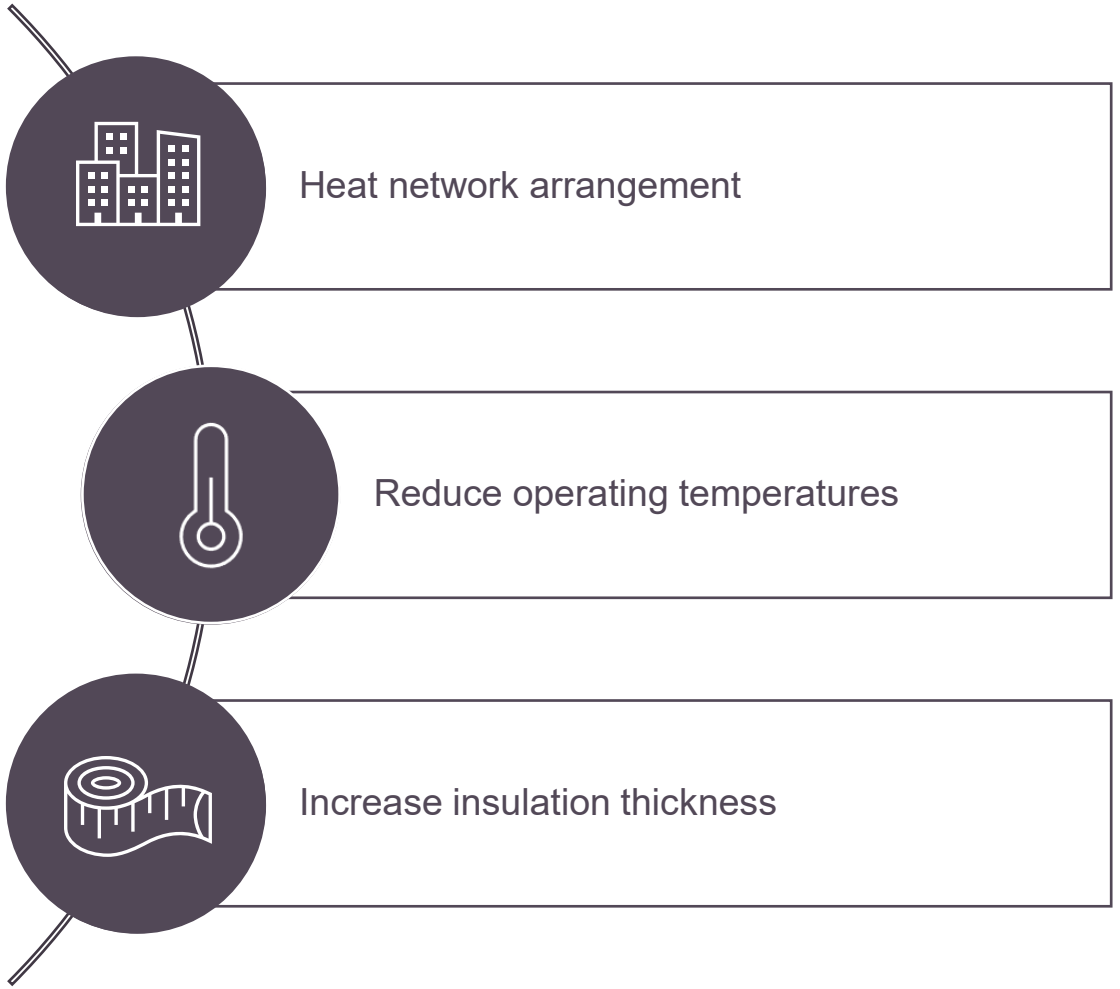
Key takeaways to minimise network heat losses



Meet 550 kWh/dwelling/annum

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Overview of Acceptance Testing: HNTAS

Jake Adamson and Sebastian Janssens

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Speaker

Jake Adamson
Consulting Engineer

- Consulting Engineer at FairHeat
- HNTAS project team member
- Over 2 years' experience in heat network quality assurance on both new build and retrofit developments

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Speaker

Sebastian Janssens
Graduate Engineer

- Graduate Engineer at FairHeat
- 2 years' experience in the design and delivery of new build and retrofit projects
- Involved in the quality assurance of energy centres
- Developed methodologies and templates for standardising quality assurance

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Heat Network failures observed at the point of handover

- Heat Networks typically fail to perform as they should
- Lack of performance testing and QA prior to handover leads to poor performance outcomes of heat networks
- Failures can impact:
  - Specific consumers – e.g., poorly performing space heating system
  - Whole developments – e.g., cycling generation equipment reducing security of heat supply

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HNTAS Core principles

Core Principle	Definition
Outcome Orientated	Focused on performance outcomes rather than process.
Preventative	Focused on preventing performance issues from arising through identification of issues, rather than taking punitive approach
Proportionate	Balance the effectiveness of assurance process against the cost of compliance
Deliverable	Based on established processes, that fit with existing contractual and delivery processes, taking into account market capacity and regulatory framework
Adaptable	Able to adjust approach as market moves down the experience curve and adapt to wider changes at a regulatory and industry level
Enforceable	Sets out clear rules and consequent required actions in the case of non compliance that are able to be enforced.

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Acceptance Testing provides confidence that Elements meet their requirements

- HNTAS is designed to minimise risk of poor performance
- Acceptance Testing provides assurance for:
  - ✓ Element performance as per design
  - ✓ Resident/Consumer comfort
  - ✓ Optimal efficiency = lower cost

- **Acceptance Testing proposed to form part of technical standards**
  - Element must demonstrate performance outcomes via an Acceptance Test to achieve certification
  - Applies to all elements

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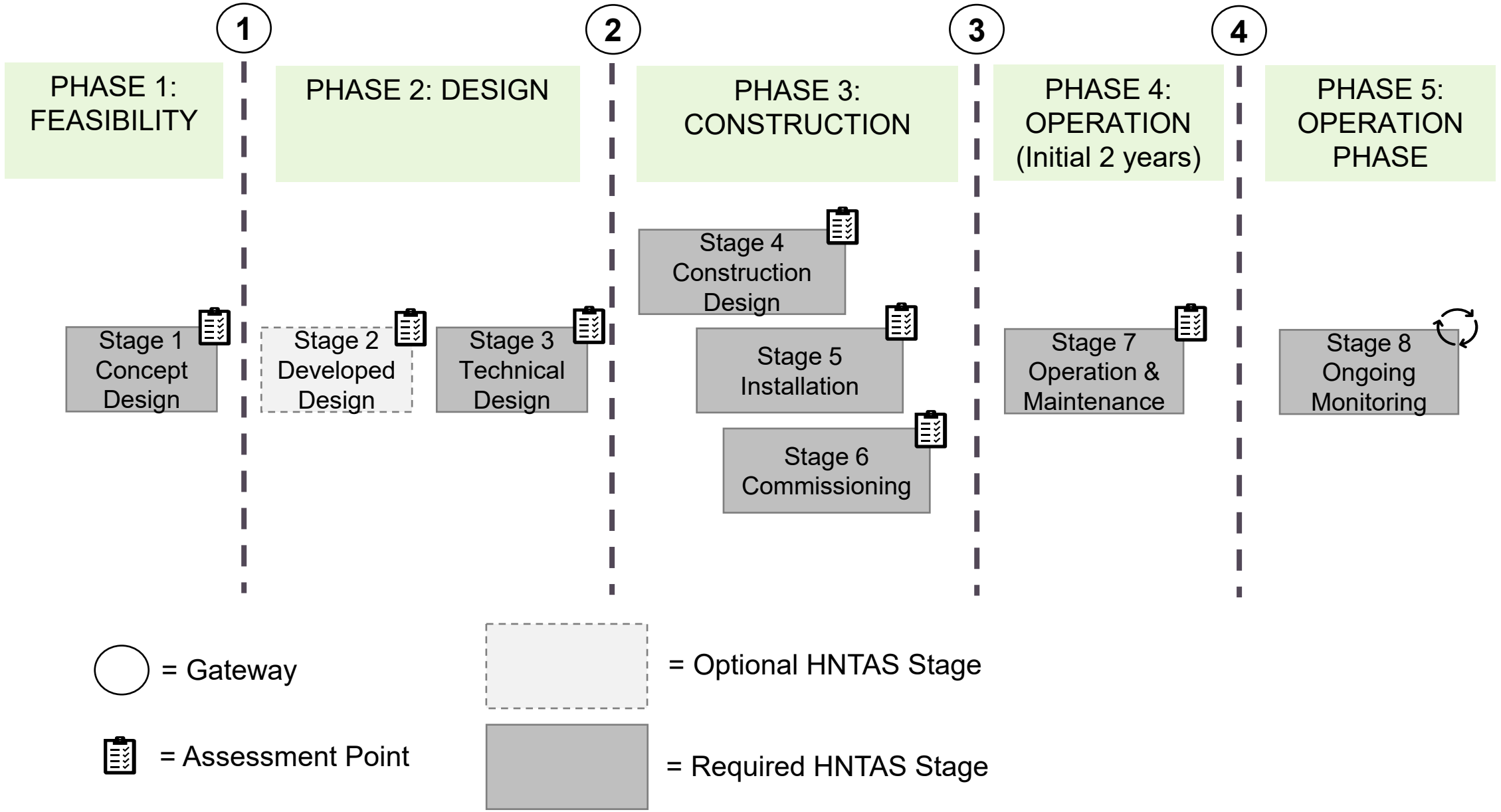
Acceptance Testing occurs prior to handover



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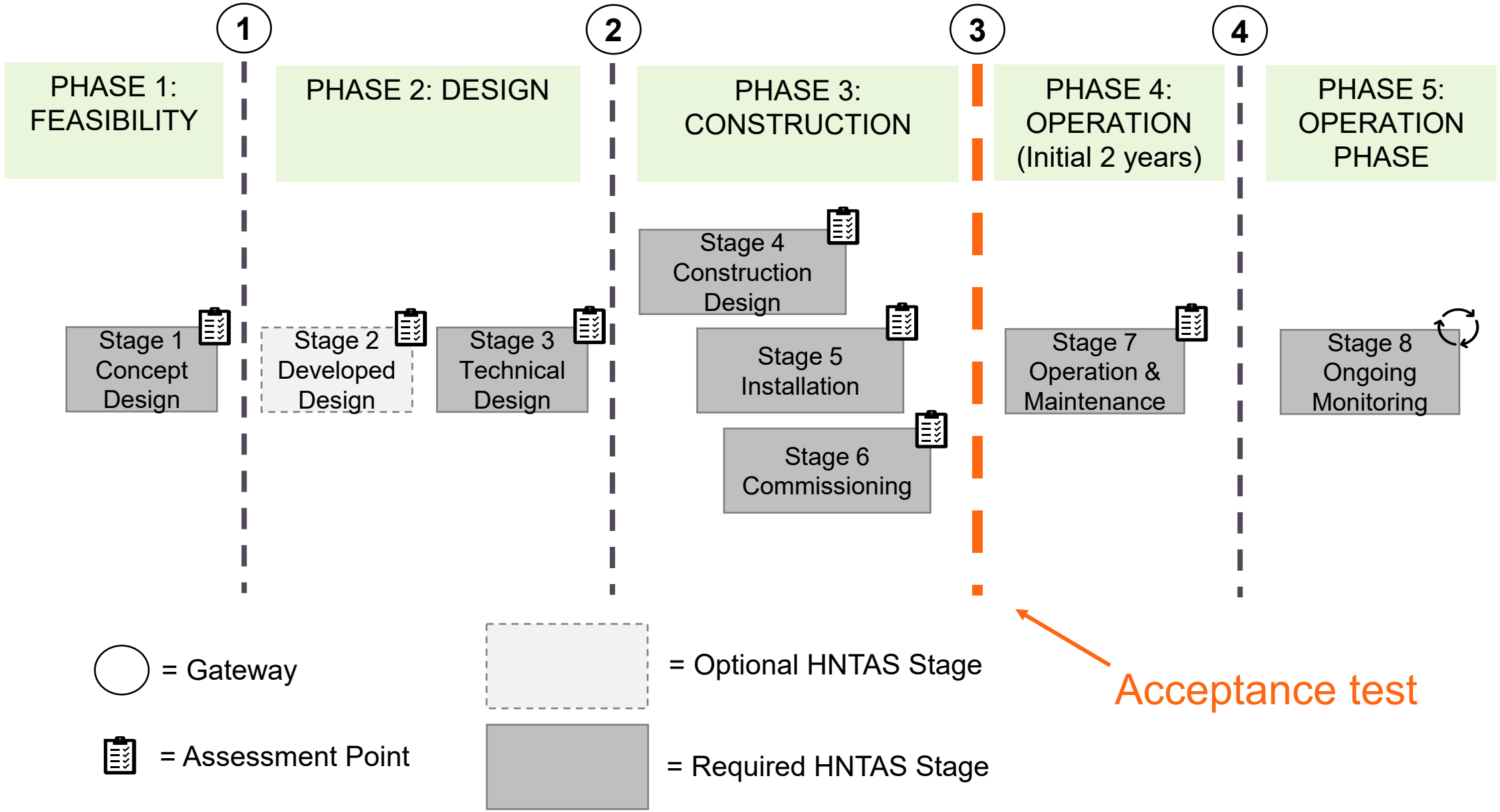

Industry consultation called for Acceptance Testing guidance

- Current lack of standardised methodology for Acceptance Testing
- Industry consultation requested a standardised methodology and guidance on Acceptance Testing

- **Project purpose:**
  - Research and develop the requirements Acceptance Testing
  - Identify the KPIs to be demonstrated at this stage

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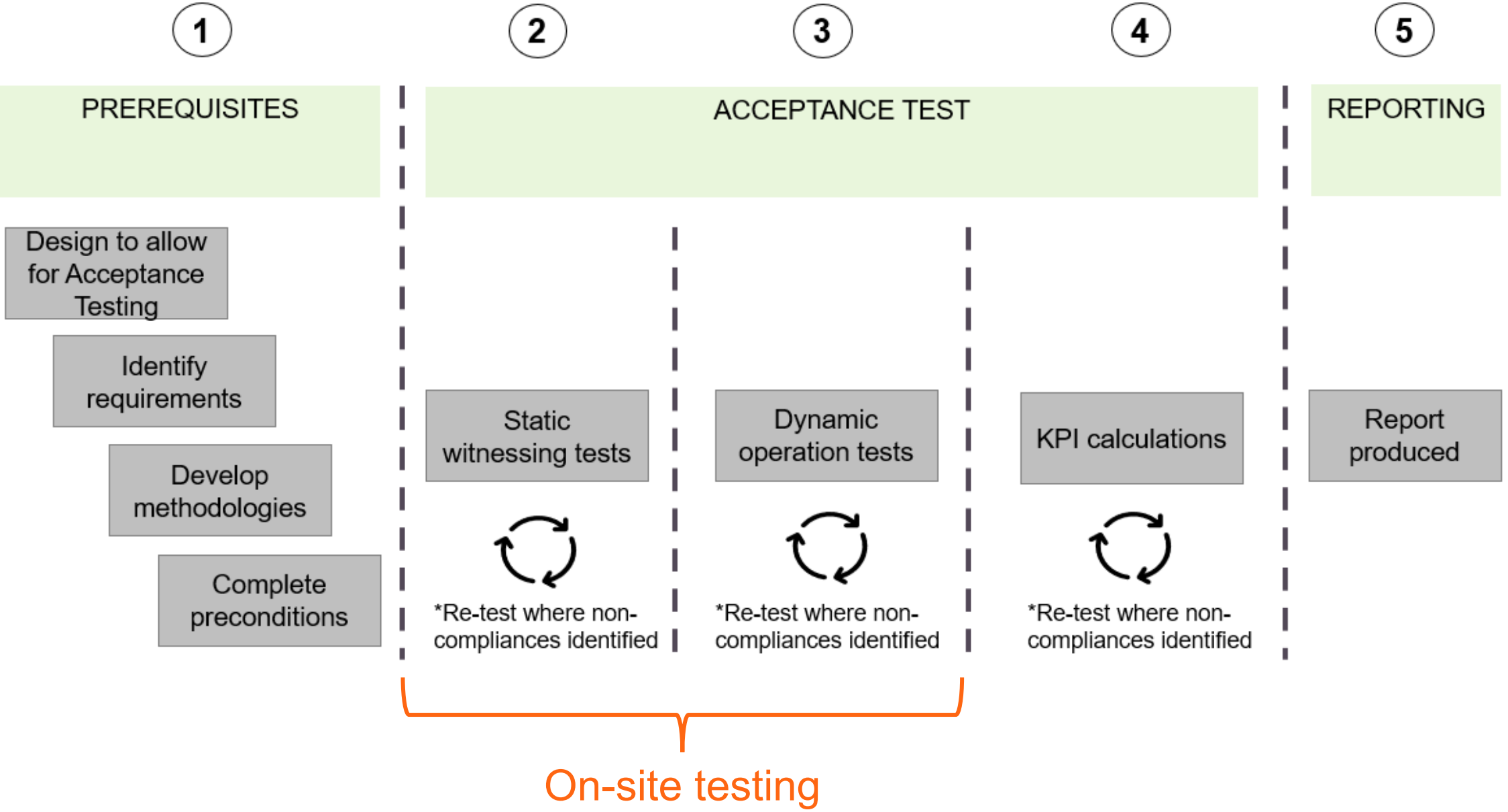
Specifications set out the requirements of Acceptance Testing

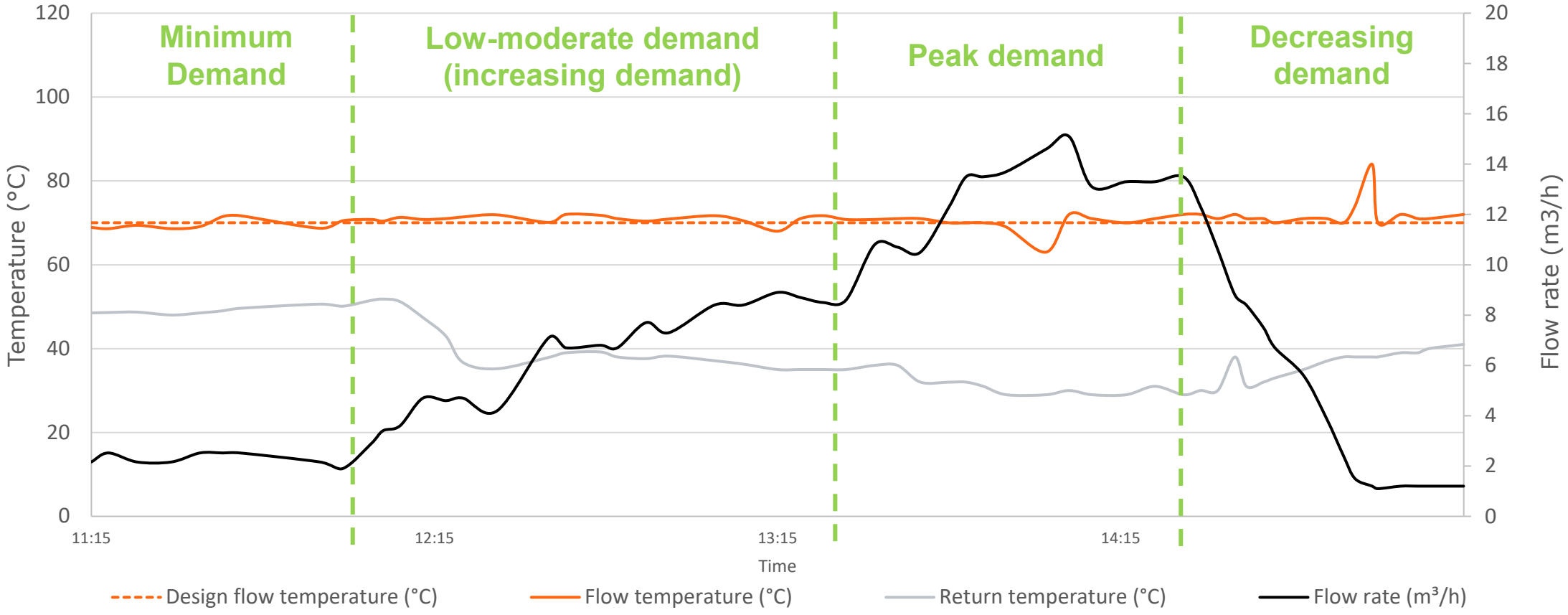
- Specification developed for each element
  - Consumer Connection and Heat System combined
- **Documents set out:**
  1. Mandatory pre-requisites to be complete prior to test
  2. Requirements to be met during test
  3. Example methodologies for different scenarios/system types
- Supplementary templates developed for each Element

ENERGY CENTRE	DISTRICT DISTRIBUTION NETWORK	SUBSTATION	COMMUNAL DISTRIBUTION NETWORK	CONSUMER CONNECTION	CONSUMER HEAT SYSTEM

Energy Centres and Substations

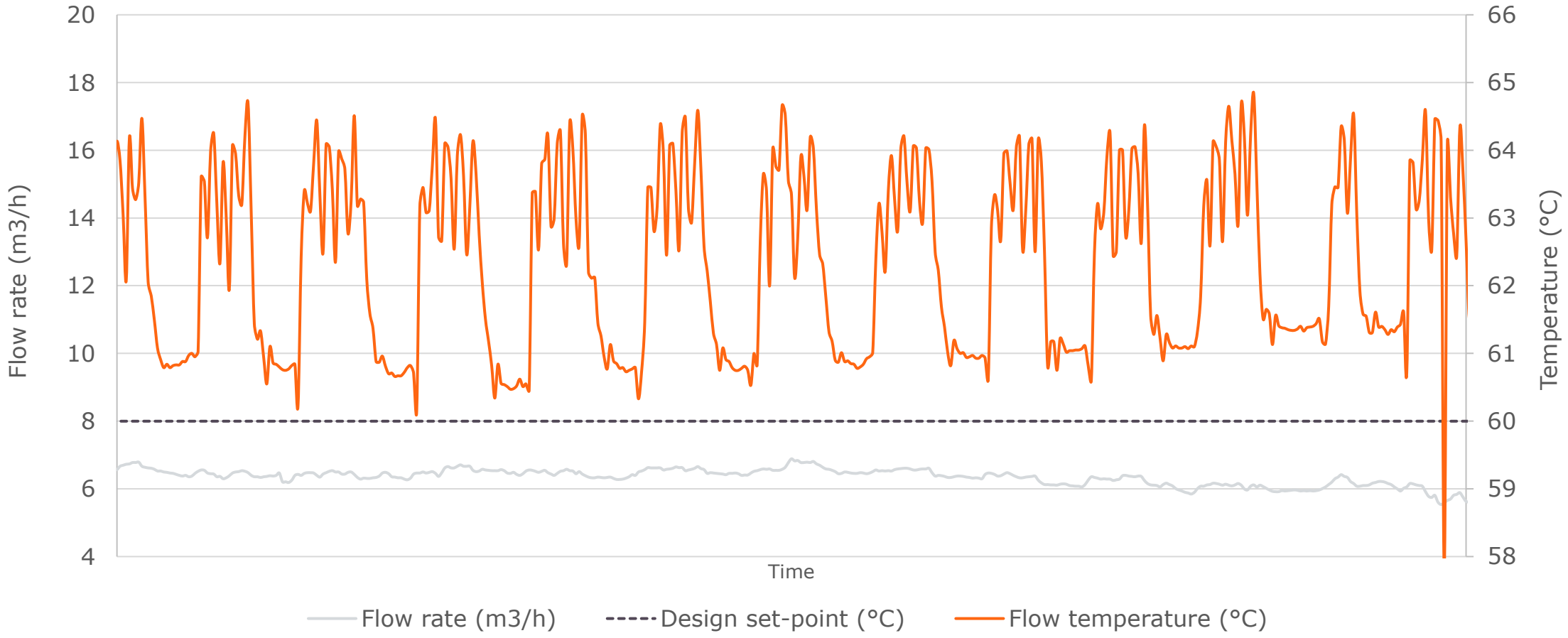


Performance to be demonstrated across all modes of operation



ENERGY CENTRE DISTRICT DISTRIBUTION NETWORK **SUBSTATION** COMMUNAL DISTRIBUTION NETWORK CONSUMER CONNECTION CONSUMER HEAT SYSTEM

Acceptance Test is preventative by capturing issue with performance

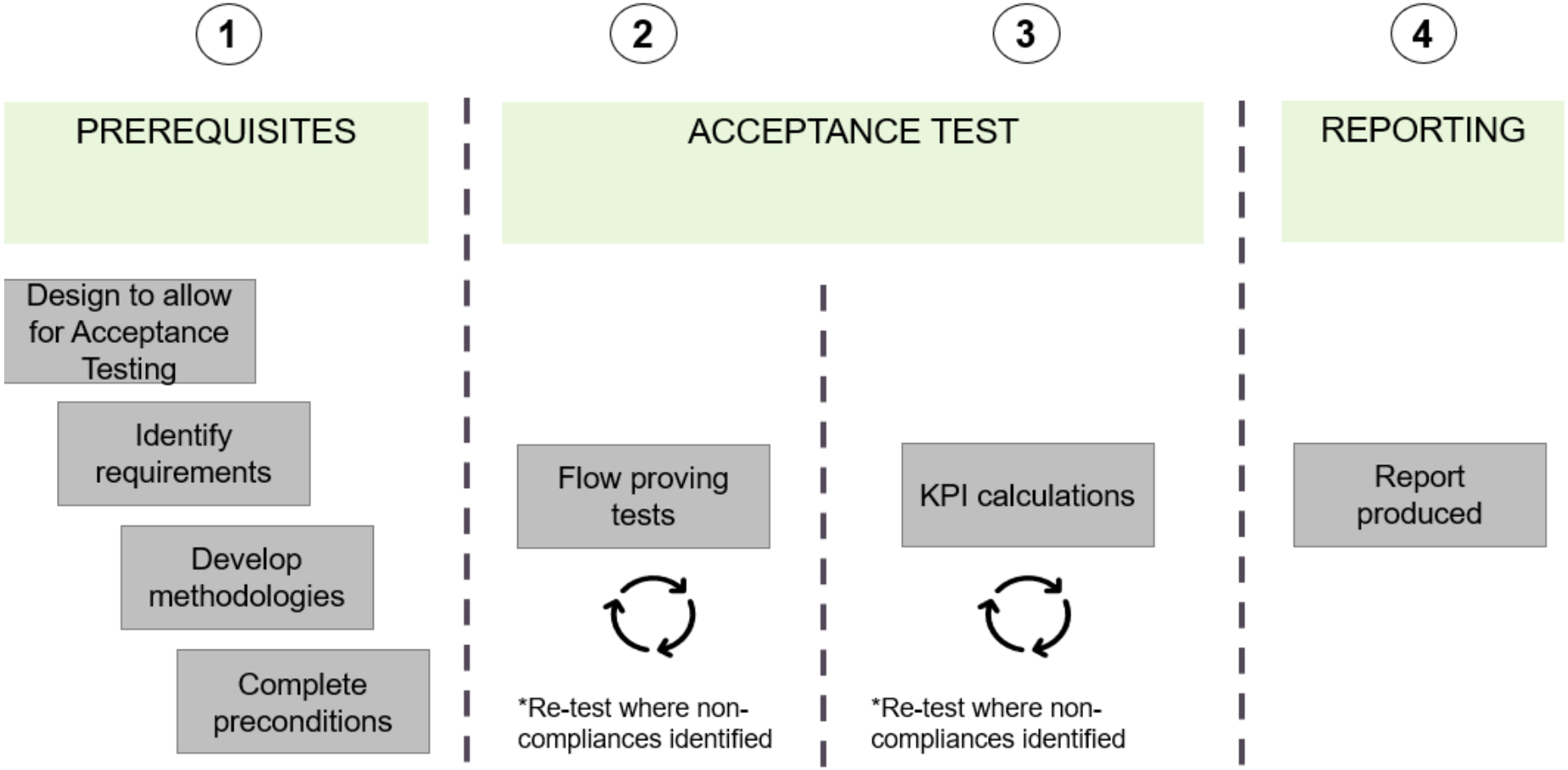


Process - Energy Centre/Substation

- Static witnessing
  - Set points
  - Auto-changeover functionality
  - Fault monitoring
  - Reliability interlocks
- Dynamic operation test

Dynamic operation test	
Test	Result
Correct and stable flow temperature	
Stable network differential pressure	
Boiler: correct and stable outlet temperature	
Boiler: correct sequence up	
Boiler: correct sequence down	
Boiler: stable network flow temperature during start up	
Boiler: stable network flow temperature during shut down	
Boiler: fault free operation	
PHE: correct and stable outlet temperature	
PHE: correct sequence up	
PHE: correct sequence down	
PHE: stable network flow temperature during start up	
PHE: stable network flow temperature during shut down	
Pumps: correct and stable differential pressure	
Pumps: correct sequence up	
Pumps: correct sequence down	
Pumps: operation as per control strategy (e.g., duty/assist)	

Networks – Communal/District



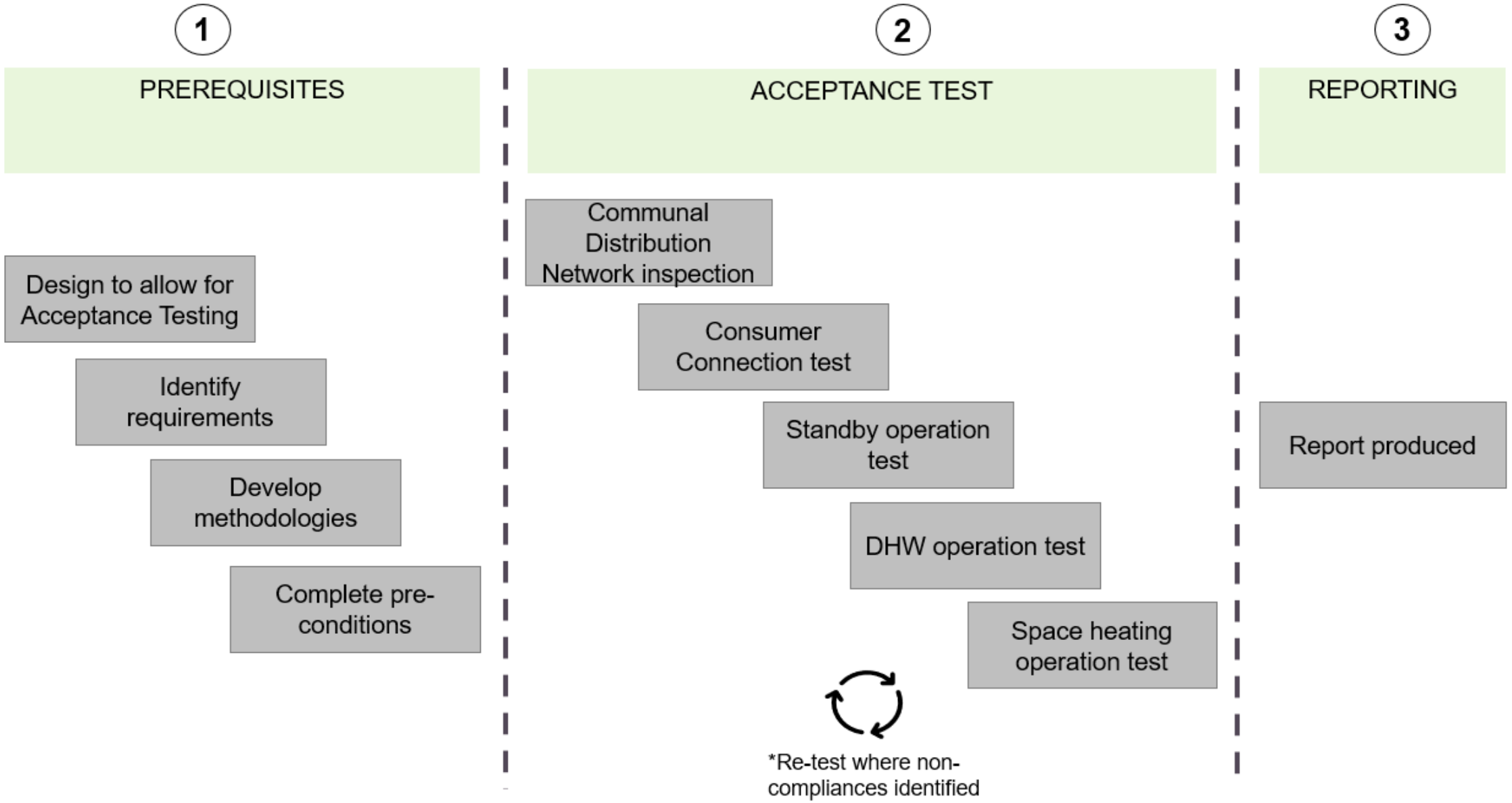
- Primary requirement to demonstrate flow
- Could be integrated with Energy Centre/Substation test

Process – Communal/District Distribution

- Flow proving at index locations
- District – continuity test and leak detection (if applicable)

Communal Distribution Acceptance Testing Template	
Site name	
Date attended	
Assessor	
Flow proving – index location 1	
Test	**Result**
Design peak flow rate	
Measured peak flow rate	
Design differential pressure	
Measured differential pressure	
Suitable operation?	
Flow proving – index location 2	
Test	**Result**
Design peak flow rate	
Measured peak flow rate	
Design differential pressure	
Measured differential pressure	
Suitable operation?	

Consumer Systems



Process – Consumer Systems

- Install quality
- Set points
- Testing in all operation modes
  - Standby
  - DHW
  - Space heating

Standby Tests		
Test	Result	Comments
Primary flow rate (l/h)		
Primary flow temperature (°C)		
Primary return temperature (°C)		
Primary power consumption (kW)		

DHW Tests		
Test	Result	Comments
Stabilised cold water temperature (°C)		
Kitchen hot water tap: time to deliver 45 °C (s)		
Kitchen hot water tap: final temperature (°C)		
Kitchen tap: flow rate (l/min)		
Maximum bath temperature (°C)		
Primary flow rate (l/h)		
Primary flow temperature (°C)		
Primary return temperature (°C)		
Primary power consumption (kW)		

HNTAS Performance Thresholds for Legacy Networks

Francesca James & Faizah Ahmed

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Speaker

Francesca James
Consulting Engineer

- Consulting Engineer at FairHeat
- Over 2 years' experience in optimising existing heat networks and the design of large district heating networks

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Faizah Ahmed
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HNTAS Performance Thresholds For Legacy Networks

Overview of proposed approach for Legacy Networks

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Significant challenges associated with bringing legacy networks into an assurance scheme

- Large number of legacy networks (c.14,000)
- Performance gap
- Lack of metering/monitoring
- Resource/skills gap
- Improper maintenance of sinking funds

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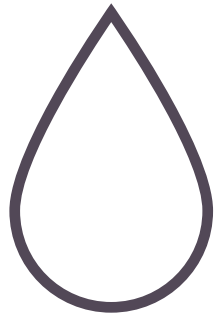
Key principles of HNTAS approach to legacy networks

- ✓ Ensure very worst performing networks caught and addressed in timely manner
- ✓ Market able to comply (deliverable)
- ✓ End state is every network certified to a minimum level of performance by a future date

Heat loss



Water quality

Proposed approach

Milestone	Requirement
Milestone 1	Register heat network
Milestone 2	Demonstrate meeting minimum metering & monitoring requirements Demonstrate meeting **threshold performance**
Milestone 3	Submit Performance Improvement Plan (to reach certification)
Milestone 4	Certification – meeting **performance requirements**
Milestone 5	Certification (end Stage 6) – meeting O&M requirements

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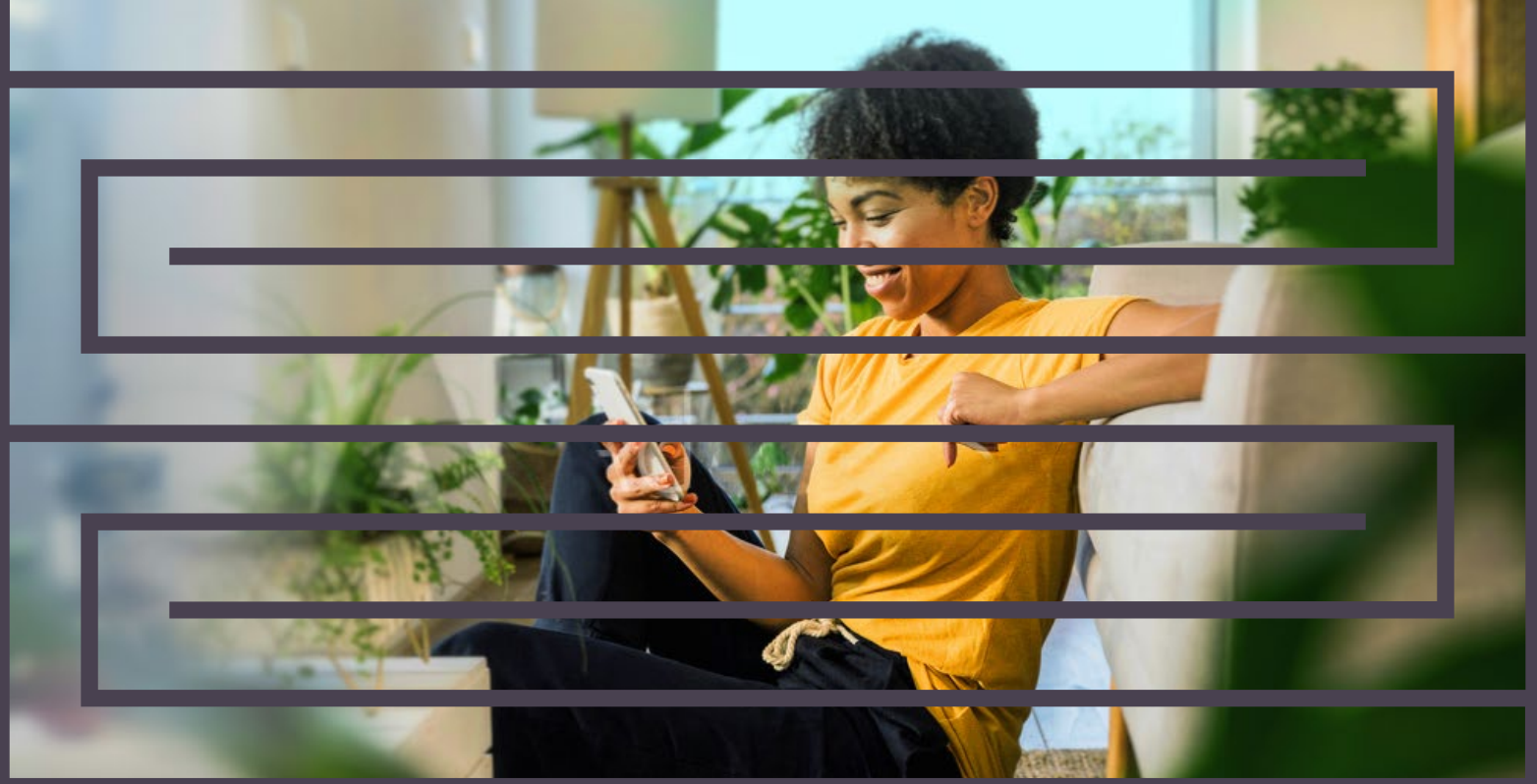

HNTAS Performance Thresholds For Legacy Networks

Setting the Minimum Threshold Requirements

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Key aims

- Set early to ensure worst networks are brought up to an absolute minimum threshold:
- Two main aims:
  1. Ensure minimum level of reliability
     - **Water quality**
     - Controlled network flow
     - Reduce outages
  2. Set **maximum heat losses** (£/kWh)

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Water quality is a large issue in the industry

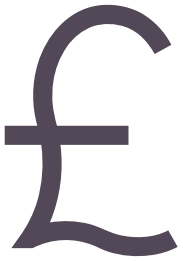
- Poor water quality is common across many legacy heat networks
- One of the main causes of performance and reliability failures – can lead to network replacement before end of life
- Essential to address poor water quality early using a holistic approach
- Spoken to manufacturers and reviewed industry guidance to develop requirements to set out a proposed approach to water quality

Proposed minimum installed equipment at milestone 2

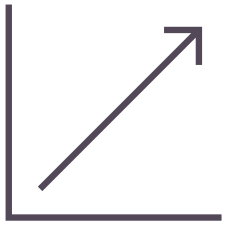
- **Preventative water treatment equipment:**
  - Strainers
  - Automatic air vents
  - Drainage points
  - Pressurisation units (PU)
  - Expansion vessels
  - Vacuum degassers
  - Side stream filtration units (SSF)
  - Dosing pots
  - Dirt separators
  - Deaerators
- **Monitoring equipment:**
  - Water meter on MCWS to PU prior to any manual quick fill connections
  - System working pressure sensor
  - Differential pressure sensor across SSF
- **Where online monitoring is implemented:**
  - Electronic coupon monitoring (ECM) corrosion probes
  - Automatic pH monitoring
  - Automatic conductivity monitoring
  - Automatic dissolved oxygen monitoring

Importance of water quality works

c.90% of sites required to install water quality equipment



Of sites requiring works, average CAPEX of c.£300/dwelling



Carrying out water quality works has an average NPV of **c.£720**

Water quality management and monitoring approach

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Two main approaches are used for managing water quality within UK heat networks:

- Dosed systems
- Deoxygenated systems

Minimum water quality KPIs are monitored through one of two approaches:

- Laboratory sampling
- Online monitoring

Frequency of sampling dependent on current conditions

- Three sampling categories available:
  - Fortnightly
  - Monthly
  - Quarterly
- Testing procedure in accordance with BS 8552.
- If poor water quality trends are observed, to increase and maintain sampling and reporting frequency until improvements are seen.

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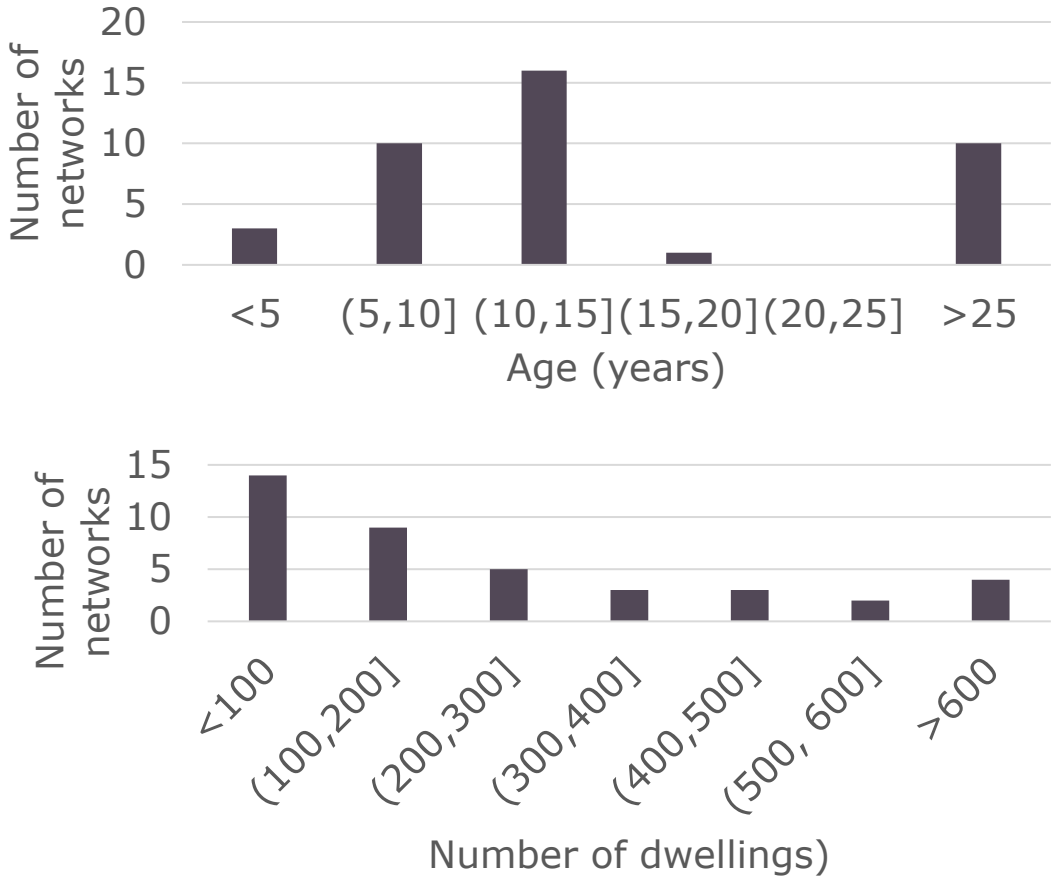
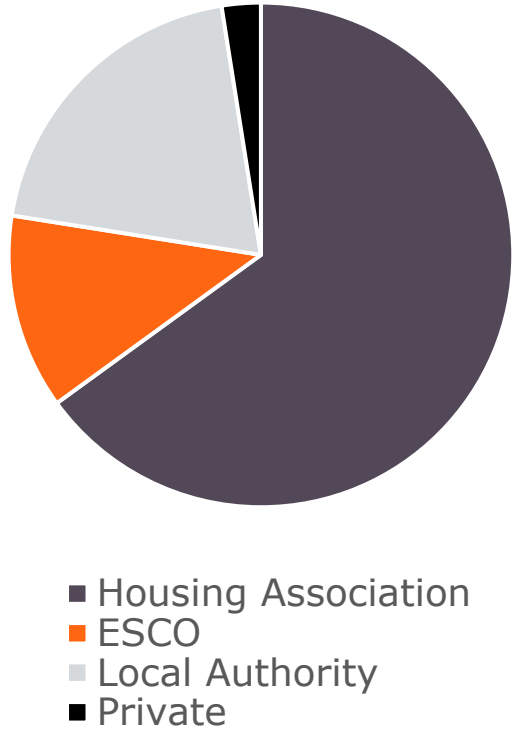
Online monitoring

- **Recommended for deoxygenated systems and larger size heat networks**.
- Minimum water quality KPIs reported monthly.
- Annual sampling for non-online monitoring KPIs.
- Water quality issues may not directly stem from the continuously monitored KPIs tracked using the online monitoring equipment.
- If poor water quality trends are observed, to increase and maintain sampling and reporting frequency until improvements are seen.

Maximum heat loss: outline of analysis

Assessment of 44 of FairHeat's Optimisation Studies, used to estimate cost and benefit of reaching varying levels of performance





Outline of analysis

Optimisation studies propose work packages

- Easy wins, low CAPEX
- Major works, high CAPEX

Resulting reductions in:

- Heat loss
- Pumping energy consumption
- Return temperature

Resulting savings:

- Gas consumption
- Electricity consumption
- Carbon emissions
- Operational costs

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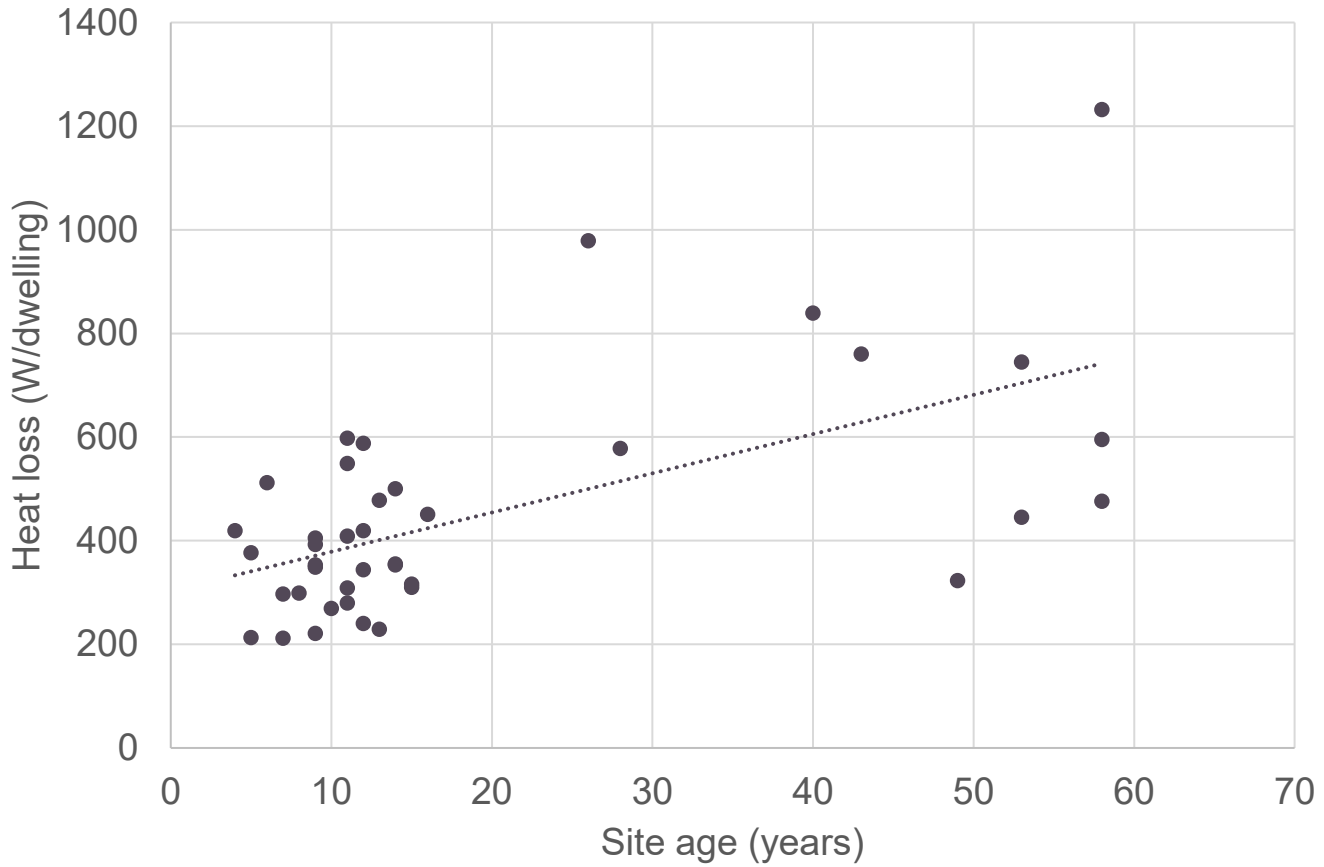
Heat loss used as threshold

- Benchmarked in HNTAS for new builds (<100 W/dwelling)
- Measurable through metering
- Heat losses directly impact cost of heat delivered
- Works that will reduce heat losses also stabilise the network, reduce pumping electricity and reduce return temperatures
- 500 – 200 W/dwelling considered

FAIRHEAT

End of life schemes

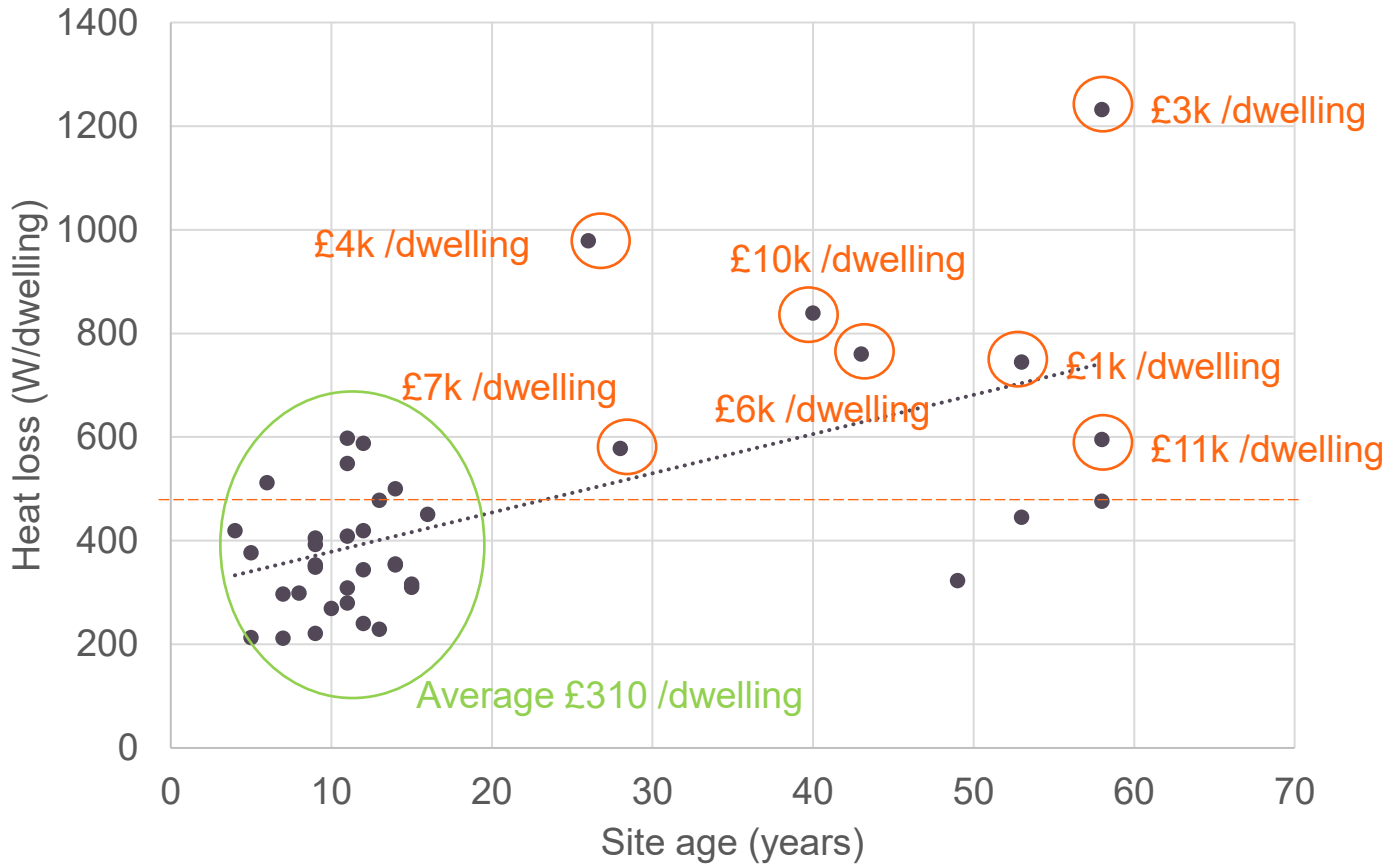
W/dwelling heat loss increases as scheme age increases



FAIRHEAT

End of life schemes: CAPEX to reach <500 W/dwelling

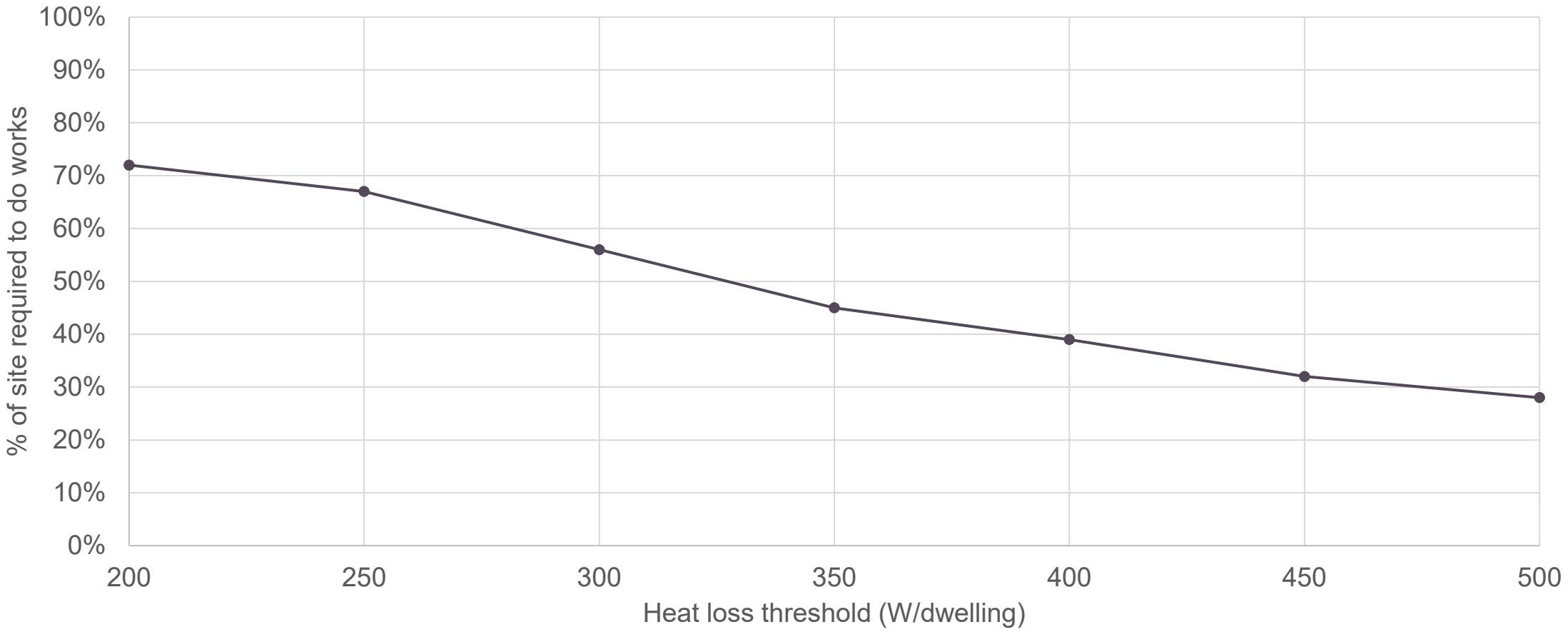
CAPEX required to reduce heat loss increases as scheme age increases



- Removed from following averages
- Proposed to allow a different minimum requirement on end-of-life networks

Deliverability

Higher proportion of sites required to do works as threshold becomes more stringent



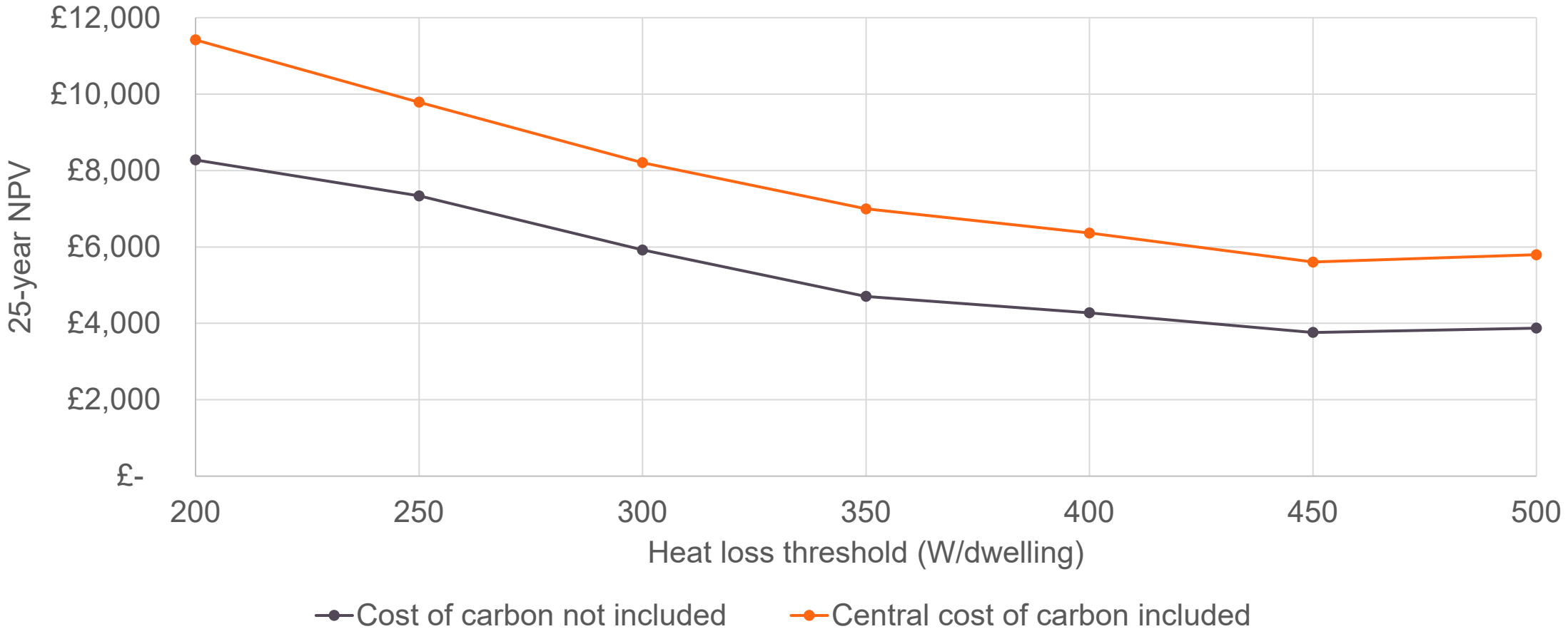
FAIRHEAT

CAPEX and Savings

Savings and CAPEX increase as threshold becomes more stringent

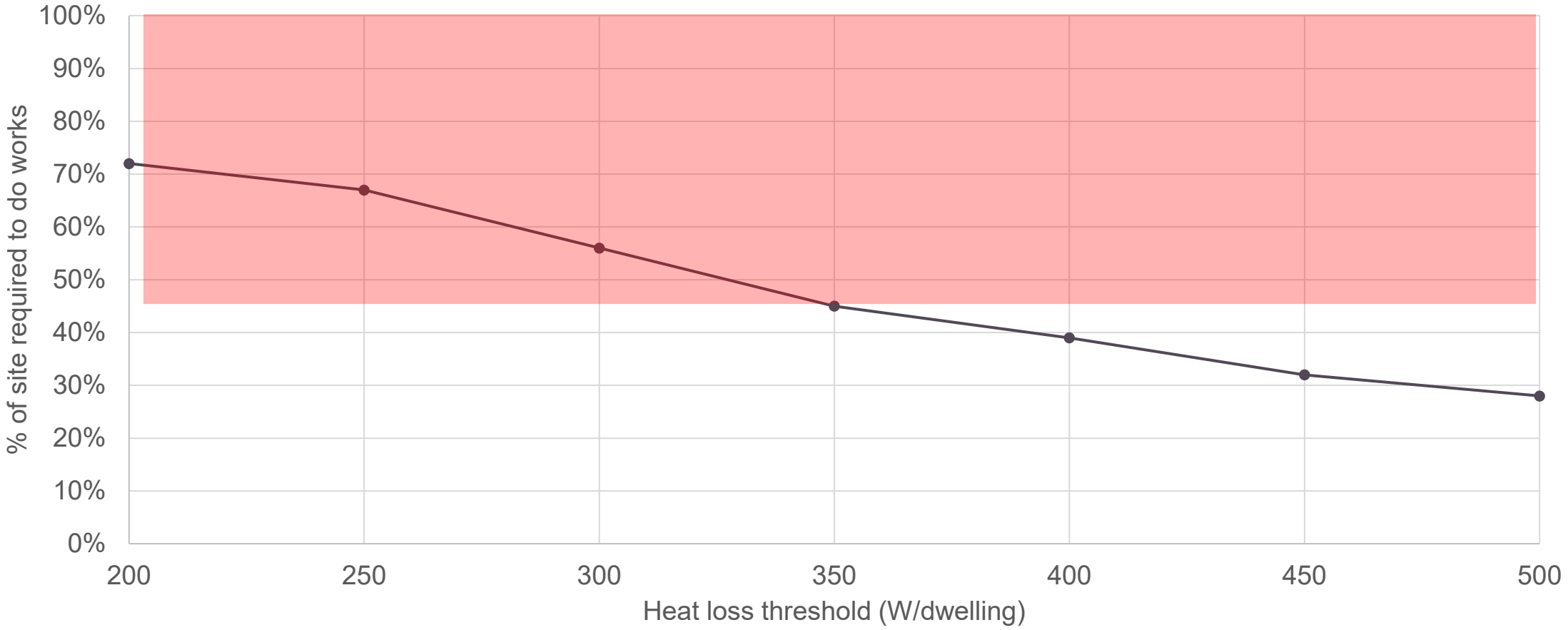
Net Present Value of works

NPV of carrying out works increases as threshold becomes more stringent



Minimum threshold governed by deliverability

Higher proportion of sites required to do works as threshold becomes more stringent



FAIRHEAT

HNTAS Performance Thresholds For Legacy Networks

Setting the Final Certification Requirements

FAIRHEAT

Dosed system KPIs

Parameter		Final certification requirements	Units
System working pressure		Within range specified in the O&M manual	Bar
pH	Steel	9.0 – 11.0	-
	Copper	7.5 – 9.2	-
	Aluminium	7.0 – 8.5	-
Conductivity		100 - 600	µS/cm
Hardness		< 100	mg/l
Sulphate		< 100	mg/l
Chloride		< 100	mg/l
Fill water metering		< 5	% per annum of system volume
Inhibitor		Within range specified by water treatment specialist	mg/l
Corrosion products	Total Iron	< 15	mg/l
	Dissolved Iron	< 3	mg/l

Dosed system KPIs continued

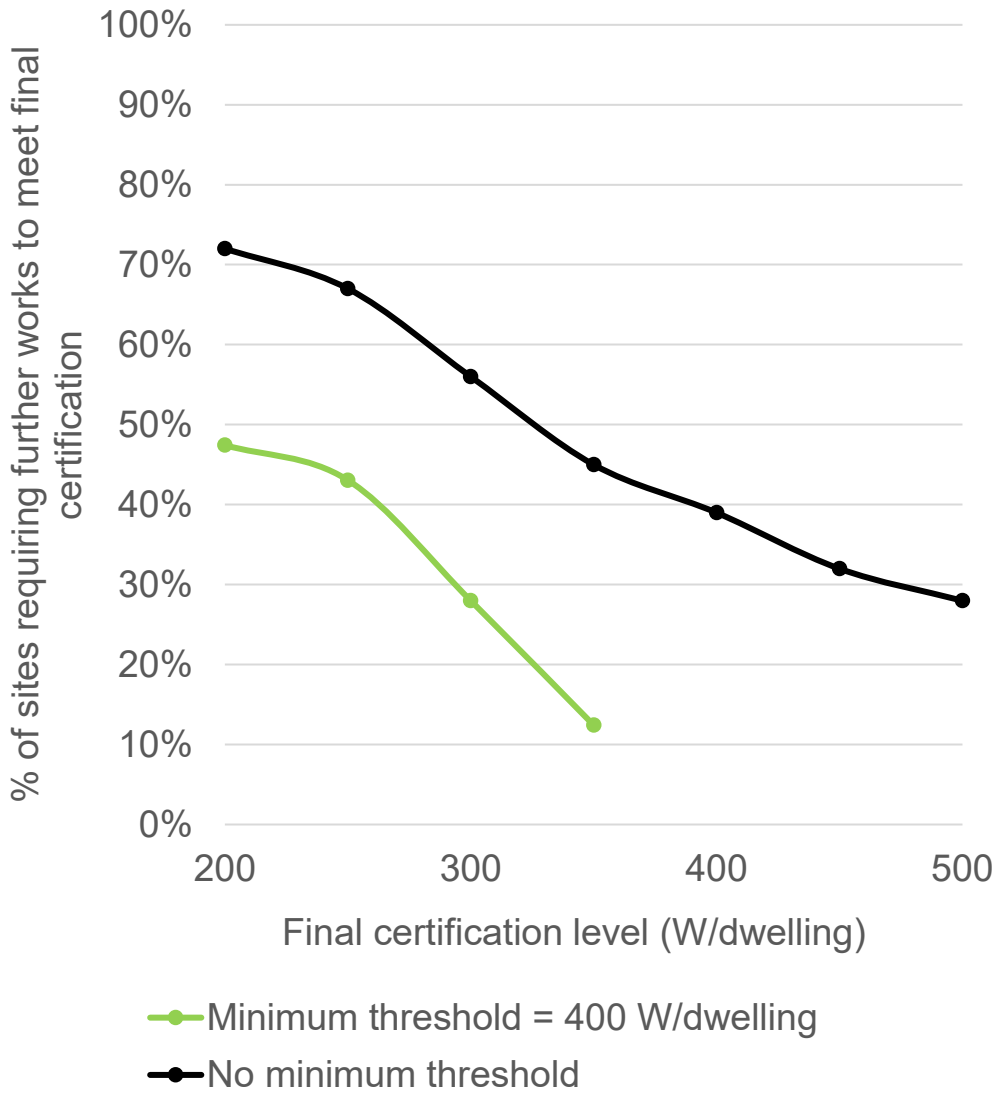
Parameter		Final certification requirements	Units
Corrosion products	Total Copper	< 1	mg/l
	Dissolved Copper	< 1	mg/l
	Total Aluminium	< 1	mg/l
	Total Zinc	< 1	mg/l
Corrosion rates	Mild steel	< 40	µm/year
	Copper	< 5	µm/year
	Extruded aluminium	< 100	µm/year
	Brass	< 5	µm/year
	Stainless steel	< 2	µm/year
Microbiology	TVC	< 10,000	cfu/ml
	Pseudomonads	< 1,000	cfu/ml
	SRB	0	cfu/ml
	NRB	0	cfu/ml

Deoxygenated KPIs

Parameter		Final certification requirements	Units
System working pressure		Within range specified in the O&M manual	Bar
pH	Non-aluminium	8.2 – 10.0	-
	Aluminium	8.2 – 8.5	-
Conductivity*		> 10 to ≤ 100	µS/cm
Dissolved oxygen*		< 0.1	mg/l
Hardness		20 - 100	mg/l
Suspended solids		< 30	mg/l
Fill water metering		< 5	% per annum of system volume

* Both conductivity and dissolved oxygen limits do not have to simultaneously be met, it is acceptable for one parameter to meet requirements.

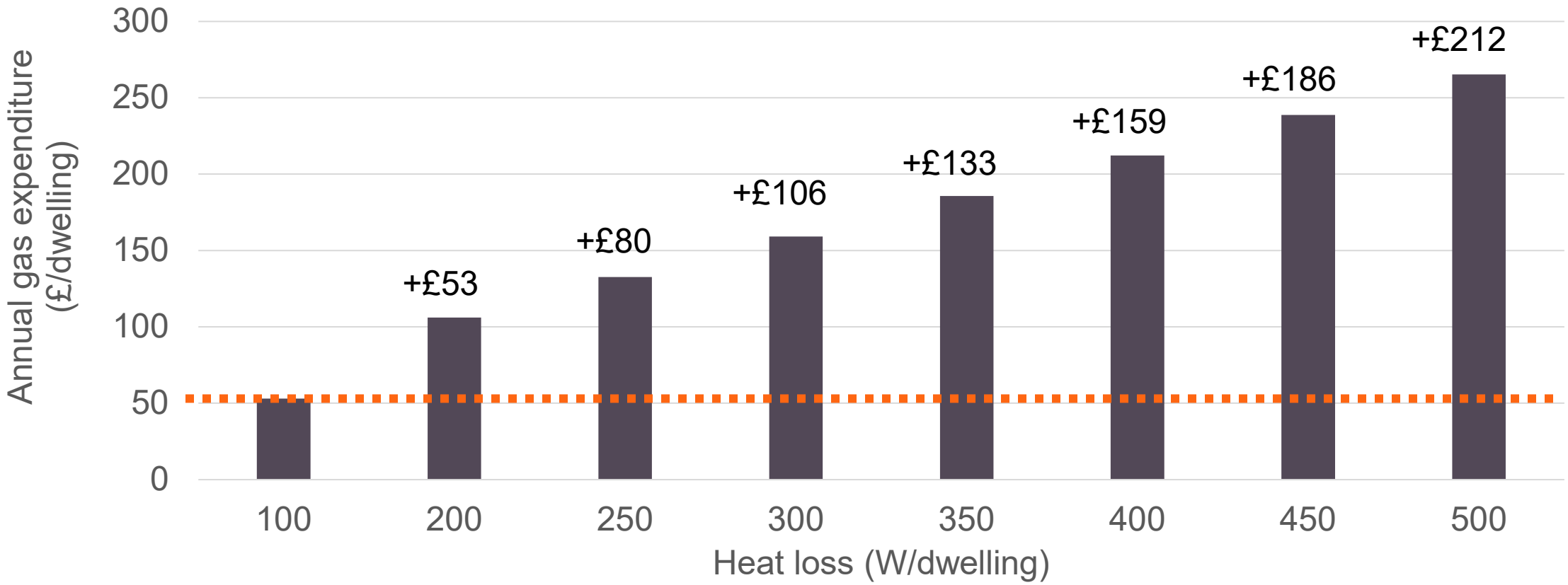
Minimum threshold vs final certification



- In achieving the minimum threshold, the majority of sites will achieve **better performance** than this threshold.
- This reduces the number of sites that are required to carry out further works to reach final certification.

Balance between deliverability and cost to residents

Annual cost of losses (gas) per dwelling vs heat loss



Key takeaways

01
Register Heat Network.

02
Minimum metering and monitoring. Minimum threshold performance.

Water quality:

Install minimum equipment

Set up approach

Heat loss:

400-500 W/dwelling

03
Performance improvement plan

04
Certification: meeting performance requirements

Water quality:

Meeting reportable KPIs

Heat loss:

200-250 W/dwelling

05
Certifcation: meeting O&M requirements

HNTAS: Developing Standardised Templates For Industry

Thomas Lupton & Faye Bautista

FAIRHEAT

Speaker

Thomas Lupton
Graduate Engineer

- Graduate Engineer at FairHeat
- 2 years’ experience in heat network optimisation and commissioning
- Engaged with commissioning engineers and project managers to deliver high performance across retrofit and design projects

FAIRHEAT

Speaker

Faye Bautista
Graduate Engineer

- Graduate Engineer at FairHeat
- 2 years' experience in optimising existing heat networks and new build networks
- Conducted optimisation studies within existing networks and providing quality assurance in the design, installation, commissioning, testing and operation of new heat networks.

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Why the need for standardised templates?

c. 8,000 heat networks to be brought in line with HNTAS requirements

These are massive tasks that will collectively take a lot of time and effort from the industry

HNTAS will provide templates that standardize the process to ease burden on the industry

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Templates

The templates we will be talking about today are:

1. Performance improvement plan template

- Heat networks owners will have to produce a plan to prove that their network will align with regulations by the HNTAS deadline
- Template will standardise the plan format to help the be produced and reviewed

2. Heat Interface Unit (HIU) Servicing template

- Current HIU maintenance practices lack consistency, leading to inefficiencies
- Developing a standardised HIU servicing procedure will ensure consistent approach and improve HIU performance

Performance Improvement Plan Template

FAIRHEAT

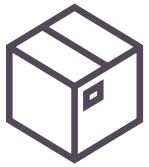
Performance Improvement Plan - Timeline

Milestone	Requirement
Milestone 1	Register heat network
Milestone 2	Demonstrate meeting minimum metering & monitoring requirements Demonstrate meeting threshold performance
Milestone 3	Submit Performance Improvement Plan (to reach certification)
Milestone 4	Certification – meeting performance requirements
Milestone 5	Certification (end Stage 7) – meeting O&M requirements

FAIRHEAT

Objectives

In order for the performance improvement plan template to be as effective as possible it will need to meet a few key criteria



Deliverable – template should be practical so that it streamlines the process of developing an improvement plan

Applicable – The template should be as widely applicable as possible.

Specific – the template should specifically focus on HNTAS requirements

Method

Literature review
Draft
Case studies
Finalised template
Guidance document

Five improvement plan and application templates have been reviewed

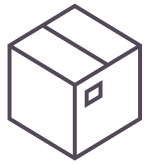
1. PSDS (DESNZ/Salix)
2. HNES (DESNZ)
3. Green Heat Network Fund (GHNF)
4. Carbon reduction plan (UK GOV)
5. Environmental action plan (RPGNSW)

Improvement plan template contains the following:

Define the current performance of the network

- KPIs
- Water quality

Identify key failures currently present in the network



Detail key interventions that will be undertaken in improvement works

Define the expected final performance of the network

FAIRHEAT

Current Performance

C - Current performance

Workbook status: INCOMPLETE
Worksheet status: COMPLETE

	Ref	Description		Value	HNTAS / User Target	% Above / (% below)	Pass?
		Minimum KPIs					
OK	C1	Network heat losses	*W/dwelling*	1141	200	471%	NO
OK	C2	Pump energy use	*kWh/year*	60190	140000	-57%	YES
		Reportable KPIs					
OK	C3	Generation efficiency	%	80	65	23%	YES
OK	C4	Average flow temperature	°C	74	55	35%	NO
OK	C5	Average return temperature	°C	66	35	89%	NO
X	C6	District distribution HN loss	*TBC*		TBC	0%	X
X	C7	Communal distribution HN loss	*TBC*		300	0%	X
OK	C8	Meters operational and connected via AMR	%	0	100	-100%	NO
X	C9	Heat network interruptions	*Number*		0	-	X
X	C10	Consumer connection interruptions	*Number*		0	-	X
X	C11	VWAFT	°C			0%	X

Ref		
C12	Supporting evidence	As per CIBSE Technical Symposium, UK April 2024
C20	Further comments	

END OF WORKSHEET

D - Current performance water quality

Workbook status: INCOMPLETE
Worksheet status: INCOMPLETE

	Ref	Description		Value	HNTAS Lower limit	HNTAS Upper limit	% Above / (% below)	Pass?
		Methodology						
OK	D1	Water treatment methodology	*Method*	Dosed (e.g BSRIA)				
OK	D2	Sampling or online monitoring	*Method*	Sampling				
		Pipework material present						
OK	D3	Aluminium	*Yes/No*	No				
OK	D4	Copper and copper alloys	*Yes/No*	Yes				
OK	D5	Steel	*Yes/No*	Yes				
OK	D6	Stainless steel	*Yes/No*	No				
OK	D7	Brass	*Yes/No*	No				
		KPIs						
OK	D8	pH	*Number*	8.20	8	9		YES
OK	D9	Conductivity	*µS/cm*	1600.00	100	600	167%	NO
OK	D10	Dissolved oxygen	*mg/l*					N/A
OK	D11	Suspended solids	*mg/l*					N/A
OK	D12	Fill water metering	*% turnover of system volume per year*	10.00		5	100%	NO
		Corrosion products						
OK	D13	Total iron	*mg/l*	0.70		15	-95%	YES
OK	D14	Dissolved iron	*mg/l*	0.20		3	-93%	YES
OK	D15	Total copper	*mg/l*	0.10		1	-90%	YES
OK	D16	Dissolved copper	*mg/l*	0.10		1	-90%	YES
OK	D17	Total aluminium	*mg/l*	0.25		1	-75%	YES
OK	D18	Total zinc	*mg/l*	0.22		1	-78%	YES
		Corrosion rates						
OK	D19	Mild steel	*µm/year*					N/A
OK	D20	Copper	*µm/year*					N/A
OK	D21	Extruded aluminium	*µm/year*					N/A
OK	D22	Brass	*µm/year*					N/A
OK	D23	Stainless steel	*µm/year*					N/A
		Microbiology KPIs						
OK	D24	TVC	*cfu/ml*	100.00		10000	-99%	YES
OK	D25	Pseudomonads	*cfu/ml*	0.00		0	-	YES
OK	D26	Sulphate reducing bacteria (SRB)	*cfu/ml*	0.00		0	-	YES
OK	D27	Nitrate reducing bacteria (NRB)	*cfu/ml*	0.00		0	-	YES

Minimum Equipment

E - Minimum Equipment

Workbook status: INCOMPLETE
Worksheet status: COMPLETE

	Ref	Description		Input	Pass?
		Preventative water treatment equipment (on all circuits)			
OK	E1	Strainers before sensitive equipment	*Yes/No*	No	NO
OK	E2	Automatic air vents installed on all high points	*Yes/No*	No	NO
OK	E3	Drainage points installed on all low points	*Yes/No*	No	NO
OK	E4	Pressurisation unit (PU)	*Yes/No*	Yes	YES
OK	E5	Expansion vessel	*Yes/No*	Yes	YES
OK	E6	Vacuum degasser	*Yes/No*	No	NO
OK	E7	Side stream filtration unit	*Yes/No*	No	NO
OK	E8	Dosing pot	*Yes/No*	No	NO
OK	E9	Dirt separator	*Yes/No*	No	NO
OK	E10	Deaerator	*Yes/No*	No	NO
OK	E11	Water meter on PU supply and any water treatment equipment	*Yes/No*	No	NO
		Online monitoring equipment			
OK	E12	Is online monitoring to be used?	*Yes/No*	No	YES
OK	E13	Electronic coupon monitoring corrosion	*Yes/No*		N/A

F - Key Failures

Workbook status: INCOMPLETE
Worksheet status: COMPLETE

	Ref	Description	Primary KPI influenced	Secondary KPI influenced	Addressed by interventions?
		Key failures			
OK	F1	Unnecessary hydraulic breaks	Average flow temperature		Yes
OK	F2	Oversized network pipework	District distribution HN loss		Yes
OK	F3	Increased network flow temperature	Average flow temperature		Yes
OK	F4	Dwelling cylinders	Average return temperature		Yes
OK	F5	Poor insulation coverage and thickness	Network heat losses		Yes
X	F6				
X	F7				
X	F8				
X	F9				
X	F10				
X	F11				
X	F12				
X	F13				
X	F13				
X	F14				
		Water treatment methodology			*Addressed by interventions?*
OK	F15				Yes
		Minimum equipment failures			*Addressed by interventions?*
OK	F16	Strainers before sensitive equipment			Yes
OK	F17	Automatic air vents installed on all high points			Yes
OK	F18	Drainage points installed on all low points			Yes
OK	F19				
OK	F20				
OK	F21	Vacuum degasser			Yes
OK	F22	Side stream filtration unit			Yes
OK	F23	Dosing pot			Yes
OK	F24	Dirt separator			Yes
OK	F25	Deaerator			Yes
OK	F26	Water meter on PU supply and any water treatment equipment			Yes
		Online monitoring equipment			
OK	F16	Electronic coupon monitoring corrosion probes			No
OK	F17	Automatic pH monitoring			No
OK	F18	Automatic conductivity monitoring			No
OK	F19	Automatic dissolved oxygen monitoring			No
		Offline monitoring equipment			
OK	F16				
OK	F17	Differential pressure sensor across side stream filtration unit			Yes
		Minimum metering failures			*Addressed by interventions?*
OK	F24	Heat metering present at all blocks?			Yes
OK	F25	Heat metering present in all dwellings?			Yes

Key Interventions

G - Key interventions

Workbook status: INCOMPLETE
Worksheet status: COMPLETE

	Ref	Key Interventions	Date (DD/MM/YYYY)	Primary KPI influenced	Secondary KPI influenced
		Primary interventions			
OK	G1	Remove plate heat exchanger in plantroom	08/07/2022	Average flow temperature	Pump energy use
OK	G2	Replace network pipework	06/10/2022	Network heat losses	Communal distribution HN
OK	G3	Reduce flow temperature	06/10/2022	Average flow temperature	Network heat losses
OK	G4	Replace radiators	06/10/2022	Average flow temperature	Network heat losses
OK	G5	Replace cylinders with instantaneous HIU	06/10/2022	Average return temperature	Communal distribution HN loss
OK	G6	Re-insulate all pipework	06/10/2022	Network heat losses	Communal distribution HN loss
X	G7				
X	G8				
X	G9				
X	G10				
X	G11				
X	G12				
X	G13				
X	G14				
X	G15				
X	G16				
X	G17				
X	G18				
X	G19				
X	G20				

G21	Supporting evidence	As per CIBSE Technical Symposium, UK April 2024
G22	Further comments:	

Final Performance

H - Final performance

Workbook status: INCOMPLETE
Worksheet status: COMPLETE

	Ref	Description		Value	HNTAS / User Target	% Above / (% below)	Pass?
		Minimum KPIs					
OK	H1	Network heat losses	*W/dwelling*	100	200	-50%	YES
OK	H2	Pump energy use	*kWh/year*	1000	140000	-99%	YES
		Reportable KPIs					
X	H3	Generation efficiency	%		65	0%	X
X	H4	Average flow temperature	°C			0%	X
X	H5	Average return temperature	°C			0%	X
X	H6	District distribution HN loss	*TBC*		TBC	0%	X
X	H7	Communal distribution HN loss	*TBC*		300	0%	X
X	H8	Meters operational and connected via AMR	%		100	0%	X
X	H9	Heat network interruptions	*Number*		0	-	X
X	H10	Consumer connection interruptions	*Number*		0	-	X
X	H11	VWAFT	°C			0%	X
	H12	Supporting evidence					
	H13	Further comments					

END OF WORKSHEET

I - Final performance water quality

Workbook status: INCOMPLETE
Worksheet status: INCOMPLETE

	Ref	Description		Value	HNTAS Lower limit	HNTAS Upper limit	% Above / (% below)	Pass?
		Methodology						
X	I1	Water treatment methodology	*Method*					
X	I2	Sampling or online monitoring	*Method*					
		Pipework material present						
X	I3	Aluminium	*Yes/No*					
X	I4	Copper and copper alloys	*Yes/No*					
X	I5	Steel	*Yes/No*					
X	I6	Stainless steel	*Yes/No*					
X	I7	Brass	*Yes/No*					
		KPIs						
OK	I8	pH	*Number*					N/A
OK	I9	Conductivity	*µS/cm*					N/A
OK	I10	Dissolved oxygen	*mg/l*					N/A
OK	I11	Suspended solids	*mg/l*					N/A
OK	I12	Fill water metering	*% turnover of system volume per year*					N/A
		Corrosion products						
OK	I13	Total iron	*mg/l*					N/A
OK	I14	Dissolved iron	*mg/l*					N/A
OK	I15	Total copper	*mg/l*					N/A
OK	I16	Dissolved copper	*mg/l*					N/A
OK	I17	Total aluminium	*mg/l*					N/A
OK	I18	Total zinc	*mg/l*					N/A
		Corrosion rates						
OK	I19	Mild steel	*µm/year*					N/A
OK	I20	Copper	*µm/year*					N/A
OK	I21	Extruded aluminium	*µm/year*					N/A
OK	I22	Brass	*µm/year*					N/A
OK	I23	Stainless steel	*µm/year*					N/A
		Microbiology KPIs						
OK	I24	TVC	*cfu/ml*					N/A
OK	I25	Pseudomonads	*cfu/ml*				-	N/A
OK	I26	Sulphate reducing bacteria (SRB)	*cfu/ml*				-	N/A
OK	I27	Nitrate reducing bacteria (NRB)	*cfu/ml*				-	N/A

Cover sheet

Performance Improvement Plan

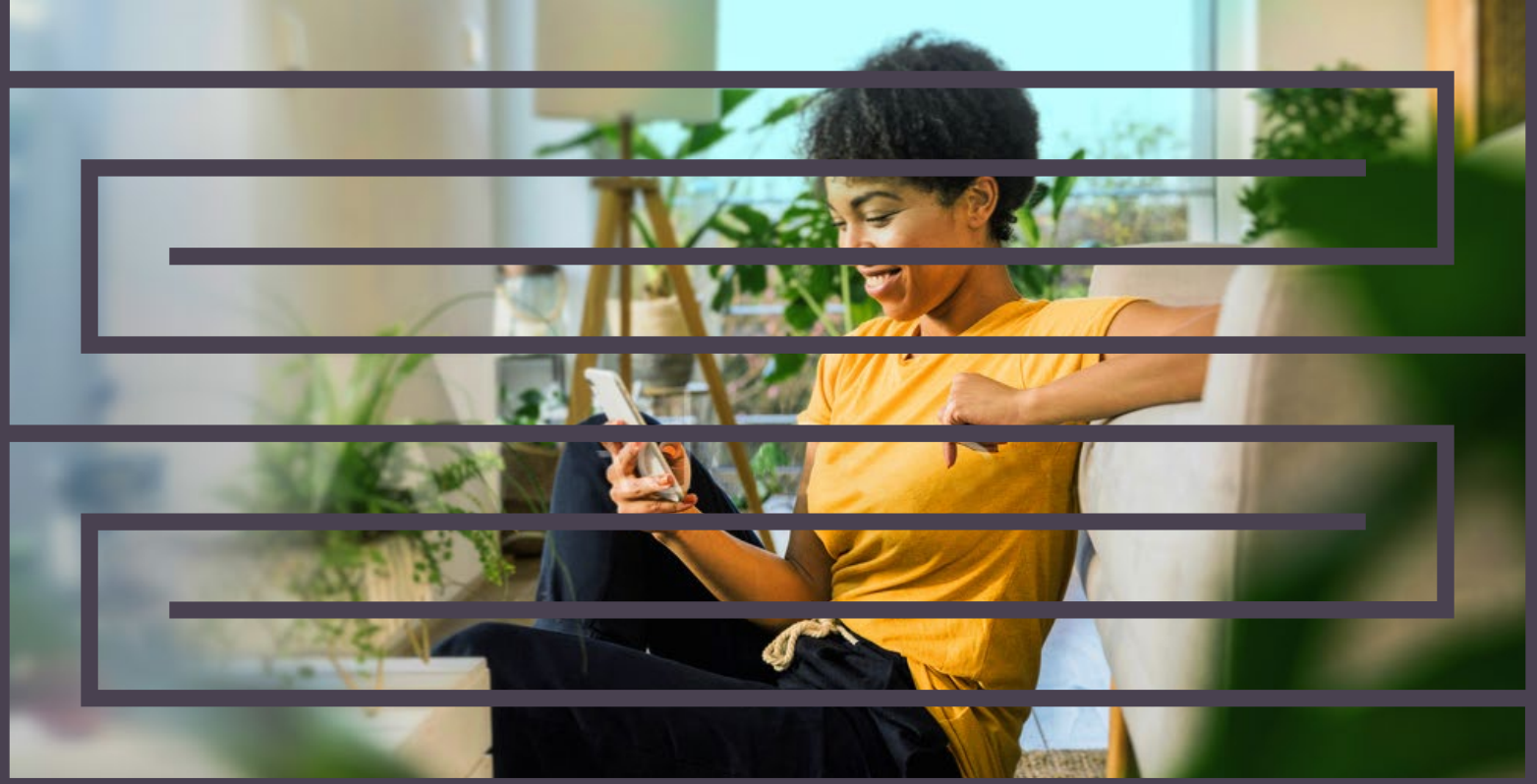
Site name

Current Performance	Pass?	Final Performance	Pass?
Minimum KPIs	NO	**Minimum KPIs**	YES
Water Quality	NO	**Water Quality**	NO
Minimum WQ equipment	NO	**Minimum WQ equipment**	YES
Minimum metering equipment	NO	**Minimum metering equipment**	YES

Key Failures	*Resolved?*	*Key Interventions*
Unnecessary hydraulic breaks	YES	Remove plate heat exchanger in plantroom
Oversized network pipework	YES	Replace network pipework
Increased network flow temperature	YES	Reduce flow temperature

Dispensation

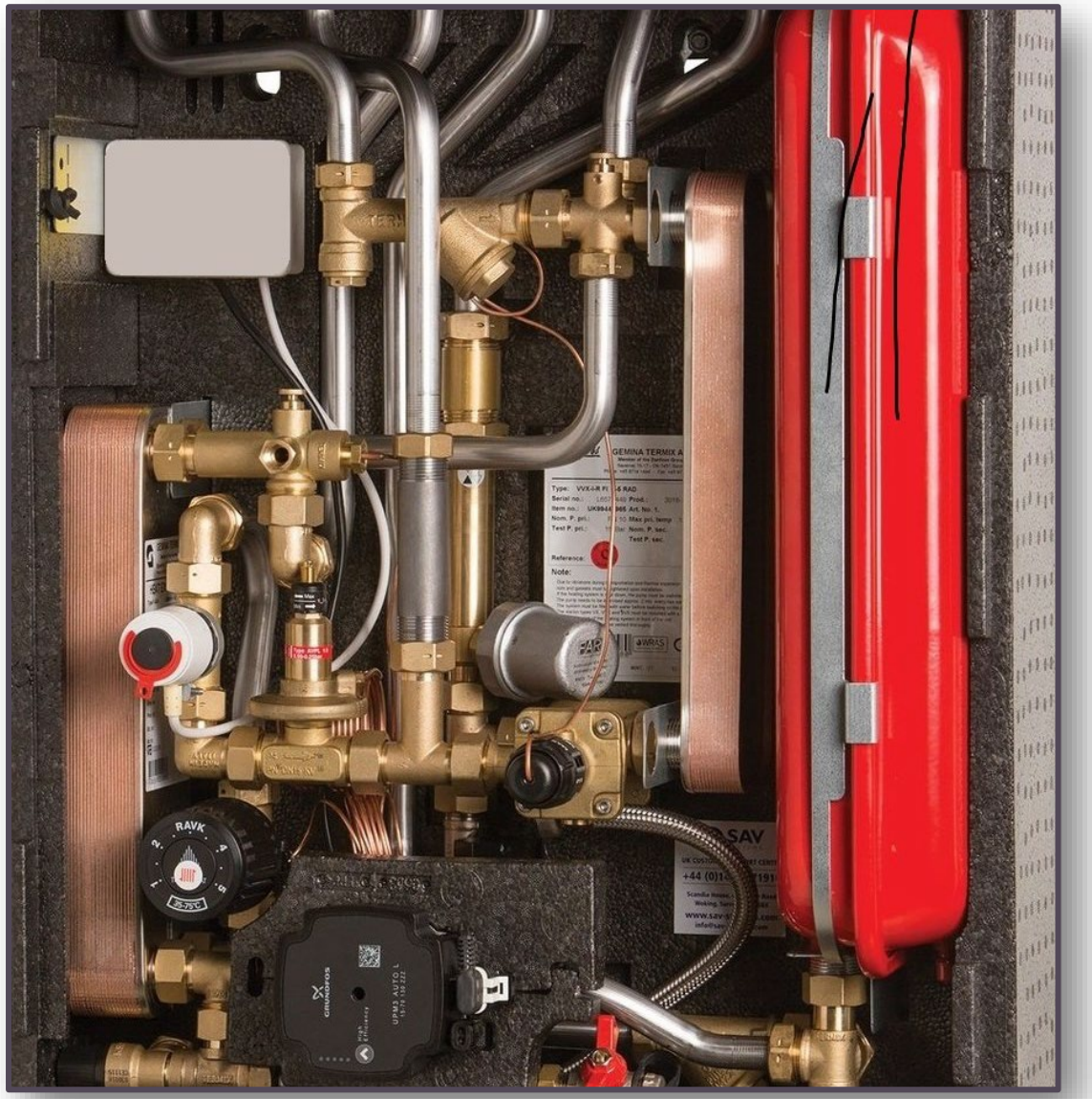
KPI	*Value*	*Reasoning*



Servicing HIUs: Standardised Procedure

FAIRHEAT

Servicing HIUs: Standardised Procedure



- Current HIU maintenance practices often lack consistency, leading to poor outcomes.
- Limited information on HIU servicing procedures within industry
- Developing an industry best practice standardised HIU servicing procedure

FAIRHEAT

Industry Best Practice

Documented Procedures

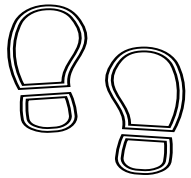
- Standardised servicing template and guidance

Qualified Personnel

- Servicing engineers possess expertise

Performance Testing

- Ensure HIU's safe operation and verification of performance



Traceability

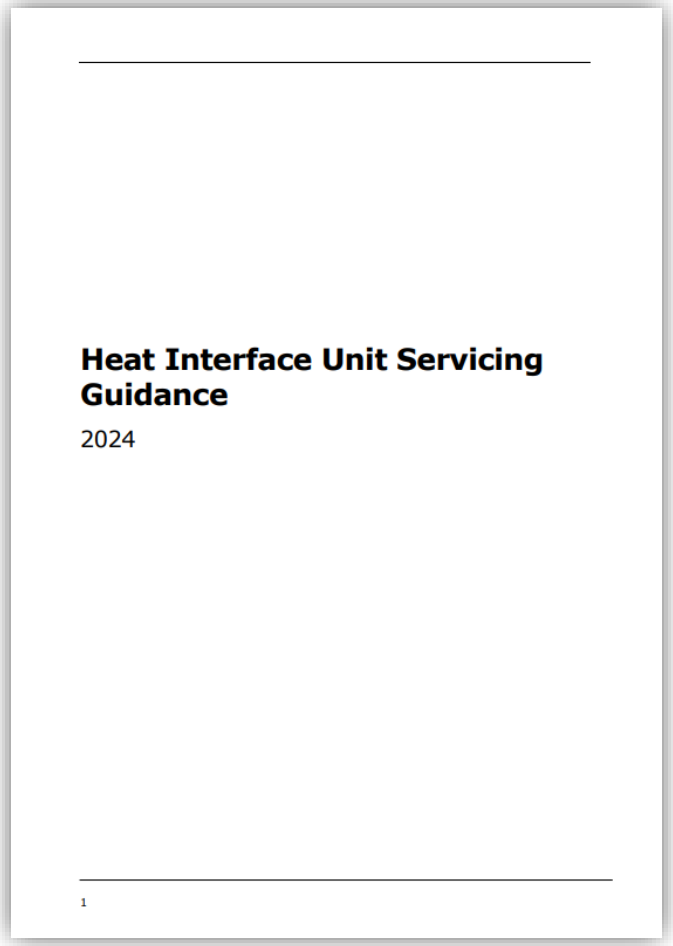
- Servicing templates provide record of activities

*whilst noting the important role played by **manufacturers' instructions**

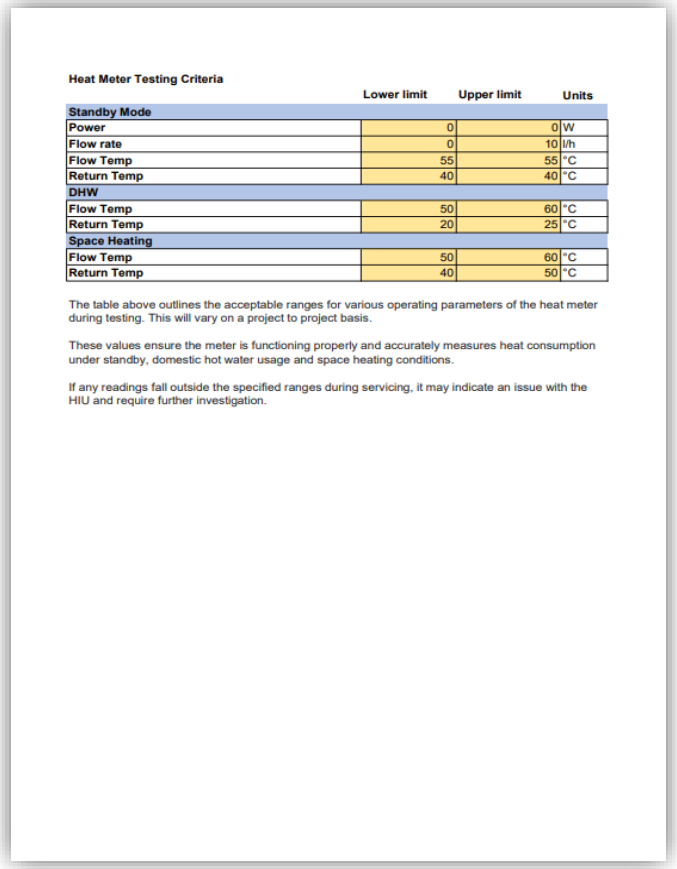
Outputs

Template

Guidance



Servicing Template



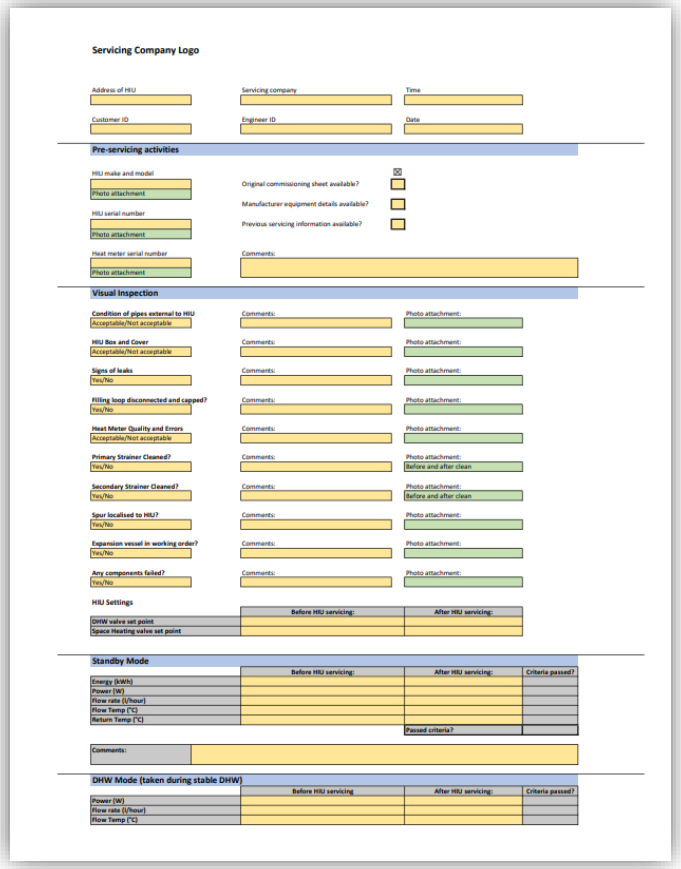
Heat Meter Testing Criteria

	Lower limit	Upper limit	Units
Standby Mode			
Power	0	0	W
Flow rate	0	10	l/h
Flow Temp	55	55	°C
Return Temp	40	40	°C
DHW			
Flow Temp	50	60	°C
Return Temp	20	25	°C
Space Heating			
Flow Temp	50	60	°C
Return Temp	40	50	°C

The table above outlines the acceptable ranges for various operating parameters of the heat meter during testing. This will vary on a project to project basis.

These values ensure the meter is functioning properly and accurately measures heat consumption under standby, domestic hot water usage and space heating conditions.

If any readings fall outside the specified ranges during servicing, it may indicate an issue with the HIU and require further investigation.



Servicing Company Logo

Address of HIU | Servicing company | Time

Customer ID | Engineer ID | Date

Pre-servicing activities

HIU make and model | Photo attachment | Original commissioning sheet available? ☒

HIU serial number | Photo attachment | Manufacturer equipment details available? ☐

Heat meter serial number | Photo attachment | Previous servicing information available? ☐

Comments:

Visual Inspection

	Comments:	Photo attachment:
Condition of pipes external to HIU (Acceptable/Not acceptable)		
HIU Box and Cover (Acceptable/Not acceptable)		
Signs of leaks (Yes/No)		
Filling loop disconnected and capped? (Yes/No)		
Heat Meter Quality and Errors (Acceptable/Not acceptable)		
Primary Strainer Cleaned? (Yes/No)		Before and after clean
Secondary Strainer Cleaned? (Yes/No)		Before and after clean
Spur localised to HIU? (Yes/No)		
Expansion vessel in working order? (Yes/No)		
Any components failed? (Yes/No)		

HIU Settings

	Before HIU servicing:	After HIU servicing:
DHW valve set point		
Space Heating valve set point		

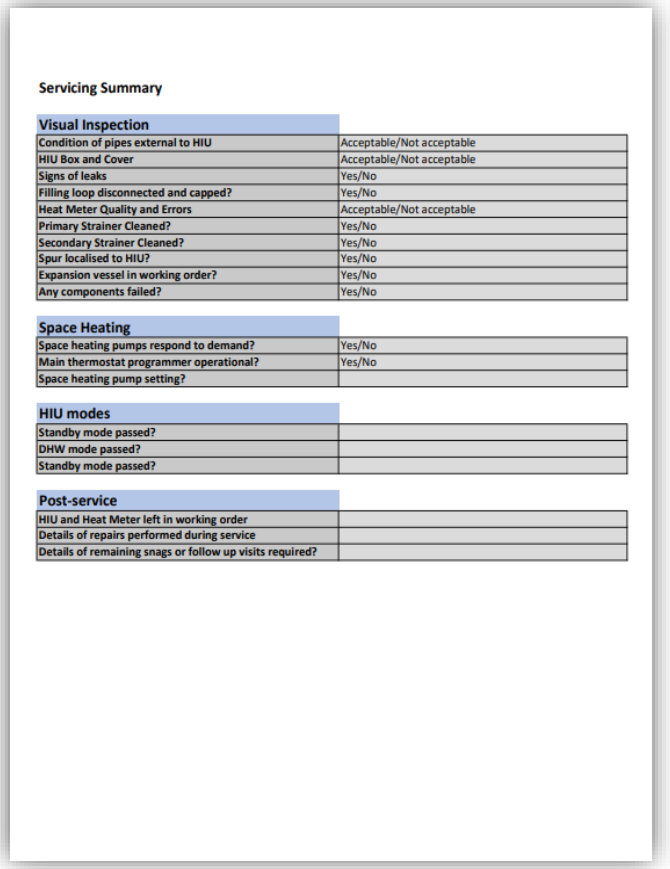
Standby Mode

	Before HIU servicing:	After HIU servicing:	Criteria passed?
Energy (kWh)			
Power (W)			
Flow rate (l/hour)			
Flow Temp (°C)			
Return Temp (°C)			
		Passed criteria?	

Comments:

DHW Mode (taken during stable DHW)

	Before HIU servicing	After HIU servicing:	Criteria passed?
Power (W)			
Flow rate (l/hour)			
Flow Temp (°C)			



Servicing Summary

Visual Inspection	
Condition of pipes external to HIU	Acceptable/Not acceptable
HIU Box and Cover	Acceptable/Not acceptable
Signs of leaks	Yes/No
Filling loop disconnected and capped?	Yes/No
Heat Meter Quality and Errors	Acceptable/Not acceptable
Primary Strainer Cleaned?	Yes/No
Secondary Strainer Cleaned?	Yes/No
Spur localised to HIU?	Yes/No
Expansion vessel in working order?	Yes/No
Any components failed?	Yes/No

Space Heating	
Space heating pumps respond to demand?	Yes/No
Main thermostat programmer operational?	Yes/No
Space heating pump setting?	

HIU modes	
Standby mode passed?	
DHW mode passed?	
Standby mode passed?	

Post-service	
HIU and Heat Meter left in working order	
Details of repairs performed during service	
Details of remaining snags or follow up visits required?	

Part 1. Testing Criteria

Heat Meter Testing Criteria

	Lower limit	Upper limit	Units
Standby Mode			
Power	0	0	W
Flow rate	0	10	l/h
Flow Temp	55	55	°C
Return Temp	40	40	°C
DHW			
Flow Temp	50	60	°C
Return Temp	20	25	°C
Space Heating			
Flow Temp	50	60	°C
Return Temp	40	50	°C

The table above outlines the acceptable ranges for various operating parameters of the heat meter during testing. This will vary on a project to project basis.

These values ensure the meter is functioning properly and accurately measures heat consumption under standby, domestic hot water usage and space heating conditions.

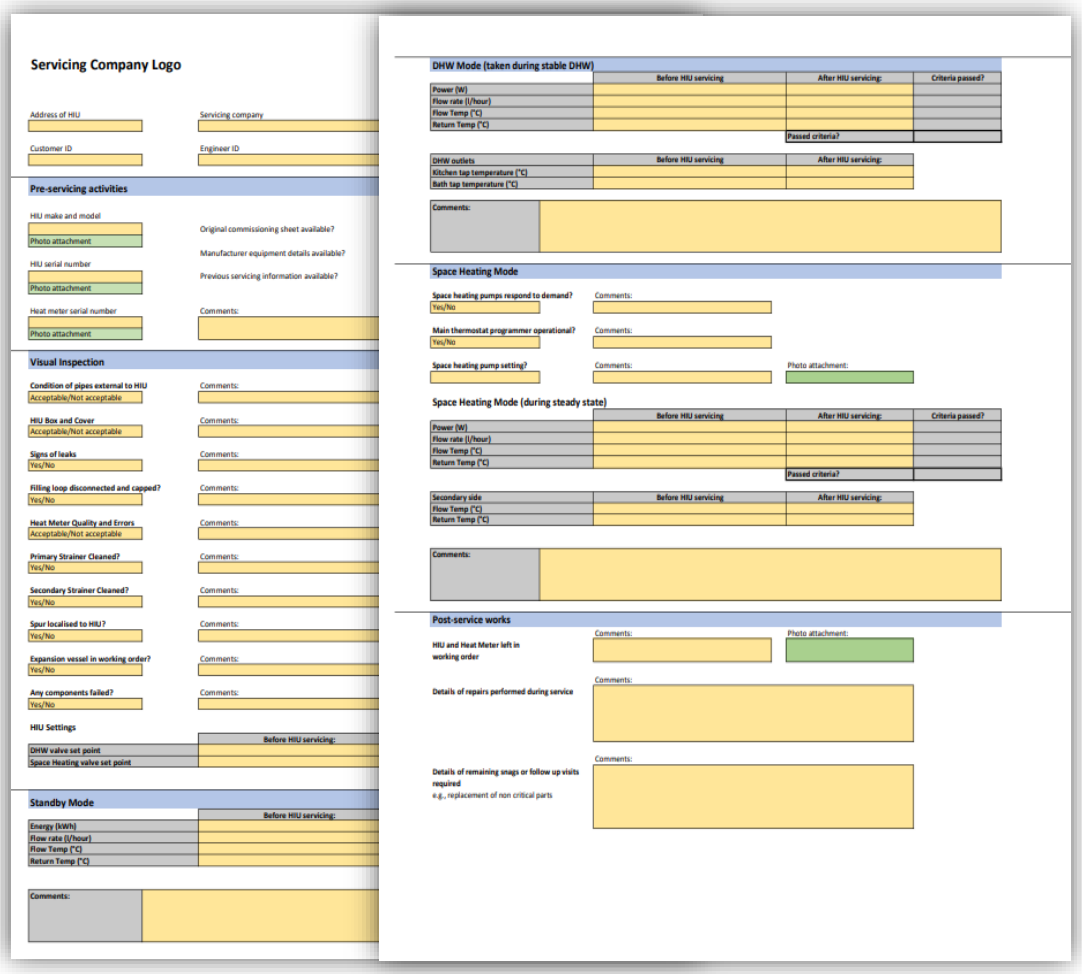
If any readings fall outside the specified ranges during servicing, it may indicate an issue with the HIU and require further investigation.

- Project Specific
- Three Key Operating Modes
- Performance Verification
- Identifying Issues

FAIRHEAT

Part 2. Servicing Template

Text
Photo attachments/links



Servicing Company Logo

Address of HIU | Servicing company
Customer ID | Engineer ID

Pre-servicing activities

HIU make and model | Original commissioning sheet available?
Photo attachment | Manufacturer equipment details available?
HIU serial number | Previous servicing information available?
Photo attachment
Heat meter serial number | Comments:
Photo attachment

Visual Inspection

Condition of pipes external to HIU (Acceptable/Not acceptable)	Comments:
HIU Box and Cover (Acceptable/Not acceptable)	Comments:
Signs of leaks (Yes/No)	Comments:
Filling loop disconnected and capped? (Yes/No)	Comments:
Heat Meter Quality and Errors (Acceptable/Not acceptable)	Comments:
Primary Strainer Cleaned? (Yes/No)	Comments:
Secondary Strainer Cleaned? (Yes/No)	Comments:
Spur localised to HIU? (Yes/No)	Comments:
Expansion vessel in working order? (Yes/No)	Comments:
Any components failed? (Yes/No)	Comments:

HIU Settings

	Before HIU servicing:
DHW valve set point	
Space Heating valve set point	

Standby Mode

	Before HIU servicing:
Energy (kWh)	
Flow rate (l/hour)	
Flow Temp (°C)	
Return Temp (°C)	

Comments:

DHW Mode (taken during stable DHW)

	Before HIU servicing	After HIU servicing:	Criteria passed?
Power (W)			
Flow rate (l/hour)			
Flow Temp (°C)			
Return Temp (°C)			
		Passed criteria?	

DHW outlets	Before HIU servicing	After HIU servicing:
Kitchen tap temperature (°C)		
Bath tap temperature (°C)		

Comments:

Space Heating Mode

Space heating pumps respond to demand? (Yes/No)	Comments:	
Main thermostat programmer operational? (Yes/No)	Comments:	
Space heating pump setting?	Comments:	Photo attachment:

Space Heating Mode (during steady state)

	Before HIU servicing	After HIU servicing:	Criteria passed?
Power (W)			
Flow rate (l/hour)			
Flow Temp (°C)			
Return Temp (°C)			
		Passed criteria?	

Secondary side	Before HIU servicing	After HIU servicing:
Flow Temp (°C)		
Return Temp (°C)		

Comments:

Post-service works

HIU and Heat Meter left in working order	Comments:	Photo attachment:
Details of repairs performed during service	Comments:	
Details of remaining snags or follow up visits required (e.g., replacement of non critical parts	Comments:	

- **Pre-service details**
- **Service**
  - Visual
  - Standby
  - Domestic Hot Water
  - Heating
- **Post-service**
  - Remedial works
  - Replacement parts/follow up visits

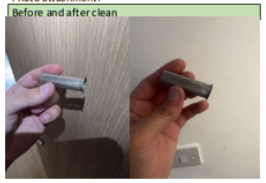
FAIRHEAT

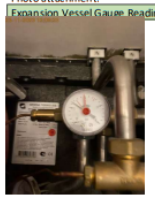
Example

Visual Inspection

Condition of pipes external to HIU Acceptable	Comments:	Photo attachment:
HIU Casing Acceptable	Comments:	Photo attachment:
Signs of leaks No	Comments: No signs	Photo attachment:
Filling loop disconnected and capped? Yes	Comments:	Photo attachment:
Heat Meter Quality and Errors Acceptable	Comments:	Photo attachment: Photo of heat meter

Primary Strainer Cleaned? Yes	Comments:	Photo attachment: Before and after clean
Secondary Strainer Cleaned? Yes	Comments:	Photo attachment: Before and after clean
Electrical isolation to HIU? Yes	Comments: Unswitched fused spur	Photo attachment: Electrical isolation of HIU
Expansion vessel in working order? Yes/No	Comments:	Photo attachment: Expansion Vessel Gauge Reading
Any components failed? No	Comments:	Photo attachment: Photo of components that have failed





HIU Settings

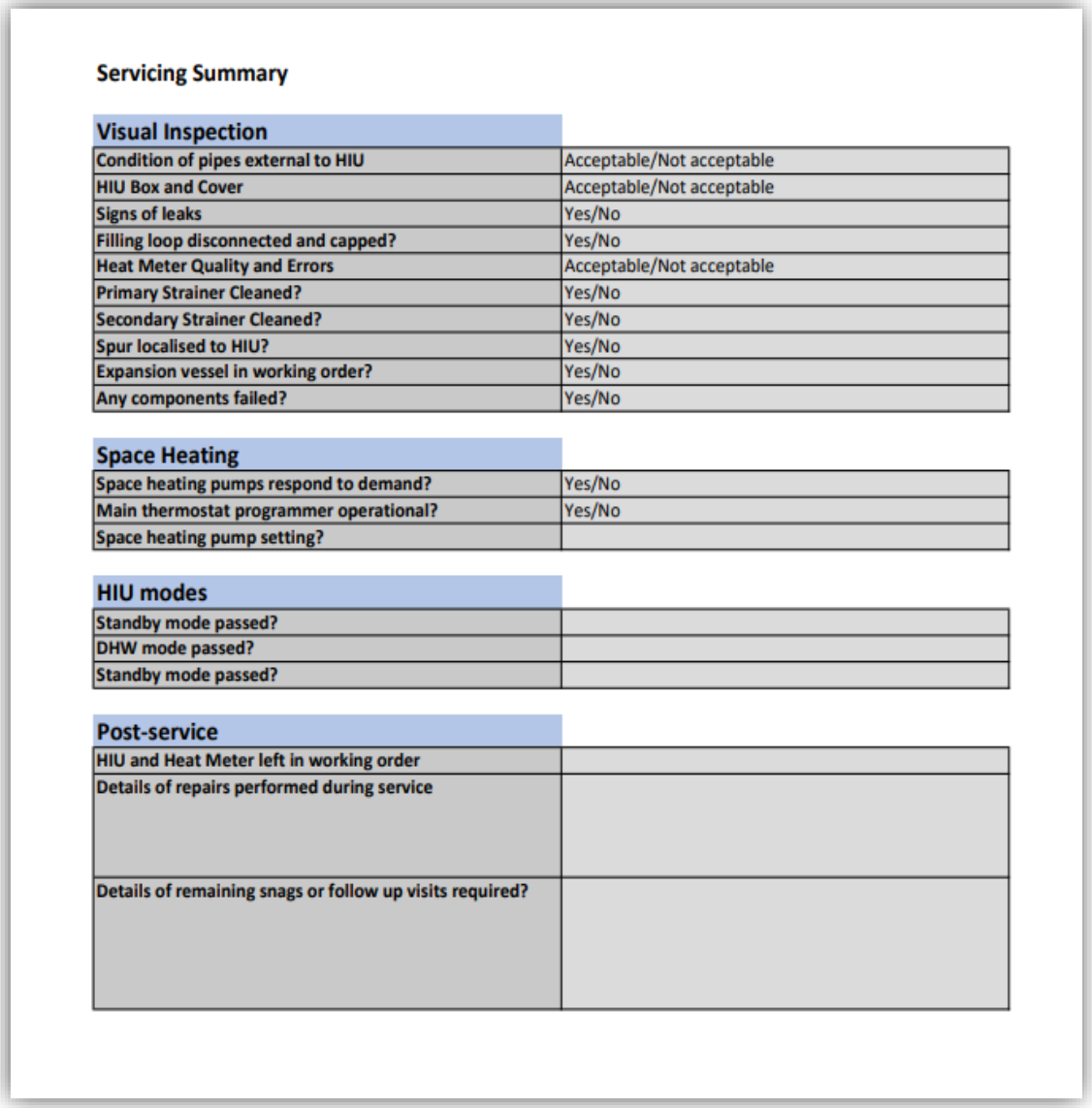
	Before HIU servicing:	After HIU servicing:
DHW valve set point	3.5	3.5
Space Heating valve set point	3	4

Standby Mode

	Before HIU servicing:	After HIU servicing:	Criteria passed?
Energy (kWh)	12,000	12,110	N/A
Flow rate (l/hour)	8	0	Yes
Flow Temp (°C)	58	55	Yes
Return Temp (°C)	56	40	Yes
		Passed criteria?	Yes

Comments:	Bypass resolved

Part 3. Summary



Servicing Summary

Visual Inspection	
Condition of pipes external to HIU	Acceptable/Not acceptable
HIU Box and Cover	Acceptable/Not acceptable
Signs of leaks	Yes/No
Filling loop disconnected and capped?	Yes/No
Heat Meter Quality and Errors	Acceptable/Not acceptable
Primary Strainer Cleaned?	Yes/No
Secondary Strainer Cleaned?	Yes/No
Spur localised to HIU?	Yes/No
Expansion vessel in working order?	Yes/No
Any components failed?	Yes/No

Space Heating	
Space heating pumps respond to demand?	Yes/No
Main thermostat programmer operational?	Yes/No
Space heating pump setting?	

HIU modes	
Standby mode passed?	
DHW mode passed?	
Standby mode passed?	

Post-service	
HIU and Heat Meter left in working order	
Details of repairs performed during service	
Details of remaining snags or follow up visits required?	

- Quick Performance Assessment
- Action Transparency
- Issue Identification

FAIRHEAT

Impact on industry

Performance improvement plan:

- Standardised template: Consistent structure and format
- Streamlined process: Reduces time spent producing and reviewing plans

HIU servicing:

- Standardised Servicing: Ensures consistent approach across industry
- Improved Data Collection: Structured format for recording information
- Enhanced Reporting: Facilitates clear and comprehensive reports

Thank you!

www.fairheat.com | info@fairheat.com

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