Evidence Gathering Report

Evidence assessment for the implementation of Heat Networks Regulation in Scotland

December 2019

Scottish Government
Riaghaltas na h-Alba
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HEAT NETWORKS (SCOTLAND) BILL: SCOTTISH GOVERNMENT COMMENT ON EVIDENCE-GATHERING

In preparing the Heat Networks (Scotland) Bill, the Scottish Government has been required to undertake a Financial Memorandum and a Business and Regulatory Impact Assessment (BRIA) to understand the impact of the Bill's proposals on the Scottish Administration, Scottish Local Authorities, businesses and consumers.

The Bill will introduce regulation to the heat networks market in Scotland. However, at present, there is very limited regulation which applies to district and communal heating schemes, and as such the Scottish Government had limited evidence available to it to undertake a Financial Memorandum and a BRIA.

In light of this, in May 2019 the Scottish Government commissioned KPMG to gather data on the heat networks market, as well as views on the likely impacts of the Bill's proposals.

This evidence was provided to the Scottish Government as a Report in November 2019. The Report forms the remainder of this publication, and it has been a valuable source of information for the Scottish Government as it has developed the Heat Networks (Scotland) Bill.

Readers should note, however, that following receipt of the Report, and as we have continued to prepare the Bill, other sources of information have become available to the Scottish Government.

Where it was felt that other evidence was more accurate, this has instead been used in the Financial Memorandum and the BRIA.

Scottish Government

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13 December 2019

Contents

Terms and Acronyms

Acronyms and abbreviations

BEIS	Department for Business, Energy and Industrial Strategy
BRIA	Business and Regulatory Impact Assessment
CCC	Committee on Climate Change
CHP	Combined Heat and Power
CIBSE	Chartered Institution of Building Services Engineers
CMA	Competition Markets Authority
CO2	Carbon dioxide
DECC	Department for Energy and Climate Change
DNO(s)	Distribution Network Operators
ECO	Energy Company Obligation
EESSH	Energy Efficiency Standard for Social Housing
EPC	Energy Performance Certificate
FM	Financial Memorandum
FTE	Full Time Equivalent
GDNs	Gas Distribution Network Operations
GWh	Gigawatt hours
HNIP	Heat Networks Investment Programme
IAG	Interdepartmental Analysis Group
kWH	Kilowatt Hour
LCITP	The Low Carbon Infrastructure Transition Programme
LHEES	Local Heat and Energy Efficiency Strategies
LHS	Local Housing Strategy
MMO	Marine Management Organisation
NHS	National Health Service
Ofgem	Office of Gas and Electricity Markets
Ofwat	The Water Services Regulation Authority
OGA	Oil and Gas Authority
SCR	Scottish Charities Regulator
SEEP	Scotland's Energy Efficiency Programme
SEPA	Scottish Environment Protection Agency
SHR	Scottish Housing Regulator
SIMD	Scottish Index of Multiple Deprivation
SMEs	Small and Medium Enterprises
TWh	Terawatt Hours
WICS	Water Industry Commission for Scotland

1 Executive summary

This report provides a summary and consideration of a range of evidence sources around the potential impacts of the proposed heat network regulation in Scotland.

This report considers evidence gathered from both primary sources (including workshops and stakeholder interviews) and research, to consider the potential materiality, likelihood and direction of the potential impacts of these policies.

This report will support development of a later Financial Memorandum and Business and Regulatory Impact Assessment (BRIA) of these policies. Within Table 1, we highlight the high level indicative impacts of the proposed regulations from the Scottish Government on heat networks, including the introduction of licencing and consenting regimes.

We note that much of the analysis within this report is based on policy proposals put forward at the current time, as well as the existing technological and political landscape (2019). Given the fundamental implications stemming from achieving a net-zero society by 2045, we might expect further significant change in regulatory proposals from both the UK and Scottish Government, as well as wider factors, which could cause change to the projections within this report.

Throughout this report we outline a number of cost estimates, particularly for local authority and government. We note that these costs represent the initial expected cost of implementing many of the policy proposals outlined within this report at the current point in time. Where further experience, shared tools and learnings are gathered by relevant parties over time, we expect these estimates to fall.

Table 1: Overview of heat networks regulation impacts

Impact	Description	Impact
Consumer		
Bill Savings	Consumer bill savings from heat network deployment compared to the counterfactual heat cost (not including energy efficiency changes). Savings vary substantially based on type of scheme household.	0 - 36% (See 6.1.1)
Consumer Disruption	Consumer disruption from installation of networks.	(See 6.1.2)
Consumer Service	Negative impacts on consumer choice and tariff offerings, such as reductions in the available payment methods for consumes.	(See 6.1.3)
Consumer Health	Lack of evidence to assume link from use of heat networks to better consumer healthcare outcomes.	(See 6.1.4)

Local Authorities and Government		
Regulator Set Up	Initial one off costs to set up any new heat networks regulator.	£0.99m - £6.72m (See 6.2.3)
Licence Application Review	Annual cost to regulator for initial review of licence applications.	£100,000 - £300,000 (See 6.3.3)
Annual Licence Admin	Annual cost to regulator to manage licencing regime.	£0.86m - £2.57m (See 6.3.3)
Consenting Review	Annual cost to review consents for heat network construction.	£50,000 - £120,000 (See 6.2.4)
Business		
Capital / Op cost reduction	Reduction in operational and capital costs from learnings.	(See 6.3.1)
Licence Application	Annual cost of applying for licencing regime.	£1,050 - £3,150 (See 6.3.3)
Socioeconomic Assessment	Cost of running scheme specific socio-economic assessments.	£20,000 - £40,000 (See 6.3.2)
Market Dynamics	No evidenced impact on market dynamics / concentration.	(See 6.3.5)
Deployment	Potential incremental increase in deployment of heat networks out until 2050, based on current proposals. These increases are in addition to a counterfactual heat supply of 3.4TWh in 2050.	Increase around 3.6 TWh annually. (Total 7 TWh, See 6.3.6).
Waste Heat Connection	Potential increased connection in waste heat.	(See 6.3.7)
Essential Services Other	Decrease in revenues and heat provision from incumbents.	(See 6.3.8)
Wider		
Carbon Emissions	Reductions in carbon emissions compared to counterfactual.	0 – 23% (See 6.4.1)
Air Quality	No evidenced impact on air quality.	(See 6.4.2)
Jobs	Likely positive impact on net jobs within Scottish regions.	(See 6.4.3)

2 Introduction

2.1 Background

Scottish Ministers designated energy efficiency as a national priority in 2015, recognising the benefits delivered by improving the energy performance of buildings. Subsequently, the Scottish Government began the Energy Efficient Scotland (EES) programme to deliver these priorities.

Energy Efficient Scotland is a 20 year programme aimed at making Scotland's existing buildings near zero carbon wherever feasible by 2050, in a way that is socially and economically sustainable.

As part of the Energy Efficient Scotland framework, the Scottish Government has explored the potential for the implementation of a regulatory system for heat networks and communal heating, following on from several consultations across 2017 and 2018.

The Scottish Government has consulted on the use of a number of regulatory tools including a potential licencing regime for the development and operation of heat network schemes[1]. These proposals could include processes such as a multi-tiered licencing regimes, mediation services and consenting processes.

2.2 Aim

As part of the policy development process, the Scottish Government will at some stage complete both a Financial Memorandum and full Business and Regulatory Impact Assessment (BRIA) of these policies as they are introduced.

- **The Financial Memorandum**[2] would include an estimate of the administrative, compliance and others costs (and benefits) which could arise from policy implementation. This will allow an assessment of impacts upon any relevant bodies ((a) the Scottish Administration; (b) local authorities; and (c) other bodies, individuals and businesses) arising from proposed legislation.

[1] Scottish Government - Heat and energy efficiency strategies: second consultation analysis. https://www.gov.scot/publications/scotlands-energy-efficiency-programme-analysis-second-consultation-local-heat-energy-efficiency-strategies-regulation-district-communal-heating/pages/2/

[2] Scottish Government – Scottish Public Finance Manual. https://www.gov.scot/publications/scottish-public-finance-manual/finance-guidance-notes/fgn2009-01-financial-memoranda-that-accompany-scottish-government-bills/

- **The Business and Regulatory Impact Assessments (BRIA)**[3] would be used to assess potential impacts of different available policy options. The BRIA would include an analysis of the cost and benefits to government, businesses and consumers of the proposed regimes, ensuring an objective approach to the delivery of the finalised policy.

The Scottish Government has consulted extensively around heat network regulation, and has begun the early development of the potential evidence base.

The Scottish Government has also sought to undertake a range of specialist evidence gathering activities to supplement the existing evidence around the potential impacts of these policies.

These activities will build on the existing evidence base, supplemented with new information and data as necessary, and allow the Scottish Government to undertake a robust appraisal of policy impacts for the purposes of a Financial Memorandum and BRIA.

This report sets out the findings of these evidence gathering activities and considers their potential viability for later assessment.

- **Part 1 (Approach)** focuses on – The approach to gathering the underlying evidence base on the potential impacts of policy, who was spoken to, how they were spoken to, when they were spoken to.
- **Part 2 (Heat Networks)** considers – An assessment and illustration of the potential impacts and evidence around upcoming heat networks policy.

2.3 Structure of this report

1) Part 1 is structured as follows:

- **Chapter 3 sets out –** The overall approach to this report.

2) Part 2 is structured as follows:

- **Chapter 4 sets out –** Background to heat networks regulations.
- **Chapter 5 sets out –** Our initial list of potential impacts of these policies gathered throughout the engagement process.
- **Chapter 6 sets out –** A further evidence based consideration of these potential impacts.

[3] Scottish Government - Business and Regulatory Impact Assessments (BRIA) guidance. https://www.gov.scot/publications/bria-guidance/

Part 1
Approach

3 Approach

3.1 Overarching approach

This section outlines the approach used to construct the underlying evidence base. This includes an overview of the key routes used to gather information, including an overview of the stakeholder engagement activities undertaken.

This report summarises the set of potential evidence sources which can be used to quantify and assess the potential impacts of these policies. These have been gathered through a wide range of activities conducted with relevant stakeholders, including workshops, interviews and evidence gathering requests, as well as additional supplementary desktop based research.

This report does not constitute a full impact assessment. However the approach to this report where appropriate has been conducted in accordance with assessment principles of the HM Treasury Green Book[4] and Scottish Government impact assessment guidance[5].

When looking to construct the underlying evidence base, we have followed the regulatory principles of proportionality. We have looked to gather the appropriate evidence to reflect the scale and materiality of the impacts.

As appropriate and where sufficient data allows, we have also primarily looked to gather quantifiable evidence to allow a future assessment of these impacts, and where possible provide this evidence on a monetised basis.

As per HM Treasury Green Book guidance, this monetised evidence is based on real terms 2019 prices in GBP. As our analysis of impacts will be based on data in current market prices, we will not need to make any specific adjustment for inflation in our analysis.

Where we have not been able to provide quantifiable or monetised evidence, we have looked to provided qualitative evidence gathered throughout the process to consider the direction, likelihood and scale of any potential impacts. This evidence has been gathered from a range of technical and specialist stakeholders who are likely to be those facing the impacts of any final policy decisions.

In summary this report looks to, in a proportionate, consistent and transparent manner, conduct the preliminary analysis and evidence gathering to inform the construction of any Financial Memorandum and BRIA.

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[4] HM Treasury – Green Book. https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-governent

[5] Scottish Government – Business and Regulatory Impact Assessments (BRIA) guidance. https://www.gov.scot/publications/bria-guidance/

3.2 Sources of evidence

The evidence gathered of the potential impacts of the proposals has been based on primary and secondary research, with the data and information gathered from a number of varied routes and sources, including:

- Data collected from relevant stakeholders through information requests;
- Evidence gathered through a series of meetings and workshops held as part of this evidence gathering project;
- Existing market data held by BEIS and CMA;
- Information collected through the two previous stakeholder consultations as part of LHEES and heat networks regulation;
- Academic literature and international evidence; and
- Other publicly available information.

As outlined above, specifically as part of this evidence gathering process we have conducted a number of primary evidence gathering activities, including workshops and interviews with different key stakeholder groups.

Within our direct engagement with stakeholders, we have sought to keep an open discussion to gather their views on the potential impacts. These engagements looked to:

1) Illustrate how the upcoming impact assessment / policy analysis being planned would be used to assess the potential impacts of the different policy proposals around heat networks regulations.
2) Provide a brief overview of the key areas of regulation of the policy areas considered.
3) Seek open views and discussion on the potential impacts of these policies as they currently stand, from the specialists in attendance.

We note that all views and information gathered as part of this process have been formed based on the current best known view on the format, scope and design of the incoming regulations.

We note that the potential policy proposals as outlined within this document are not finalised and could change, with a consequential impact on the assessment of the costs and benefits of the policy. Our evidence gathering has been conducted between June and October 2019.

3.3 Key stakeholder groups

In total as part of this evidence gathering phase, we have directly interacted with over 45 stakeholders from different groups representing key groups who could potentially be impacted by these new policies. These stakeholders are:

- Domestic heat network and low carbon energy developers;
- Trade and industry bodies;
- Wider business and industry;
- Housing associations;
- Consumer advocacy groups and academics; and
- Government, including local authorities and the Scottish Government.

When presenting evidence and views gathered from stakeholders, we have provided full details of the sources of the evidence relied upon where possible, however we did not attribute any specific comments or views to actual organisations. In addition, we have outlined any assumptions and uncertainties on which this evidence is based.

Part 2

Heat Networks Regulations

4 Heat Networks Introduction

4.1 Introductions to heat network regulations

This section provides a brief overview of the incoming heat networks regulations. This includes an overview of the previous work undertaken to develop these proposals, and latest thinking on the proposals themselves.

In January 2017, the Scottish Government held an initial consultation[6] regarding the regulation of heat networks, designed to gather views to help inform further development of the proposals prior to more detailed consultation. Then in November 2017, the Scottish Government launched a second consultation[7], to further explore views on a potential new regulatory framework for heat networks.

Within these, the Scottish Government outline the potential for a new regulatory framework for heat networks, including:

- Area-based zoning for heat networks through LHEES;
- Granting of concessions for heat networks;
- Licensing of heat networks;
- Connecting supply of surplus industrial heat.

Subsequently the Scottish Government is looking to review existing legislation and consider what new or amended duties are required to support the sector. This could consider creating new powers and duties to regulate heat networks. The incoming regulations could also look to include and or remove areas of policy which have previously been highlighted.

4.2 Indicative regulatory overview

The proposals for the scope and design of the incoming regulatory changes for heat networks are still in development, and as such the potential regulatory tools included as part of these regulations could change.

However, we have been undertaking work to identify and develop initial views regarding the potential impacts, both positive and negative, for different stakeholder groups that could arise from these interventions. These evidence gathering activities have been based on a set of potential policy tools, which we outline below.

[6] Scottish Government - Heat and energy efficiency strategies and district heating regulation consultation. https://www.gov.scot/publications/consultation-heat-energy-efficiency-strategies-regulation-district-heating/

[7] Scottish Government - Heat and energy efficiency strategies consultation. https://www.gov.scot/publications/scotlands-energy-efficiency-programme-second-consultation-local-heat-energy-efficiency/

At this stage, we have looked to gather evidence on a range of potential impacts for a specific set of policy interventions, which may or may not come to pass. This evidence will allow a future assessment of these interventions, when the Scottish Government will publish a draft impact assessment on any final proposals. We caution that the regulatory proposals outlined below could come to change.

Table 2: Overview of a potential regulatory regime

Cost driver	Overview
Heat Network Licencing	– This legislation would make it mandatory for companies developing or operating a heat network in Scotland to have a relevant licence. This licence would grant companies the right to operate a communal heating system or to operate a heat network. – This could mean that a single licence can be used to develop, design and operate a heat network. A licence will be granted by an authority if they are satisfied with the applicant's ability to perform properly. The licence conditions would be set by the chosen regulator. – Consumer protection will not be included in the licence conditions due to the reservation of this under the Scotland Act 1998. – Technical standards could be considered such as building on the Heat Networks Code of Practice developed by CIBSE.
Heat Network Consenting	– The Scottish Government have proposed to introduce a requirement that companies who want to develop a heat network must apply for consent.
Wayleaves	– The Scottish Government will introduce necessary wayleaves (a right of way granted by a landowner) to allow the following: 1) for any purpose with the continuation of activities with authorised consent to keep installed heat network pipework under or over any land. 2) The licence holder is able to install and keep installed heat network pipework under or over any land as well as have access to land for maintenance, repair, inspection etc.
Facilitation	– Any regulator will be given the role of intervening on contractual negotiation in situations where suppliers and users of heat reach impasse to facilitate an agreement. – Where socio-economically and cost effective the introduction of regulator-led facilitation process would be introduced to encourage

	consumers to connect to a heat network. Facilitation would bring parties together to discuss excess heat. – Scottish Ministers would set guidelines to be taken into account by the facilitator and parties. Facilitation will not be made mandatory on any party.

5 Identification of potential impacts (heat networks)

5.1 Key points

This section outlines at a summary level, the list of all key impacts we have identified over the engagement process. These impacts have been grouped into those applicable to the key stakeholder groups identified across the course of evidence gathering, as outlined above. The underlying evidence, likelihood, scale and direction and additional key factors of these impacts will be assessed in the next section.

5.2 Consumer Impacts

i. **Consumer pricing and bills –** The potential for changes in the levels of consumer bills. These impacts could arise from moving on heat networks which are priced at a different level to their counterfactual heating source, or potentially from changes in the costs of delivering networks stemming from the incoming regulations or from changes in market structure.

ii. **Consumer disruption from installation –** The potential for increased one off disruption for consumers stemming from an increase in the number of heat network developments, and the subsequent impacts these can have on local areas.

iii. **Consumer service offering –** The potential for changes in the services offered to consumers alongside their underlying heat supply (heat network or counterfactual gas boiler). For instance, changes in the availability of tariff types, services and technologies.

iv. **Consumer health and wellbeing –** Changes in consumer health and wellbeing. Potential for increases in health and wellbeing from policy targeted at reducing fuel poverty, leading to increase in ability to heat homes and for increases in local level air quality from reductions in air damaging heating routes within local areas.

5.3 Local Authority and Government

i. **Development costs of a heat networks regulator -** The set up and administrative costs which would be required in order to develop any new heat networks regulator to deliver the new regulatory regime. Including;

1) **Development and delivery of any licencing regime -** Development of licence conditions, licence requirements and management and administration of all licence related areas (application and assessment, guidance development, list management, licence changes and updating).

2) **Development and delivery of a heat network consenting process -** The costs arising from the regulator (or potentially local authority) reviewing each heat network application for alignment with local and national policy.

3) **Delivery of facilitator role -** Costs of technical, legal and contractual specialists to oversee the facilitator role held by the heat networks regulator.

5.4 Business impacts

i. **Development and operating costs -** Potential for increase in development and operational costs for business stemming from specific technical requirements within the licence.

ii. **Socio-economic assessments -** Costs of developing and submitting project specific socio-economic assessments alongside the application for consent of any new heat network developments.

iii. **Licencing process -** Costs of application fees for licence within the new heat network licencing scheme, as well as preparation and submission time.

iv. **Unintended licence consequences -** Potential consequences stemming from the inclusion of a single licence regime covering design through to operation for multi-site operators. With individual licences delivered at organisation level there could be potential for single problem specific sites to risk licence revocation.

v. **Market dynamics -** The potential for changes in the number and concentration / market power of participants within the market due to higher barriers to entry.

vi. **Deployment -** Changes in the deployment and number of heat networks which are installed and operated, due to the overarching support provided to heat networks from the wider regulatory package.

vii. **Connections -** The potential for the regulation to lead to changes in connections for waste heat providers, due to better facilitation and mediation from local authorities with developers and producers of waste heat.

viii. **Essential services companies -** Potential impacts on other essential services companies such as retail energy suppliers, including decreases in provision of energy (heat) and subsequent revenues for energy suppliers from an increased deployment of households switching to heat networks.

5.5 Wider

i. **Carbon Savings -** Reductions in carbon emissions from the incremental increase in deployment of heat networks leading to carbon reductions on counterfactual heat sources.

ii. **Wider economic and job impacts –** Wider economic impacts from policy stemming from increases in deployment of heat networks and potential impacts on the number of jobs.

6 Consideration of evidence (heat networks)

This section runs through each of the identified impacts in turn. It considers the underlying evidence identified around these impacts, and provides a view on the potential likelihood and scale of these impacts on stakeholders.

6.1 Consumer

6.1.1 Consumer pricing and bill savings

Heat network pricing

One of the key drivers for intervention around heat networks is the need to address issues of fuel poverty across Scotland. Throughout engagement with stakeholders, we have received a variety of claims (both agreeing and disagreeing) with the potential for heat networks to deliver price savings on consumer bills when compared with a counterfactual heat source.

If heat networks can provide heat at a cheaper rate than any counterfactual heating source, we might expect, that any increased deployment in heat networks would therefore lead directly to aggregate consumer savings.

As part of our evidence gathering, we looked to evidence existing prices paid for heat networks, compared to what they might pay under a counterfactual scenario. We sought both evidence directly from stakeholders, as well as desktop research.

Firstly, we have looked at BEIS (DECC) 2014 survey estimates around heat network pricing ranges for Bulk and Non-Bulk networks[8], outlined at a p / kWh level. These figures, displayed below, were gathered based on survey results[9] from 2014 and have been rebased[10] using the GDP deflators to June 2019 prices, these are summarised below. These figures highlighted an average cost of 6.89 p / kWh, but with significant variability across schemes.

[8] Bulk heat networks are where the main operators deliver heat in bulk to major distribution points, but who do not have responsibility for final delivery to the end customers. Non-Bulk schemes are those where the operator or manager of the scheme is responsible for final delivery to the individual customer.

[9] BEIS - Assessment of the Costs, Performance, and Characteristics of UK Heat Networks https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/424254/heat_networks.pdf

[10] We would have ideally looked to rebase figures based on a retail supply index, such as the Ofgem gas supply index, however this was unavailable for the time periods required.

Table 3: BEIS heat pricing summary

Heat prices from schemes	All schemes (2018/19)	Bulk schemes (2018/19)	Non-bulk schemes (2018/19)
Mean average (p / kWh)	6.89	6.18	8.05
Minimum (p / kWh)	4.97	5.29	4.97
Maximum (p / kWh)	10.58	7.38	10.58

We then sought feedback from stakeholders. Broadly, stakeholder feedback highlighted that these costs reflected a fair range of costs paid by consumers for heat networks. However stakeholders highlighted the significant variability within range, particularly for social/non-profit and private schemes. With some respondents highlighting prices as low as **3.0 p/kWh** for some schemes.

As part of the Heat Network Markets Study in 2018, the Competition and Markets Authority assessed[11] the potential pricing of heat networks, comparing prices and charges against an estimate benchmark they constructed based on the costs of owning and operating an individual household gas boiler[12].

The CMA identified that the weighted average price per p/kWh of heat networks in their sample was **6.4 p/kWh**, similar to that of the BEIS survey initial 2014 survey. This reflects all costs and charges associated with the provision of heat to consumers. When compared to the CMA's comparators, they recognised that:

> CMA - "*average prices paid on the large majority of heat networks within our sample are close to or lower than our gas comparators*".

However, the CMA also noted the significant variability between prices of different types of networks. Average bills vary significantly between schemes. The average price highlighted were substantially reduced due to the inclusion of socially and publicly operated schemes. Privately operated schemes had an average price of **8.1p/kWh**.

We have therefore evidenced a range of potential prices for heat networks. We have taken an average price of **6.4 p/kWh** as per the latest CMA estimates, these figures are based on the wider BEIS heat network metering and billing regulations with a large survey pool, compared to the smaller initial BEIS survey in 2014. We

[11] CMA - Heat Networks Market Study. https://assets.publishing.service.gov.uk/media/5af31b9640f0b622d18b2d3f/Update_paper_heat_networks.pdf

[12] The CMA believe the most accurate counterfactual for heat provision is that of mains gas heating. Around 85% of households (22 million out of 26 million) in Great Britain use mains gas for heating. Insights paper on households with electric and other non-gas heating, Ofgem, 11 December 2015.

have then applied a range based on the BEIS survey[13] to reflect the uncertainty in pricing, due to no range data from CMA.

Table 4: Heat network pricing summary

Heat network prices	Low	Medium	High
Average (p/kWh)	4.97	6.4	10.58

Counterfactual price

Identifying a suitable counterfactual price for heat network pricing is complicated. Both the type of dwelling and service costs significantly impact the counterfactual bill. We have assumed, as above, that the customers would likely be on a gas powered boiler and that they would be required to pay additional maintenance costs on a yearly basis.

For household type, the majority of heat network schemes are deployed in typically smaller higher density housing areas, such as flats or terraced housing. We have therefore used such properties as the suitable counterfactual household. Based on these factors BEIS have calculated[14] that the typical unit price to be around **7.73 p /kWh** in 2019 prices. Using this figure, we have outlined a potential saving range.

Table 5: Potential consumer savings

Heat network saving	Low	Medium	High
Mean average (p/kWh)	-2.85	1.29	2.76
Potential Saving (Medium Heat Price)	-37%	17%	36%

Overall, we have therefore concluded that heat networks could provide savings in aggregate, and that these savings could potentially range up to 36%, with a medium potential saving of around 17% or 1.29p p /kWh. However, we note that these savings will depend significantly on the scheme and household type.

The price saving benefits of heat networks are scale-dependent and vary greatly between project sizes. Larger networks are able to generally create higher cost savings, due to their lower average cost of development and operation, driven by

[13] BEIS Survey costs have been inflated using RPI to June 2019 prices. Ideally, we would have used the Ofgem gas supplier cost index, but this does not allow rebasing to 2019.
[14] BEIS - Assessment of the Costs, Performance, and Characteristics of UK Heat Networks. Prices rebased to June 2019.
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/424254/heat_networks.pdf

factors such as more consistent demand, storage potential, renewable usage and available business models.

Stakeholders have highlighted specific challenges for this data in a Scottish context. Noting that in Scotland, heat networks are generally of lower scale compared to the average within the UK, such that they are unable to fully realise the optimised efficiencies of plant and costs on the lower ends of our range.

While household type is also crucial in determining potential savings. For instance, we are aware that public housing tenants are highly unlikely to have to fund their own individual boiler costs, which means the potential associated counterfactual price paid by these consumers is likely lower than those identified above.

The potential savings from any heat network scheme in these situations would then be split between any tenant and association paying for maintenance. This could influence and reduce savings for tenants. Potentially, the distribution savings could lead to council tenants paying more than they might expect under the counterfactual if they were footing their entire heat network bill.

These results demonstrate that savings are highly dependent on individual situations. We would expect that any socio economic assessments on potential schemes would consider these factors in full.

Cost increases

We also considered the possibility that the potential new licencing and regulatory requirements lead to cost increase for heat network developers, to such an extent that prices for heat on those networks would rise.

Overall, as outlined below stakeholders highlighted how they expect that any new licencing requirements around technical standards could lead to small increases in capital costs. However, they would expect that due to higher construction and technical standards that operational costs of networks under such standard would be lower to such an extent that overall costs where decreased.

Overall, we identified limited evidence that the incoming regulations will lead to material cost increases which could be passed on to consumers. We would therefore not expect increases in prices for consumers stemming from these regulations.

Similarly, below we consider the potential evidence for the incoming regulations impacting market costs. We outline how we do not believe that there will be significant changes in market concentration stemming from the incoming regulations. We would therefore not expect there to be material impacts on price and service quality stemming from changes in market power of incumbents.

6.1.2 Consumer disruption from installation

One impact highlighted by stakeholders was the potential for increased disruption from capital projects needed for implementation of heat networks.

As with other utilities, development comes with granting land access rights which could cause issues such as traffic disruption, noise pollution, road and path closures and the disruption from having to allow heat networks operators access to private property.

Any increase or uptake in heat network deployment could lead to an increase in such negative impacts, leading to costs to consumers and the local area. Stakeholders highlighted that although compensation mechanisms existed, (in the form of wayleave payments)[15] these often did not accurately reflect the costs of the disruption caused.

6.1.3 Consumer service offering

An increase in the deployment of heat networks could also influence consumers based on non-price factors. We have sought stakeholder views on the existing business models used by the majority of heat networks, and have looked to identify the differences in service offerings for consumers on heat networks compared to a counterfactual supplier such as a standard retail energy supplier. We received limited direct response highlighting potential issues, however through supplementary research we have identified some potential impacts on customer choice.

Customers often value the availability of nonstandard pricing options and tariff types, for instance, many customers place value in the ability to prepay for their energy usage through using prepayment meters as a payment option. Prepayment can help consumers limit energy usage within their household budgets and provide more certainty around their spending on energy. Heat networks have the potential to decrease the choice and flexibility for consumers in accessing these payment options.

Citizen's Advice has previously highlighted the limited choice available in offerings[16] for customers using heat networks compared to counterfactual retail supply, specifically around payment method and tariff type (single or dual fuel tariff). Their analysis highlighted that around 70% of the schemes surveyed only offered a single heat tariff for domestic customers with no electricity option, while around 50% had restricted meter choices available including reduction in the availability of using a prepayment meter to pay for a household's consumption. We also note that we have not identified any heat networks which offer more innovative cutting edge tariffs (such as time of use tariffs).

An increase the deployment of heat networks could therefore lead to lower levels of customer service through restrictions in customer choice. This could negatively impact consumers who rely on such services, particularly: those consumers who wish to use a prepayment meter for budgeting reasons; those who wish to pay for

[15] Energy Networks Association – Applicable Wayleaves Compensation Rates http://www.energynetworks.org/assets/files/electricity/regulation/Owner%20and%20Occupier%20Wayleave%20Compensation%202016-17.pdf

[16] Citizens Advice - District heat networks 2. https://www.citizensadvice.org.uk/Global/CitizensAdvice/Energy/District%20Heat%20Networks%20IR%20Report%202%20(May%202017)%20-%20FINAL.pdf

their gas and electricity under a single bill to reduce complexity; and those who wish to use more innovative tariffs types.

6.1.4 Consumer health and wellbeing

As part of our evidence gathering activities we looked to identify potential impacts on consumer health and wellbeing stemming from increased provision of heat networks. Broadly, we did not identify any clear evidence to outline either an increase or decrease. We consider later on within this chapter the impacts on air quality.

6.2 Local Authority and Government

6.2.1 Development costs of heat networks regulator

As outlined above, it is likely that as part of the regulatory intervention for heat networks, the Scottish Government would develop or appoint a new sector regulator for the industry. The regulator could be required to manage oversight of the overall statutory regulatory regime for heat networks.

One of the key impacts on the Scottish State of any such development will be the financial and resource costs of setting up and running any new regulatory body. These exact costs will depend upon the scope and nature of the roles of any regulator.

For the purposes of evidence gathering, we have undertaken a top down and bottom up costing, as an indicative estimate of the costs of this intervention on the Scottish State.

- Our top down benchmark has outlined a potential benchmark operating cost of around **£2.56m - £4.17m** per annum.
- Our bottom up analysis has outlined a potential operating cost of around **£0.91m - £2.69m** per annum, however we note this approach has not considered all potential costs to the organisation such as overheads.

A summary of the cost drivers is presented below.

Table 6: A summary of the primary operating cost drivers

Cost driver	Overview
Staff	– Expertise will be required in order to help with heat network regulatory development and implementation of the associated heat network projects. – Specialists in the fields of legal, technical and expert advice for certain roles. – General and administrative costs, and staff costs for the running of any functions.

Facilities	– Proposals will require suitable facilities to operate. – Offices will therefore require the installation and/or maintenance of systems such as air conditioning, lighting and heating.
Systems	– Internal IT and infrastructure systems.

In addition to the operational costs of any body, we would expect a set of one off costs in order to set-up the body itself.

These would include regulatory, legal and process costs required to establish the body, recruitment costs for hiring of staff in preparation for the establishment of the body and contractual procurement costs, dependent on what type of body is put in place.

6.2.2 Regulator role

As the final role, scope of work and delivery mechanism for such a body has not yet been defined, there are significant uncertainties around the potential size and subsequent costs. For instance a body including enforcement functions is likely to require a large number of personnel and specific legal specialists.

However, we can assume a list of likely functions which any new regulatory body for heat networks would deliver. We might expect such a body to undertake functions similar to existing utilities regulators notably:

- Managing the overall regulatory regime;
- Managing the consent process and application review;
- Assessment and administration of all licencing requirements and registers;
- Development of technical / functional standards to regulate quality of service;
- Monitoring and compliance functions with such technical standards; and
- Development / publication of guidance and other assistance to stakeholders.

We have assessed costs for such an organisation, assuming that it functions as a new standalone regulatory body.

6.2.3 Top down benchmark

We have looked to benchmark the costs of a number of Scottish regulators which are fulfilling similar roles to the proposed new heat sector regulatory body.

We have focused where possible on Scottish only regulators which are delivering functions outlined above such as licencing regimes, monitoring, guidance and facilitation roles or wider overview to regulated frameworks.

We note that these organisations are not perfect proxies for potential costs of any new heat network regulator, as the roles and industries they operate in are different. However, we might expect the underlying cost profiles (staff, buildings, infrastructure, and processes) to be similar for both. The table below outlines a benchmark of a number of Scottish based sectoral regulators, which undertake similar functions (albeit on different sectors) of the economy.

Table 7: Top down comparator benchmark[17]

Body	Role	Functions	Year	Cost (£m) 2019	
				Staff	Total
Water Industry Commission for Scotland (WICS)	Non-departmental public body with statutory responsibilities. Manage the regulatory framework which encourages the Scottish water industry to provide a high-quality service and value for money to customers.	Monitoring / reporting Scottish Water's performance such as customer service, investment, costs and leakages. Price setting frameworks conducted every 6 years to deliver Ministers' objectives for the water industry at the lowest reasonable overall cost. Creating / managing regime for licensing the provision of retail water services to the nonhousehold sector.	2017/18	£1.76m	£3.56m
			2016/17	£1.45m	£3.80m
Scottish Charities Regulator (SCR)	A non-ministerial office and part of the Scottish Administration. They are the independent regulator and registrar for over 24,000 Scottish charities	Assess applications for charitable status against the charity test set by the Scottish Parliament, managing admission to charity register. Monitor charities annual accounts and information requests submitted to charities about resources. Identify / deal with misconduct, as well as provide wider guidance and support to charities and charitable bodies.	2017/18	£2.19m	£3.04m
			2016/17	£2.67m	£2.98m

[17] Sources from regulator annual accounts.

Scottish Housing Regulator (SHR)	Independent Non-Ministerial Department which works to monitor, assess, report and intervene as appropriate in relation to social landlords (private and local authority)	Manage and conduct risk based assessments on annual assurance statements submitted by social and private landlords throughout Scotland. Manages register of all the social landlords. Provide help and guidance to tenants and landlords around regulation and standards of service.	2017/18	£3.09m	£4.04m
			2016/17	£3.12m	£4.17m
Ofwat (Retail Competition Regulation)	Costs of with administering the regulatory regime for competition within water.[18]	Assessment by Professor Cave into the regulatory costs of administering retail water licences and regulatory regime to the Economic Regulator.	Estimate	-	£2.56m

In addition to these bodies, we also considered and looked at the Scottish Environment Protection Agency (SEPA). We discounted the use of SEPA as a comparator, as it delivers a number of different functions which we would not expect of a heat network regulator, such as managing an enforcement regime, flood forecasting services and education services to name a few. The organisation has a far larger remit than we would expect from any heat regulator.

These organisations have also broadly been shown to have similar expenditure requirements, ranging from around **£2.56m - £4.17m** per annum in 2019 prices for the management of their regulatory functions across Scotland, as summarised below.

Table 8: Regulatory body annual cost range

Cost range	Low	Medium	High
Cost (£m) 2019	£2.56m	£3.36m	£4.17m

These costs illustrate the annual operating and staff costs of different regulatory bodies regulating areas of the Scottish economy, they do not include additional set up costs.

[18] Ofwat - Costs and benefits of introducing competition to residential customers in England. https://www.ofwat.gov.uk/wp-content/uploads/2016/09/pap_tec20160919RRRfinal.pdf

There are some potential factors which could mean that spending on any sectoral regulator for heat networks might differ from those above, however these are unlikely to lead to significantly differing costs. These include:

- Specialist technical and engineering capabilities could likely be required, as is expected within the existing Water Industry Commission for Scotland.
- It might be required that the potential number of licenced bodies is far larger than currently assessed by the water regulator, however we would not expect these differ significantly and due to the early stages of the regulatory proposals are not able to assess the number of potential licenced bodies.

It might be expected that any new heat network regulator would be appended to an existing organisation. Under this scenario, we might expect the potential annual costs to fall towards the lower end of our identified range. These estimates outlined above are based on individual standalone bodies with their own independent overheads. We would likely therefore expect these to represent the upper end, or maximum cost of development of any new regulator if it where appended to an existing organisation, due to the sharing of overheads with the incumbent body.

Regulatory set up costs

In addition to annual operational costs of the body, there will be a number of specific one off set up costs in order to develop the underlying regime and cost and deliver the overheads which the regulator will be using.

These costs will ultimately vary based on the structure of any new regulator. For instance, if the regulator is appended to an existing body, these might be lower due to sharing of certain overheads compared to the development of a new body from scratch. These costs could include:

- Legal and project costs
- Costs to develop corporate governance
- Employee recruitment
- Premises, infrastructure and overheads
- Initial marketing, branding and communication strategy
- Potential contingency.
- Set up costs for the regulator regime (licencing, codes, registers, guidelines, regulation).

As above, we have looked to benchmark the set up costs of a number of Scottish regulators which are fulfilling similar roles to our proposed new heat sector regulatory body. These should be seen as indicative.

Table 9: Regulatory body set up cost range

Body	Set up costs	£ 2019
Industry Commission for Scotland (WICS)[19]	WICS incurred set-up costs to establish the competitive framework, these included market codes, developing the licencing regime and other staff and set up costs.	£6.72m
Ofwat – Retail Competition Regulation[20]	Costs of development of economic regulation of retail competition for water within England and Wales. Costs to the economic regulator include work to design and implement market arrangements including development of codes, licences, contracts and other market architecture.	£5.80m
Scottish Housing Regulator Transition (SHR)[21]	Total transitionary costs to develop an efficient data collection system and include the cost of changing the SHR from an executive agency to a non-Ministerial Department.	£0.99m

We have looked to identify a range of set up costs for any new regulatory body. Broadly, we identified a large range of costs from around **£0.99m - £6.72m** for the initial set up and development of these bodies. We note that, our lower end estimates for the SHR amount to the transitional costs, stemming from the prior SHR executive agency switching to that of a non-Ministerial Department.

Upon analysis of our proxies, we believe that the WICS represents a more accurate estimate of the potential set up of any new heat network regulator. This body, created from scratch, were involved in the development of the market codes and licencing regime of the new WICS framework, which believe is most similar to our expected set up requirements of the new heat networks regulator.

We have defined a range below of indicative set up costs of the new regulator. We believe that the higher end of this range best reflects the potential costs of the setup of the new body.

[19] WICS - Retail competition in Scotland an audit trail of the costs incurred and the savings achieved.
https://www.watercommission.co.uk/UserFiles/Documents/WICSAuditTrail(B)%20(2).pdf
[20] Ofwat - Costs and benefits of introducing competition to residential customers in England.
https://www.ofwat.gov.uk/wp-content/uploads/2016/09/pap_tec20160919RRRfinal.pdf
[21] Scottish Government – Housing Bill.
http://www.parliament.scot/Research%20briefings%20and%20fact%20sheets/SB10-19.pdf

Table 10: Regulatory body one off set up costs

Cost range	Low	Medium	High
Cost (£m) 2019	£0.99m	£3.86m	£6.72m

6.2.4 Bottom up assessment

We have then looked to, where possible, estimate the costs of the functions of any heat network regulator from a bottom up perspective. We have taken three of the key functions of this regulator as outlined above and where possible, looked to estimate the potential costs of these functions. These include:

- The facilitation role;
- Licence administration; and
- Consenting administration.

a) Facilitator role

It is expected that the new heat network regulators will be given the role of intervening on contractual negotiations in situations where suppliers and users of heat reach impasse to facilitate an agreement. It would be expected that in fulfilling this role certain resource costs will be required on an annual basis.

These costs will depend on a number of factors, most crucially the frequency of delivering this role on an annual basis, and the actual time and resource costs involved. Due to the uncertainties involved, particularly in the likely annual frequency of this role being used we have not sought to assess the costs of this on monetised basis.

However, it would be expected that certain technical, legal and contractual specialists would be required on a full time basis to oversee the facilitator role held by the heat networks regulator, these costs would comprise a material amount.

b) Licence administration

One of the key known roles which might be undertaken by the new heat network regulator is development of licence process to heat network developers and operators. This role will include development of licence requirements, assessment of licence applications, and development of guidance around licences, licence management, licence changes, updating and appeals.

Each of these areas will have specific cost to the Scottish state through staff resource and the required overheads to enable these functions to be completed (costs of business are assess earlier above).

Below, we have looked to evidence the costs of other licence assessment processes performed by UK authorities, as an indicative estimate of the potential costs of any licence process revolving heat networks.

Initial licence assessment

One of the key costs involved is the initial assessment of any licence submissions. Assessment of individual licences will require resource requirements from actions such as filling in forms, responding to queries and assessing the overall licence submission against the criteria. This initial, one off process would be completed for all potential licences.

A number of UK regulatory bodies practice the process of cost reflectivity, whereby fees for a specific process are determined based on the costs of delivery for this process to the regulator, such as licence applications.

Through this principle we can gather a range of indicative financial costs in order to process and assess licence applications. Based on our research of similar processes, we have looked to benchmark what a suitable cost range for undertaking this initial assessment and screening. These are set out below.

We note that these costs do not contain the underlying costs of managing the licence and the underlying regulatory and process requirements which come with this, (this could include licence changes, consultations, decisions and impact assessment). We also assume that these licences and that within the new regulatory proposals are of similar complexity.

Table 11: Licence application review benchmark cost

Process	Role	Source	Indicative Cost*
Ofwat – Supply Licence	Licence to supply eligible stakeholders with retail services, application fee reflects the costs incurred to undertake the necessary assessments / associated public consultation.	Ofwat Website[22]	£5,250
Water Industry Commission for Scotland – Supply Licence	Licence for delivery of water and wastewater services in Scotland, initial cost designed to cover costs of processing applications.	Water Industry Commission for Scotland Website[23]	£4,750

[22] The Water Services Regulation Authority (Ofwat) – Licence fees. https://www.ofwat.gov.uk/regulated-companies/ofwat-industry-overview/licences/new-suppliers/becoming-water-supply-sewerage-licensee-wssl/
[23] Water Industry Commission for Scotland – Licence fees. https://www.watercommission.co.uk/view_Licence_fees.aspx

Ofgem – Supply Licence	Licence for provision of gas or electricity supply to domestic or non-domestic premises. Based on Ofgem new application and vetting process from 2019, cost reflective.	Ofgem Website[24]	£2,150
Ofgem – Distribution or Transmission Licence	Licence for distribution or transmission of gas or electricity supply. Based on Ofgem new application and vetting process from 2019, cost reflective.	Ofgem Website[25]	£3,200
Ofgem – Interconnector Licence	Licence for operation of interconnector. Based on Ofgem new application and vetting process from 2019, cost reflective.	Ofgem Website[26]	£1,050

We would expect that any licence regime for heat networks would look to assess applications based on a risk based approach, looking into both company and director information, track record and potential financial information. Broadly, we believe that this process is more similar to that undertaken by Ofgem as part of the licence applications into the supply market under their new approach.

We note that several of the above licence assessment process contain additional rigour which we might not expect from the heat networking licence scheme, particularly the Ofwat assessment which involves a 20 days consultation on potential licence.

We would therefore likely expect that any licence application costs would fall within the lower end of our range and would expect a range of around **£1,050 - £3,150** for assessment costs for any new regulator, on a per assessment basis, as summarised below.

Table 12: Licence application review individual cost

Cost range	Low	Medium	High
Cost (£) 2019	£1,050	£3,150	£5,250

Appeals process

We would also likely expect there to be a subsequent appeals process against licensing decisions and potential exemptions from licensing, in which appeals would be assessed and potential given hearing and inquiry support. At this stage, due to the lack of information on licence requirements and exemptions thresholds, we have not looked to estimate the potential costs of this process.

[24] Office for Gas and Electricity Markets – Licence application. https://www.ofgem.gov.uk/licences-industry-codes-and-standards/licences/application-process
[25] IBID.
[26] IBID.

One off licence cost to regulator

We would expect that all 32 local authorities within Scotland would be required to seek licences for development and / or operation as part of these proposals. In addition, we expect a large number of private operators would be required to seek licences.

The number of potential licensees will depend on a range of factors, including the overall number of operators and potential exemptions.

At this stage, we have been unable to identify an exact number of potential licensees, however based on the proportion of Scottish heat networks as a whole compared to the UK, this could be in the region of around **95** operators[27], potentially operating multiple sites. To reflect the uncertainty in these figures, we have looked to estimate the annual number of potential licensees using a range of 50% from the central value, with the potential for **48 – 143** licensees.

Based on these figures, and the costs of reviewing highlighted above, we have estimated, using an individual licence review cost of **£2,100** that the potential costs of assessing licence applications could be between **£100,000 - £300,000** on a one off basis.

Table 13: Licence application total cost

Cost range	Low	Medium	High
Cost (£) 2019	£100,000	£200,000	£300,000

Ongoing licence administration

In addition to the initial assessment of licence applications, any regulatory body would likely incur annual administrative costs involved with ongoing operations of the body.

For instance, the Water Industry Commission for Scotland uses both a cost reflective initial application assessment fee, as well as an annual levy, designed to cover the ongoing costs of their licencing activities. This levy directly covers the administrative costs involved with monitoring compliance with licensing terms and administering the licensing regime.

Any heat networks regulator would have to undertake similar licencing administration functions as part of their mandate to issue and manage licences. We have therefore looked to gather a range of indicative costs associated with the administration and management of licencing regimes.

[27] We have looked to estimate the potential number of operators in Scotland, due a lack of specific data on this factor. We have identified that in total, there are around 1,600 supplier/operators across the UK as a whole, we have proportionally scaled this to reflect the 6% of total UK heat networks stationed in Scotland.

Table 14: Indicative costs of licence administration

Process	Role	Costed activities	Source	Indicative Cost Per Licence £ 2019*
Oil and Gas Authority (OGA) Production Licence	Licence levy for the producing oil and gas under the remit of the authority, funding OGA production administration costs.	Licence administration monitoring, wider investment promotion	OGA Website[28]	£94,000
Water Industry Commission for Scotland Levy	Licence levy directly covers the administrative costs involved with monitoring compliance with licensing terms and administering the licence.	Licence administration and monitoring	Water Industry Commission for Scotland Levy Annual Report[29]	£29,000*
Oil and Gas Authority (OGA) Exploration Licence	Licence levy for the exploration for oil and gas under the remit of the authority, funding OGA exploration administration costs.	Licence administration monitoring, wider investment promotion	OGA Website[30]	£11,300
Marine Management Organisation (MMO) Licence	Licence administration costs to the MMO over course of a 5 year licence period.	Licence administration	The Marine Works Impact Assessment [31]	£11,300
Ofwat Licencing Fee Costs	Licence fee annual cost require the payment of fees to cover the operating costs of Ofwat licence.	Codes, licensing, complaints, policy, monitoring	Ofwat Website[32]	£7,000

[28] OGA – Licencing Cost Recovery.
https://www.ogauthority.co.uk/regulatory-framework/legislative-context/industry-levy/
[29] Water Industry Commission for Scotland Levy Annual Report 2018 outlining total levy fees of 2019 prices ~£1,500,000 servicing over 50 licences (individual licences for both water and sewerage) providing an indicative cost per licence.
https://www.watercommission.co.uk/view_List_of_current_licensees%20.aspx
[30] OGA – Licencing Cost Recovery.
https://www.ogauthority.co.uk/regulatory-framework/legislative-context/industry-levy/
[31] Department for Environment and Rural Affairs (DEFRA) - Marine Works Impact Assessment.
http://www.legislation.gov.uk/uksi/2011/735/pdfs/uksiem_20110735_en.pdf
[32] The Water Services Regulation Authority (Ofwat) – Indicative licencing administrative costs per licence.
https://www.ofwat.gov.uk/wp-content/uploads/2018/12/19-02-28-Responses-and-conclusions-WSSL-Licence-fee-consultation.pdf

These organisations have been shown to have a large range of different costs related to the management of the regulatory activities. Our indicative range has highlighted potential expenditure, on a per licence basis or between **£7,000 - £94,000** per annum in 2019 prices.

Our indicative range is likely down to two crucial factors, differences in the underlying activities taken by the regulatory bodies involved, and importantly the underlying costs and skills sets involved within these particular industries.

For instance we note that as well as undertaking additional activities which we might not expect to be undertaken by any heat networks regulator, the oil and gas authority, particularly for production licences, requires a number of technical site visits for licence and monitoring activities which are charged at day rate far in excess[33] of what is expected for any heat network regulator. We would therefore discount these costs as a suitable comparator.

Table 15: Licence administration individual cost

Cost range	Low	Medium	High
Cost (£) 2019	£7,000	£18,000	£29,000

Ongoing licence administration cost to regulator

Based on the potential licence numbers outlined above, we might expect the potential for **48 – 143** licensees. Based on these figures, and the costs of administering above taking a mid-point of **£18,000**, we have estimated that the potential costs of administering the licencing regime could be between **£856,000 - £2,568,000** on an annual basis.

Table 16: Licence regime total cost per annum

Cost range	Low	Medium	High
Cost (£) 2019	£856,000	£1,712,000	£2,568,000

c) Consenting

Another important potential cost for any new heat network regulator would be the consenting process. It is expected that companies who want to develop a new heat network must apply for consent approval prior to development. This would be conducted alongside any existing planning approval processes required.

The individual heat network developments would be assessed by either a regulatory authority or local authority based on a number of factors, which could potentially include:

- Adherence to LHEES and identified Zones;

[33] Oil and Gas Authority day charge out rate per technical officer of £500 per day. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/66575/6792-cost-recovery-oil-gas-consents-consi.pdf

- Local Fuel Poverty Targets; and
- Project level socio-economic assessments.

This process would likely involve a number of different costs to any regulator, primarily stemming from the assessment time taken to review individual applications based on the above criteria, but could also include management of the consenting process, potential requirements for public and confidential hearings to assess individual developments and the development of guidance on consent conditions.

Consenting assessment

The Scottish Government will look to further develop the details of this consenting process and submission at a later date, therefore the impacts on the Scottish State are at this stage indicative.

However, any consent application will require firstly an assessment by the relevant parties. This would be expected to be the largest cost continuing across the regulations. This process could include hearing stages to engage party views, as well as likely continued correspondence and engagement with the submitting organisation.

Based on our research of similar processes we have looked to evidence the time it might take to manage and assess consent applications for new heat network developments, and an provide an indicative cost for this on a per application basis.

We note than there are already significant planning approval processes for potential heat network developments, which the consenting process is not looking to duplicate. For larger scale capital project developments, we have looked to identify a number of potential proxies of the resource requirements placed on regulatory bodies, to both assess consent applications (including the added requirements such as hearing stages and engagement).

Table 17: Indicative comparators for consent assessment

Process	Role	Source	Resource	Indicative Cost*
DNO Wayleaves Consent Assessment	Assessment (DECC) of compulsory "necessary" wayleave for land access for Distribution Network Operators (DNOs) installations. Including hearing and assessment stage.	DECC Impact Assessment[34]	31 days	£5,500
Oil and Gas Development Plan Consent	Assessment of new Field Development Plan and Gas Storage Development Plan approvals consents for Oil and Gas.	DECC Impact Assessment[35]	21 – 33 days	£3,700 - £5,800
Marine Works Environmental Impact Consent	Consent assessment of environmental impact assessments for certain regulated activities in UK waters and UK controlled waters.	Marine Works Environmental Regulations[36]	10 days	£1,800
Oil and Gas Pipeline Consent	Assessment of new Pipeline Works Authorisations consents for application within Oil and Gas fields.	DECC Impact Assessment[37]	5 days	£900

We have identified a range of resource requirements stemming from 5 days up to 33 days, which based on our indicative staff costs* corresponds to a range of around **£900 to £5,800**. Staff costs based on ONS Quality assurance professional with standardised 2019 day rate of £175.

However, we note that these comparators are only partial proxies for the potential costs involved with the assessment stage of heat network development consent. Heat networks are large multi layered capital projects, often concentrated in busy high density urban areas. We think our potential comparators would not face many of the additional complexities faced for assessment of heat network consent.

The potential assessment requirements will include multiple facets (which could be considered more complicated than say an Marine Impact Assessment based only on environmental factors), such as that outlined above.

[34] DECC - IA No: DECC0100. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/66650/6240-impact-assessment-for-the-consultation-the-necessa.pdf
[35] DECC – Cost Recovery Consents. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/66575/6792-cost-recovery-oil-gas-consents-consi.pdf
[36] DEFRA – The Marine Works Environment Impact Assessment. http://www.legislation.gov.uk/uksi/2007/1518/pdfs/uksiem_20071518_en.pdf
[37] IBID.

Table 18: Consenting application review individual cost

Cost range	Lowest	Low - Medium	Medium - High	High
Cost (£) 2019	£900	£2,500	£4,100	£5,800

We would therefore expect the time requirements to fall within the higher end of our identified range. This indicates costs per consenting assessment of between **£2,500 - £5,800** to the Scottish State on a per application basis. Taking up to 33 days of staff time.

Consenting appeals process

We would also likely expect there to be a subsequent appeals process against consenting decisions and potential exemptions from licensing, in which appeals would be assessed and potential given hearing and inquiry support.

At this stage, due to the lack of information on potential numbers of applications and consent decisions, we have not looked to estimate the potential costs of this process. However we would therefore highlight that the financial estimates above do not include the potential costs of dealing with what could be a material impact on costs.

Application and guidance

Similarly, any new consenting process would also require the development of a formalised set of rules and guidance documents to manage applications. This would involve an additional one off cost during any initial set up.

Annual consenting cost to regulator

The total annual cost of any consenting process to the Scottish state would also crucially depend on the number of potential consent applications submitted every year. Based on our estimated medium deployment scenario of around 6.5 TWh a year in 2050 (which we outline later on within this report), we have calculated that around 21 larger district heating heat network schemes would require delivery every year to enable meeting our deployment trajectory[38].

We have estimated that the potential costs of consenting for all of these individual district heat network schemes could cost between **£50,000 - 120,000** on an annual basis.

[38] This is based on an existing average scheme size comparable to existing Scottish district heat networks, and current deployment rates. We have not included the potential for smaller communal heating schemes forming part of this projected take up. We might therefore expect that these estimates underestimate the potential total number of heat network and communal heating schemes which come online by 2050. Estimates rely on use of BEIS Experimental Statistics on heat networks.

Table 19: Consenting review total cost per annum

Cost range	Low	Medium	High
Cost (£) 2019	£50,000	£90,000	£120,000

Total bottom up assessment cost

Based on our bottom up analysis, we have estimated a potential cost range for annual running costs of a heat network regulator as between **£906,000 - £2,688,000**.

However, we note that these costs do not include additional set up costs, overheads of running the body itself, or certain costs related to functions such as the facilitator role. We would therefore propose that the higher end of these ranges better reflected the potential costs of a new regulatory body.

Table 20: Total regulator cost summary

Cost range (£) 2019	Low	Medium	High
One off costs			
Licence review	£100,000	£200,000	£300,000
Annual ongoing costs			
Licence / reg admin	£856,000	£1,712,000	£2,568,000
Consenting review	£50,000	£90,000	£120,000
Facilitator role	Un-costed	Un-costed	Un-costed
Total ongoing	**£906,000**	**£1,802,000**	**£2,688,000**

6.3 Business Impacts

6.3.1 Development and operating cost

One of the key potential impacts highlighted by numerous stakeholders and also identified through desktop research, was the potential for the regulatory proposals for heat networks to impact the costs of direct construction and / or operating networks themselves.

We identified two key routes in which these regulations could impact these costs (we examine other specific process costs driven by the regulations later on below), these include:

1) Potential for increased technical and regulatory requirements to directly increase the costs involved with the direct construction or operation of a heat network.

2) Potential for cost reductions attributable to “learning-by-doing”, driven from support new regulations provide to the development of heat networks in the UK.

1) Development and operating costs

As outlined below, the incoming regulations for heat networks will make it mandatory for companies developing or operating a heat network in Scotland to have a relevant licence.

This licence could come with additional technical standards which could be based on practices similar to the standards of the Heat Networks Code of Practice developed by CIBSE[39]. This could, in theory, lead to additional regulatory requirements for companies and subsequently increase their costs of development or operation. These impacts will depend on a number of factors, including:

- The number of heat network developers/operators who are currently performing at standards equivalent to the potential requirements.
- The impact of any new potential requirements linked to the code of practice on the underlying costs of development and / or operation of heat networks.

As part of our evidence gathering activities, we spoke to a number of developers around these standards of conduct. Broadly, we learnt that outside a limited number of members of the Heat Networks Code, only a limited numbers of developers would look to mimic standards of equivalent rigour. We have assumed that therefore adherence to such requirements are limited across industry.

On potential additional costs of these requirements, we sought direct feedback from a number of developers on the potential impacts of the incremental costs[40], which these requirements could have on development or operation, looking at connections (substations, meters HIUs), Networks (piping, installation), operation and others including ancillary plant.

We received a limited response. There did not appear to be evidence which highlighted that these requirements could lead to a potential for material cost increases for business developers. We have therefore been unable to determine whether these requirements would lead to material cost increases for industry. We note that respondents were suitably aware of the potential scope of these regulations.

2) Learning by doing

As outlined below, the incoming regulations for heat networks could lead to an increase in deployment compared to any counterfactual scenario.

We believe that because of the new regulatory support, deployment of certain numbers of heat networks could occur earlier than might otherwise be the case. For instance, we have outlined how in combination, better zoning policy,

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[39] CIBSE - CP1 : Heat Networks: Code of Practice for the UK https://www.cibse.org/knowledge/knowledge-items/detail?id=a0q200000090MYHAA2

[40] We looked to directly measure the incremental costs of adhering to these codes, in advanced of the counterfactual of the standards of construction and operation across industry.

facilitation, standardisation across industry processes and regulatory support could lead to increased deployment. Through these increases in deployment, we might expect to see cost reductions gained from learnings for industry.

The Carbon Trust, as part of assessments into the heat networks Investment Programme (HNIP), has outlined[41] the potential for decreases in cost arising from greater deployment. Their 2018 study examined the potential cost reductions from deployment of networks in the UK out to 2025 and beyond, through "learning by doing ", driven from additional deployment.

Through increased construction of physical assets and the expenditure of financial resources, learnings can facilitate cost reductions for industry which might not have otherwise been achieved. The Carbon Trust highlighted five key areas which could lead to cost reductions.

Table 21: Cost reduction avenues

Saving Area	Description
Financing	Access to financial capital and processes related to the formulation of administrative, purchasing, planning and legal agreements.
Supply Chain	Elements pertaining to the existence of a competitive supply chain of industry stakeholders and the multiplying effects of increased competition.
Infrastructure	Built environment elements which facilitate the operation of heat networks.
Standardisation	Benefits as heat networks begin to mature and systems, processes and designs become standardised.
Sites	Better understanding and exploitation of the individual complexities of heat network sites.

6.3.2 Socio-economic assessments

The Scottish Government has proposed that a potential requirement within any consenting process would be submission of project level socio-economic assessments. Organisations seeking consent would be required to demonstrate that schemes have been designed according to national and local objectives, including fuel poverty.

Development of any socio-economic assessments would likely require a one off resource impact and/or financial outlay on businesses seeking consent.

[41] Carbon Trust - Estimating the cost-reduction impact of the Heat Network Investment Programme. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/699306/Carbon_Trust._Estimating_the_cost-reduction_impact_of_the_Heat_Network_Investment_Proj...pdf

As part of this work, we have received input from an external consultancy which has outlined a potential cost profile for undertaking similar work. Depending on scheme size and complexity, it was estimated that using external consultants could cost in the region of **£20,000 - £40,000** per socio-economic assessment.

Table 22: Indicative cost for undertaking socio-economic assessment

Cost range	Low	Medium	High
Cost (£) 2019	£20,000	£30,000	£40,000

We note however that many businesses would look to conduct these assessments internally at lower day rates that required using an external consultancy. We would therefore expect the potential cost per assessment to fall within the lower end of our identified range between, **£20,000 - £30,000**.

6.3.3 Licencing process

Cost of application

As outlined above, one of the key costs involved is the initial assessment of any licence submissions. To compensate for these costs, we would expect any heat networks regulator to seek a licence assessment fee during applications. This initial, one off process would be completed for all potential licences.

In line with the cost recovery principles, and examples highlighted earlier, we might expect this fee to require a direct cost to business of around of around **£1,050 - £3,150** on a per licence basis, as outlined above. We would therefore likely expect that any licence application costs would fall within the lower end of our range.

Table 23: Licence application fee

Cost range	Low	Medium	High
Cost (£) 2019	£1,050	£3,150	£5,250

In addition to any licence application fee, we would expect that a resource outlay would be required from business in order to develop, engage and submit any application for a licence. Businesses, for example, would have to incur the time, opportunity and administrative costs associated with applying for a licence (consumers could also incur some of these costs through increases in price).

However, we would not expect this to be a significant undertaking when combined with the individual project socio-economic assessment already being undertaken.

6.3.4 Unintended licence impacts

We have received a variety of feedback from stakeholders outlining potential unintended consequences of the licencing regime as designed. Some stakeholders highlighted the potential for unintended consequences leading to issues for business. For instance:

- Some stakeholders highlighted that schemes should be licenced on an individual basis and not on an operator/developer level. Stakeholders highlighted that the quality, specifications, design and individual technical factors of heat networks are incredibly diverse and site dependent. If licences were to be granted to developers on an aggregate level covering all their schemes, poor performance of one individual "problematic" heat network could lead to revocation of a licence for a developer who otherwise controlled a large number of high quality schemes.
- Some stakeholders also highlighted concerns around the structure of having a joint licence covering all of development, build and operation. Highlighting the need for further information around how this would work in practice, with there often being multiple firms specialised within different aspects of each of these areas across a development.

6.3.5 Market dynamics

Throughout our evidence gathering activities we considered the possibility of the incoming regulations impacting market dynamics. Specifically, we looked to identify evidence for changes in costs or barriers to entry limiting competition within the market (through the number of potential developers / operators), or leading to market exit of potential developers and or operators. We received limited evidence or stakeholder engagement that highlighted these risks as material. We note that stakeholders were suitably aware of the implications of the policy proposals.

As outlined above, we do not believe that these regulations will lead to significant increases in costs for industry.

Regulations could lead to limited process costs such as licence applications or socio-economic assessments, however on a business specific basis we do not view these as material on their own. These increased costs (such as licencing applications), could be more burdensome to smaller or potential new entrants due to their inability to leverage scale. These costs could potentially decrease market entry and lead to changes in market concentration.

However, it is expected that there will be a certain exemption threshold and measure of proportionality for small scale developments. We would therefore expect that the impact on smaller scale entrants to develop networks to be limited.

While similarly, we outlined above how through "learning by doing" deployment increases could lead to material decreases in technology costs, counteracting

potential increases in regulatory costs and easing entry requirements for potentially new developers.

We would therefore deem it unlikely to see changes in the number of suppliers looking to develop and or operate networks.

6.3.6 Increase in deployment

As of March 2018, the latest BEIS experimental data[42] on heat networks identified around 832 individual heat network schemes across Scotland. These schemes were supplying a total of 1,240 GWh of heating or hot water, serving over 25,000 customers.

Table 24: BEIS heat network deployment 2018

Data	Heating / Hot Water Supplied (GWh)	Number of networks		Customers
		All Networks	District	
United Kingdom	14,364	13,995	2,087	476,951
Scotland	1,240 (9% UK)	832	113	25,712

Currently, the Heat Policy Statement[43] has outlined the Scottish Government's ambition to achieve 1.5 TWh of Scotland's heat demand to be delivered by district or communal heating and to have 40,000 homes connected by 2020. While the 2015 National Comprehensive Assessment of District Heating and Cooling[44] estimated that 6.7% of Scotland's heat demand could be met by heat networks in 2025. The potential for heat networks to provide wide scale heat delivery throughout Scotland has been widely highlighted. With one of the key goals of the heat networks regulation package being to support the deployment of networks to meet decarbonisation goals.

Assessing the incremental impact of how these policies could encourage deployment is inherently complex. Firstly, it is extremely hard to predict what the direct impact of policy will be on the likely deployment profiles of the technology over such timescales. While secondly, over such a long timeframe the impact of the cost effectiveness of other technologies will be a key factor in the likelihood of developing heat networks in the future.

[42] BEIS - Experimental statistics on heat networks. https://www.gov.uk/government/publications/energy-trends-march-2018-special-feature-article-experimental-statistics-on-heat-networks

[43] Scottish Government - Heat Policy Statement. https://www.gov.scot/publications/heat-policy-statement-towards-decarbonising-heat-maximising-opportunities-scotland/

[44] BEIS - The national comprehensive assessment of the potential for combined heat and power and district heating and cooling UK. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/499417/Final_NCA_Report_for_publication.pdf

We also note that we, in line with the requirements for any financial memorandum or BRIA, are only interested in the incremental impact which these policies could achieve. In the absence of the any new regulatory intervention there would remain a number of policy drivers to support deployment, including:

- District Heating Loan Fund;
- The Low Carbon Infrastructure Transition Programme (LCITP);
- Heat Network Partnership;
- 50% business rate reductions; and
- Other UK wide schemes including HNIP.

As part of our evidence gathering we have looked to identify potential deployment profiles applicable to different options of regulatory policy. The Committee on Climate Change (CCC), Element Energy and Imperial College have[45] previously commissioned deployment estimates based on different regulatory states. This study estimated based on three core scenarios the potential deployment profiles of heat networks to 2050, based on differing levels of policy intervention. We outline these below[46]. This study estimated the potential roll out profiles for the UK as a whole.

Table 25: CCC, Element Energy, Imperial College – Estimated Heat Network Deployment

Scenario	Description	Deployment (GWh)	
		Country	2050
Low	- A lower connection fraction from consumers likely to result from a lower level of consumer trust and engagement. - Lower level of adoption of the public body policy of connecting to heat networks. - Competition with other incentivised low carbon heating	UK	39,300
Medium	- Cost-effective path to the 2050 carbon emissions reduction target. - The provision of dedicated local heat zones within which heat networks are deemed cost-effective. Within these zones relevant local policies can be applied in a targeted way.	UK	80,500

[45] CCC, Element Energy, Imperial College - Research on district heating and local approaches to heat decarbonisation https://www.theccc.org.uk/publication/element-energy-for-ccc-research-on-district-heating-and-local-approaches-to-heat-decarbonisation/

[46] The CCC study outlines potential deployment profiles for the UK as a whole, we have estimated the potential share of this deployment based on the current heat network share (9%) from Scotland as a whole and linearly projected these forward out until 2050.

	- Financial incentives paid to investors to address externalities in the market related to carbon emissions. - Competition policy, in the form of CMA oversight, to address natural monopoly concerns and help to ensure fair outcomes for consumers to preserve the reputation of the sector.		
High	- Deployment of heat networks pushed towards high potential. - Very strong local heat zoning policy to ensure almost full connection in areas suitable for heat networks. - Higher incentives for low-carbon heat networks.	UK	110,800

We have looked to estimate what the impact of these roll-out profiles could mean in a Scottish context. We have subsequently isolated the indicative impact on Scotland. This is based on attributing a fixed proportion of these roll outs to projects in Scotland. We have estimated this based on the current 9% proportion of UK heat networks as a whole based within Scotland, as outlined above within the BEIS experimental heat network statistics. We project this forward linearly.

Table 26: Heat Network Deployment Scotland

Scenario	Scotland Deployment (GWh) 2050	Proportion of Scottish non-electrical heat demand (2018)[47]
Low	3,400	4.1%
Medium	7,000	8.5%
High	9,600	11.7%

We have looked to align the regulatory intervention, as stands, to one of these scenarios. Firstly, we considered the high scenario where heat networks were pushed towards a maximum potential. This scenario relied on strong zoning policy leading to almost full connection within heat network areas, as well as financial incentives for development.

We have received strong feedback from a number of developers and industry bodies which has highlighted that the proposals, as they stand, would not lead to deployment along such a trajectory. Due to removal of mandatory connection criteria and concessions, stakeholders did not agree that policy would directly lead to a substantial increase in network deployment.

Responses highlighted that proposals currently do not mitigate demand risk. We therefore do not think that maximum potential for network deployment is feasible

[47] Proportion of heat demand based on 2018 demand levels of around 82 GWh per annum demanded of total non-electric heat.

without further powers to support developers. While in addition, this scenario would require high levels of financial incentives for development.

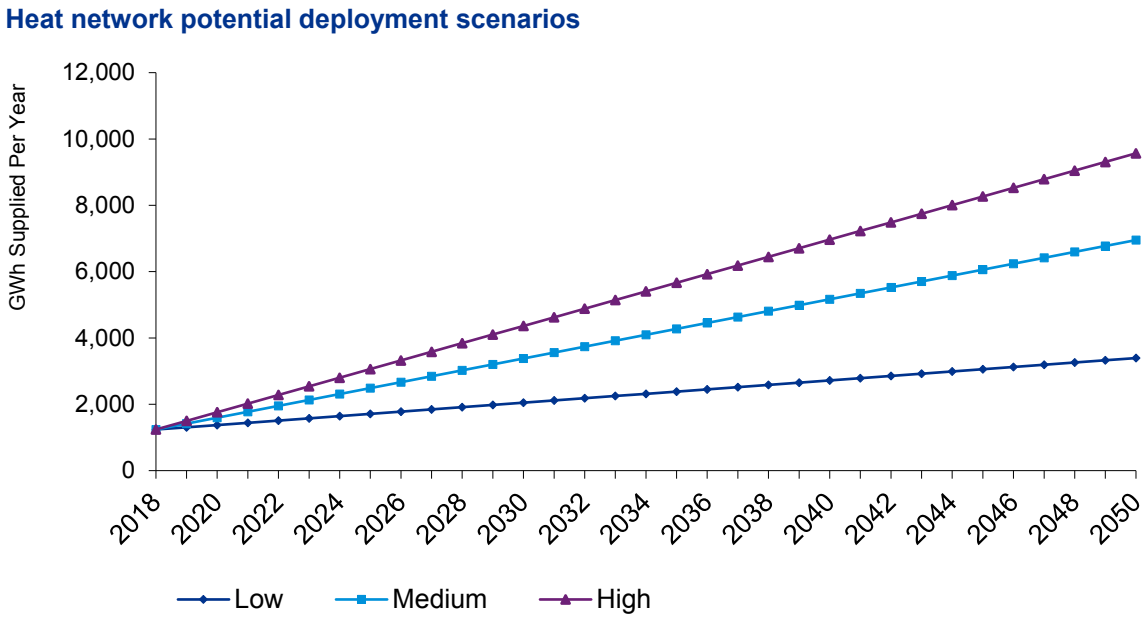
However at this stage, we note that the Scottish Government has already signalled some measures to address these issues. These include for instance, potential requirements for the public sector to assess potential connection to heat networks during the preparation of LHEES and the encouragement of connection or the supply of surplus heat, and also particular consideration of public sector buildings as the ‘anchor load’ for networks and future expansion, within the confines of public procurement regulations. We therefore think these policies will generally align to that of the medium profile trajectory.

The combination of licencing regimes and the addition of a heat network regulator, has the potential to increase consumer trust and engagement, and their likelihood to connect, avoiding the outcomes of the low scenario. While the expected zoning process will decrease competition with other technologies.

One of the crucial policy drivers which is outlined as required for meeting the medium deployment scenario above is the use of heat network zoning. We expect that zoning for heat networks be delivered under the umbrella of the LHEES policy framework not that of the incoming heat networks regulations.

We therefore note that, the incremental impact of the package of heat network regulations as a discrete package, in the absence of any zoning regulations might not support deployment to reach the medium scenario. We concluded that further policy drivers would be required to incentivise deployment and enable meeting those high deployment scenarios outlined above. We might consider the medium deployment scenario as an upper bound of what we might expect based on the existing package of heat networks regulations.

Figure 1: Potential deployment scenarios[48]



Above we have outlined the estimated potential deployment profiles. We estimate that currently, in absence of the proposed regulatory interventions, Scotland could meet the expected low scenario of around 3.4 TWh of heat supplied by heat networks in 2050.

While with the addition of the proposed regulatory packages to support deployment, we believe that the medium scenario is achievable with 7.0T Wh or 8.5% of Scottish non-electrical heat demand (2018) met by heat networks. This would represent an incremental increase of 3.6 TWh in heat supply per compared to the counterfactual.

As with all long term estimates there is a significant degree of uncertainty, we therefore view these roll out profiles as an indicative estimate of what could come to pass.

6.3.7 Connections of waste heat

As part of our evidence gathering we identified the potential for positive impacts on distilleries (and other providers of waste heat). Distilleries use a lot of heat through their activities. They also generate waste heat through production, with the potential for both supply and demand interactions with heat networks. There are over 120 active distilleries spread across Scotland which serve as a producers of waste heat.

[48] Developed from linear projection of existing deployment statistics (BEIS) out to deployment projections formed as part of the Committee on Climate Change Heat Network Deployment predictions. Scottish proportion of overall heat networks unchanged at 9%.

We received feedback that as currently stands, contractual hurdles around the connection of waste heat from distillers often arise due to specific business requirements (such as annual shut down periods).

Stakeholders highlighted how there was potential via the incoming facilitation function to work towards bridging parties across contractual hurdles, particularly through the natural mediation from an independent third party. We might therefore expect this function to lead to greater connection (both generation and demand) for heat from these businesses.

6.3.8 Essential services companies

We have sought information on whether the incoming heat network regulations could lead to impacts on other providers of essential services, such as water and energy retailers. We have identified the potential for impacts on energy retailers in particular.

We would expect where increased deployment of heat networks replaces counterfactual heat sources (gas boilers) there will be impacts on energy suppliers. In these areas, heat supply would transition from multiple energy retail companies to one network supplier. We would expect a decrease in revenues and customers for those incumbents' retailers, with an increased concentration of supply to the network supplier.

The size of these decreases depend heavily on deployment. In Figure 1 we outline how in total around 3.6 TWh of heat per year could be incentivised through these interventions. This would represent a material decrease in customers and revenues for the provision of heat from those incumbent retail suppliers.

6.4 Wider

6.4.1 Carbon Savings

One potential impact of the new heat network regulation is for an increase in deployment in the number of heat networks across Scotland compared to a counterfactual scenario of no intervention.

By directly increasing the deployment of heat networks on the grid, we might expect that there would be direct savings in CO2 emissions, due to the potential for heat networks to provide heat at a lower carbon intensity than heat sources in a counterfactual scenario.

The Report of the Special Working Group on Regulation on District Heating highlighted how reductions in emissions as a result of substituting heat networks for other forms of heating are estimated at 30 - 40%[49]. However, we note that other sources note far lower potential savings rates.

[49] Report of the Special Working Group on Regulation - For the Scottish Government and the Expert Commission on District Heating https://www2.gov.scot/Resource/0049/00497892.pdf

Heat networks generally use a variety of heat sources (CHP, gas boiler, heat pump) with varying carbon intensities. Emission savings are therefore dependent on the fuel mix and counterfactual heating source for individual schemes. The heat sources for individual networks and the counterfactual supply it replaces determine its ability to deliver savings.

All of the different technology types must be taken into account when calculating savings for individual schemes. For instance, use of a CHP will mean additional electricity generation onto the grid which is offsetting emissions from alternative sources.

BEIS has studied[50] at an aggregate level the potential for heat networks to deliver savings in emissions. Crucially, they have shown the significant dependence of potential savings on the value placed on emissions factors (short run, long run, and marginal, average) particularly for CHP electricity generation offset on the grid. These are outlined below.

Table 27: Potential CO^2 savings on counterfactual boiler heat supply[51]

CO^2 Savings	Low	Medium
Special Work Group		
Special Working Group	30%	40%
BEIS Short Term Estimates		
2014 Short Term	-1% (Marginal)	75% (Average)
BEIS Medium Term		
IAG 15 year	-12% (Marginal)	23% (Average)
Mid 15 year	-24% (Marginal)	-18% (Average)

Each heat network would be assessed on an individual basis looking at its impact on fuel poverty and decarbonisation. We would likely therefore expect that where projects are approved, these projects are likely to lead to a positive benefit from a carbon reduction perspective.

We would therefore not expect the negative emissions factors identified above to be applicable for these new schemes. We might therefore expect that potential longer term CO2 savings will range between 0% - 23% (using the IAG 15 year average) for the aggregate programme compared to counterfactual heating sources.

Table 28: Carbon savings

[50] DECC - Assessment of the Costs, Performance, and Characteristics of UK Heat Networks https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/424254/heat_networks.pdf

[51] CO2 emissions from a heat network scheme constructed from BEIS benchmarking data collected, compared to a counterfactual gas boiler with efficiency level of 85%. Negative (-) figures indicate increases in carbon emissions compared to the counterfactual scenario.

Cost range	Low	Medium	High
Cost (£) 2019	0%	11.5%	23%

6.4.2 Air Quality

Another potential impact identified during our stakeholder engagement was a potential impact on air quality. A limited number of stakeholders highlighted potential for improvements in local level air quality, stemming from an increase in deployment of heat networks, and the avoided combustion of fossil fuels or biomass from the counterfactual heat source in populated areas.

While in addition, having a limited number of heat generators allows close monitoring, regulation and assessment of emissions.

However, we have been unable to gather sufficient evidence to conclude that, on aggregate, an increased in deployment of heat networks will deliver such benefits. We are aware of a number of studies[52] which have highlighted potential negative effects, such as studies into effect of CHP in populated areas.

The expansion of CHP could potentially lower overall emissions due to replacement of domestic boilers, however, this could be combined with an increase in pollutants. Heat provided from a combustion-based CHP plant will also directly lead to emissions by burning fuels, which can lead to generation of NOx (nitrogen dioxide and nitric oxide) and finer particulate matter (PM10 and PM2.5).

6.4.3 Wider economic and job impacts

Overall we would expect there to be a number of interconnected impacts relating to jobs and the wider economy stemming from the heat networks proposals.

Firstly, we would expect that any increase in the deployment of heat networks would lead to additional jobs, revenues and business opportunities for those companies and individuals involved in the operation of these technologies.

We would expect more engineering and technical opportunities in order to deliver and operate networks themselves, as well as secondary increases in opportunities for supply chain firms involved in their creation. These opportunities could arise from areas such as:

- Specialist consultants, designers, architects and developers;
- System controls, sensors and heat modelling;

[52] BEIS - The Potential Air Quality Impacts from Biomass Combustion. https://uk-air.defra.gov.uk/assets/documents/reports/cat11/1708081027_170807_AQEG_Biomass_report.pdf
Ricardo Energy - Pilot study on the air quality impacts from Combined Heat and Power in London https://www.london.gov.uk/sites/default/files/pilot_study_on_the_air_quality_impacts_from_combined_heat_and_power_in_london.pdf

- Equipment manufacturers;
- Installation, civil engineering and drilling engineers; and
- Maintenance; and
- Supply chain.

However secondly, as outlined above we might also expect a redistribution of revenues as a secondary impact from any increase in heat network deployment. Essential services companies could see reductions in heat demand of 3.6 TWh by 2050, and this could potentially lead to reductions in employment.

The overall net impact on jobs is therefore complex. Previous research[53] has highlighted how a significant proportion of the total costs of heat networks are spent on capital costs, and installation roles which are often locally based in the areas the networks are created (such as civil engineering, installation and management of Heat Interface Units). It is therefore likely that any redistributed revenues to heat network operators / developers would sustain and encourage local jobs to a material extent.

Comparatively, essential services companies who might see reductions in revenue are usually not geographically concentrated within Scotland, with their customer base, operations and jobs (at a commercial level) not directly related to the local area. As these organisations' operations are spread across the UK, regional reductions in revenue will be mitigated. While any job losses which could occur would be unlikely to be based within the local area.

A decrease in the deployment of gas boilers might lead to reductions in the need for service engineers at a more local level. However, as outlined above we might expect that the significant requirement for local level maintenance to mitigate these losses.

[53] ADE – Heat Networks in the UK. https://www.theade.co.uk/assets/docs/resources/Heat%20Networks%20in%20the%20UK_v5%20web%20single%20pages.pdf

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