Title: Amendments to the Heat Network (Metering and Billing) Regulations 2014 **IA No:** BEIS021(C)-19-CG **RPC Reference No:** RPC-4346(1)-BEIS **Lead department or agency:** Department of Business, Energy and Industrial Strategy **Other departments or agencies:** N/A	**Impact Assessment (IA)** **Date:** 10 September 2019 **Stage: Consultation** **Source of intervention:** EU **Type of measure:** Secondary legislation **Contact for enquiries:** Adam Gardiner (Adam.Gardiner@beis.gov.uk)

Summary: Intervention and Options

RPC Opinion: RPC Opinion Status

Cost of Preferred (or more likely) Option				
Total Net Present Value	**Business Net Present Value**	**Net cost to business per year** (EANDCB in 2016 prices)	**One-In, Three-Out**	**Business Impact Target Status**
£518m	-£363m	£32.2m	Not applicable	To be determined

What is the problem under consideration? Why is government intervention necessary?

The Heat Network (Metering and Billing) Regulations 2014 ('the Regulations') were implemented to transpose Articles 9-11, and 13 of Directive 2012/27/EU (the 'Energy Efficiency Directive' or 'EED') and set requirements for heat suppliers to install and maintain heat metering devices, as well as minimum requirements for billing information. In some circumstances, the obligation to ensure installation of heat meters and heat cost allocators (HCAs) is subject to its cost-effectiveness and technical feasibility. However, the benchmark methodology used to assess the cost-effectiveness of installing meters and HCAs, prescribed in current regulations, needs updating to ensure consistency with the minimum requirements of the Directive.

What are the policy objectives and the intended effects?

The objective is to ensure the installation of heat meters and heat cost allocators on heat networks where it is cost-effective and technically feasible to do so. This is in order to incentivise energy savings by the end customer through giving information on energy use and billing customers on their actual heat consumption, which is shown to lead to changes in behaviour and a reduction in energy use. A further objective is to specify categories of buildings where individual meters should always be installed (Viable) and categories that should always be exempt from a requirement to install individual meters (Exempt). This leaves only the Open class to undertake a cost effectiveness test for heat meter and HCA installation. These steps are to help minimise administrative burden on businesses, in line with the guidelines published by the European Commission on the implementation of the requirements set out in Articles 9-11 of the EED. The policy also proposes to ensure that all appropriate customers of heat are protected by the provisions of the Regulations, including those who have meters that have been installed before the Regulations came into force or voluntarily since then.

What policy options have been considered, including any alternatives to regulation? Please justify preferred option (further details in Evidence Base)

- Option 0: Here, the 'Do nothing' option would have resulted in a continuation of existing arrangements and the Regulations remain unchanged.
- Option 1: (Preferred) Amend the Regulations to specify three building classes: Viable, Exempt and Open as recommended by the EU guidance. The methodology used to assess cost-effectiveness under the Open category is amended to improve the accuracy of results from the test. This is the preferred option as without amendments the policy will not be able to assess cost-effectiveness of installing meters accurately and therefore ensure meters are installed where feasible and cost-efficient, which is required by the Energy Efficiency Directive. Additionally, we will be consulting on whether the amendment should extend some of the requirements already imposed by the Regulations to those meters that have been installed voluntarily or before the Regulations came into force.

Will the policy be reviewed? It will be reviewed. **If applicable, set review date:** 12/2024

Does implementation go beyond minimum EU requirements?		No		
Are any of these organisations in scope?	**Micro** Yes	**Small** Yes	**Medium** Yes	**Large** Yes
What is the CO_2 equivalent change in greenhouse gas emissions? (Million tonnes CO_2 equivalent)		**Traded:** -0.25 MtCO2e	**Non-traded:** -4.43 MtCO2e	

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

Signed by the responsible SELECT SIGNATORY: .... Date: ....

Summary: Analysis & Evidence

Policy Option 1

Description:

FULL ECONOMIC ASSESSMENT

Price Base Year 2018	PV Base Year 2018	Time Period Years 14	Net Benefit (Present Value (PV)) (£m)		
			Low: 67	High: 1,419	Best Estimate: 518

COSTS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	0		5	**70**
High	0		106	**1,489**
Best Estimate	0		39	**543**

Description and scale of key monetised costs by 'main affected groups'

The main affected group in terms of costs are the heat suppliers (those who would install the meters following a cost effectiveness test). The NPV of costs incurred includes the costs of: a) administrative tasks associated with complying with the new amendments; b) undertaking technical feasibility and cost-effectiveness tests (if chosen to do so); c) capital and operating costs as a result of installing meters; d) operating costs associated with providing billing information; and, e) a one-off cost to allow businesses to familiarise themselves with the new Regulations.

Other key non-monetised costs by 'main affected groups'

For businesses, there may be additional installation costs as a result of changes to the billing arrangements (switching from a flat fixed rate to a real-time metered rate) and temporary disruption to the heat supply while meters are installed. For consumers, the expected behavioural change as a result of meter installation may result in under-consumption of heating when faced with the cost of their heating consumption which can lead to adverse health impacts and associated costs. Temporary disruption to heat supply in which meters are being installed and tested will also have an adverse impact on consumers.

BENEFITS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	Optional		Optional	**Optional**
High	Optional		Optional	**Optional**
Best Estimate	0		76	**1,061**

Description and scale of key monetised benefits by 'main affected groups'

Monetised benefits are expected for both the recipients of meters and society as a whole. The installation of heat meters is expected to result in reductions in heat usage by customers on heat networks as heat meters allow for billing based on actual usage. This increases transparency in heat usage allowing the consumer to control their energy use in order to lower bills. As a result, there are expected reductions in energy use and consequently carbon emissions and air quality damage costs.

Other key non-monetised benefits by 'main affected groups'

With better information on actual heat usage, heat suppliers could have the opportunity to optimise network performance which could result in a cost reduction. Consumers with reduced energy bills could spend this saved money elsewhere in the economy, thus benefiting from this new consumption. It is not possible to quantify the extent of this benefit, given the uncertainty around what consumers will spend saved money on.
Extending the provision of the regulations to customers with existing meters will also improve consumer protection, e.g. redress in the event that meters are not working satisfactorily.

Key assumptions/sensitivities/risks **Discount rate** 3.5

There is uncertainty regarding the total number of heat networks in operation in the UK and therefore in scope of the Regulations. From 2014 all networks were required to notify the Office for Product Safety and Standards (OPSS) of their existence and certain details about the network (number of customers, heat generation, fuel type etc). However not all networks notified OPSS and not all who did submitted a quality return. Quality assurance was carried out on this database and the analysis is run on the quality assured but reduced number of networks. The model is then scaled up to account for the larger amount of heat networks known within the market (and notified to OPSS). Uncertainty around the number of heat networks in scope persists.
Another key risk is the decrease in energy consumption assumed. The assumed level of energy saving is based on evidence from other countries in Europe and assumes all domestic buildings face the same energy savings (and all non-domestic buildings face the same energy savings). This is a simplifying assumption for ease of modelling as it is not possible to know the energy savings at the building level.

BUSINESS ASSESSMENT (Option 1)

Direct impact on business (Equivalent Annual) £m:			Score for Business Impact Target (qualifying provisions only) £m: 160.8
Costs: 37.1	**Benefits:** 0.0	**Net:** -37.1	

1. Executive summary

1. This Impact Assessment (IA) supports a consultation on amendments to the Heat Network (Metering and Billing) Regulations 2014 as amended ('the Regulations') which transposed Articles 9-11, and 13 of Directive 2012/27/EU (the European Union's 'Energy Efficiency Directive' or 'EED'). The Regulations require heat suppliers to install individual heat meters or heat cost allocators (HCAs)[1] in buildings on heat networks, unless a test is carried out in accordance with the Regulations which shows it is not cost-effective and technically feasible to do so.

2. Amendments to the Regulations are required to address two main issues:
    a. The benchmarking methodology for assessing the cost-effectiveness of installing meters and heat demand estimation (prescribed in the current Regulations), needs to be updated to ensure meters are installed where feasible and cost-effective, in line with the requirements of the EED.
        i. New European Commission guidance on implementation (published in December 2016) recommends Member States specify categories of buildings where heat meters should be installed, subject to suitable assessments (i.e. building classes).
        ii. The proposed building classes are:
            a) Open Class: Buildings where heat meters should be installed subject to a cost effectiveness and technical feasibility assessment.
            b) Viable Class: Buildings where heat meters should always be installed.
            c) Exempt class: Buildings which should always be exempt from installing heat meters.
    b. Ensure that the provisions of the Regulations cover all customers on heat networks with final consumption meters including those whose meters installed before the Regulations came into force or voluntarily since then.

3. From 2014 all heat networks were required to notify the Office for Product Safety and Standards (OPSS) of their existence, over 18,000 notified. Quality assurance was carried out on this database and this created a smaller dataset of approximately 14,000[2]. The analysis in this IA used the smaller dataset and is scaled up as it is assumed that the total number of heat networks notified to OPSS equals the total market size of heat networks in the UK.

4. Approximately 442,000[3] dwellings and units (both domestic and non-domestic), are connected to heat networks but are unmetered[4]. Under the proposed amendments (Option 1), it is estimated over 265,000 of these customers will have heat meters installed and around 22,000 will have heat cost allocators (HCAs) installed, between 2020 and 2024. In addition, it is estimated over 16,000 customers are currently metered, but receive no billing information for their heat usage. The Regulations require businesses to provide accurate bills and billing information based on actual consumption – it is assumed all existing metered customers will receive billing information following amendments to the Regulations[5].

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[1] Is a device which is attached to a radiator in order to measure its total heat output, and can thus be used to reduce heat output

[2] BEIS Energy trends, special feature article 'Experimental statistics on heat networks' (2018): https://www.gov.uk/government/publications/energy-trends-march-2018-special-feature-article-experimental-statistics-on-heat-networks.

[3] Ibid. The number is based on Experimental Statistics but scaled up to account for the number of networks known to exist.

[4] This refers to those heat networks that are currently unmetered after the 4-year installation period, this number has thus been subject to market growth over the four years

[5] A simplifying assumption has been made to assume that there is 100% compliance with the Regulations

5. This IA differs from the IA that was published in 2014, in a number of ways including:
    a. In the 2014 IA, the "options appraisal focuses on the least cost way of implementing the minimum requirements of the Directive". This was because only the options considered would meet the UK's obligations under the directive, and therefore there is no 'Do nothing' option. This differs from this IA, where the 'Do nothing' option is a continuation of the regulations without amendment.
    b. The 2014 IA used a smaller figure (12,900) from a database DECC commissioned in 2012 prepared by Databuild and BRE[6], whilst this IA scales up the approximately 14,000 heat networks from the OPSS dataset.

6. It is estimated that installations will result in a Social Net Present Value (SNPV) of £518m. This includes the additional resource costs of heat supplier administration and assessments, heat meters and heat cost allocators (HCAs); and the additional benefits arising from reduced energy use, carbon emissions and air quality emissions. It is estimated the amendments will deliver carbon emissions savings of around 5 MtCO2e and a reduction in energy use of 25 TWh over the appraisal period.

7. The Equivalent Annual Net Direct Cost to Business (EANDCB) of the proposed amendments is estimated to be £32.2 million per year. This includes the additional costs to heat suppliers of administration and assessments.

8. There is uncertainty around these impacts, in particular due to uncertainty over the total number of heat networks in operation in the UK and the savings which will result from installing meters. These uncertainties are explored in detail in this IA. **We welcome views from stakeholders on the evidence presented and the way it has been used in this assessment.**

2. Problem under consideration

9. In 2014, the Heat Network (Metering and Billing) Regulations were implemented to transpose Articles 9-11, and 13 of Directive 2012/27/EU, known as the Energy Efficiency Directive. The Regulations imposed a number of requirements on heat suppliers, including a duty to install customer-level heat metering devices, that accurately reflect actual energy consumption, in buildings on heat networks unless it would not be cost-effective and technically feasible to do so. This then ensures that billing, which is compulsory, at least annually by the Regulations, is clear and based on actual consumption, again a specification of the Regulations.

10. The EU published guidelines to help Member States implement the Regulations which introduces building classes (Exempt, Viable and Open). Second to this, the "Heat Metering Viability Tool" to assess cost effectiveness has been suspended as it became apparent that very few buildings would have been required to install heat meters[7]. This tool needs to be amended and thus this IA proposes to do this alongside the implementation of building classes. Together, this will ensure consistency with the minimum requirements of the Directive.

11. Requirements in addition to individual consumptions meters imposed on Members States are:

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[6] A summary of the data has been published at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/212565/summary_evidence_district_heating_networks_uk.pdf

[7] This was because the tool widely used benchmarking data to estimate heating and cooling demand across domestic and non-domestic buildings of different types

a. If it is not cost effective or technically feasible to install heat meters, buildings on heat networks should then install individual heat cost allocators (HCAs) on all radiators within an individual apartment/unit and hot water meters. These are also subject to a cost-effectiveness and technical feasibility assessment. If this is not possible, heat suppliers may seek other cost-efficient options to measure heat usage.
b. Multi-apartment and multi-purpose buildings must install a building-level heat meter at the point of heat exchange or point of delivery, cost-effectiveness and technical feasibility conditions do not apply.
c. Conditions of cost-effectiveness and technical feasibility do not apply in the following situations and heat suppliers must always install individual meters on:
    i. A newly constructed building supplied by a district heat network.
    ii. A building supplied by a district heat network that undergoes major renovations which relate to the technical services of that building

12. In December 2016, the European Commission published new guidelines for EU Member States to support implementation of the cost-effectiveness requirements of the Directive.

13. The EU guidance introduces the concept of 'building classes' that specify the categories of buildings where heat metering devices should always be installed (Viable Class) or never installed (Exempt Class). For all other buildings, meters should be installed unless it would not be cost-effective and technically feasible to do so (Open Class). All three classes are introduced by the guidelines and the introduction of building classes is therefore considered to be the best way of ensuring clear and effective implementation of the EED and is thus the basis for Option 1 of this IA.

14. Building classes have been introduced to avoid 'gold-plating'[8], as the classes should provide a practical framework, at minimal cost, to assess whether buildings will need to install metering devices or not. This will allow for implementation of the Directive in the least burdensome way, in line with the guidelines.

15. In order to define these building classes, amendments to the Regulations are required.

16. In order to assess the cost-effectiveness of installing meters, the Department of Energy and Climate Change (DECC, now BEIS) commissioned the development of the original cost-effectiveness tool. However, it became evident that the tool produced a negative result for almost all buildings tested. A follow up review identified a number of areas for improvement in the methodology. BEIS is now consulting on changes to the cost-effectiveness methodology and tool to ensure it is robust and can be used by heat suppliers to accurately assess the cost-effectiveness of installing meters by 2020.

Heat Meters and Heat Cost Allocators (an explainer):

- A heat meter (in this context) is a device which measures the thermal energy provided by a source and gives a central source of control for consumers within their home. Heat meters will enable customers to engage with their heat usage in real time to allow them to decide when to use their heating and at what temperature to heat their homes thus having greater control over their energy use and their bills. Customers will have a transparent view of the heat they use which will encourage a reduction in wasteful consumption. If customers for example want to save energy (and reduce their heating bills), they can decrease their demand for heating (by turning off their heating or reducing the temperature). This will reduce the demand for the energy source in the heat network for heating, which means the energy source can reduce its

[8] Gold plating is defined as 'exceeding the requirements of EU legislation when transposing Directives into national law'.

supply. This results in the energy saving, and its subsequent benefits. If the energy source remains active however and there is a thermal store, then the excess heat which is produced can be stored in the thermal store for later use when demand increases. This future demand is in part serviced by the thermal store, and the energy source need not produce.

- Heat Cost Allocators are affixed to radiators and measure temperature. In particular they measure both the temperature of the radiator surface and air temperature. Based on these two values, the HCA can calculate the radiator usage. Comparing the aggregated values of the radiator usage, the HCA calculates the percentage of usage for each radiator. Thus, from the overall total cost of heating for a certain period of time, the share each apartment has contributed to this sum can be calculated and each customer can be billed based on their consumption. Thus, the consumer can receive information about their energy use and can, if desired, alter their behaviour.

3. Rationale for intervention

The 'Free-rider' problem and market failure

17. The cost of supplying heating and hot water to buildings on communal or district heat networks is often apportioned according to the methodology set out in the lease of the property. This means that Landlords and Housing Associations often charge a fixed percentage of the total building service charge for heat to each flat based on certain characteristics.
18. As a result, consumers are not charged for the actual consumption of heating and hot water- as this information is not readily available at an individual level. Instead, customers are billed based on a fixed charge, so they face a zero-marginal cost for heat usage, meaning there is a risk consumers over-heat their homes.
19. This can generate a free-rider problem[9], whereby some consumers subsidise the use of heating for others in the same building. Installation of heat metering devices should resolve these problems by introducing a variable charge, ensuring that consumers face the cost of the energy they use. This will encourage more efficient use of heating and a more equitable charging of heating based on actual consumption[10].

Equity issues

20. Heat consumption can lead to inequitable transfers between consumers in the context of a free-rider problem, given those using more heat than the quantity they pay for are being subsidised by those paying a higher fee. This can lead to particularly adverse outcomes for households on low incomes. However, those who may be overpaying on a fixed charge, may benefit most from paying for their actual consumption of heat on a variable charge[11].

Externalities

21. Externalities represent a problem in the market, as the price within the market does not reflect the interests of all those impacted. For negative externalities, the price does not reflect the cost which is borne onto those not involved in production or consumption of the good or service. Thus, the good or service is overproduced relative to what is considered optimal. There are two externalities to be considered for this IA.

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[9] This differs from a 'pure' free-rider problem whereby individuals would benefit from consumption of all of a good or service without contributing towards it. Under this scenario, only a portion of heat consumption can be considered to be paid by others.

[10] It is assumed that customers do not value the convenience of a fixed charge given difficulties around estimating this.

[11] There may be a similar impact on vulnerable customers with high levels of heat usage who may receive higher bills as a result of a variable charge; however, it is felt that the impact of this would be minimal.

a. Firstly, consumption of heat imposes a negative externality on society, as the generation of this heat results in the production of greenhouse gas emissions and other pollution. These emissions impose a cost on those not involved in production or consumption of this heat, by impacting air quality for example.
b. Secondly, customers on a fixed charge face no additional charges for increasing their heat consumption and so there is no incentive to reduce consumption of heat. Since the supplier cannot recover additional costs of higher heat consumption from those using a larger quantity of heat than they are paying for, they will impose these additional costs on all customers. Thus, the cost of consumption is not directly borne by those using a higher quantity of heat than they are paying for, but the cost (externality) is passed on to all consumers.

22. The installation of heat metering devices should help to rectify these externalities by introducing a variable charge, ensuring that consumers face the cost of the energy they use. It is assumed therefore that the introduction of heat meters will mean the price customers face reflects what is considered optimum. In the first case, customers will reduce their consumption, which will reduce production, which will reduce the negative externalities exerted on society. In the second case, those increasing their heat usage will face the costs of their consumption without impacting other consumers.

4. Policy objective and description of options considered

23. The objective of the policy is to update existing regulations to ensure the UK is meeting the minimum requirements of heat metering and billing as set out in the Energy Efficiency Directive. Updated regulations will ensure the UK is acting consistently with the Directive while also addressing the market failures set out above.

24. The Regulations[12] state that, with exceptions on technical or financial grounds, meters are installed for final customers for district heating or communal heating "to measure the consumption of heating, cooling or hot water by that final customer." This allows billing based on actual consumption of heat. Where it is not cost effective to install a heat meter, heat cost allocators must be fixed to each radiator of every unit in addition to a water meter, where technically feasible and cost effective, to ensure customers are billed on actual consumption of heat.

25. Page 6 of the EU guidelines[13] comments that the regulatory approach recommended is to "declare entire classes (collections, types) of buildings as either viable or exempt from the provisions of EED Articles 9-11". The guidance then goes on to define that the Open class captures all remaining buildings which would be subject to the cost effectiveness test. To meet the EU Directive effectively, this IA follows the EU guidelines by testing amending the Regulations to align with building class definitions.

26. Two options are considered in this Impact Assessment (IA):
    a. **Option 0: Do Nothing.** The Do Nothing scenario is a continuation of existing arrangements whereby the Regulations are implemented, but unchanged. Heat suppliers would be required to install individual heat meters/HCAs when major renovations take place or when a connection is made in a newly constructed building supplied by a district heat network. The cost-effectiveness tool would remain suspended, which is expected to lead to no installations, as a result of the cost-effectiveness assessment.
    b. **Option 1: Amend the Regulations to define three building classes: Viable, Exempt and Open Class. This is the preferred option.** Here the existing Regulations are

[12] The Heat Network (Metering and Billing) Regulations (2014): http://www.legislation.gov.uk/uksi/2014/3120/pdfs/uksi_20143120_en.pdf
[13] https://ec.europa.eu/energy/sites/ener/files/documents/mbic_guidelines20170123_en.pdf

amended to introduce three building classes: Viable, Open and Exempt, as recommended by the EU guidelines. The description of each class has been developed to ensure an easy and reliable categorisation of buildings into different classes at minimal or no expense. The Open class has been updated so the cost-effectiveness assessment carried out for buildings in this category is methodologically robust and as consistent as possible with updated guidelines from the European Commission. This will mean meters will be installed where cost effective which will mean customers will be billed based on the actual consumption, as specified by the Regulations. The Regulations specify the installation of meters where it is cost effective to do so, however where it is not then heat cost allocators should be installed instead, which is also included within this Option 1. A full description of the building classes and revised cost-effectiveness methodology is set out below.

27. The Government has also considered options for non-regulated approaches to meet the requirements of the EED, however these approaches may not meet the EU Directive effectively. The Heat Trust, which launched in November 2015, established an industry-led consumer protection scheme for heat networks that guarantees service standards (including standards for metering and billing), from heat suppliers who are members. Separately, the heat networks code of practice, launched in 2015, defines minimum technical standards for heat networks, including metering.

28. Although these are welcome initiatives, becoming a member of the Heat Trust is voluntary. This means heat suppliers cannot be relied on to meet the UK's legal obligations under the Directive, even when included as eligibility criteria for government funding schemes (e.g. Heat Networks Delivery Unit funding or Heat Networks Investment Project funding). Therefore, the industry itself and key consumer groups (e.g. Citizens Advice, Fuel Poverty Action) are calling for further statutory consumer protections, in line with wider gas and electricity users.

29. Additionally, the scope of the Regulations has been extended to include existing metered customers. This is to maximise possible energy savings and improve the coverage of existing enforcement activity.

Introduction of building classes

30. The consultation proposes amending the Regulations to introduce Exempt, Viable and Open building classes and the categories of buildings that fall into them. These are set out below in Table 1.

Table 1: Proposed building classes and characteristics used to determine these classes

Building class	Requirement to install individual meters or heat cost allocators?	Categories of buildings	Rationale for inclusion
Viable Class	Individual meters must always be installed	Newly constructed buildings supplied by a district heat network	Regulation 7(2)(a) of the Regulations based on EED 2012 Article 9(1)(b)
		Building supplied by a district heat network that undergoes major	Regulation 7(2)(b) of the Regulations based

		renovations relating to the technical services of that building	on EED 2012 Article 9(1)(b)
		New-build buildings with a communal network	Pending consultation outcome on whether considered to always be technically feasible and cost-effective
Exempt Class	Individual meters or heat cost allocators do not need to be installed.	Buildings consisting mainly of domestic units on communal or district heat networks in which heat is distributed by means of water with a normal operating temperature above 90°Celsius.	Not considered technically feasible as described in Paragraph 4(b) of Schedule 1 to the Regulations
		Buildings on communal or district heat networks where there is more than one entry point for the flow and return pipes of the network into each private dwelling within that building or where the entry point is not known.	Not considered technically feasible as described in Paragraphs 4(a) and 5(b) of Schedule 1 to the Regulations
		Buildings, consisting mainly of non-domestic units, on communal or district heat networks in which heating is supplied by a system using means other than hot water.	Not considered technically feasible as described in Paragraphs 5(a) of Schedule 1 to the Regulations
		Buildings, consisting mainly of non-domestic units, on communal or district heat networks in which cooling is supplied by a system using a transfer fluid other than water.	Not considered technically feasible as described in Paragraph 5(c) of Schedule 1 to the Regulations
Open Class	Requirement to install individual metering devices subject to positive outcome of	A building that is already metered, when replacements are required.	Regulation 7(3) of the Regulations based on EED 2012 Article 9(1)(a)

	assessment of cost-effectiveness.	All other buildings on existing communal and district networks.	Regulation 5 of the Regulations based on EED 2012 Article 9(1) and (3)

Cost-effectiveness testing

31. Buildings in the Open class are required to install heat meters or HCAs unless it would not be "cost effective and technically feasible to do so"[14]. We assume that where heat meters break, they would be replaced anyway and not necessarily undertake a cost-effectiveness test, given the practical implications for billing already metered consumers.

32. The European Commission commissioned research to gather evidence and provide guidelines for Member States on how to assess feasibility and cost-effectiveness. This was published in December 2016[15].

33. Schedule 1 of the Regulations sets out the calculation for determining cost-effectiveness. It considers installation of heat meters or HCAs as cost-effective if the net present value (NPV) of the projected energy savings to all final customers in the building over the 10-year period subsequent to installation is greater than the NPV of the estimated costs of installing meters (or HCAs) in that building.

34. Guidelines from the European Commission sets out that the required inputs for the cost-effectiveness calculation, however there may be issues with the availability and quality of data. Where data does exist, this is often averaged across the building stock. We will be testing this as part of our consultation and consider stakeholder responses for the amendments to the cost-effectiveness tool.

5. Costs and Benefits

35. This IA assesses the costs and benefits associated with the installation of heat meters and HCAs following amendments to the Regulations. The costs and benefits of installation are compared against the counterfactual scenario (Option 0: 'Do Nothing').

Analytical methodology

36. The costs and benefits are assessed over a 14-year period in total between 2020 and 2034[16]. This covers the four years from 2020 to 2024 during which metering devices are installed plus the 10-year lifetime of those metering devices.

37. The methodology used to assess the costs and benefits is as follows:

    a. Estimate the number of meters that will be installed under the counterfactual scenario, Open and Viable classes.

[14] The Heat Network (Metering and Billing) Regulations (2014), this document sets out the conditions for implementation. http://www.legislation.gov.uk/uksi/2014/3120/pdfs/uksi_20143120_en.pdf

[15] European Commission Guidelines (2016) for feasibility and cost-effectiveness of implementation of regulations. https://ec.europa.eu/energy/sites/ener/files/documents/mbic_guidelines20170123_en.pdf

[16] Based on discussion with the Office for Product Safety and Standards, it is assumed the Regulations will require a familiarisation period between 12 and 24 months.

b. Construct a cost profile for an average metering device installed in a domestic and non-domestic building, taking into account the various costs associated with a meter or HCAs installation, operation and billing.
c. Construct a benefit profile for an average domestic or non-domestic metering device, based on the social benefits incurred from the installation of a heat meter or HCA.
d. Multiply the estimated number of metering devices installed[17] by the corresponding costs and benefits profiles, to get total costs and benefits.
e. Scale up these total costs and benefits[18] to reflect the estimated number of heat networks in the UK.

Number of meters installed

38. It has been estimated that just under 442,000 customers are on heat networks but are unmetered[19], and this will increase year-on-year as the market grows[20]. It is assumed that 25% of those in scope will be exempt from the requirements of the Regulations to install meters, which will reduce the total number of networks in scope across the appraisal period to around 332,000. In the absence of further evidence 25% has been assumed, based on analytical best judgment of existing heat networks. It was felt that the proportion of those networks that were exempt, could exist within a range of 10% to 50%, with 25% constituting a reasonable assumption. This is an assumption we will test through consultation.

39. Under the counterfactual scenario, it is estimated that around 22,000 heat meters will be installed over the appraisal period. This is based on the heat meters that would have be installed regardless (in what would be considered the Viable and Open class): due to undergoing renovations (2%), or if an existing meter breaks (2%) and new building on a network (3.6%) – see Annex A for rationale of percentages.

40. Furthermore, of those heat networks in scope of the Regulations, in Option 1 those in the Open class must undergo a cost effectiveness test (outlined in the box below) which is undertaken by the network. If it is not cost effective, then they will not have to install a heat meter as per the Regulations. This reduces the number of heat networks that will have to install a heat metering device, as it is assumed 65% pass the cost-effectiveness test for a heat meter and thus must install. For those that do not pass for a heat meter, they take a test to assess the cost effectiveness of HCA's in which 19% pass. These assumptions are based on running a simplified cost effectiveness test for installing a heat meter for each network within the OPSS notification database and finding the proportion of those which would 'pass' the cost effectiveness test[21]. This analysis was completed on a sub-set of the full OPSS dataset which had higher data quality, and then scaled up to reflect the full number of networks that have notified and is explained in the cost effectiveness test methodology box below.

Cost effectiveness test methodology

- It is considered cost effective to install a meter or HCAs, as per the 2014 regulations, where the projected energy savings (to all final customers in the building) over the 10-year period following installation, are greater than the estimated costs of installing meters (or HCAs) in

[17] More detail on the assumptions used to estimate meter installations can be found in Annex A.

[18] Costs and benefits are scaled up from the 14,000 heat networks assessed in this IA to just over 18,000 – this is to account for the heat networks which have notified BEIS RD and are known to exist but not captured in the analysis

[19] This estimate is scaled from the experimental Heat Networks statistics of March 2018 found here: https://www.gov.uk/government/publications/energy-trends-march-2018-special-feature-articles

[20] It is assumed that the market will grow at 3.6%, which is based on analysis of the OPSS database.

[21] The figures are calculated as the number of domestic and non-domestic meters to be installed, as a proportion of total unmetered networks.

that building. Thus, cost effectiveness is determined by making a net present value (NPV) calculation for each dwelling / building on the network.

- Energy savings for individual buildings are calculated by taking into account the heat supplied by heat networks listed in the Office for Product Safety and Standards (OPSS) notification database. The heat supplied is then averaged across the number of buildings on that heat network to obtain an estimate of benchmark heat usage per building. This is a simplification necessary due to the lack of data on how energy use varies between different buildings on each network.

- The Regulations (Paragraph 3 of Schedule 1) stipulate projected energy savings of 20% for domestic buildings[22]. The expected reduction of 20% in heat usage for domestic buildings that is assumed is based on evidence from countries in Europe, specifically a 2015 study from the University of Dresden[23], which found a 20% domestic reduction when 'consumption-based billing' was introduced. The study also argued that a 20% reduction could be expected in other countries in Europe, including France, Sweden, Poland and Italy.

- For other buildings, the Regulations (Paragraph 3 of Schedule 1) stipulate energy saving should be at 10% or 5%. In the absence of further evidence, we have used the conservative assumption that non-domestic building heat savings will be half those of domestic building heat savings (so assumed to be 10%[24]). The rationale behind this is that non-domestic buildings are likely to have a bill payer that is different from the heat user. Thus, heat metering will induce smaller heat savings in non-domestic buildings than for domestic buildings, by reducing the incentive to reduce heat usage.

- In the first year of the appraisal period it is assumed only half of the expected reductions will materialise for both domestic and non-domestic buildings. This is consistent with existing Regulations[25].

- To estimate the final meter/HCA NPV, a private discount rate of 3.5% is assumed[26]. A discount rate is used to show the value of future benefits and costs relative to benefits and costs realised in 2020[27]. These benefits and costs are multiplied by the retail price[28] of the input fuel used to generate heat, in order to estimate the final NPV at 2018 prices.

- The NPV associated with meter/HCA installations takes into account the cost of billing, the capital cost of the meter and the operational costs associated with meter installation, including the cost of conducting cost-effectiveness assessments. These costs are explained in more detail in the next section. It was found it was cost effective to install a meter in 65% of heat networks.

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22 http://www.legislation.gov.uk/uksi/2014/3120/pdfs/uksi_20143120_en.pdf

23 'Effects of Consumption-Based Billing Depending on the Energy Qualities of Buildings in the EU' - University of Dresden (2014) https://www.ista.com/fileadmin/twt_customer/countries/content/Hungary/Documents/EED/Summary_LiteraturrechercheEinsparungHKV_final_20151218.pdf

24 This should be tested through the consultation.

25 Evidence suggests energy savings lags can be between 1-2 years in length: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48389/5462-district-heating--heat-metering-cost-benefit-anal.pdf

26 This is in line with guidance from the European Commission which recommends "a discount rate of up to 4 % is used" and Green Book guidance which recommends 3.5%

27 The Green Book guidance does not provide guidance on private discount rates, therefore 3.5% has been assumed in line with EU Commission guidance and Green Book social discounting practices.

28 Industrial price for non-domestic and domestic price for domestic customers. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/793632/data-tables-1-19.xlsx

- If final costs exceed energy savings, no meters are installed. The same test is then carried out for heat cost allocators. Energy savings for heat cost allocators are also assumed to result in a 20% reduction over the appraisal period. The only difference between these two tests is the costs incurred as, capital costs for HCAs are considerably lower than heat meters.

41. From those networks considered in scope, the proportion estimated to be installed in each class is set out as per the categories in Annex A and from the assumptions outlined in the same section. In the Open class, it is estimated around 212,000 heat meters and 22,000 HCAs are installed. This takes place in the first year of the appraisal period, as it is assumed that for existing unmetered customers, they take the test in that year, and those for which it is cost effective they will install a meter. Under the Viable class, around 54,000 heat meters are installed.

Table 2: Summary of scaled heat meters and HCAs installed

	Domestic Meters/HCAs Installed (000s)	**Non-domestic Meters/HCAs Installed (000s)**	**Total Meters/HCA Installed (000s)**
Counterfactual	15	7	22
Open Class	163	69	232
Viable Class	37	16	53
Total	215	92	307

Note: the figures in this table may differ from elsewhere in this IA slightly due to rounding

42. There is also a proportion of customers that are already metered, but receive no billing information for their heat usage. There are estimated to be over 16,000 customers of this type. These meters already installed do not fall under the current billing requirements of the Regulations as only customers who have a meter installed due to the existing Regulations are required to be billed on consumption. This IA includes an extension of scope to the Regulations so that all currently metered customers will receive a bill based on consumption as part of the amended Regulations[29]. This will be explored further during the consultation.

Monetised costs from implementation of the regulation amendments

43. A cost profile is constructed based on the administrative costs, assessment costs and installation costs, and is then multiplied according to the number of meters installed in each class.

Administrative costs

44. The administrative costs associated with heat meters and HCAs involve the cost to business of familiarising themselves with the amended Regulations[30]. A standard cost model approach is used to estimate the costs. It is assumed that at a cost of £24 per hour, one manager[31] per business will spend 7.5 hours (one day) familiarising themselves and then disseminating information to other staff.

[29] These provisions cannot be implemented under s2(2) of the European Communities Act 1972 as they are not mandatory under the EED, hence alternative primary powers would need to be identified.

[30] This cost also includes familiarisation with information and guidance on the cost-effectiveness effectiveness test

[31] ONS, (2017), 'Annual Survey of Hours and Earnings: 2017 Provisional Results', available at: https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/datasets/occupation4digitsoc2010ashetable14

45. There is another cost to business from registering with the OPSS and the subsequent reporting– typically once every four years. It is assumed a total of 15 hours per network will be spent, requiring either an estate manager or consultant at an hourly cost of £23[32].

46. This gives a total of £525 per network for administration costs which are incurred once[33]. However, these costs are not affected by the proposed amendment to the Regulations as the duty to notify remains unchanged.

Table 3: Summary of administration costs per network

	Costs per hour (£)	Hours required	Total Costs (£)
Familiarisation with regulation and dissemination	24	7.5	180
OPSS notifying/ registering	23	15	345
Total			525

Note: the costs in this table may differ from elsewhere in this IA slightly due to rounding

Heat meter operational costs

47. A cost of £81 per year is assumed to be incurred for all heat meters installed in order to account for ongoing costs. This was found to be the median value of maintenance, data collection, generating and sending bills and the collection of money from individual end users from the BRE Heat Metering Cost Benefit Analysis report.[34]

48. For existing metered customers who currently receive no heat bill but will receive billing information post regulations, there is an assumed cost of £35 per customer per year[35] to business for meter readings and providing billing information.

Table 4: Summary of operational costs per meter

	Costs per year (£)
Ongoing Costs	81
New billing costs *(additional billing)*	35
Total	116

Note: the costs in this table may differ from elsewhere in this IA slightly due to rounding

Assessment costs

49. The assessments costs borne by heat suppliers relate to the costs of undertaking cost-effectiveness and technical feasibility assessments for the installation of heat meters and heat cost allocators (HCAs).

50. In order to assess the cost-effectiveness of installing a heat meter, heat suppliers will need to collect data on each building on the network and calculate the associated costs. It is assumed

32 Ibid

33 The estimated time requirements used above are based on evidence submitted to OPSS in 2016 by a sample of businesses that undertook assessments under the current Regulations.

34 District Heating – Heat Metering Cost Benefit Analysis (2012). Based on a compiled database of heat networks and consumers in the UK. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48389/5462-district-heating--heat-metering-cost-benefit-anal.pdf

35 Based on responses to the 2014 Consultation for Heat Metering and Billing for the on-going operating cost of heat meter, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/396087/EED_Metering_Final_IA_-_signed_.pdf

this task will be undertaken by an estate manager or consultant and this will cost £23 per hour[36] for 12 hours.

51. Technical feasibility assessments must also be carried out to ensure the building is suitably designed for the installation of meters. It is assumed this task will be undertaken by an estate manager and take 1 hour per building at a cost of £24 per hour[37].

52. The estimated time requirements used above have been informed by evidence submitted to OPSS in 2016 by a sample of businesses that undertook assessments under the current Regulations. This gives a total assessment cost (undertaking both the cost effectiveness test and the technical feasibility assessments) of £303 per building – as meters are installed at the building level.

Table 5: Summary of assessment costs per building

	Costs per hour (£)	Hours required	Total Costs (£)
Cost effectiveness test	23	12	276
Technical feasibility assessment	24	1	24
Total			303

Note: the costs in this table may differ from elsewhere in this IA slightly due to rounding

Installation costs

53. Capital and operating costs associated with the installation of heat meters or HCAs are assumed to be borne by heat suppliers. Suppliers may pass these costs onto consumers through higher energy bills; however due to difficulty estimating this with the evidence available, it is assumed that no costs are passed on.

54. Cost estimates for domestic and non-domestic heat meters are taken from a report by Sustain (2017)[38], which provides estimates for heat meters installed in domestic and non-domestic buildings. Costs for domestic and non-domestic buildings, are based on an average pipe diameter of 15mm and 50mm respectively. The sum of the cost of a heat meter and its installation are taken and summed, to give a cost of £372 for domestic properties and £1,457 for non-domestic properties.

55. It is also assumed that both domestic and non-domestic buildings will implement a data gathering system[39]. The costs for this are based on responses from the previous 2014 consultation which provided evidence on the capital cost of a data gathering system, installation of data gathering system and the details of what this included.

56. The capital and installation cost of a data gathering system are taken from 2014 consultation responses[40], which in 2018 prices are estimated at £64 and £96 respectively. The consultation responses agreed that the BRE (2012) report estimated the costs of data gathering accurately and therefore these costs were unchanged from the BRE (2012) report in the 2014 IA.

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36 ONS, (2017), 'Annual Survey of Hours and Earnings: 2017 Provisional Results', available at: https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/datasets/occupation4digitsoc2010ashetable14

37 Ibid.

38 'Establishing the unit costs of heat meters', Sustain (Jan 2017, unpublished), Department for Business, Energy and Industrial Strategy (BEIS) Regulatory Delivery Directorate appointed Sustain, part of the Anthesis Group, to undertake the task of researching and reporting relevant data pertaining to the cost of heat meters.

39 This is at the discretion of the heat supplier, however there is limited evidence around the number of buildings with data systems installed.

40 'Implementing the Energy Efficiency Directive: metering and billing of heating and cooling' (2014). https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/379049/EED_Government_response_-_261114_version.pdf

57. Summing the total installation costs and data gathering costs for non-domestic buildings gives a total cost of £1616 per building.

58. Heat cost allocators provide a less accurate indication of the quantity of heat used and are not widely used in the UK. However, they are cheaper than heat meters and more modern electronic HCAs are fitted with anti-tampering technology and have greater accuracy than older evaporative models. As HCAs take readings of space heating only, a hot water meter would also be necessary, as a requirement of the Directive. A hot water meter is distinct from a heat meter and has a lower cost. As an allocator is required for every radiator, the capital costs will depend upon the number of radiators in each property.

59. It is assumed the average dwelling will have 6 radiators. This is based on evidence from the English Housing Survey[41], where an average number of rooms has been taken across dwelling types.

60. Capital costs for individual HCAs are drawn from the responses to the 2014 consultation[42] . The costs are £150 per unit/dwelling for installation of the HCA and the cost of water meter, and £45 for HCA CAPEX (including data gathering). These costs are inflated to 2018 prices using the GDP deflator, and are thus respectively £155 and £46. The same costs are assumed for both domestic and non-domestic buildings; giving an overall HCA cost therefore of £201 per building.

61. Responses to the consultation from when the Regulations were first introduced identified the potential of requiring two meters in heat networks where space heating and hot water are delivered through separate piping systems. Due to a lack of knowledge on the number of such systems in the UK, in this analysis it is assumed that all heat network dwellings would require one meter for both space heating and hot water. This is in line with the assumption made for the final stage impact assessment for the original regulations.

Table 6: Summary of installation costs

	Total cost (£)
A: Heat meter supply and installation (domestic)	372
B: Heat meter supply and installation (non-domestic)	1,457
C: Supply data gathering system	64
D: Installation data gathering system	96
Total domestic meter cost (A+C+D)	**532**
Total non-domestic meter cost (B+C+D)	**1,616**
Installation cost and cost of a Water Meter	155
Capital cost of an HCA	46
Total HCA cost	**201**

Note: the costs in this table may differ from elsewhere in this IA slightly due to rounding

Monetised benefits from implementation of the regulation amendments

62. Benefits arising from the amended Regulations arise due to the expected behavioural changes in the use of heating and hot water as a result of meter installation. The types of expected benefits are:

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[41] Based on number of rooms per dwelling type from English Housing Survey Homes Report 2011, Figure 1.12, p.20: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/211324/EHS_HOMES_REPORT_2011.pdf and Dwelling Size Survey 2010, Table 3.3, p. 9: http://webarchive.nationalarchives.gov.uk/20110118095356/http:/www.cabe.org.uk/files/dwelling-size-survey.pdf. Radiators are assumed in each room, including the hall.

[42] 2014 Consultation for Heat Metering and Billing, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/396087/EED_Metering_Final_IA_-_signed_.pdf

a. Energy savings.
b. Reduced carbon emissions.
c. Avoided health impact from poor air quality[43].

63. The methodology used is consistent with HMT guidance on the valuation of energy use and greenhouse gas emissions for appraisal[44]. The central values for energy and carbon prices are used for this IA. The impact of using high and low carbon prices are presented as sensitivities in Section 6.

Energy savings

64. Schedule 1 of the Regulations stipulates that a reduction in heat demand of 20% should be used for the assessment of cost effectiveness[45]. However, this is with the exception of the first year prior to installation, where it is considered to be 10%[46]. This is based on a behavioural assumption which assumes a lag between meter installation and the full impacts of energy reduction taking effect.

65. The starting point for assessing the benefits associated with meter installation is to estimate the reduction in energy use. In order to assess these savings from metering, an average energy savings profile was constructed based on building heat demands[47] from domestic and non-domestic buildings, as well as thermal efficiency. It is assumed networks operate with a thermal efficiency rate of 80%[48]. Estimated building fuel demand is then derived by dividing the assumed building heat demand by the thermal efficiency rate. To estimate the energy savings, building fuel demand is multiplied by the assumed energy reductions.

66. This gives the average energy reduction caused by domestic meters per year as 2MWh and 26MWh for non-domestic meters. This is then divided by two for the first year only, to account for the fact that the first year will see a lower energy reduction due to familiarisation with the regulations and a lag in consumer behavioural change. A profile of energy savings is then calculated.

67. Reductions in energy are valued at the long run variable cost (LRVC) of fuel, taking into account the size of the change in energy use and the value of this change. A weighted average of the LRVCs of gas, electricity, biomass and oil is used[49], thus accounting for the primary energy sources associated with production and consumption of heat energy.

68. Under policy Option 1, domestic energy savings are estimated to be 4.2 TWh, which gives an annual average saving of 0.22 TWh across the appraisal period. This social value of this is £110m (discounted, 2018 prices). Non-domestic energy savings are estimated to be 21.3 TWh, which gives an annual average saving of 1.52 TWh across the appraisal period. In monetary terms this is equivalent to £542m (discounted, 2018 prices).

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[43] It is worth noting that the first benefit accrues to customers whilst the later accrue to society

[44] Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal at https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal

[45] http://www.legislation.gov.uk/uksi/2014/3120/pdfs/uksi_20143120_en.pdf

[46] This considers domestic meters. For non-domestic meters, the figures are 5% for the first year and 10% for subsequent years.

[47] Heat demand estimates were obtained from the OPSS notification data.

[48] Network efficiency can vary according to the age and design of a network, however for the purposes of this IA it has been assumed that losses amount to 20% and this is similar to assumptions made by the Standard Assessment Procedure (SAP)

[49] The LRVCs for each fuel type, is weighted by the proportion that fuel makes of the total fuel mix – this fuel mix is drawn from the OPSS database.

69. Under policy Option 1 this gives a total energy saving of 25.4 TWh and annual average energy saving of 1.8 TWh across the appraisal period. In monetary terms this is equal to £653m (discounted, 2018 prices).

Table 7: Summary of energy savings by class

	Class	Total Energy Savings (TWh)	Annual average Energy Savings (TWh)	Value of energy Savings (£m)
Domestic	Open	3.1	0.22	82
	Viable	0.7	0.05	19
	Additional Billing	0.4	0.03	10
	Total	4.2	0.3	110
Non-domestic	Open	17.1	1.22	437
	Viable	3.9	0.28	99
	Additional Billing	0.3	0.02	7
	Total	21.3	1.52	542
Total		25.4	1.8	653

Note: the benefits in this table may differ from elsewhere in this IA slightly due to rounding

Reduced carbon emissions

70. The expected reduction in heat usage will cause carbon emissions to fall as less energy is consumed for space heating and hot water. The projected carbon savings are valued at the central carbon prices[50]. Associated carbon emissions are predominantly in the non-traded sector, with the exception of some networks which are either powered by electricity or networks which participate in the EU Emissions Trading System.

71. Under the proposed policy option (Option 1), estimated domestic carbon emissions reductions over the appraisal period result in savings of 0.77 MtCO2e, which gives an annual average yearly saving of 0.05 MtCO2e across the appraisal period. This is equivalent to £29m in monetary terms (discounted, 2018 prices). Under Option 1, estimated non-domestic carbon emissions reductions over the appraisal period result in a savings of 3.91 MtCO2e, which gives an annual average yearly saving of 0.28 MtCO2e across the appraisal period. This is equivalent to £237m in monetary terms (discounted, 2018 prices).

72. For existing metered customers who now receive billing information, there is an estimated carbon saving equivalent to £7m (discounted, 2018 prices). This gives an estimated net carbon saving of 0.1 MtCO2e, which is equivalent to £188m (discounted, 2018 prices).

73. Under Option 1, the total carbon emissions savings are equal to 4.68 MtCO2e and an annual average of 0.33 MtCO2e across the appraisal period. This is equivalent to £266m in monetary terms (discounted, 2018 prices). This is split between traded and non-traded carbon savings of 0.25 MtCO2e and 4.43 MtCO2e respectively, £14m and £252m in monetary terms (discounted, 2018 prices).

[50] HMT Green Book supplementary guidance - Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal at https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal

Table 8: Summary of carbon savings

	Total Carbon Savings (MtCO2e)	Total Non-Traded Carbon Savings (MtCO2e)	Total Traded Carbon Savings (MtCO2e)	Total Carbon Savings (£m)	Yearly Carbon Savings (£m)	Total CB3 Saving 2018-2022 (MtCO2e)	Total CB4 Saving 2023-2027 (MtCO2e)	Total CB5 Saving 2028-2032 (MtCO2e)
Domestic	0.77	0.73	0.04	29	2.09	0.18	0.40	0.18
Non-domestic	3.91	3.70	0.21	237	16.95	0.92	2.03	0.95
Total	4.68	4.43	0.25	266	19.04	1.1	2.43	1.13

Note: the benefits in this table may differ from elsewhere in this IA slightly due to rounding

Air quality damage costs averted

74. Improvements to air quality are also expected in line with the energy reduction, given that less air pollution should be created. Air quality damage is valued at the air quality damage costs provided by HMT Green Book supplementary guidance[51]. As with energy savings, the air quality damage costs for each fuel type is weighted by the proportion that fuel makes of the total fuel mix[52].

75. Under Option 1, domestic air quality damage costs averted is equivalent to £23m (discounted, 2018 prices). Non-domestic air quality damage costs averted is equivalent to £119m (discounted, 2018 prices).

Total air quality damage costs under Option 1 are estimated therefore to be £142m (discounted, 2018 prices).

Table 9: Summary of air quality damage costs averted

	Class	Total Air quality damage costs (£m)	Yearly Air quality damage costs (£m)
Domestic	Open	18	1.24
	Viable	4	0.28
	Additional Billing	2	0.15
	Total	23	1.67
Non-Domestic	Open	96	6.84
	Viable	21	1.52
	Additional Billing	2	0.11
	Total	119	8.47
Total		142	10.14

Note: the benefits in this table may differ from elsewhere in this IA slightly due to rounding

Summary of costs and benefits

76. A summary of the total costs and benefits associated with the counterfactual scenario and the amended regulations are presented in Table 10.

[51] Data tables 1 to 19: supporting the toolkit and the guidance, available at https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal

[52] This information is taken from the OPSS database.

77. Costs incurred to business are shown in Table 10, they are largely due to the capital and installation costs associated with metering. The largest benefit is the reduction in energy use.

Table 10: Summary of costs and benefits

	Option 1 (£m, discounted)
Administrative costs	16
Assessment costs	277
Capital and installation costs	250
Total cost	543
Reduced carbon emissions	266
Energy savings	653
Air quality damage costs averted	142
Total benefit	1,061
Net Present Value	518

Note: the sum of costs in this table may differ from elsewhere in this IA slightly due to rounding when separating out the costs

78. The costs and benefits outlined indicate a Social NPV of £518m for Option 1 (amending the Regulations). This calculation is based on a central estimate of over 14,000 heat networks, which is then scaled up to account for the just over 18,000 heat networks known to exist.

79. There is substantial uncertainty around this estimate due to the limited data surrounding the total number of heat networks in operation in the UK. Sensitivities are considered in Section 6.

80. Due to RPC accounting practices, only the direct costs and benefits are considered when assessing the impact on businesses. As explained in explained in Section 7, the benefits considered in this IA are indirect. Therefore, based on RPC procedures, the net impact on businesses only considers costs in this IA.

6. Sensitivity analysis

81. There is considerable uncertainty associated with many of the assumptions and inputs used in this assessment. While some of this uncertainty will be mitigated through evidence collected during the consultation, we illustrate the effects on the social net present value of varying the assumptions which have the most influence on the overall outputs. These assumptions include the assumed metering costs, assumed reductions in heat demand as a result of meter installation, and carbon prices.

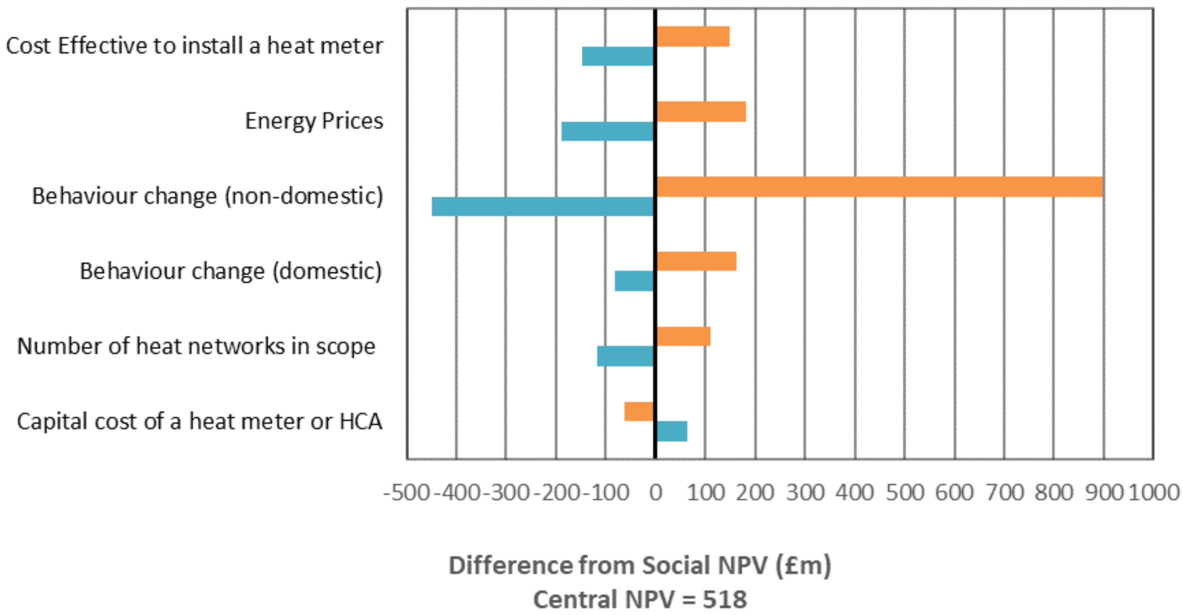
82. As set out in Table 3, the social NPV is highly sensitive to the assumed level of behaviour change associated with metering, particularly for non-domestic installations. This is to be expected as the assumption affects both the initial cost-effectiveness assessment, determining whether meters are installed, and the benefits associated with meters which are deemed cost-effective.

83. Higher metering costs results in a lower social NPV as it is deemed to be cost-effective to install meters in fewer dwellings and the resulting benefits are not realised, the reverse holds true for lower metering costs. This relationship also holds for installation costs.

Table 11: Sensitivity analysis carried out and the difference to overall Social NPV

	Sensitivities tested	Difference from central estimate (£m)	Scenario NPV (£m)
Cost Effective to install heat meter	35% pass and install a meter (-30%)	-148	369
	95% pass and install a meter (+30%)	148	666
Energy prices	Low price scenario	-188	330
	High price scenario	182	699
Behaviour change (non-domestic)	2.5% in the first year, 5% in the years following	-449	69
	10% in the first year, 20% in the years following	898	1416
Behaviour change (domestic)	5% in the first year, 10% in the years following	-81	436
	20% in the first year, 40% in the years following	161	681
Number of heat networks in scope	Assume 14,000 heat networks	-118	400
	Assume 22,000 heat networks	111	629
Capital cost of a heat meter, HCA and data gathering system	Reduction of 25%	63	580
	Uplift of 25%	-63	455

Figure 1: Sensitivity analysis carried out and the difference to overall Social NPV



Risks and uncertainties

<u>Heat networks in the UK</u>

84. There is considerable uncertainty surrounding the number of heat networks in operation, and in scope of the Regulations, in the UK. Heat suppliers are required to notify the OPSS of the details of any heat networks. These heat networks are documented in its notification database, which has been used to aid the analysis in this IA. However, it is believed the database underreports the true number of heat networks. This is due to the existence of many smaller heat networks which either may not be aware of the Regulations or have simply failed to register.

85. In order to account for the heat networks missing from the database, OPSS commissioned Sustain in 2017 to estimate the total market size. As a result, it was estimated that around 40,000 heat networks are currently operational and in scope of the Regulations. However, there is uncertainty in this estimate and on the total number of heat networks. For the purposes of this IA, we have only included heat networks which are known to exist based on notifications to the OPSS.

Heat savings

86. For the purposes of this IA we have assumed that total savings of 20% can be expected following the installation of either heat meters or HCAs. However, there are two potential issues with this assumption.

   a. Firstly, the assumed reduction of 20% in heat demand is based on evidence from countries in Europe[53] [54] [55], as we currently have no evidence from UK experience to draw on. As outlined in the box on 'Cost effectiveness test methodology', the 20% is based on savings expected in Germany and other European nations, such as France. It is reasonable to assume that the UK will experience similar reductions given similarities between heating systems.
   b. Secondly, the assumption that heat meters and HCAs will yield similar heat savings is untested, drawing on evidence from a German study[56]. It was felt that this is a reasonable assumption as heat meters and HCAs both operate on a similar principle: by making actual consumption known to consumers they are expected to reduce their heat usage.

7. Costs and benefits to business (direct and indirect)

Direct benefits and costs:

87. This IA has considered the costs and benefits arising to business as a result of the amendments to existing Regulations. Costs and benefits to business can be considered direct or indirect. An impact is considered 'direct' if it arises directly from the implementation of the measure. BEIS assesses these direct impacts using the standard methodology to calculate the annual net direct costs for business (Equivalent Annual Net Direct Costs for Business, or EANDCB)[57].

88. All costs within the IA are considered direct. The total direct costs to business are valued at £363m over the 14-year total appraisal period (between 2020 and 2034). There are no direct benefits accruing to businesses from these amendments, as the benefits which are accrued are considered indirect.

[53] 'District Heating – Heating Metering Cost Benefit Analysis' (2012), BRE and Databuild. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48389/5462-district-heating--heat-metering-cost-benefit-anal.pdf

[54] Siggelsten and Hansson (2010) which identifies studies that find savings between 10 – 40% ('Incentives for Individual Metering and Charging', Siggelsten and Hansson (2010): http://dspace.mah.se/dspace/bitstream/handle/2043/10791/Incentives_for[1].pdf?sequence=1)

[55] A literature review for Defra found that there was a 5-15% saving to be made from direct feedback (i.e. live monitors) and a 0-10% saving from indirect feedback (i.e. through informative billing). However, only one of these studies, from Sweden, focused on heat networks specifically and it failed to include a comparable control group.

[56] Impact of Individual metering and billing presentation (study yet to be translated into English): http://iet.jrc.ec.europa.eu/energyefficiency/sites/energyefficiency/files/files/documents/events/3_felsmann_11.11.2013.pdf

[57] EANDCB does not consider indirect impacts. Thus, within this IA, only costs are included as benefits are considered indirect.

Indirect benefits and costs:

89. Benefits and costs are considered to be indirect if they arise as a 'secondary' impact of the direct changes caused by the policy. Given that all the costs considered in this IA are direct, there are no costs which are considered indirect.

90. All benefits within this IA are considered indirect, given that any behavioural change with regards to heat usage occurs after the installation of heat meters or HCAs, and once billing information is provided.

Total benefits and costs:

91. Given that the benefits accrued are indirect, they are not included in the EANDCB, which only includes the direct costs to business. This results in a total EANDCB of £32.2m. As this measure contributes towards the deregulatory targets of the Government, the EANDCB will count towards the Business Impact Target commitment of the Government.

Small and Microbusiness Assessment (SaMBA)

92. A small and micro-business assessment is not required as the regulations are transposing a European Directive.

8. Wider impacts

93. The estimated direct quantified impacts on business are covered in the monetised costs and benefits in Section 6. However, a number of impacts have not been monetised due to the uncertainty involved. There are not expected to be any direct financial or resource impacts on Departments other than BEIS.

Economic and financial impacts

94. Heat suppliers may face additional costs of installing metering devices as a result of the costs of any changes to billing software, disruption to operations during metering device installation or any need to consult with consumers about changes to the way they are billed.

95. Customers may have their heating and hot water turned off for a period during installation and testing and may also incur 'hassle costs' where a technical assessment of meter installation is required. However, heat suppliers may be able to infer from inspecting one property if meters are technically feasible in all properties of that kind, reducing the likelihood of disruption.

96. The analysis assumes consumers respond to the introduction of variable pricing alongside meter installation by reducing heat consumption. If this results in consumers under-heating properties, there could be additional costs in terms of sub-optimal health outcomes, reduced quality of life and greater demands on health care services.

97. One of the knock-on effects from a consumer reducing heat consumption as a result of metering is that some of the financial savings may be spent on other energy consuming goods and services: the rebound effect. This means that the overall impact on energy consumption is smaller (although consumers will still benefit from the welfare provided by these other goods and services). This will reduce the carbon reductions and air quality improvements associated with the amendments to the Regulations. It is not possible to quantify this however as energy savings will vary significantly between different consumers and we do not have this information available.

98. Improved data on customers' heat use from the use of meters could allow heat suppliers to optimise their network performance, reducing costs.

99. There may be distributional impacts to the extent that the amendments increase meter/HCA uptake and billing based on actual use. This should reduce situations where low-demand consumers subsidise high demand users when bills are composed of fixed charges that only loosely reflect consumption.

Social impacts

100. The impact of the amended Regulations on fuel poverty has not been assessed. An analysis of households using communally heated buildings suggests that only a small minority of these in England are in fuel poverty. Low income households connected to communal heating tend to have low costs as they have relatively low energy needs and are not in fuel poverty. On this basis the impact on fuel poverty is expected to be limited.

101. As a result of additional metering, it is considered likely that the amendments will lead to beneficial local impacts, for example improved employment conditions, in areas with companies that have a significant presence in the supply chain of heat metering tools and instruments.

Legal impacts

102. There are EU-level and domestic legal risks associated with a failure to implement, or under-implement, the Directive. The outcome of EU Exit negotiations will determine what arrangements apply in relation to EU legislation in the future once the UK has left the EU.

103. Domestically, a legal challenge by way of judicial review could be brought. The cost of this has not been monetised as there is uncertainty over the exact nature, and extent of, any financial penalty which may be applied.

9. Equalities assessment

104. Under the Equality Act 2010, all public authorities are required to have due regard in the exercise of their functions to[58]:

c. Eliminate discrimination, harassment, victimisation and any other conduct that is prohibited by or under this Act.
d. Advance equality of opportunity between persons who share a relevant protected characteristic and persons who do not share it.
e. Foster good relations between persons who share a relevant protected characteristic and persons who do not share it.

105. The Act introduced nine protected characteristics for which discrimination is unlawful, they are: age, disability, gender reassignment, marriage or civil partnership, pregnancy and maternity, race, religion or belief, sex and sexual orientation.

106. The Department has considered the potential impacts of the proposal outlined in this Impact Assessment in the context of its duty to promote equality and eliminate discrimination. The elderly who use more heat than other age groups owing to being at home more often and requiring higher temperatures, may potentially be affected. However, analysis of households using communally heated buildings suggests that only a small minority of these households in England are in fuel poverty. Additionally, elderly people, irrespective of income, receive winter fuel payments to assist them with their energy bills. Additional support in the form of Cold Weather Payments are also available to those who meet the eligibility criteria. As a result, the

[58] The Equality Act 2010, Public Sector Equality Duty, s. 149, available at: http://www.legislation.gov.uk/ukpga/2010/15/section/149

expectation is that the proposals will not unlawfully discriminate or have disproportionate impacts against any persons belonging to the above protected characteristics.

10. Rationale and evidence that justifies the level of analysis

107. The analysis contained in this Impact Assessment is considered proportionate for a Consultation Stage IA on the introduction of regulations required to comply with an EU Directive. There has been input from the regulatory enforcement body, OPSS. The total appraisal period of 14 years is considered an appropriate time horizon for assessing the costs and benefits as this is consistent with the expected 10-year lifetime of a heat meter or HCA and assuming meters are installed over four years. This is also consistent with the appraisal period used to assess cost effectiveness and heat savings in the current Regulations. The key analytical risks and uncertainties have been identified, and sensitivity analysis has been undertaken on key variables**.** We welcome views from stakeholders on the evidence presented and the way it has been used in this assessment.

11. Evaluation plan

108. The Government has committed itself to reviewing the requirements of the Heat Network (Metering and Billing) Regulations 2014, within 5 years of the Regulations first coming into force, therefore by November 2019. The next review in this cycle will include an evaluation of implementation of the amendments to the Regulations in 2024.

109. The evaluation will investigate a number of areas the Regulations will have implemented, including how effective the amended cost effectiveness methodology is for determining whether a meter should be installed, the number of meters installed due to the amendments and the costs of implementing the amendments (including the costs of heat meters and HCAs). The evaluation is expected to cover the clarity of the definitions of the building classes and how easy they are to. Ideally the evaluation would also cover the energy savings seen from installing heat meters, however there may be issues with collecting counterfactual data which would make this impossible. Additionally, we expect to evaluate the effectiveness of the extension of scope of the requirements of the Regulations to meters installed voluntarily or before the Regulations came into force.

Annex A – Assumptions used to estimate individual meter installations by class

Class	Description	Assumption	Methodology/Source
Exempt	Buildings consisting mainly of private dwellings, on communal or district networks in which the heating is distributed to individual units/tenants by means of water with a normal operating temperature above 90 degrees Celsius	25% of all units/dwellings	In the absence of evidence, analysts have assumed 25%. Sector experts suggested the proportion is larger than 10% but less than 50%, thus it was suggested a mid-range 25% was reasonable.
	Buildings on communal or district heat networks, where there is more than one entry point for the flow and return pipes of the network into each private dwelling within that building		
	Buildings not consisting mainly of private dwellings on communal or district heat networks, in which heating and cooling is supplied by means of a system other than water		
Viable	A newly constructed building supplied by a district heat network	Counterfactual Assume 3.6% growth rate	Based on BEIS analysis of OPSS data on the growth rate of the heat network market
	A building supplied by a district heat network that undergoes major renovations relating to the technical services of that building	Counterfactual: Assume 2% of building undergo major reservations each year	A report by the UK Energy Research Centre (UKERC) looked at homeowners' decisions to renovate their homes to improve energy efficiency
	A new build communal network	Assume a 3.6% growth rate and that it is always cost effective to install meters	Based on BEIS analysis of OPSS data on the growth rate of the heat network market
Open	A building that is already metered (when replacements are required)	Counterfactual: Assume 2% of meters break and need replacing each year	In the absence of evidence BEIS analysts assume 2% - in line with the proportion of renovations each year
	All other buildings on existing communal or district heat networks	We assume the market grows at 3.6% for new meters. The number of existing meters covered by this class is calculated from the proportional split of meters on district and communal networks, taking into account meters installed under other classes	Based on BEIS analysis of OPSS data on the growth rate of the heat network market. It is assumed 65% of buildings find it cost effective to install an individual meter, based on BEIS analysis as described in Section 5 of this IA