Options assessment

Title:	Heat Networks Technical Assurance Scheme
Type of measure:	Consultation
Department or agency:	Department for Energy Security and Net Zero
IA number:	DESNZ007(OA)-25-CLH
RPC reference number:	…
Contact for enquiries:	David.egan@energysecurity.gov.uk
Date:	…

If your measure is to be submitted for RPC scrutiny you should complete the whole form as much as you are able, given the state of policy development and available evidence. This should include the regulatory scorecard with quantified business impacts, even if this is just the best estimate at this stage. Other impacts may be left unquantified at this stage, including household impacts where quantification may not always be proportionate at this stage. When complete, the whole form should be submitted to the RPC secretariat. **Please include annexes for supporting material where relevant. This form is not expected to be published.**

1. Summary of proposal

To date the Heat Networks Market Framework Regulation has focussed on appointing Ofgem as Regulator of the heat networks market and introducing consumer protection measures. The government is now consulting on technical standards regulations for heat networks, to further improve heat network consumer experience and reduce carbon emissions from wasted heat.

Regulation is necessary as heat networks have the characteristics of a local natural monopoly, meaning that consumers do not have the option to switch away from providers offering poor service. Additionally, there are negative externalities, imperfect information and misaligned incentives in the market. These are discussed in more detail in chapter 2.

Data shows there are cases of networks with high losses between the heat generated and the heat supplied. Networks not performing at the optimum level can lead to negative consumer outcomes such as temperamental heat supply and higher prices. The Heat Network Consumer and Operator

Survey has shown heat networks have a higher proportion of heat loss instances compared to non-heat network customers. Intervention is required to implement standards and guidance to support the production of new heat networks and improve the efficiency and reliability of existing networks. Regulation will also support the expansion of metering coverage as a lack of meters on networks makes issues of this type difficult to monitor.

The regulation being consulted on aims to define technical standards which heat network operators must comply with. These include a variety of performance indicators, such as water quality, flow temperature and heat loss thresholds. Due to a lack of data on these performance indicators across the market, levels of heat losses (efficiency) are used as a broader proxy for heat network performance in this analysis. A clear correlation between high heat loss levels and other performance indicators have been identified through Heat Network Efficiency Scheme (HNES) studies.

The intended effect of this policy is to improve efficiencies, to reduce unnecessary heat generation, reducing fuel usage and carbon emissions. Additionally, network upgrades are expected to reduce the consumer detriment from outages and unreliable heat supply currently faced by some heat networks consumers. As part of this regulation, the government will ensure there is clear guidance which aims to make the construction of networks easier, hence increasing investment in the market.

This Options Assessment (OA) considers establishing minimum technical standards that heat suppliers will be required to comply with, as well as a continuation of existing market arrangements (Counterfactual). Non regulatory options, such as voluntary standards and grants, were considered but have been ruled out at the long list stage.

Many of these standards and requirements are proposals, which are not yet confirmed. Feedback is being sought on many of these measures, within the consultation that this OA accompanies.

2. Strategic case for proposed regulation

A heat network is a distribution system of insulated pipes that takes heat from a central source and delivers it to several domestic or non-domestic buildings. Heat networks are a crucial aspect of the path towards the cost-effective decarbonisation of heat and achieving net zero by 2050. In the right circumstances, they can reduce bills, support local regeneration and can be a cost-effective way of reducing carbon emissions from heating. Heat networks have the potential to provide around 20% of the UK's heat demand in a least-cost pathway to net-zero[1], up from 3% today[2].

Following the introduction of the Heat Networks Market Framework Regulations 2024, which introduced Ofgem and consumer protection organisations into the market, the government is now consulting on further regulations. Regulation is necessary as heat networks have the characteristics of a local natural monopoly and therefore consumers do not have the option to switch away from providers providing unreliable heat supply, overheating and high prices.

A market study by the Competition and Markets Authority (CMA)[3] found that, though many heat network consumers are supplied heat at comparable consumer standards to the wider energy sector, a significant proportion experience poor service, including higher levels of outages. The CMA suggest that a lack of enforceable standards for the design, build and operation of heat networks leaves customers at risk of expensive, inefficient, and unreliable networks. The report recommended that the sector should implement measurable performance indicators for service

[1] https://www.gov.uk/government/publications/net-zero-strategy

[2] CMA Market Study on Heat Networks <l https://www.gov.uk/cma-cases/heat-networks-market-study >

[3] https://assets.publishing.service.gov.uk/media/5b55965740f0b6338218d6a4/heat_networks_final_report.pdf

quality, with the objective that heat networks should be required to report against performance targets to the regulator and to customers.

DESNZ agrees with the findings of the CMA to promote technical standards and regulate heat networks to ensure adequate protections for all heat network consumers, support market growth and decarbonise at the required rate to meet the 2050 Net Zero target. The government is proposing to extend the regulatory framework for heat networks to further protect consumers, promote technical standards, and drive forward the growth and decarbonisation of the heat networks market.

A lack of standards around the construction and maintenance of heat networks means that networks can be inefficient and unreliable. There are cases of networks with high losses between the heat generated and the heat supplied. It is estimated that around 65% of domestic, communal heating networks currently have heat losses above 200W/dwelling, of which 45% have heat losses above 400W/dwelling. This is calculated using Heat Network Metering and Billing Regulation (HNMBR) data; however, networks do not report directly on this metric so there is a high level of uncertainty about the current state of the market.

The Heat Network Consumer and Operator Survey (HNCOS) 2022 and 2018 CMA report both find the heat network market to have more heating outages than other heating options. HNCOS shows that 50% of heat network consumers reported having had some loss of hot water or heating in their property over a year, significantly higher than non-heat network customers (29%). There is also significant anecdotal evidence showing poor performance on networks, with heat outages and higher bills which are often caused by inefficiencies.

Intervention is required to implement standards and guidance to support the production of new heat networks and improve existing networks to be efficient and reliable. The regulations consulted on alongside this OA aim to mitigate these issues by improving performance through promoting technical standards and increasing transparency with metering requirements.

International comparisons have been made on heat network technical standards[4]. The Netherlands have a licensing regime ensuring heat networks meet certain technical qualities including the quality of the heat and services to be supplied for small scale customers. Norway also operates a licensing regime though this focuses on mandatory connections and pricing rather than explicit technical standards. Finland and Germany currently operate a voluntary technical code, though explicit efficiency targets were not identified, Germany does specify broader energy efficiency requirements for new builds and the refurbishment of existing buildings. The voluntary codes are similar to voluntary compliance with the Heat Networks Code of Practice CP1[5], currently present in the UK. It is important to view these comparisons in context as markets such as Denmark have a much higher rate of state ownership than is present in the UK, thus reducing the need for regulation of standards. Though HNTAS will not be directly emulating any of these approaches, it is taking elements of existing approaches, including the current CP1 standards published by the Chartered Institution of Building Services Engineers.

Government intervention is required to help resolve four market failures and barriers that have been identified in the heat network market. These contribute to underinvestment in compliance with existing voluntary standards, leading to inefficiencies, poorer consumer outcomes, and negative environmental impacts.

Monopolistic characteristics - In the right circumstances, heat networks can offer the most cost-effective provision of heating and/or cooling. It is most efficient for one supplier to supply the market, or in this case supplying the heat to a pool of consumers. Most HN customers are in multi-

[4] https://assets.publishing.service.gov.uk/media/5e3bea0aed915d095784f525/international-heat-networks-market-frameworks-research-regulatory-document-review.pdf

[5] https://www.cibse.org/knowledge-research/knowledge-portal/cp1-heat-networks-code-of-practice-for-the-uk-2020-pdf

occupancy buildings where the tenants do not usually contract with the HN provider themselves and where there are contractual and practical obstacles to providing one's own heating solution. This means heat network customers have little alternative but to continue to buy heat from their existing heat supplier, giving heat networks monopoly power. In a competitive market customers could move from inefficient networks to efficient, reliable networks or install their own heating system with lower long term costs. With a monopoly heat network, prices can be raised without losing customers, therefore there is little incentive to invest to drive down costs and improve reliability as customers on an existing heat network cannot be gained or lost.

Incentives – Heat networks are often developed by for-profit organisations without full representation of the future operators or customers. This leads to misaligned incentives meaning networks are not necessarily built with efficiency prioritised. This drives the need for standards on newly constructed heat networks. The CMA's market study[2] suggested that developers could have an incentive to be myopic and try to minimise the up-front costs to the detriment of consumers, through lower build standards.

Negative externalities – For many heat networks the expected private return is not high enough to incentivise investment in improving efficiency of existing heat networks. This calculation does not factor in the social benefits of reduced carbon emissions or improved air quality. It also likely does not factor in the non-monetised benefits to customers of increased reliability and reduced overheating. This can lead to efficiency-enhancing investment being below the socially optimum level.

3. SMART objectives for intervention

As set out within the consultation document, there are five clear policy objectives:

1. **Improve consumer outcomes** by ensuring that all heat network consumers experience a good quality of service and a reliable supply of heat. For consumers, this means addressing issues such as unplanned outages, overheating and inconsistencies in hot water and heating temperatures throughout a building. Though the headline options refer to reductions in heat losses, the improvements driving these have also been shown to deliver improvements in reliability and reduced overheating.

2. **Improve affordability** by reducing operational costs of networks. Improving the performance of heat networks enables operators to run their networks more cost-efficiently, reducing ongoing operation and maintenance costs as well as extending network lifespans to spread end of life replacement costs over a longer period of time. Performance improvements deliver savings for consumers by reducing the amount of energy and fuel required to provide heat, improving the affordability of heat. There is however an expectation that in the short run, upgrade costs will be passed on to consumers.

3. **Improve reputation and investor confidence** in heat networks by guaranteeing high technical standards are met for new build networks and ensuring that the standards of existing networks are raised over time.

4. **Reduce carbon emissions** by making heat networks more efficient. Heat networks that are performing well require a significantly lower amount of fuel to meet heat demand needs, reducing the carbon emissions and contributing to the UK's target to reach net zero by 2050.

5. **Build evidence** by better reporting of information about technical quality to support understanding of the heat network sector and the development of future heat network policy.

In order to achieve these aims, the policy must meet these six core principles:

1. **Outcomes oriented** - HNTAS focuses on measurable outcomes rather than rigid processes. The goal is to achieve real-world improvements in heat network performance.

2. **Preventative** - We aim to prevent issues before they arise. Proactive measures, such as adherence to technical standards during planning and construction, contribute to long-term success.

3. **Proportionate** - The scheme balances requirements with practicality. We avoid unnecessary burdens on operators and consumers while ensuring meaningful impact.

4. **Deliverable** - HNTAS sets achievable goals. It is designed to be practical and effective, delivering tangible results.

5. **Adaptable** - The heat network landscape is ever evolving, and HNTAS must adapt accordingly. Flexibility allows us to address emerging challenges and seize opportunities.

6. **Enforceable** - Compliance with technical standards is essential. HNTAS provides mechanisms for enforcement, ensuring accountability.

We consider these policy aims and outcomes over a long time period as some networks have up to 10 years to reach the regulated standard and then there will be long term benefits of reduced fuel usage for the network. For this reason, a 30-year appraisal period has been used to capture the full long term policy effects.

The technical standards policy sets heat loss thresholds (an interim and final certification level) which heat networks must comply with, measured by watts per dwelling. HNTAS also sets out a range of KPIs that the network must meet. However, this OA uses the heat loss threshold as a proxy, assuming that meeting these KPIs aids in reducing heat loss below the threshold. We also assume that inefficiency often reflects that a network is poorly constructed or designed and is likely to be unreliable or of low quality, based on observation from the department's heat network capital schemes. Therefore, as networks meet heat threshold levels, customers will experience improvements to the service and reliability of their network. Heat networks will require assessments and certification from an authorised body to advise on improvements to be made and validate that they meet the regulated threshold and KPIs. Heat thresholds will have clear dates which operators will need to improve their networks by to meet the regulation. By having an interim threshold, the policy targets the worst performing networks in the first instance and allows a longer time frame for the more stringent threshold, allowing for engineering and assessment capacity.

4. Description of proposed intervention options and explanation of the logical change process whereby this achieves SMART objectives

Preferred option- Option 1a: 400W/dwelling initial heat loss threshold, 200W/dwelling final threshold. Regulations include existing networks with 11 or more dwellings.

The preferred option includes regulation to introduce a Heat Network Technical Assurance Scheme. Our current preferred option for technical standards is 400W/dwelling heat loss as an interim threshold and 200W/dwelling heat loss for final certification. Whilst this is the preferred option at present, this is subject to further research and consultation responses. Findings from the HNTAS pilot scheme will be the main source of further information on this area.

HNTAS is planned to have an 8-year implementation period to ensure the feasibility of upgrades given current technical skills constraints, ensuring the policy achieves its objective of being deliverable. Heat networks will have to register within the first year following the implementation of HNTAS requirements. They will then be required to meet the interim threshold within 3 years and achieve final certification within 8 years. There is an option for older networks to declare as end of life networks and then submit a plan to demonstrate that their replacement works will meet the technical standards required of new builds. This makes the scheme proportionate as it prevents networks having to do costly upgrades in instances where it would be cheaper to fully redesign or where the network will need to do end of life upgrades in the next few years regardless. New networks will also be required to meet HNTAS standards, including submitting plans throughout the design and construction phases and ongoing monitoring once operational. The policy scope covers all heat networks to ensure maximum improvement to consumer outcomes and reputation. The consultation seeks views on the scope of HNTAS, with the current preferred option excluding existing networks with less than eleven domestic dwellings and new builds with less than six domestic dwellings. The analysis within this OA has excluded these networks and further details, as well as the costs and benefits of this option, are provided within the regulatory scorecard.

Risks to delivery against objectives:

There is a risk that if the costs to make improvements are too high some heat network operators could choose to leave the market. This would damage customer outcomes, heat networks reputation and investor confidence. To mitigate this risk heat networks will be able to self declare as ‘end of life’ if the costs of upgrade cannot be justified and a separate process set out in the consultation document will be followed to ensure customers are protected and the heat network is replaced in an effective manner. Furthermore, separate heat networks regulation is due to be implemented regarding ‘step in’ which will protect heat network customers if their heat network operator has financial difficulty.

Secondly there is a risk that due to the monopoly power of heat networks the lower running costs may not be passed on to heat network customers. This means there is a significant dependency of HNTAS on the implementation of planned pricing regulation which will be enforced by OFGEM. Pricing regulation will seek to ensure fair prices are charged, but will not address the issue of heat networks being expensive due to high running costs. HNTAS and pricing regulation therefore are complementary in effectively delivering improved affordability.

Thirdly this option will lead to significant levels of upgrade works being required. If the market is not prepared there could be a shortage of skills required to deliver these upgrades. This is another reason why a phased approach has been chosen, to allow time for the necessary recruitment and upskilling.

The cost of meeting the 200 W/dwelling threshold is estimated to be over £2.9bn, a breakdown of this is available in the “Investment and improvement costs” section of Appendix A at the bottom of this document. There is a risk that these costs are passed on to heat network customers, potentially reducing affordability in the short to medium term. The private payback period of investments observed in HNES varies significantly ranging from 2 years to over 30 years, with the average across each funding round typically being below 5 years. We acknowledge that this data is skewed as it only represents networks which have chosen to pursue upgrades, albeit with a grant covering 50% of the costs. This means that there is a risk of reduced affordability on some networks which take significantly longer for upgrades to pay for themselves. However, once the investment is

undertaken and Ofgem price regulation takes effect, affordability and other consumer outcomes are expected to improve.

5. Summary of long-list and alternatives

Do nothing (counterfactual)

The current voluntary standards and grants available within the market are set out within the non-regulatory options. This includes CP1 which outlines advised voluntary technical standards and HNES which is a government grant scheme to help heat networks finance capital works to improve the efficiency and reliability of their network.

In the absence of sufficient regulation, the monopolistic characteristics of heat networks can enable operators to offer poor service without the threat of losing customers. This is because customers cannot change supplier, leaving them stuck on networks with low standards. Without intervention, heat networks can continue to underperform, and new builds may be built to low standards with high operating inefficiencies.

The analysis conducted within this OA is compared to the counterfactual scenario in which networks are assumed to not invest in improving the efficiency of their networks. Ongoing maintenance costs are included within the counterfactual and hence are not outlined as costs from this policy.

Non regulatory options:

Throughout the development stage of this policy, non-regulatory options have been considered but ruled out as they are insufficient to meet the policy aims. The two key non-regulatory options are outlined below.

Voluntary standards

The Chartered Institution of Building Services Engineers (CIBSE) publish the Heat Networks Code of Practice (CP1) which launched in 2015 and was updated in 2020. This documentation defines voluntary minimum technical standards for the design and build of heat networks. CP1 advises on a range of structural and performance indicators including pipe sizes, water return temperatures and the quality of heat interface units. CP1 states that, when designing systems for multi-residential buildings, the annual heat loss from secondary systems should not exceed 100 W/dwelling on average. However, this value should not be treated as a target and the guidance advises that well designed systems should aim to achieve heat losses of less than 50 W/dwelling.

Although these are welcome initiatives, heat suppliers are under no obligation to join and/or comply. The HNMBR data shows only a 23% compliance rate to the 100 W/dwelling threshold and 8% compliance to 50W/dwelling. Data from HNCOS shows that just 7% of operators reported being a member of a voluntary standard scheme. Over 75% of operators were aware of at least one of the industry schemes, with 42% aware of CP1. Despite a high level of awareness, there is a lack of voluntary compliance.

Heat Trust is a non-profit organisation that champions heat network standards and consumer outcomes. Heat Trust operates on a voluntary basis, with 122 heat networks registered with Heat Trust, covering 79,8000 customers.[6] As with CP1 guidance, this alone is not sufficient as it leaves

[6] https://www.heattrust.org/our-members

thousands of networks without any obligation to meet standards and nearly 400,000 domestic customers on non-Heat Trust networks.

Voluntary standards do not have negative impacts on small businesses as there is no obligation to comply if it will be burdensome for them, but they can still access the guidance and follow the standards if they feel it is advantageous to do so. However, it could negatively impact small businesses that are heat network customers, as they may remain on a poor performing network if the operator does not follow the standards.

A potential option is to update the scope and guidance provided within this documentation and increase market awareness of the standards. The standards could also provide guidance and encouragement for heat networks to move to low carbon heating methods such as heat pumps and energy from waste. However, given the very low compliance rate despite relatively high awareness with the current voluntary standards and the monopolistic characteristics of the market, there is unlikely to be a significant increase in compliance. This option would therefore have minimal impact on the policy aims of improving consumer outcomes and affordability.

Grants

The UK government currently provides grants to help finance the improvement of efficiency on heat networks through HNES, which has been running since 2023. It has up to £77m in grant support and is currently planned to run until 2027/28. Heat networks apply to this scheme and the government provides grants to help finance the cost of work to improve the overall efficiency and reliability of the network. The first four rounds of the scheme have provided £28M worth of government grant to heat networks which cover a total of around 33,000 residents. However, this only covers 7% of residential customers and leaves a substantial number of customers on inefficient networks.

Grants are accessible for all sizes of business, including small and micro businesses; however, smaller businesses may be disadvantaged due to a lack of awareness of the scheme or insufficient expertise for the planning and application process. This may cause a bias towards larger networks receiving the funding and reaping the benefits from the upgrades.

This policy has and continues to be important for the improvement to sub-optimal heat networks in the short and medium term. However, a more long-term focus is required to ensure all networks are brought up to acceptable standards and to ensure that new networks are designed to a high calibre. This is vital for the long-term reputation and growth of the market. Funding alone only partially meets the policy objectives of improving customer outcomes, reducing bills and lowering carbon emissions as it does not achieve this for all customers. The level of taxpayer funding required to deliver the objectives of this policy purely through grants would be unaffordable.

Alternative regulatory options:

100w/dwelling final threshold

Multiple options for the level of the heat loss threshold have been considered throughout the policy development for technical standards. This option considers a threshold that requires networks to improve their efficiency even further than the preferred heat threshold set out below. This would require more extensive work by heat networks, increasing both the quantity of heat networks that would need to do upgrades and increasing the extent and cost of these works. These further reductions in heat losses would improve carbon emissions and could result in an even better service for customers.

However, this option has been discounted due to its lack of deliverability and proportionality. A stricter threshold would mean that more networks would need to conduct works, for example a 100w/dwelling threshold would mean c.80% of the current market may need to make improvements.

Given the current low level of expert heat network engineers, it is unrealistic to assume that all these networks would be able to upgrade in the regulations time frames. This additional demand in the market for both engineers and compliant elements could drive up the price, making the cost burden on businesses even higher. These costs may be disproportionate as the preferred option achieves all the policy aims and hence these additional costs reap minimal marginal benefit. With this extensive work, there is also a risk that network improvements will be disruptive to customers (e.g. disruptive work within properties) and the high costs will be passed through bills to households. Both these outcomes would reduce customers benefits.

A stringent heat loss threshold will incur extra costs on all business sizes as there are additional costs to achieving this lower level of heat loss. This could disproportionately affect small and medium businesses as they may have to pay a premium to contract external engineers to assess and complete this work, whereas larger businesses may have this expertise internally available. This policy could positively impact small businesses that are heat network customers as they may experience improvements in their networks performance as a result of these standards. However, there is a risk that the heat network will pass on costs to customers, including to small and micro businesses.

New builds only

There is an option to only regulate technical standards on heat networks built after the introduction of the regulation. This policy option has been considered due to the initial capex costs that regulation on existing networks would incur and the risk that this would be passed on to consumers, or borne by social housing providers. Regulation on new builds would require heat networks to plan and validate that they will meet technical standards within the design stage of the project and then to then receive verification that they have achieved this once the network is operational.

Regulation of just new builds has been removed as an option due to its failure to achieve multiple policy aims listed above in this OA. By leaving existing networks without regulation, their consumers will be unprotected from poor performing networks and at risk of high prices due to inefficiencies on the network. The domestic customer market is currently estimated at just under 500,000 households, leaving many households at risk of poor consumer outcomes on an essential utility. There a many vulnerable customers on heat networks who could be inequitably impacted by potential high prices. Excluding existing networks from regulation could also damage the reputation of heat networks as instances of poor performance will remain. This could act as a blocker to future heat network investment, slowing down the growth of the market. Additionally, leaving these networks with high levels of inefficiency does not meet the aim of reducing carbon emissions, with the policy estimated to save 11.1 MtCo2e of carbon savings over the 30 year appraisal period, assuming existing heat networks decarbonise over time. However, if existing heat networks were not to decarbonise or decarbonised more slowly than expected, this could rise to up to 29.9 MtCo2e.

By excluding existing networks, this ensures that all existing small and medium heat suppliers will avoid regulatory burden. However, small new builds will still be subject to these regulations. This cost can be mitigated by providing an exemption for new networks with less than six domestic dwellings (or equivalent capacity). Six has been selected because the core “elements” under which a network would be assessed and certified – for example, an energy centre and a distribution system – would not be commonly present below the level of six dwellings. At five dwellings and below, equipment is more likely to be comparable to a domestic property than a heat network as defined by the elements in HNTAS. The proposal is therefore that under all shortlisted options no network below six dwellings, or capacity equivalent, would be required to meet the HNTAS specifications or engage with the Code Manager.

Requirements for existing Heat Networks exclude all communal networks

Applying technical standards regulations for existing networks to just district heat networks have been considered as this would significantly reduce the scale of upgrade works required by the

sector through exempting 78% of existing British heat networks. It would also prevent disproportionate requirements being placed on very small heat networks.

This option however has not been taken to the short list as this would significantly hinder the delivery of the policy objectives. 47% of British, domestic heat network customers currently live on communal heat networks and a single communal heat network can supply hundreds of customers. A blanket exclusion of communal heat networks would significantly dimmish the positive impacts of the policy. To address the issue of disproportionate requirements being placed on very small heat networks the short list options include exemptions based on network size.

Two of the four shortlisted options consider an exemption of existing networks with below eleven dwellings, with the other two applying the same exemption of below six which is recommended for new builds. The rationale for eleven this was derived via stakeholder engagement and discussion, including at the HNTAS Programme Board. This exclusion makes technical sense whilst also removing costs to the smallest heat network businesses whilst simultaneously protecting consumers. The size profile of new build networks cannot be predicted accurately; however, on the existing stock this would only exclude 3% of customers at the below eleven level and 1% at the below six level, but this would equate to 24% and 13% of registered networks respectively. We anticipate there to be fewer small networks built in the future as policies such as zoning encourage the growth of larger networks.

Requirements for existing Heat Networks exclude networks with only non-domestic connections

Applying technical standards regulations for existing networks to just heat networks with communal connections has been considered as for these networks the consumer outcome and affordability objectives of the policy are less relevant if non-domestic customers have more power to negotiate with heat suppliers. This measure would exempt roughly 25% of existing networks from HNTAS and reduce upgrade costs of the policy by roughly £1bn (32%) compared to the preferred option.

This option would however, significantly reduce the policy impact on the other three objectives, in particular reducing carbon emissions. These would be expected to reduce by 6.0 MtCo2e in a scenario where existing heat networks decarbonise and 15.9 MtCo2e if they do not. This is valued using Green Book values as a loss of £1.9bn (47%) or £5.5bn (50%) respectively in carbon benefits.

There is also a risk that this policy would create a perverse incentive for existing heat networks with both domestic and non-domestic customers to disconnect their domestic customers. HNMBR data shows that 6% of registered heat networks have both domestic and non-domestic customers.

For these reasons this option has not been taken to the short list in this options assessment.

Exclude end of life networks fully from regulation

End of life networks will require the most amount of work but also offer the largest potential benefits as they are often the lowest performing based on HNMBR data. Excluding these from the policy would create an incentive for heat networks to declare as end of life and in extreme circumstances, potentially reduce heat network performance to qualify as end of life. As a result, this has not been considered as a policy option.

Though not taken forward for full appraisal, the relative cost and benefits specifically for end of life networks have been considered in the analysis. There is limited data available on the cost of complete refits of heat networks and views on the approach to end of life networks are being sought in the consultation. The modelling assumptions for these costs are derived from major upgrade costs in capital scheme data, sense checked against anecdotal evidence on a small number of networks and against the expected costs to build new heat networks taken from Green Heat

Network Fund and Heat Network Zoning policies. This is an average of cost per dwelling of c.£9,500. On the other hand, these networks have heat loss levels as high as 80%, meaning overall we expect a positive SNPV from the typical end of life heat network undergoing a refit.

6. Description of shortlisted policy options carried forward

Option 1b: 400W/dwelling initial heat loss threshold, 200W/dwelling final threshold. Regulations include existing networks with six or more dwellings.

This option mirrors Option 1a, except the scope for applying HNTAS regulations to existing networks is reduced from eleven dwellings or above to six dwellings or above. This reduces the expected rate of exemptions due to size from 24% to 13% of networks and 3% to 1% of dwellings. Views are being sought in the consultation on the appropriate level. Six dwellings has been selected as below this level equipment is more likely to be comparable to a domestic property than a heat network as defined by the elements in HNTAS.

As this option will bring more heat networks and heat network customers into scope, it would be expected to increase delivery against the policy objectives, however due to the very small increase in scope in terms of customers and heat delivered, the increase would be marginal. This has not been selected as the preferred option at this stage as the small increase in delivery of policy objectives is thought to be offset by the additional burden on small heat networks, which would be disproportionate compared the impact on larger heat networks.

Option 2a: 400W/dwelling final heat loss threshold. Regulations include existing networks with eleven or more dwellings.

This option mirrors option 1a but removes the final heat loss limit of 200W/dwelling.

The Heat Network Technical Assurance Scheme could set the final heat loss threshold at 400W/dwelling, without an additional, more stringent threshold as set out within the preferred option. This option would significantly reduce costs on business as the magnitude of work to meet the standards would be lower. It would also result in fewer networks having to do any work, with only 40% of networks having to do upgrades compared to 56% in Option 1a. This option would operate in the same way as the preferred option, giving networks 3 years to meet the threshold.

This option would partially meet the policy objectives as all the worst performing networks would improve their efficiency, likely reducing carbon emissions and improving consumer outcomes. This is also likely to improve affordability in the long run for customers. However, this threshold represents a relatively low level of efficiency in which consumer outcomes may still not be optimal or equivalent to standards on non-heat network heating systems.

This option has lower costs on small businesses as they will not be required to do as much work to meet the regulated threshold, compared to the preferred option. This would also have an exclusion level with existing network with less than 11 domestic dwellings and new builds with less than 6 domestic dwellings being exempt from the regulation, ensuring the policy does not implement costs on the smallest networks.

Research conducted by specialist heat network consultants found this threshold to be easily deliverable with greater scope for continued improvement. Anecdotal evidence finds that customers may continue to be subject to poor outcomes on networks operating at a 400W/dwelling threshold. This means that there is further potential to improve the state of the market, both to improve consumer outcomes and reduce carbon emissions. Therefore, regulation can go further to ensure objectives are maximised.

Option 2b: 400W/dwelling final heat loss threshold. Regulations include existing networks with six or more dwellings.

This option mirrors Option 2a, except the scope for applying HNTAS regulations to existing networks is reduced from eleven dwellings or above to six dwellings or above. This reduces the expected rate of exemptions due to size from 24% to 13% of networks. Views are being sought in the consultation on the appropriate level.

Summary of value for money analysis (2026 prices):

The rate of decarbonisation of existing heat networks plays a significant impact on the impact of HNTAS. This is because improved efficiency will result in lower gas consumption without decarbonisation, but lower electricity consumption if existing heat networks replace their gas boilers with low carbon options in future. Due to uncertainty over how quickly existing heat networks decarbonise both scenarios are reflected below. A 30 year appraisal period has been used to reflect the expected life of heat networks and the long term nature of the policy. A full breakdown of the appraisal and sensitivity analysis is available in Annex A.

Assuming existing heat networks **do not** decarbonise their energy centre

Value For Money: Total present value (£m)	Option 1a (preferred)	Option 1b	Option 2a	Option 2b
SNPV	£6,155	£6,178	£5,325	£5,342
Benefit Cost Ratio	2.53	2.53	2.92	2.91

Assuming existing heat networks decarbonise their energy centre over time

Value For Money: Total present value (£m)	Option 1a (preferred)	Option 1b	Option 2a	Option 2b
SNPV	£1,971	£1,966	£2,164	£2,162
Benefit Cost Ratio	1.49	1.49	1.78	1.77

Though Option 1b has the highest Social Net Present Value, this is very marginal and the added benefit compared to 1a is offset by the burden it would place on very small heat networks. Option 2a and 2b offer lower SNPVs in a scenario where existing heat networks do not decarbonise, but this is almost equal to Option 1a if existing heat networks decarbonise fairly rapidly following the implementation of HNTAS. This is because Option 1 will involve more improvement works to be completed for networks which perform closer to, but still below recommended standards and for these networks carbon savings play a larger role in delivery of a strong SNPV. As there is currently not a specific policy being introduced to decarbonise existing heat networks and the reluctance to undergo other improvement works voluntarily, observed for the worst performing networks, Option 1 is expected to deliver the highest SNPV.

Options 2a and 2b have a higher benefit-cost ratio because the largest return is expected to come from bringing the worst performing networks up to an acceptable standard. Though a net positive value is expected from improving networks below, but more close to, the recommended standard, these have a lower BCR.

Ultimately Option 1a has been selected as the preferred option due the better delivery against policy objectives, as explained in the previous section and the expectation of a higher SNPV in the most likely scenario.

Small and Micro Business Impacts and Mitigations

Small and micro business heat network operators.

Analysis from the 2022 Heat Network Consumer Operator Survey (HNCOS)[7] showed 19% of heat network operators employed fewer than 10 employees suggesting they are a micro business and 20% employed between 10 and 49 employees suggesting they are a small business. This shows the proportion of operators, but not the proportion of heat networks or the proportion of heat demand operated by SMEs. Further analysis showed that 11% of these operators with fewer than 49 employees identified were local authorities or other government/public bodies. This suggests that at least some of the suspected SMEs identified in the survey were not SMEs. A further 46% of the suspected SMEs identified were operated by housing associations, facility management companies, energy service companies (ESCOs) or charities/NGOs. These types of entities may have had a heat network workforce below 49 employees but with a larger overall workforce. This suggests that the true proportion of small and micro heat network operators may be smaller than the figures suggested by survey data.

This policy includes a minimum exclusion level which is the key feature of the regulation to minimise costs on small and micro businesses. HNTAS sets an exclusion level for existing network with less than 11 domestic dwellings and new builds with less than 6 domestic dwellings in the preferred option. These networks are then exempt from the regulation, ensuring the policy does not implement costs on the smallest networks.

The less than 11 domestic dwelling exclusion for existing networks will exclude roughly 24% of networks. When compared to the estimated proportion of operators which are small or micro businesses it is likely many of these businesses will be exempted from regulation, especially in cases where they run a very small operation.

Further evidence on the expected impact of HNTAS on small and micro businesses is being sought in the consultation.

Small and micro business heat network customers

There is an important trade off when considering the impact of HNTAS on small and micro businesses. As well as being operators, they can also be customers of heat networks, often without the same level of negotiating power as larger businesses. This is a key consideration when the exclusion of heat networks supplying only non-domestic customers was considered.

This regulation protects small and micro businesses by requiring their heat supplier meets the outlined standards which are expected to improve the cost, reliability and performance of heating provision. This is beneficial to small businesses connected to a network, especially those that require heating for their business. In combination with HNTAS, separate consumer protection measures are also scheduled to be introduced in 2026 which will benefit small and micro business customers of heat networks.

7. Regulatory scorecard for preferred option

Please provide quantitative estimates and qualitative descriptions of impacts under each heading in the following sections. The right hand column for directional ratings should be based on the description of impact and the sign of the suggested indicator (NPV, NPSV, all impacts): **Green** – positive impact, **red** – negative impact, **amber** – neutral or negligible impact, **blue** – uncertain impact. Please use the colours in the examples shown below, as these are suitable accessible colours. Please see BRF guidance technical annex for definitions.

Part A: Overall and stakeholder impacts

[7] Heat network consumer and operator survey (2022) - GOV.UK

(1) Overall impacts on total welfare		Directional rating Note: Below are examples only
Description of overall expected impact	Provide a qualitative description of the overall expected impact of the regulation on social welfare. Where this is driven by groups other than businesses or households, please specify. The overall expected impact of HNTAS under the central scenario is positive, although under one sensitivity scenario the monetised impact was negative. We expect HNTAS to have significant upfront costs but these will be netted off in the long run through fuel savings and reduced carbon emissions. As shown within sensitivity analysis, this will vary significantly dependent on future fuel prices and heat network technology. In addition, improved customer outcomes and network longevity are also expected as non-monetised benefits. See summary of value for money analysis in section 5 and Annex A for full details.	**Positive** **Based on all impacts (incl. non-monetised)**
Monetised impacts	The largest, monetised cost of HNTAS will be the capital cost to business. The significant benefit is the fuel saving and carbon emissions savings, with the former being a business benefit, with the expectation this would be passed to consumer and the latter being a social impact. Full monetised impacts set out in Annex A and SNPVs included in chapter 6.	**Positive** **Based on likely £NPSV**
Non-monetised impacts	This policy is costed based on reaching heat thresholds, however HNTAS includes other performance indicators such as water quality and flow temperature stability that may lead to additional costs to operators. We assume the heat loss threshold to be a proxy that is likely to require improvements to these other indicators in order to reach this performance level. In addition to the benefits which have been monetised, significant non-monetised benefits are forecast relating to: • Reduction in consumer detriment including outages, overheating and complaints. • Improved water quality lengthening the life span of networks – This reduces replacement expenditure within the market, lowering costs for business. • Investment and industry growth – Better guidance is likely to make the design and construction of networks easier. Also, an improvement in the reputation of heat network outcomes is likely to help attract investment into the market. Full non-monetised impacts set out in Annex A.	**Positive**
Any significant or		**Neutral**

adverse distributional impacts?	Distributional impacts are outlined within the business and household impact sections	

(2) Expected impacts on businesses		
Description of overall business impact	There are expected to be considerable costs to businesses that are currently operating networks which are below the regulated efficiency level. This will be in the form of upfront capex costs to complete infrastructure upgrade works to ensure the network meets the standards. Networks that are already compliant with the heat loss thresholds and new build networks will not be subject to these capex costs. There are also costs for all heat network businesses resulting from assurance processes such as external assessments and certification requirements. In the long run, networks will make savings on their fuel usage as network efficiency improves. This reduction in fuel usage will save on businesses costs. Based on HNES grants we observe significant variation in the pay back period of the full capex costs, ranging from 2 years to over 30 years, with the average across each funding round typically being below 5 years. We acknowledge however that this data is skewed as it only represents networks which have chosen to pursue upgrades, albeit with a grant covering 50% of the costs. Though we expect fuel savings to outweigh upgrade costs over the appraisal period, when expected costs to business of assurance are added the overall impact on business becomes narrowly negative, as shown in the monetised impacts.	**Negative**
Monetised impacts	Business NPV (if available) -£259m EANDCB of £12.9m. Direct cost to business (Equivalent Annual) are £201.8m, of which £50.5m relate to admin costs. Overall costs to business include the capex costs of upgrades (c.£2.9bn) and assurance costs (c.£1bn). The benefits include the resultant savings from fuel usage reduction (c.£3.3bn) and pumping electricity savings (c.£0.3bn). A full breakdown is included in Appendix A. No pass through to households has been deducted from these figures. The extent of pass through to households will be dependent on the network and its ability and willingness to absorb or finance the costs, along with planned pricing regulation.	**Negative**
Non-monetised impacts	Having a more efficient and reliable network is likely to reduce unexpected problems which could reduce the burden on emergency engineering capacity in the long run. KPIs such as water quality improvements are expected to increase the lifetime of a heat network, saving businesses replacement costs in the long run.	**Positive**

Any significant or adverse distributional impacts?	Specific business sectors - There will likely be a disproportionate impact on the worst performing heat networks as they will have the most extensive work to complete. Due to a lack of data, it has not been possible to identify if this issue impacts specific business sectors such as housing associations or local authorities. Regional impacts - Similarly to sectors, it is not possible to identify if some regions have worse performing networks than others. Regions with more heat networks will both face higher levels of cost but also reap the benefits of better performing networks.	**Neutral**

(3) Expected impacts on households		
Description of overall household impact	If networks pass on some of the capex costs to households through bills, this will negatively impact heat network customers in the short/ medium term. However, there are expected to be fuel savings in the long term which may be passed on to consumers in lower bills. It is difficult to know the level of pass through from businesses to households and will vary dependent on the type of heat network, however, in combination with heat networks pricing regulation planned for 2026 we expect bills will be reduced to reflect the lower running costs. If all assurance costs are passed through to households as well this would result in a small negative monetised impact, though these are expected to affect customers differently as the vast majority will occur during the design and construction of new heat networks rather than during the operation, whilst heat is being supplied to customers. There is a clear non-monetised positive impact on households as improvements to the network will deliver a more reliable heat supply to customers and reduce overheating.	**Positive**
Monetised impacts	All costs to households are those passed through from businesses so to avoid double counting have only been counted under business costs. If all upgrade costs and fuel saving benefits are passed through, which relies on future pricing regulation, then net direct cost to households annual equivalent would be -£37.6m meaning there would be an overall benefit over the 30 year appraisal period. In the short to medium term however there would be a net cost to households, because as discussed in the business impact, we observe significant variation in the pay back period of capex costs, ranging from 2 years to over 30 years.	**Neutral**

Non-monetised impacts	The significant impact on households is the expected improvement in the service and reliability of their networks. Full description in Annex A.	**Positive**
Any significant or adverse distributional impacts?	A full Public Sector Equalities Duty assessment has been carried out. A summary is included below. Impacts will mainly be felt by customers on poor performing networks, there is not a regional aspect to this, though heat networks in general are mostly found in built up, densely populated areas. There has not been sufficient data to determine how requirements to upgrade are distributed across customers with different protected characteristics, but data is available on heat network customers more generally. In 2022, the results of the Heat Network Consumer Survey (HNCOS)[7] commissioned by the government found that 31% of heat network consumers had at least one person aged 65 or over. This is a disproportionately elderly consumer base when compared to the general population, where 18.6% of people are in this age category. Furthermore, the HNCOS found that, for 29% of households on a heat network, the main earner is retired, compared with 25% of households in the general population. A significant proportion of heat network consumers are impacted by a disability. HNCOS found that 35% of heat network consumers reported having physical or mental health conditions or illnesses lasting or expected to last for 12 months or more, and 27% reported having a long-term illness, physical or mental health problem which limits their daily activities. This is a little higher compared with 24% of the general population as found by the Family Resources Survey (2022-2023). Other groups with protected characteristics were not found to be overrepresented amongst heat network customers. Though not a protected characteristic HNCOS also found that 44% of heat network customer rent from a local authority, housing association or similar.	**Uncertain**

Part B: Impacts on wider government priorities

Category	Description of impact	Directional rating
Business environment: Does the measure impact on the ease of doing business in the UK?	- Technical standards regulation has the potential to act as a barrier to entry as investors may be dissuaded from having to build to certain standards. However, research conducted by Fairheat has found that technical standards will save new networks capex costs and hence networks are unlikely to be discouraged from building. They may also find extensive guidance makes the design and build process of a new network easier. The benefit of the full market framework regulatory landscape is its aim to improve the image of heat networks. Customer protections and improved efficiency will improve households experience on a heat network. This makes heat networks more attractive to consumers and a more stable market for businesses to invest in.	**Neutral**
International Considerations: Does the measure support international trade and investment?	There is a potential indirect impact on trade if heat networks or external contractors require imported specialist materials and equipment to complete improvement work on network infrastructure. The impact on investment is uncertain. One intended impact of HNTAS is to improve the reputation of heat networks, to make them more attractable for investors. Similarly, an increase in guidance on best practice will aid Heat Network developers.	**Neutral**
Natural capital and Decarbonisation: Does the measure support commitments to improve the environment and decarbonise?	The reduction in fuel usage will have a significant impact on reducing greenhouse gas emissions. However, this will be dependent on the decarbonisation of heat network heating technologies. As networks transition to low carbon technologies, the fuel saving from HNTAS will have less impact on emissions. The central estimate quantifies carbon emissions savings at 31.3MtCo2e for the appraisal period, with an additional benefit to air quality valued at £276m. See Annex A for full analysis.	**Supports**

8. Monitoring and evaluation of preferred option

Monitoring Data:

For HNTAS, it is expected that Ofgem will be collecting monitoring data. The HNTAS digital platform will also self-track and monitor operator's compliance with obligation conditions, which can be utilised for any evaluation work.

HNTAS sets out several monitoring requirements to ensure compliance with technical standards for heat networks:

1. **Performance Monitoring**: Heat networks must demonstrate that they meet the mandated minimum technical standards through regular performance assessments.
2. **Data Collection and Reporting**: Operators are required to collect and report data on various aspects of the network's performance to the scheme operator, including energy efficiency, heat losses, reliability, and consumer satisfaction.[8] This is to demonstrate continued compliance with the regulations.
3. **Assessment and Certification**: Heat networks will undergo assessments to verify compliance with the technical standards. This includes inspections and audits of the network's components, such as the energy centre, district distribution network, and consumer connections.
4. **Transparency and Accountability**: The scheme aims to enhance transparency in heat network performance and strengthen accountability among operators.

Networks will use digital meters that can easily and regularly report the required information. This set up of reporting requirements will generate a vast amount of data to allow the scheme operator to monitor both individual networks and the general performance of the market.

This data can be used to identify trends between different types of networks and monitor high-risk areas that may require audits. It will also be important to use this data to monitor the compliance of the market with this new regulation, both at the interim standard and the final threshold. Regular reporting on the reduction in heat losses and updates on the overall state of the market will be crucial to assess how successful the policy has been.

The market currently has a minimal monitoring; however, the introduction of Ofgem into the market will increase the data available on heat networks. Data sharing and linking of authorisation conditions and HNTAS monitoring data will provide an even richer picture of the market, areas for policy development and potential risks.

A key aim of this policy is to improve the performance of networks to ensure positive customer outcomes. It would be useful for the department and scheme operator to monitor the customer experience to ensure the aim of the policy is being met.

Evaluation:

Evaluation of the HNTAS pilot scheme is currently underway, led by DESNZ and a subcontractor (Fairheat) to assess the cost of implementing the scheme as well as quantifying some benefits, such as reduced heat loss. Qualitative research will also be conducted by gathering feedback from participants of the pilot scheme. Plans for evaluation of the full scheme are not yet finalised; however, will likely be led by DESNZ and a subcontractor to assess the costs to the scheme operator and to heat networks and the benefits gained from the regulation. Further potential evaluation questions are outlined below. The HNTAS evaluation may form part of a broader evaluation of the heat networks market framework.

This monitoring and evaluation plan will continue to be developed alongside the policy and will be guided by responses from the consultation that this IA runs alongside. However, some potential evaluation questions are outlined below.

Process Evaluation:

1. How effectively was HNTAS implemented?
    - What challenges were encountered and how were these addressed?

[8] The version of this document cleared by the Regulatory Policy Committee (RPC) refers to a service provider. All instances of 'service provider' have now been changed to 'scheme operator'. This is a wording change made to further clarify the role of the scheme operator and to align with the policy consultation. The wording change has no effect on the policy or analysis in this document.

2. What is the cost for heat network operators of meeting the HNTAS requirements, including monetarily and in terms of resource and time?
3. How well were stakeholders (e.g., heat network operators, consumers, regulatory bodies) engaged in the implementation process?
4. Were views from the consultation sufficiently considered?
5. Can the policy be improved?

Benefits:

1. What benefits can be attributed to HNTAS and did they occur as initially intended? Do they vary by network type and size?
    - Reduced heat loss
    - Reduced pump electricity savings
    - Reduced carbon emissions
    - Reduced cost of heat
    - Affordability of heat networks e.g. reducing capital and operational costs, long term financial benefits for operators and consumers
2. Where and how are benefits passed through to network customers?
3. What impact has the HNTAS had on the performance and reliability of heat networks?
4. Has HNTAS met the intended objectives of the policy? Have there been any indirect impacts?
5. Have there been any unintended effects e.g. unexpected costs, externalities which are unexpected)?

Value for money:

6. What is the emerging cost-benefit analysis position of the scheme?
7. What are the quantifiable costs and benefits that have been realised that are attributable to the scheme?
8. How does this compare to the ex-ante view of the cost-benefit analysis of the project?

Consumer Outcomes

9. What improvements in customer outcomes have been observed since the scheme's implementation? e.g. in quality of service, reliability of heat, reduction in overheating reduction in number of customer complaints, reduction in unplanned outages
10. What are the common issues faced by consumers (e.g., unplanned outages, overheating, inconsistencies in heating) and how have these been addressed by the scheme?
11. How has consumer satisfaction changed since the introduction of the scheme?
12. How have performance improvements translated into cost savings for consumers?

Market Development

13. How has the introduction of Ofgem and increased data availability influenced the heat network market?
14. How effective is the data reporting and monitoring system in providing a comprehensive picture of the market?
15. How has the HNTAS affected the reputation and investor confidence in heat networks?

Compliance and Enforcement

16. What is the level of compliance among heat network operators?
17. How frequently and broadly are compliance checks conducted?
18. What are the common compliance issues identified through regular reporting, and how are they being addressed?
19. How effective are the enforcement mechanisms in ensuring adherence to technical standards?
20. What barriers are there to ensuring compliance?

Pilot Scheme Learnings

21. What lessons were learnt from the HNTAS pilot, and how did this feedback inform the full roll out?

9. Minimising administrative and compliance costs for preferred option

Please state how you intend to minimise the administrative burdens of complying with the regulation. This should include burdens on businesses and people. It should include factors such as time taken for familiarisation, filling in forms, reporting requirements etc.

DESNZ and Ofgem have worked together to ensure administrative costs from regulation are minimised. Most information about heat network characteristics will be collected through the authorisation requirements of the wider Heat Network Market Framework regulation. Access to this information means that the HNTAS programme will not have to recollect data and saves businesses resource burden and familiarisation time.

The collection of additional information will be required for some metrics but the scheme aims to keep this to a minimum. This information will be collected through the same systems used for the authorisation scheme run by Ofgem, meaning firms will already be familiar with this system. The aim of having one system across the whole market framework regulatory requirements is to ensure a smooth and coherent process for suppliers and operators.

There is ongoing engagement with the industry to gather views and share current plans to allow for feedback and refinement of processes to ensure regulation has minimised burden on businesses.

The installation of smart meters throughout the upgrade process allows for the automatic transmission of performance and efficiency data to the service operator for monitoring and ensuring compliance. This minimises administrative costs as the majority of ongoing data requirements will be automated, with an annual expected cost of only £6/dwelling.

Compliance costs are also removed for the smallest businesses as all existing networks will be exempt from the regulation if there are 11 or less dwellings on the network in the preferred option. Similarly, new build networks will be exempt if there are 6 or less dwellings on the network. This is particularly important as small businesses may not viably be able to cover additional costs.

Declaration

Department:	Department of Energy Security and Net Zero

Contact details for enquiries:

David.egan@energysecurity.gov.uk

Director responsible: Mike Hawkins (Deputy Director of Clean Heat Analysis)

I have read the Options Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.

Signed: Sign here

Date: Date

Summary: Analysis and evidence

For Options Assessment, it is not a requirement to complete all the below, but please complete as much as you can where possible.

Price base year:

PV base year:

This table may be reformatted provided the side-by-side comparison of options is retained	**1. Business as usual (baseline)**	**2. Preferred way forward- Option1a**	**3. Option 1b**	**4. Option 2a**	**5. Option 2b**
Net present social value (with brief description, including ranges, of individual costs and benefits)	…	£6,321m	£6,335m	£5,482m	£5499m
Public sector financial costs (with brief description, including ranges)	…	£13m	£13m	£13m	£13m
Significant un-quantified benefits and costs (description, with scale where possible)	…	Costs: Disruption during improvement works Benefits: Reduced outages Reduced overheating	Costs: Disruption during improvement works Benefits: Reduced outages Reduced overheating	Costs: Disruption during improvement works Benefits: Reduced outages Reduced overheating	Costs: Disruption during improvement works Benefits: Reduced outages Reduced overheating

		Improved reputation of sector	Improved reputation of sector	Improved reputation of sector	Improved reputation of sector
Key risks (and risk costs, and optimism bias, where relevant)		Risk of retrofit costs being unaffordable to heat network operators. Risk of high retrofit costs being passed on to customers, leading to significantly higher bills. Analysis has taken a generalised approach, applying average expected costs and benefits to networks. In reality it is likely there will be outlier networks where costs are significantly higher than average. The 'end of life' process explained in the consultation document has been introduced to try	Risk of retrofit costs being unaffordable to heat network operators. Risk of high retrofit costs being passed on to customers, leading to significantly higher bills. Analysis has taken a generalised approach, applying average expected costs and benefits to networks. In reality it is likely there will be outlier networks where costs are significantly higher than average. The 'end of life' process explained in the consultation document has been introduced to try	Risk of retrofit costs being unaffordable to heat network operators. Risk of high retrofit costs being passed on to customers, leading to significantly higher bills. Analysis has taken a generalised approach, applying average expected costs and benefits to networks. In reality it is likely there will be outlier networks where costs are significantly higher than average. The 'end of life' process explained in the consultation document has been introduced to try	Risk of retrofit costs being unaffordable to heat network operators. Risk of high retrofit costs being passed on to customers, leading to significantly higher bills. Analysis has taken a generalised approach, applying average expected costs and benefits to networks. In reality it is likely there will be outlier networks where costs are significantly higher than average. The 'end of life' process explained in the consultation document has been introduced to try

		mitigate the impact on these networks.	mitigate the impact on these networks.	mitigate the impact on these networks.	mitigate the impact on these networks.
Results of sensitivity analysis	…	See sensitivity analysis section.	See sensitivity analysis section.	See sensitivity analysis section.	See sensitivity analysis section.

RAG rating of options meeting objectives:

Option/ objective	**Do nothing**	**No regulation**	**Option 1a**	**Option 1b**	**Option 2a**	**Option 2b**
Improve customer outcomes	No improvement	Possible if networks take schemes on board voluntarily, though adoption of standards to date has been low.	Significant improvements to the full market	Significant improvements to the full market	Regulation could go further to improve this	Regulation could go further to improve this
Improve affordability	No improvement	Possible if networks take schemes on board voluntarily, though adoption of standards to date has been low.	Affordability expected to improve in long run but risk of decrease in short run if capital costs are passed on. Affordability is also reliant on planned pricing regulation being introduced.	Affordability expected to improve in long run but risk of decrease in short run if capital costs are passed on. Affordability is also reliant on planned pricing regulation being introduced.	Reduced upfront costs but also reduced potential ongoing savings	Reduced upfront costs but also reduced potential ongoing savings
Improve reputation	No improvement	Possible if networks take schemes on board voluntarily,	Widespread improvements in network quality	Widespread improvements in network quality	Improvements of the worst networks but some networks	Improvements of the worst networks but some networks

		though adoption of standards to date has been low.	and customer experience.	and customer experience.	remaining at a fairly low standard	remaining at a fairly low standard
Reduce carbon emissions	No improvement	Possible if networks take schemes on board voluntarily, though adoption of standards to date has been low.	Significant improvements to the full market	Significant improvements to the full market	Regulation could go further to improve this	Regulation could go further to improve this
Build evidence	No improvement	No reporting of data	Reporting data will be generated	Reporting data will be generated	Reporting data will be generated	Reporting data will be generated
Proportionate	No attempt to meet outcomes however no burden	Low burden as schemes voluntary	Excludes networks with less than 11 dwellings or capacity equivalent	Excludes networks with less than 6 dwellings or capacity equivalent	Excludes networks with less than 11 dwellings or capacity equivalent	Excludes networks with less than 6 dwellings or capacity equivalent
Deliverable	Currently being delivered	Grants would be too costly to government and adoption of guidance cannot be mandated.	Challenging but expected to be deliverable	Challenging but expected to be deliverable	Challenging but expected to be deliverable	Challenging but expected to be deliverable

Appendix A: Appraisal results

This section includes details on the estimated costs and benefits of the preferred option, providing an overview of how these have been calculated and sensitivity analysis for a variety of uncertain metrics.

Estimated costs

Costs for the impact of HNTAS have been estimated and compared to the counterfactual scenario. These costs pertain to improving existing networks to meet standards, the additional costs for new networks and the assurance costs of assessing, monitoring and certifying heat network performance.

Investment and improvement costs

Costs: Total present value (£m)	Option 1a (preferred)	Option 1b	Option 2a	Option 2b
Upgrade costs - first limit	£1,656	£1,675	£1,656	£1,675
Upgrade costs - second limit	£1,224	£1,236	£0	£0
Upgrade costs - new builds (see costs section)	£0	£0	£0	£0

Existing networks

The cost to improving existing networks performance has been calculated using a subset of HNMBR data about the current market. Due to incomplete data this subset covers 19% of existing registered heat networks. The cost to a network is determined based on the starting efficiency and the size of the network. For example, a large network with low levels of efficiency would have a very large cost to reach the legislated efficiency threshold. Within the subset, we estimate the efficiency saving each network will need to make and multiply this by a "cost per W/dwelling saved". These costs are modelled on previous upgrade costs and the resultant improvements from DESNZ funded capital schemes focused on improving efficiency, mainly the Heat Network Optimisation Opportunities project (HNOO). The aggregate capex cost of the subset is then scaled up to the full market and this total cost is split over a few years, based on expected yearly upgrades, up until the deadline for the threshold. A 20% optimism bias adjustment has been applied.

Some networks will declare as end of life if upgrade costs are more expensive than a complete network rebuild. The analysis includes an upper limit of capex costs per dwelling to represent the estimated cost burden of a full replacement of the network infrastructure. This is estimated to be roughly 15% of the networks requiring upgrades.

Investment and improvement costs are the largest aggregate cost involved within technical standards; however, will vary greatly between different types of networks. Some operators will experience low to no improvement costs if they already have a well running network whereas an inefficient network could have very high upfront improvement costs.

With the current preferred option, it is estimated that 40% of networks will need to do work to reach the 400W/dwelling and 56% to reach 200W/dwelling.

New Builds

Heat network developers will need to ensure they meet the standards that have been set out, including the 200 W/dwelling heat loss threshold. We estimate roughly half of new networks would meet these heat loss thresholds without the introduction of HNTAS, based on HNMBR data for newly built networks. For the half which we expect not to be compliant, an adjustment will be needed to the planning and building of the network. Fairheat research suggests that capital cost savings of up to £900/dwelling could be achieved through compliance with HNTAS standards due to

factors such as reduced oversizing. This saving however is likely to be offset somewhat by increased design costs. Evidence on the impact that HNTAS regulation will have on the overall build cost of new networks is being investigated as part of the HNTAS pilot. In the central case for this OA it is assumed that any capital savings through HNTAS compliance are offset by additional design costs, giving a £0m impact on new heat network build costs. Due to the uncertainty with this assumption, this has been tested specifically in the sensitivity analysis section.

Assurance costs

Assurance costs are costs borne to networks from the enforcement and monitoring of the scheme as well as compliance costs to business.

Costs: Total present value (£m)	Option 1a (preferred)	Option 1b	Option 2a	Option 2b
Scheme running costs	£170	£170	£170	£170
Assurance, certification and compliance costs	£962	£968	£946	£951

Assessment costs

Heat network operators will be required to receive assessment of their network, understand the current performance of the network and formulate an improvement plan to meet HNTAS standards if necessary. Some large networks may have the capability to perform this in house; however, many networks will require technical expertise from an external assessor. Following completion of works on a network to meet HNTAS standards, networks require certification from an independent third party inspection. Having gained certification, networks will experience an ongoing cost associated with HNTAS reporting, to provide metrics and KPIs to the scheme operator. This will incur costs to business for both existing and new heat networks.

New build

The cost for assessing and certifying new build networks are estimated to be higher than for existing networks. New builds are estimated to be built in separate elements so will require more extensive assessments throughout the design process. Networks are also required to produce a statement of conformity (SoC) before each certification. In total, networks will be required to produce three SoCs and two certifications, different elements are expected to be certified as they are built allowing networks to split the costs.

Existing Networks

Costs for assessing and certifying existing networks are estimated to be much lower than for new builds. Networks will be able to assess various elements of the network at the same time and therefore will not be required to undergo individual assessments of each element. Although existing networks will be required to possess two certifications (one at the 400 w/dwelling threshold and another at 200 w/dwelling), they are required to initially produce only a personal improvement plan (PIP). Then before certification, networks will be required to submit a Statement of Conformity (SoC).

Compliance costs- Metering

To adhere to regular reporting requirements, operators will need to install electronic metering on their network. Existing networks will have until 3 years after HNTAS is implemented to ensure that new automatic meters are installed to facilitate data sharing. Networks will not be required to provide any manual reporting of data before this date. New networks being built are expected to install automatic meters when building the network and this will be required to pass assessment and receive certification.

Scheme operator costs

The scheme operator will be responsible for the overall running of HNTAS including managing the digital service, responding to complaints, providing support and monitoring performance and compliance. In addition there will also be running costs for the Certification Body and Training Provider. Although the scheme operator is responsible for the activities stated, all costs are expected to be cost recovered by Ofgem. There is limited data to determine the costs borne by the scheme operator hence have been estimated based on the costings for the pilot study. Entities participating in the study will be required to report costs of activities, this will provide more accurate figures on the costs incurred by the scheme operator.

Estimated benefits

Fuel savings, leading to greater long run affordability

Assuming existing heat networks **do not** decarbonise their energy centre

Benefits: Total present value (£m)	Option 1a (preferred)	Option 1b	Option 2a	Option 2b
Heat loss fuel saving	£3,335	£3,353	£2,748	£2,760

Assuming existing heat networks decarbonise their energy centre over time

Benefits: Total present value (£m)	Option 1a (preferred)	Option 1b	Option 2a	Option 2b
Heat loss fuel saving	£2,840	£2,855	£2,377	£2,387

Technical standards regulation requires heat networks to improve the efficiency of their networks. As networks improve the infrastructure on their networks, heat losses are reduced. Assuming customers maintain the same level of heat demand, this results in networks needing to generate less heat. This reduction in heat generation is beneficial for fuel cost savings which initially accrue to heat network operators.

HNTAS will have a significant impact on fuel usage of existing heat networks through improvements but also on new build heat networks. Applying findings from HNMBR data from new networks we estimate that roughly 50% of new build networks will be more efficient due to HNTAS.

HNTAS has a key dependency on planned pricing regulation to ensure that these lower running costs feed through into lower customer bills.

HNMBR does not require heat networks to report on certain performance indicators such as W/dwelling heat loss. The data is also incomplete, and both these factors make it difficult to precisely estimate the current performance of networks and consequently the amount of heat saving is uncertain.

Furthermore, studies have shown that one of the key issues in the industry is high flow rates on network. By optimising heat networks, networks can reduce flow rates around the network which requires less pump energy. The reduction in pump energy has an electricity saving for the operator. HNMBR data does not report on pump energy usage, so the analysis assumes an average saving per network completing work. This average is calculated based on the savings made on HNOO networks. We assume an electricity saving of 477kWh per dwelling to reach the 400W threshold and an additional 239kWh per dwelling at the final certification threshold.

As water pumping occurs regardless of heating fuel source the savings are unaffected by decarbonisation.

Benefits: Total present value (£m)	Option 1a (preferred)	Option 1b	Option 2a	Option 2b
Electricity pump fuel saving	£261	£261	£224	£224

Carbon savings

The reduction in fuel use also reduces carbon emissions, especially on heat networks using high carbon heating technologies. As discussed previously in this OA, these savings are heavily influenced by whether existing heat networks go on to decarbonise after HNTAS measures are introduced.

It has been assumed that as a result of lower heat prices, customers do not respond by choosing to consume more heat. If this is not the case, we would expect to see reduced carbon savings proportional to the increase in heat demand following HNTAS implementation.

Assuming existing heat networks **do not** decarbonise their energy centre

Total Carbon saving (MtCo2e)	Carbon Budget 4 (2023-2027)	Carbon Budget 5 (2028-2032)	Carbon Budget 6 (2033-2037)	Total up to 2050	Total within 30 year appraisal period
Option 1a (preferred)	0.3	4.6	5.5	25.3	31.3
Option 1b	0.3	4.6	5.6	25.5	31.5
Option 2a	0.3	3.9	4.2	19.7	24.3
Option 2b	0.3	3.9	4.2	19.8	24.4

Benefits: Total present value (£m)	Option 1a (preferred)	Option 1b	Option 2a	Option 2b
Monetised carbon saving	£6,404	£6,445	£4,995	£5,023

Assuming existing heat networks decarbonise their energy centre over time

Total Carbon saving (MtCo2e)	Carbon Budget 4 (2023-2027)	Carbon Budget 5 (2028-2032)	Carbon Budget 6 (2033-2037)	Total up to 2050	Total within 30 year appraisal period
Option 1a (preferred)	0.3	3.6	3.3	11.6	12.5
Option 1b	0.3	3.6	3.3	11.7	12.6
Option 2a	0.2	3.1	2.5	9.3	10.1
Option 2b	0.2	3.1	2.5	9.4	10.2

Benefits: Total present value (£m)	Option 1a (preferred)	Option 1b	Option 2a	Option 2b
Monetised carbon saving	£2,804	£2,821	£2,272	£2,284

KPI benefits

As previously explained, this IA uses heat loss thresholds as a proxy that all other KPIs will be met at that level. Whilst the benefits of reduced heat loss and pump energy have been monetised, there are other KPIs which could have benefits to operators and/or consumers which have not been accounted for at this stage. For example, improvements to the water quality used within a heat network may lengthen the life span of the network. This benefits operators by reducing the frequency of network replacement costs which will increase profitability.

Improved consumer outcomes

A key aim of this policy is to improve the experience faced by consumers living on heat networks. HNCOS results show a higher proportion of customer complaints and higher outage durations for heat network customers compared to a comparison group. Due to the monopolistic characteristics of a heat network, customers often cannot change supplier and operators lack incentives to improve their network quality. Therefore, it is important for regulation to ensure high quality technical standards on networks to improve consumer outcomes. Some potential benefits include:

- A reduction in system heat losses will reduce overheating within common areas and dwellings.
- An improvement to key indicators may reduce outages on the network.

- Improved hot water stability.

It is difficult to quantify the impact HNTAS will have on consumer outcomes due to a lack of data on current outcomes and by how much these are expected to improve. It is also difficult to monetise some of these welfare and convenience impacts on consumers.

Investment and industry growth
In the absence of regulation, as the market grows, more people will be affected by poor outcomes and hence it is important for governments to intervene to ensure consumer detriment does not grow. Regulation of heat networks is vital to encourage the growth of the market. The reputation of heat networks can be damaged by stories from poor performing networks, in which customers have had negative experiences. This can reduce trust and confidence in the market which may discourage investment, especially if customers perceive heat networks to have poor outcomes and are dissuaded from connecting to district heating. This increases the risk of investment as a network can only be profitable if it can gain a sufficient level of connections.

The guidance provided by HNTAS should lay out a best practice approach to designing and building a heat network. This will aid developers in ensuring they do not overcomplicate their system and increase confidence in the process, especially new entrants into the market.

Sensitivity analysis

This analysis explores the sensitivity of monetised outputs to variations in key inputs. Scenario building and key input variations test the impact of assumptions in the CBA analysis on the SNPV estimate.

Market Growth - The heat network market growth rate is expected to be positive and continue to be so over the appraisal period. However, there is significant uncertainty around the precise value, particularly across time. Throughout the IA, we have assumed a central estimate of 5.5% annual growth in heat supplied and customer growth, based on preliminary deployment predictions of all current and planned heat network policies. However, given these policies are still being developed and deployed, this is a highly uncertain estimate. We have then tested a low growth scenario (4.8%) and a high growth scenario (6.1%, based on the government's current ambition for 2050).[9]

Assuming existing heat networks **do not** decarbonise their energy centre

Value For Money: Total present value (£m)	Option 1a (Low Growth)	Option 1a (Central Growth)	Option 1a (High Growth)
SNPV	£6,154	£6,155	£6,127
Benefit Cost Ratio	2.64	2.53	2.43

Assuming existing heat networks decarbonise their energy centre over time

[9] https://www.gov.uk/government/publications/net-zero-strategy

Value For Money: Total present value (£m)	Option 1a (Low Growth)	Option 1a (Central Growth)	Option 1a (High Growth)
SNPV	£2,080	£1,971	£1,847
Benefit Cost Ratio	1.56	1.49	1.43

A higher growth rate will increase the total cost on businesses however will also increase the fuel and carbon benefits realised from the standards. As a result, these largely offset in a scenario where networks do not decarbonise. However, assuming networks do decarbonise suggests that the value of the policy decreases at higher growth rates due to the lack of increased carbon savings.

Fuel and carbon pricing – Expected values for fuel and carbon over the appraisal period are provided within green book supplementary guidance. The central estimate for these factors have been used throughout the OA. Given the high levels of uncertainty around these values, especially given the long appraisal period, it is prudent to assess how the SNPV is impacted by variation in these figures. The high and low price series from green book supplementary guidance have been used.[10]

Assuming existing heat networks **do not** decarbonise their energy centre

Value For Money: Total present value (£m)	Option 1a (Low prices)	Option 1a (Central prices)	Option 1a (High prices)
SNPV	£1,365	£6,155	£12,534
Benefit Cost Ratio	1.34	2.53	4.12

Assuming existing heat networks decarbonise their energy centre over time

Value For Money: Total present value (£m)	Option 1a (Low prices)	Option 1a (Central prices)	Option 1a (High prices)
SNPV	-£200	£1,971	£4,995
Benefit Cost Ratio	0.95	1.49	2.25

This analysis shows that if both carbon and fuel prices are low then in a scenario where existing heat networks decarbonise there could be a small, negative SNPV. Even in this scenario, the policy has multiple non-monetised benefits not reflected in this figure meaning that the policy still likely offers positive value for money.

Overall costs of new heat network construction increase by due to HNTAS standards.

Break even analysis has been conducted to test how the value of the policy would be affected if HNTAS standards placed a net cost on heat network construction capital costs. If existing heat networks do not decarbonise then the net cost would need to be roughly £900/dwelling to give a £0 SNPV and roughly £300/dwelling if they do decarbonise.

Break even analysis of existing network upgrade costs

If existing heat networks do not decarbonise then upgrade costs would need to be 3.8 times higher than expected to give a £0 SNPV. If they do decarbonise this falls to 2.0 times.

[10] Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal - GOV.UK