Metering requirements for Heating, Cooling and Hot Water networks. **IA No: DECC0154** **Lead department or agency:** **Department of Energy and Climate Change**	**Impact Assessment (IA)** **Date**: 25/06/2014 **Stage:** Final **Source of intervention:** EU **Type of measure:** Secondary Legislation **Contact for enquiries:** Sarah Doyle, 0300 068 2946, sarah.doyle@decc.gsi.gov.uk.

Summary: Intervention and Options

RPC: Green

Cost of 'least cost' option (option 1 compared against a 'no directive' baseline)				
Total Net Present Value	**Business Net Present Value**	**Net cost to business per year** (EANCB in 2009 prices)	**In scope of One-In, Two-Out?**	**Measure qualifies as**
£-32.08m	£-49.83m	£3.21m	No	Zero Net Cost

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

Around 2 per cent of homes in the UK are heated via heat delivered into their homes by a heat network. Customers on some networks are unmetered and pay a flat rate for their heat, which fails to provide customers with a financial incentive to reduce their consumption or to avoid wasteful activities. Charging customers based on actual use may provide a substantial incentive for energy efficiency, as well as allow for a more equitable distribution of costs between customers on a network.

Articles 9 and 11 of the Energy Efficiency Directive require Member States to ensure that customers of heat networks are provided with individual meters where these are cost effective and technically feasible. In addition, building level meters must be installed where heat from networks enters multi-use/multi-occupancy buildings.

What are the policy objectives and the intended effects?

The objective of the policy is to give heating, cooling and communal hot water customers greater control over their consumption, and consequently costs, of heating. Meters provide a direct financial incentive to reduce demand, increased awareness of energy use and a more equitable allocation of costs between customers. Metering also gives system operators information on heat losses and allows better management of systems. This will save energy, as well as reducing carbon emissions and improving security of supply.

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

The Government is looking to implement the requirements of Articles 9(1)&(3) and 11(2) of the Directive. An approach short of regulation is unlikely to be considered mandatory, would not properly implement the Directive, and would result in challenge from the European Commission, and potentially from customers of heat networks.

This Impact Assessment includes two options which represent different approaches to realistically implementing the minimum requirements. For ease of comparison, both options are also compared against a hypothetical 'do nothing' where the Directive does not exist.

Option 1 is preferred as it implements the requirements of the Directive at least cost.

Will the policy be reviewed? It will be reviewed. **If applicable, set review date:** 11 / 2019

Does implementation go beyond minimum EU requirements?			**No**		
Are any of these organisations in scope? If Micros not exempted set out reason in Evidence Base.	**Micro No**	**< 20 Yes**	**Small Yes**	**Medium Yes**	**Large Yes**
What is the CO2 equivalent change in greenhouse gas emissions? (Million tonnes CO2 equivalent)			**Traded: -0.016**	**Non-traded: -0.142**	

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 Minister: Amber Rudd Date: 20.11. 2014

Summary: Analysis & Evidence

Policy Option 1

Description: *Implementation is supported by broader building and scheme-level technical feasibility and cost-effectiveness test guidance provided by a scheme administrator. Notification of implementation is required. Monitoring is through minimal sampling.*

FULL ECONOMIC ASSESSMENT

Price Base Year 2013	PV Base Year 2014	Time Period Years 16	Net Benefit (Present Value (PV)) (£m)		
			Low: Optional	**High:** Optional	**Best Estimate: 0**

COSTS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	Optional		Optional	**Optional**
High	Optional		Optional	**Optional**
Best Estimate				**0**

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

The cost of implementing this option will be borne by heat network operators, which range in size from large enterprises to small organisations. Many heat networks are operated by local authorities or housing associations. An estimated 13,000 heat networks and communally-heated buildings would face assessment costs estimated at £0m (£2.5m measured against a no directive baseline). An administrative burden of £0m (£2.3m), and capital and operating costs of £0m (£45.3m). The government will face scheme administration cost of £0m (£6.1m). These costs total up to £56.2m. Further compliance costs are not foreseen.

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

Where meters are assessed to be cost-effective, consumers may incur a hassle cost from the inspection for technical feasibility and installation of meters and from learning to control their heating.

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**

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

Main groups benefiting will be customers in heat networks and the heat network operators. It is expected that these benefits will total £0m (£24.2m), of which £0m (£16.4m) will be due to energy savings leading to lower bills. Wider society will benefit from improved air quality of £0m (£0.3m), traded allowance savings of £0m (£0.4m), which are also direct benefits to business, and non-traded carbon savings of £0m (£7.1m).

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

Installation of building level and individual consumption meters will allow operators to allocate the costs of heat between buildings and customers to reflect actual use. This will ensure a fairer allocation of the costs between users and reduce transfers between users. Installation of meters where cost-effective is expected to reduce energy consumption in those properties, and therefore can be expected to reduce the energy bills for these consumers.

Key assumptions/sensitivities/risks **Discount rate (%)** 3.5

Assessment of whether individual meters are cost effective is sensitive to the assumed capital and on-going costs, and the behaviour change from consumers. The cost of assessments and administrative burdens are sensitive to the number of networks, the number of buildings and dwellings on the networks as well as the current level of metering.

BUSINESS ASSESSMENT (Option 1)

Direct impact on business (Equivalent Annual) £m:			In scope of OITO?	Measure qualifies as
Costs: 0	**Benefits: 0**	**Net: 0**	No	Zero Net Cost

Summary: Analysis & Evidence

Policy Option 2

Description: *Implementation is supported by detailed unit-level technical feasibility and cost-effectiveness test guidance provided by a scheme administrator. Notification of implementation is required. Monitoring is through minimal sampling.*

FULL ECONOMIC ASSESSMENT

Price Base Year 2013	PV Base Year 2014	Time Period Years 16	Net Benefit (Present Value (PV)) (£m)		
			Low: Optional	High: Optional	Best Estimate: -2.4

COSTS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	Optional		Optional	**Optional**
High	Optional		Optional	**Optional**
Best Estimate				**2.4**

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

The cost of implementing this option will be borne by heat network operators, which range in size from large enterprises to small organisations. Many heat networks are operated by local authorities or housing associations. An estimated 13,000 heat networks and communally heated buildings would face assessment costs estimated at £1 m (£3.5m measured against a no directive baseline). An administrative burden of £1.5m (£3.8m), and capital and operating costs of £0m (£45.3m). The government will face scheme administration costs of £0m (£6.1m). These costs total up to £58.7m. As for Option 1 further compliance costs are not foreseen.

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

Where meters are assessed to be cost-effective, consumers may incur a hassle cost from the inspection for technical feasibility and installation of meters and from learning to control their heating.

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**

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

Main groups benefiting will be customers in heat networks and the heat network operators. It is expected that these benefits will total £0m (£24.2m), of which £0m (£16.4m) will be due to energy savings leading to lower bills. Wider society will benefit from improved air quality of £0m (£0.3m), traded allowance savings of £0m (£0.4m), which are also direct benefits to business, and non-traded carbon savings of £0m (£7.1m).

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

Installation of building level and individual consumption meters will allow operators to allocate the costs of heat between buildings and customers to reflect actual use. This will ensure a fairer allocation of the costs between users and reduce transfers between users. Installation of meters where cost-effective is expected to reduce energy consumption in those properties, and therefore can be expected to reduce the energy bills for these consumers.

Key assumptions/sensitivities/risks — **Discount rate (%)** 3.5

Assessment of whether individual meters are cost effective is sensitive to the assumed capital and on-going costs, and the behaviour change from consumers. The cost of assessments and administrative burdens are sensitive to number of networks, the number of buildings and dwellings on the networks as well as the current level of metering.

BUSINESS ASSESSMENT (Option 2)

Direct impact on business (Equivalent Annual) £m:			In scope of OITO?	Measure qualifies as
Costs: 0.15	Benefits: 0	Net: -0.15	Yes	IN

Evidence Base

1. Summary

Articles 9(1) & (3) of the Energy Efficiency Directive (EED) (2012/27/EU) imposes requirements on the metering of district heating, district cooling and communal heating and/or hot water. Article 9(3) also states that Member States may consider the introduction of transparent rules on the allocation of the costs of heat consumption in multi-apartment buildings. Articles 10 and 11 require Member States to create rules to govern billing information and the costs of billing. This Impact Assessment considers the choice of options to most cost-effectively bring the UK into line with the minimum requirements of the EED. An assessment of the current regulations covering heat networks has concluded that they do not currently meet the requirements of the Directive. Therefore, there is no 'do nothing' option presented in this impact assessment.

The Directive imposes requirements for heat network operators (HNOs) to install individual meters where they are cost-effective and technically feasible. Additionally, for district heating/cooling schemes there are requirements to install individual meters when new connections are made in new buildings, buildings undergo major renovation, and to install building level meters for all multi-use/multi-occupancy buildings. These additional requirements are not subject to tests of cost-effectiveness and technical feasibility, therefore requiring all HNOs to comply.

This Impact Assessment looks at the costs and benefits imposed by these requirements under two options (set out in section 5) in order to assess the least cost means of compliance with the Directive. The options considered vary in the level of detail required by heat network operators in assessing cost-effectiveness (high-level in option 1, detailed in option 2). Previous options presented at the consultation stage included no-notification, however to meet the requirements of the Directive, notification must occur; further benefits of notification related to data capture are outlined in section 6.

The main costs imposed by the requirements are:

- Cost of installing building level meters
- Cost of assessing the case for individual meters and heat cost allocators (HCAs)
- Installing individual meters where necessary
- Administration and notification costs to heat network operators
- Scheme administration costs to government/business

The main sources of benefits come from efficiency gains to heat networks as a result of building level meters and energy savings from individual meters and heat cost allocators. There will also be additional benefits from lower levels of carbon dioxide emissions and from improvement in air quality.

The analysis in this final impact assessment has been updated to reflect new evidence collected through the consultation and at a number of stakeholder workshops. These include:

- an increased and refined estimate of the number of properties affected by the regulations;
- adjusted energy demands for individual properties (to reflect the expected consumption of heat prior to introducing metering);
- a wider scope of the type of properties undergoing cost effectiveness testing, in line with the requirements of the Directive;
- shorter lifetimes for individual meters, as well as inclusion of heat cost allocator analysis; and,
- revised analysis of the need to install meters when properties undergo major renovations.

As a result of the new evidence and adjustments to assumptions, the analysis in this impact assessment estimates that a number of heat networks would be required to install individual meters.

2. Problem under consideration

The EU Energy Efficiency Directive (2012/27/EU) entered into force on publication in the Official Journal of the EU[1] on 14 November 2012. Articles 9(1) & (3) concern the metering of energy consumption. This Impact Assessment focuses on the Directive's requirements on the metering of district heating, district cooling and hot water (this includes those situations where the final customer is purchasing hot water provided either from a common boiler or from district heating). Article 9(3) also states that Member States may consider the introduction of transparent rules on the allocation of the costs of heat consumption in multi-apartment buildings. Article 10 introduces rules on billing information. Article 11(2) includes a requirement on Member States to create rules to govern the costs of billing pursuant to Article 9(3). EU member states are required to transpose the majority of the Directive's provisions into national law by June 2014. See Annex B for the full text of the relevant Articles.

Policy timeline

Table 1 below sets out the overall timeline for the policy covered by this impact assessment.

Table 1: Policy timeline for implementing the requirements of the Directive

Scheme administrator established	July 2014
Technical feasibility and cost-effectiveness guidance in place	July 2014
Transposition of Directive – requirements come into force	July 2014
Deadline for first assessment round of case for individual meters in multi-occupancy/multi-purpose buildings, and installation as required	31 December 2016
First phase of impact evaluation of scheme	2016/17
Second phase of impact evaluation of scheme	2017/18

The Government has separately consulted on the implementation of Articles 10 and 11, and associated Annex VII, in relation to requirements these impose on the metering and billing of gas and electricity to domestic and non-domestic consumers, as well as the availability of consumption data. The costs and benefits of the billing requirements relating to electricity and gas are not within the scope of this impact assessment and are therefore not considered further. The consultation document covered articles 9 and 11. This impact assessment additionally covers the costs related to article 10, which are addressed within the analysis.

Costs of penalties have not been considered in this impact assessment, as 100% compliance has been assumed, in line with Green Book guidance[2].

3. Rationale for intervention

A survey of heat networks conducted for DECC in 2011 found that only approximately 25% of customers properties are metered for the heat they use[3]. Where customers are billed based on a flat charge (typically per m^2 of floor space) they receive no incentive to reduce their consumption of heat.

[1] 14.11.2012 OJEU L315/17 Volume 55

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

[3] District Heating – Heating Metering Cost Benefit Analysis (2012), BRE and Databuild.

Users who are charged a flat rate face little or no marginal cost from increasing their consumption[4]. This creates an incentive for users to free-ride on others as the cost of their increased energy consumption is shared by all users. Flat charges fail to provide a strong signal to use energy efficiently and therefore can lead to inefficient behaviours.

In addition, flat charges are unable to reflect the distribution of energy use between customers on a network, for instance as a result of different occupancy patterns or energy using behaviours. This could create inequitable transfers between customers on a network, where those who use less energy are subsidising others on the network.

4. Policy objective

The Government has identified heat networks (district heating) as having an important role to play in the transition to low carbon heating. Heat makes up around half of the energy consumption in the UK and contributes around a third of the UK's greenhouse gas emissions. The Government is supporting the deployment of district heating in a number of actions set out in the March 2013 publication: "The Future of heating: Meeting the challenge". https://www.gov.uk/government/publications/the-future-of-heating-meeting-the-challenge. For example, the Government has established a new Heat Networks Delivery Unit to provide specialist expertise to assist Local Authorities to develop district heating plans to the point where they are feasible investment propositions. As well as practical assistance, the Unit is also administering a funding stream to support Local Authorities' plans.

Heat networks supply heat to a number of buildings or dwellings from a central heat production facility (or facilities) through an insulated pipe system, which is in general underground. Heat networks can be both lower carbon and cheaper for consumers than a building-level heat solution. The amount of heat supplied to buildings in the UK via heat networks is around 2% of domestic, public sector and commercial heat demand[5]. In the UK and across Europe, heat networks were first used in urban areas and predominantly in blocks of flats. They became popular in the UK for new developments of this type during the 1960s and 1970s. Many of the schemes in operation today in the UK originate from this period.

Central heating and hot water provided from a heat network can be controlled in the same way as with individual gas boilers, with meters and radiator valves. New private sector developments and new local authority-led schemes have heat meters installed as standard and charge on the basis of heat usage by individual properties. However in older schemes, customers are typically billed for a fixed proportion of the total heat generated, taking into account the size of the customer's property. While approximately 25% of existing heat networks serving domestic properties are metered, discussions with industry suggest the majority of non-domestic properties are already metered.

The lack of individual heat meters in some older schemes leads to limited control by occupants over temperature and time of use, and consequently the amount of heat consumed, even when heating controls are in place. 'Smarter' heat meters have already been developed, which can be read remotely and can provide customers with near real-time information on their heat use. Smart heat meters can be switched from pre-pay arrangements to instalment-based payments immediately, providing customers with greater flexibility over billing.

The objective of the policy is to give consumers of heat and cooling greater control over their

[4] Additional consumption by one user is therefore typically shared by all customers on a network. Therefore, while on very small networks customers may see a significant fraction of the increased cost, on larger networks with more customers the share they pay for would be very small.

[5] Davies, G.& Woods, P. 'The Potential and Costs of District Heating Networks', A report to DECC, Poyry Energy Consulting and Faber Maunsell AECOM, 2009

use of these commodities, with a view to reducing final consumption and promoting the efficient use of energy. This is consistent with the overall aims of the Directive. It is important to recognise the proportion of energy consumption which is for heating – for both space heating and hot water. For example, heating within the domestic sector accounts for approximately 85% of UK domestic energy use (2012), and heating within the domestic sector accounts for around 27% of UK total energy use (2012) [6].

There is also an important interaction with energy efficiency measures, where these are combined with metering and there is a resulting change in consumer behaviour. Evidence provided by the European Commission and from trial schemes (such as one in Camden) suggests savings can be significant (up to 30%), see Box 1.

Where individual meters are installed, with greater control and transparency of consumption and charging, it allows consumers to:

- Decide when to use their heating (and cooling) systems and at what temperature to heat their homes (and businesses);
- Have greater control over the energy they use and the amount that they pay;
- See accurately what energy they use and to encourage consumers to identify and reduce wasteful consumption;
- Avoid the subsidisation of abnormally high usage by lower energy consumers. For example, in multi-apartment buildings, where flat-rate charges can distort individual heat consumption variances.

On a system-wide basis:

- Building-level meters will help to highlight those heat distribution networks that are poorly performing and therefore, where consumers are paying for heat lost though the pipework. This will enable heat network operators to identify system efficiencies and losses and help to analyse the value of potential energy saving interventions.
- In instances where individual consumption meters are not cost effective, heat networks with multiple buildings installing building-level meters will be able to allocate costs more accurately, assigned on a building-level flat-rate rather than a scheme-wide rate. This will lead to stronger consumption feedback for consumers with abnormally high usage of heat.

4.1. Requirements of the Directive

The metering provisions of the Directive can be considered in two broad areas: Individual meters and those for multi-purpose/multi-occupancy buildings. Taken in turn:

Article 9.1 (summarised): Individual heat meters - Member States shall ensure that where it is technically possible, financially reasonable and proportionate in relation to energy savings final customers for [district heating, district cooling and domestic hot water] are provided with competitively priced individual meters that accurately reflect the final customer's actual energy consumption and actual time of use.

- Individual meter must be installed where an existing meter is replaced (technical and cost conditions apply), or

- Where a new connection is made in a new building or a building undergoes major renovations

[6] DECC (2013). ECUK, Overall Tables 1.07, provisional 2012 levels. Based on 36,542 of domestic heat end use, with 43,153 total domestic consumption (thousand tonnes of oil equivalent).

Article 9.3 (summarised): Heat meters in multi-apartment and multi-purpose buildings - *at building or block level and at individual unit level*

- Multi-apartment and multi-purpose buildings must have a building-level meter at the point of heat exchange or point of delivery (cost and feasibility conditions do not apply).

- Multi-apartment and multi-purpose buildings need individual unit meters (conditions apply), if not multi-apartment and multi-purpose buildings may have heat cost allocators (conditions apply), or other ways to measure heat consumption may be considered

- Rules may be applied to multi-apartment and multi-purpose buildings' individual allocated consumption to ensure transparency and accuracy of individual consumption. Where appropriate, such rules shall include guidelines on the way to allocate costs for heat and/or hot water. This is an optional requirement that is not covered in this impact assessment. It is anticipated that the proposed industry-led consumer protection scheme will, in-part, support these objectives.

Article 10 (summarised): The provision of billing information

- Billing information based on actual consumption needs to be made available where technically and economically justified.

- Historical consumption data and electronic data is to be made available when requested.

- Where appropriate customers are to have comparative consumption and cost data.

Article 11 (summarised): Cost of access to metering and billing information

- Final customers must receive all their bills and billing information for energy consumption free of charge and final customers also need to have access to their consumption data in an appropriate way and free of charge.

- The distribution of costs of billing information for the individual consumption of heating and cooling in multi-apartment and multi-purpose buildings shall be carried out on a non-profit basis. Costs resulting from the assignment of this task to a third party, such as a service provider or the local energy provider or supplier, covering the measuring, allocation and accounting for actual individual consumption in such buildings may be passed onto the final customers to the extent that such costs are reasonable.

Article 13 (summarised): Penalties.

- Member States shall lay down rules on the penalties that will be applied in the case of non-compliance.

There will be a penalties regime in place to ensure compliance with the Directive, however, costs of penalties have not been considered in this impact assessment, as 100% compliance has been assumed, in line with Green Book guidance[7].

It is important to note that tests of cost-effectiveness and technical feasibility do not apply to the following requirements (and therefore would be required regardless of the cost):

- Where a new connection is made in a new building
- Where a building undergoes major renovations. Major renovations are defined in EU Directive 2010/31/EU as where: (a) the total cost of the renovation relating to

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

the building envelope, or the technical systems is higher than 25% of the value of the building, excluding the value of the land upon which the building is situated; or (b) more than 25% of the surface of the building envelope undergoes renovation.

- Where heating, cooling or hot water are supplied to a building from a district heating network or from a central source servicing multiple buildings, a heat or hot-water meter shall be installed at the heat exchanger or point of delivery. The Commission have clarified that this point is targeted at multi-apartment and multi-purpose buildings.

4.2. Non-regulatory approaches

The Government has considered options for non-regulated approaches to meet the requirements of the directive. The heat networks sector as a whole is not regulated in the same way as gas and electricity markets. Following the analysis undertaken for the Department's "Future of heating: meeting the challenge" publication, there are a number of industry-led initiatives that will support the development of the sector. The initiative with most relevance here is the Government's commitment to support the establishment of an industry-led consumer protection scheme for heat network users. The second concerns the development of common technical standards for heat networks to enable network expansion. One of the priorities is to assess UK standards against best practice across the UK, including standards for installation and operation and maintenance schemes.

However, these new initiatives are industry-led and it has been concluded that they would not adequately meet the UK's legal obligations under the Directive. The Directive does not allow for transposition through self-regulatory means. There is therefore no 'do-nothing' or self-regulatory options available. Attempting to transpose the metering and billing requirements for heating, cooling and hot water networks by means of a non-regulatory approach would not lead to a legally binding requirement for heat network operators. Therefore the UK would not have adequately transposed the requirements of the Directive requirements and would be infracted by the European Commission. This could result in on going fines to the UK until the requirements of the Directive were reflected in national law.

5. Description of options

An analysis of existing policies has concluded that they do not adequately meet the UK's legal obligation under the Directive. The options appraisal focuses on the least cost way of implementing the minimum requirements of the Directive and then the costs and benefits of any additional elements that could improve the net benefit to the UK. Neither of the options in this impact assessment look to gold-plate the requirements in the Directive, but instead seek to identify the most cost-effective way of meeting the requirements of the Directive, given the uncertainty around the costs and benefits.

The Government consulted on the most effective regime for enforcing the requirements of the Directive in line with better regulation principles. This included a cost benefit analysis of the requirements to provide notice of compliance, and to ensure compliance through sampling and audits. Since presenting these options in the consultation stage impact assessment, it has been determined that options that do not include mandatory notification would fall short of the minimum requirements of the Directive for the UK to report to the European Commission that the Directive has been implemented appropriately. Therefore previously considered options from the consultation which did not require notification have been discounted.

The Directive applies to the UK and this impact assessment now includes analysis for the Devolved Administrations, after discussions with relevant representatives. This increases the

number of properties under the scope of the analysis in this impact assessment, therefore costs and benefits presented in this document may differ substantially from the consultation stage impact assessment.

Both options would require the lead action on implementation to rest primarily with heat network operators. The difference between the options is the level of data required by HNOs to apply the cost effectiveness and technical feasibility tests where these conditions apply to meter installation.

Option 1: Implementation is supported by broader building and scheme-level technical feasibility and cost-effectiveness test guidance provided by a scheme administrator. Notification of implementation is required. Light touch monitoring and audit is needed.

Heat network operators (HNOs) would be required to implement the requirements of the Directive. For those requirements with conditions of technical feasibility and cost effectiveness, a scheme administrator would provide detailed guidance for a desk assessment of individual unit and dwelling-level feasibility to guide HNO implementation in these areas. Broad-level criteria will be provided to filter out some properties that are unlikely to be cost-effective, saving further in-depth data collection and reporting. HNOs would only be expected to collect information on buildings where a heat meter or HCA is likely to be cost-effective. This would reduce the burden on HNOs in complying with the scheme. HNOs would notify the scheme administrator to confirm they have completed the assessment, and installed meters where required. For the requirement for individual meters, where conditions of technical feasibility and cost effectiveness apply, the Figure 1 below sets out the broad approach that will need to be taken.

Monitoring and enforcement is likely to involve a combination of surveys and on-site visits, and it is envisaged that this would be an annual exercise, with visits conducted on a rolling basis. As a result of the data collected through notification, the scheme administrator would need to conduct fewer audits, than those required in the event of no notification. The scheme administrator will have the power to apply penalties where these are judged to be needed.

Option 2: Implementation is supported by detailed unit-level technical feasibility and cost-effectiveness test guidance provided by a scheme administrator. Notification of implementation is required. Light touch monitoring and audit is needed.

Option 2 has the same implementation and enforcement requirement as option 1. However, option 2 differs from option 1 as HNOs would be expected to collect information about all individual units connected to their network, and supply this to the scheme operator. This option is included in the impact assessment to show the cost of implementation, should it not be possible to design the guidance for HNOs, such that they only need to collect information only on properties where heat metering may be cost-effective. The benefit of option 2 would be that it would provide a greater level of information about the network as a whole, which would be valuable for government in understanding the current state of the stock of buildings connected to heat networks and communal heating systems.

Figure 1:

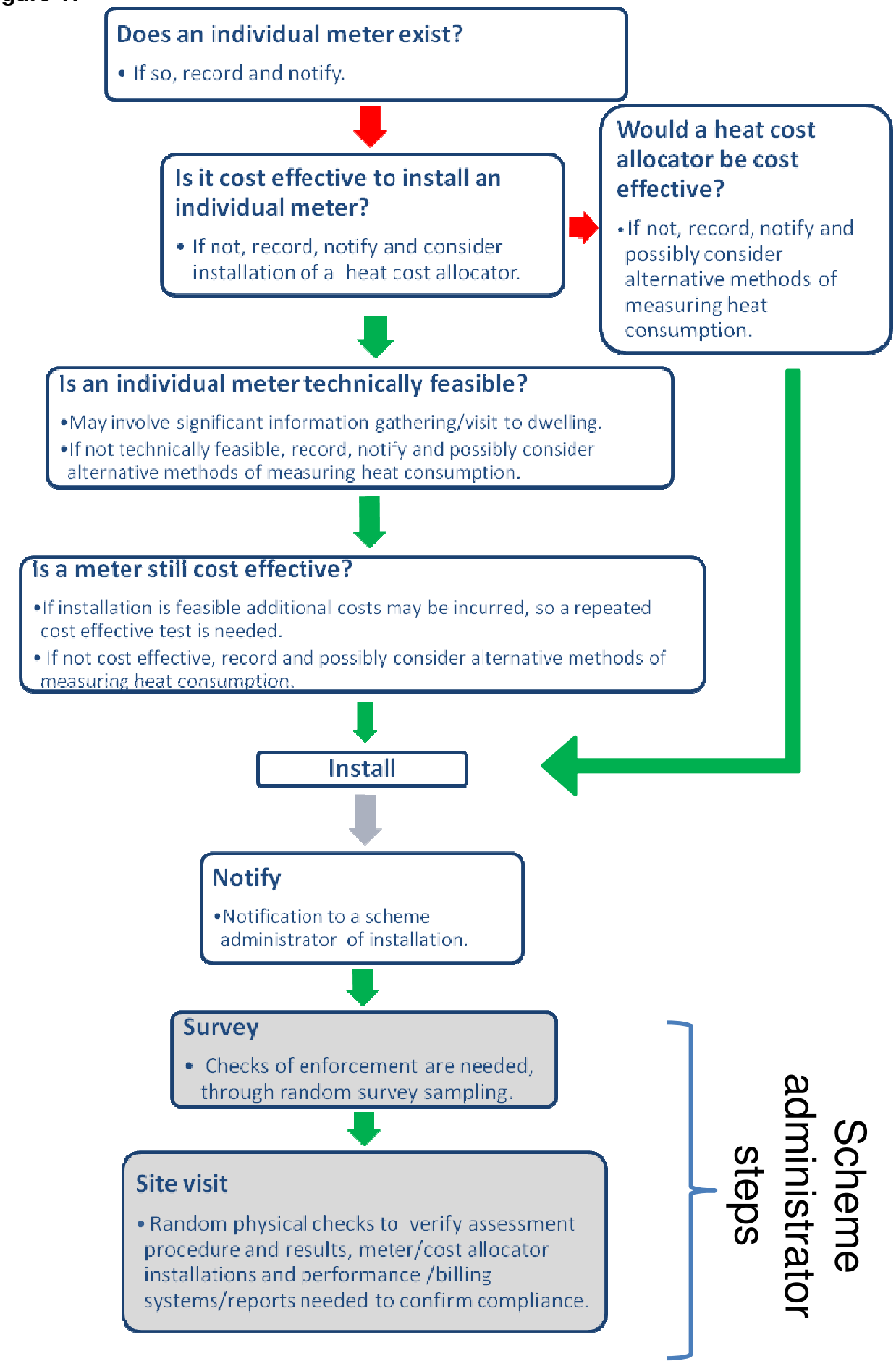

Does an individual meter exist?
• If so, record and notify.
Is it cost effective to install an individual meter?
• If not, record, notify and consider installation of a heat cost allocator.
Would a heat cost allocator be cost effective?
• If not, record, notify and possibly consider alternative methods of measuring heat consumption.
Is an individual meter technically feasible?
• May involve significant information gathering/visit to dwelling.
• If not technically feasible, record, notify and possibly consider alternative methods of measuring heat consumption.
Is a meter still cost effective?
• If installation is feasible additional costs may be incurred, so a repeated cost effective test is needed.
• If not cost effective, record and possibly consider alternative methods of measuring heat consumption.
Install
Notify
• Notification to a scheme administrator of installation.
Survey
• Checks of enforcement are needed, through random survey sampling.
Site visit
• Random physical checks to verify assessment procedure and results, meter/cost allocator installations and performance /billing systems/reports needed to confirm compliance.
Scheme administrator steps
Yes
No

Table 2 below summarises the options.

Table 2: Summary of options

Summary table of Options: Implementation, guidance, monitoring variances		
	Option 1	Option 2
Unit-level guidance		√
Building/system level guidance	√	
Notification required and smaller sample used for surveys and onsite visits	√	√
Billing information & costs	√	√

6. Cost benefit analysis of the options

Evidence for this impact assessment has been drawn from available sources including the recent Government consultation on heat metering, feedback from discussions at stakeholder events, the 2007 Desk Study on heat metering[8] and the 2012 study on Heat Metering Costs and Benefits[9]. Evidence on the number of heat networks and their characteristics has been taken from a database DECC commissioned in 2012 prepared by Databuild and BRE[10]. Annex Annex A summarises the changes to assumptions used in this impact assessment, following the consultation and subsequent collection of evidence.

6.1 Scope of the policy

6.1.1 Number of properties covered by the requirements

The regulations will cover all buildings where there is a central source of heating, cooling or hot water supplying a number of dwellings or units. This will include heat networks which supply a number of buildings, as well as blocks of dwellings which have a central heating source within the building (communal heating).

Given the broad definition of heat networks in the directive, there is some uncertainty around the number of properties which are in scope. Previous studies, completed before the Directive was agreed, have catalogued heat networks using different definitions.

The 2012 Databuild/BRE study looked only at heat networks that connected two or more buildings from a central source, or buildings with more than ten customers connected to a single

[8] http://www.chpa.co.uk/medialibrary/2011/05/18/241aecd2/DEFRA%20heat%20metering%202007%20inc%20DH%20survey.pdf

[9] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48389/5462-district-heating--heat-metering-cost-benefit-anal.pdf

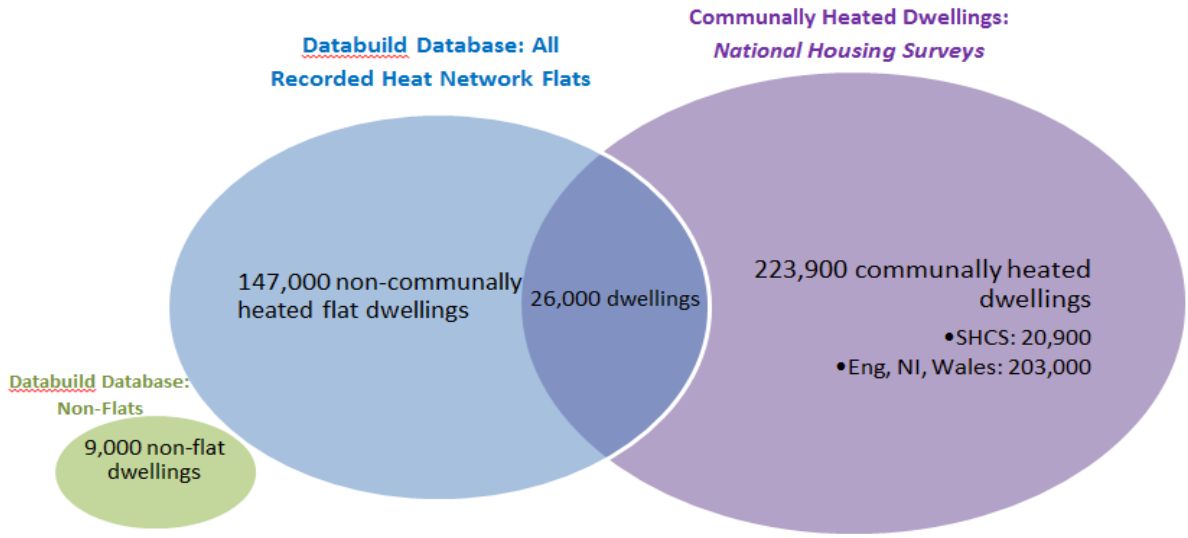
[10] A summary of the data has been published at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/212565/summary_evidence_district_heating_networks_uk.pdf

heat source. The database shows there are approximately 1,800 networks in the UK which meet this definition of a network. The database has a record of these networks supplying 182,000 dwellings, with approximately 173,000 flats[11], 6,600 terraced, 1,700 semi-detached, 400 detached and 1,300 non-domestic properties recorded.

The Databuild/BRE definition excluded single blocks of dwellings with less than ten customers from its database. However, as the scope of the Directive includes these systems they need to be included in the analysis. Evidence from the 2007 Desk Study shows there were approximately 228,000 communally-heated multi-occupancy individual blocks (flats) in England, Northern Ireland and Wales and the Scottish House Condition Survey (SHCS)[12] identifies 29,000 dwellings on community heating. These therefore could be additional to the 182,000 dwellings included in the Databuild/BRE database. For the purposes of this final impact assessment, previous estimates of communal heating have been refined: as a result 203,000 of the 228,000 communally heated English, Northern Irish and Welsh flats are not captured in the Databuild/BRE database[13] and all 20,900 additional Scottish buildings[14] are assumed to be flats. The existing estimates of known age bands (from the Databuild/BRE database) are applied to these additional communally heated flats.

Costs and benefits presented throughout this impact assessment are based on the total population of bulidngs connected to heat networks or communal heating systems. Using these assumptions set out, 26,000 dwellings are captured in the Databuild database as communally heated, with an additional 223,900 communally heated dwellings from the national housing surveys; a total of 249,900 communally heated dwellings. Figure 2 below illustrates these overlaps within the housing stock covered within this analysis.

Figure 2: Housing stock covered by analysis by source



[11] The definition in the Databuild/BRE survey grouped together flats and maisonettes as a single group. It has not been possible to separate out the number of each type.
[12] Energy Use in the home (2010), p75 Table 76: http://www.scotland.gov.uk/Resource/0039/00398667.pdf
[13] This is based on analysis of the Databuild/BRE database, using a more refined assumption of all schemes with flats only and 50 or fewer dwellings being communally heated. The approximation of 50 or fewer dwellings being communally heated is based on our knowledge and the average number of dwellings per block being 20 – 50 is an appropriate number to catch all the majority of communally heated dwellings.This amounts to 25,000 dwellings in total, with one building and one heat source. All communal or 'community heating' schemes are assumed to be flats.
[14]The definition of community heating here is wider than the 'one building, one heat source' definition. These additional buildings are the 29,000 dwellings in the SHCS (2010) minus the 8,100 Scottish dwellings assumed to be already caught in the Databuild/BRE database.

The analysis throughout this impact assessment ensures inclusion of national household survey estimates by extrapolating key Databuild entry attributes such as building age and type. The full breakdown of the housing stock by age band and type is included in Table 3 below.

It is also likely that the Databuild/BRE survey underestimated the number of networks, and for many networks that were included it was not possible to obtain information about the number of dwellings or other key information. Therefore, the best estimate of the number of systems and dwellings by age band covered in this impact assessment is presented, along with estimated age bands for additional communally heated buildings, in Table 3 below.

Table 3: Estimated number of UK properties connected to heat networks and communal heating by type and age.

	Flats	**Terraced**	**Semi-detached**	**Detached**	**Total**
1918 - 1938	0	0	0	0	0
1939 – 1959	23371	437	0	0	23809
1960 – 1975	186911	1771	440	14	189136
1976 – 1982	49884	2857	35	101	52877
1983 – 1989	16887	340	179	1	17406
1990 – 1999	11327	655	761	318	13061
Post 2000	108366	531	308	4	109210
Total	**396746**	**6592**	**1723**	**438**	**405499**

Source: DECC analysis of Databuild/BRE survey, 2007 Desk Study and SHCS (2010)

6.1.2 Requirements of the Regulations by type of network

Not all the requirements of the regulations would be imposed on all heat networks. Table 4 below summarises which requirements would apply to different categories of networks and communally heated buildings. Building level meters would only be required when the source of the heat is supplied external to a multi-occupancy/multi-use building. This means that communally heated systems where the heat is generated within the building would not be required to install building level meters. Building level meters would also not be required where individual dwellings (such as detached or terraced properties) are served by an individual connection to the network.

Individual level meters would be required for all dwellings across all of the networks types, subject to tests of cost-effectiveness and technical feasibility. The requirement for individual meters would also be triggered when a building undergoes major renovations. This would not be subject to any caveats on cost or technical suitability. However, as set out in greater detail below, the requirements are unlikely to be triggered when the source of the heat is external to the buildings. Therefore, only communally heated blocks of flats are likely be required to install heat meters when undergoing a major renovation.

Table 4: Summary of requirements by heat network type.

	Heat networks with only Flats connected	**Heat networks with a mix of property types or non-residential.**	**Communally heated Blocks of Flats**
Building Level Meters	Yes – for all multi-use/multi-occupancy buildings	Only for multi-use/multi-occupancy buildings. Not for other property types	Not required for communally heated blocks

Individual meters and HCAs	All dwellings – subject to test of cost-effectiveness and technical feasibility	All dwellings – subject to test of cost-effectiveness and technical feasibility	All dwellings – subject to test of cost-effectiveness and technical feasibility
Individual meters – following major renovations	Yes - with only a small fraction likely to be triggered.	Yes – with only a small fraction likely to be triggered	Not required for communally heated blocks

6.1.3 Energy demands in unmetered properties

The assumed energy demand for each property type and age combination considered is presented below in table 5. These figures were originally taken from the BRE report which used the BREDEM (BRE Domestic Energy Model) to predict space heating and hot water demand. As the energy demands used in the BRE report are based on observed/predicted behaviour for properties where energy consumption is already metered, these figures have been revised since the consultation stage. Figures have been adjusted to take into account the higher heating demands of an unmetered, heat network property[15].

The BRE study originally looked at three dwelling types over eight age range categories, but excluded detached properties as these were considered unlikely to be connected to a Heat Network. However, the Databuild study found 438 detached properties connected to networks. Therefore heat demand for detached properties has also been estimated for the purposes of this impact assessment[16].

The implications of higher and lower heat demands are explored as sensitivities in Section 8.

Table 5: Annual energy demand (kWh/year) for heating and hot water by property type and age.

	Flat	**Terrace**	**Semi-detached**	**Detached**
Pre 1917	10,581	16,042	20,476	30,714
1918 – 1938	9,755	14,640	18,652	27,977
1939 – 1959	8,994	13,182	16,688	25,033
1960 – 1975	8,653	12,710	16,065	24,098
1976 – 1982	8,101	11,740	14,749	22,123
1983 – 1989	8,331	11,989	15,072	22,608
1990 – 1999	6,828	9,479	11,728	17,592
Post 2000	6,218	8,371	10,306	15,459

Source: BREDEM from Databuild/BRE (adjusted by DECC)

6.2 Counterfactual

Do-nothing option

The UK is required to comply with the Energy Efficiency Directive, meaning there is no 'do nothing' option for this Impact Assessment. The NPV and Cost to Business presented in the summary sheets uses the 'least cost' minimum requirement option (option 1) as the counterfactual. However, for comparison, this option has been assessed against a 'no

[15] Assuming that metering propertied brings a 20% reduction in consumption, original figures of metered properties have been increased by a factor of 1.25.

[16] Detached properties' heat demand has been estimated using 2011 National Energy Efficiency Data (NEED) to estimate that detached properties on average demand 50% more than semi-detached properties (https://www.gov.uk/government/statistical-data-sets/need-table-creator). BREDEM semi-detached figures therefore have been scaled up by a factor of 1.5 to create comparable detached heating demands.

Directive' baseline and provides an estimate of the net cost of the impact of complying with requirements for metering in the Directive.

Metering of new-build networks

This impact assessment also makes assumptions about the installation of meters into newly built networks. From discussions with industry, and analysis of the consultation responses, the vast majority of new networks are installed with meters and controls for the customers. Installing meters and controls when the system is built can be much cheaper as the requirements for meters (such as space to locate the units, access to pipework) can be designed into the system. This impact assessment therefore assumes that new networks will install meters as routine. Therefore no additional cost of the obligation for new networks to install meters has been estimated. New networks will still have an obligation to report that they have installed, however these costs have not been included in the analysis due to the uncertainty around the future growth of heat networks.

For existing unmetered networks, there are some examples of these being retrofitted with meters. However, from discussions with operators, meters are often considered but not installed due to the high capital cost relative to the expected bill savings. This impact assessment therefore assumes that meters are unlikely to be retrofitted into existing networks without some intervention.

Evidence on current level of metering

The Databuild/BRE database shows that there is currently only limited deployment of heat network metering in England. For individual meters, the existing evidence base suggests around 25% of dwellings have a meter. Non-domestic buildings are estimated to have a greater proportion of heat meters. Heat networks generally place meters where there is a contractual exchange of the heat and where there is a step-down in heat network system pressure (required before the heat reaches the final consumer).There is very little evidence on the current installation of building-level heat meters connected to multi-occupancy/multi-purpose buildings.

Non-domestic metering

The Databuild survey shows there are approximately 1,300 non-domestic buildings connected to heat networks in the UK. These appear to cover a range of uses, with hospitals, schools, universities, industrial and commercial buildings reported as connected to networks. These uses vary widely in their heat demand, and the potential for reductions in demand following metering.

The survey did not require operators to report whether the non-domestic buildings were individually metered. Discussions with heat network operators suggest that many of these will be already metered. As it is a commercial transaction, it is likely that meters will already be installed for non-domestic buildings where it is cost-effective to do so. Therefore non-domestic buildings have not been included in this analysis.

Cost of billing

The Directive requires HNOs to not separately identify a charge for providing customers with a bill based on actual use or information on energy consumption. This impact assessment assumes that HNOs with metered systems are not currently separately identifying a cost of billing or providing information on energy use to their customers. In addition, it is assumed that the introduction of billing based on actual consumption (using meters and or HCAs) does not significantly increase the costs for HNOs as in the counterfactual they would already face costs for calculating bills and setting tariffs.

6.3 Profile of capital investment and appraisal period

The costs and benefits of the requirements in the Directive have been assessed over an appraisal period of 16 years, which covers the period from 2014 to the end of 2029. This has been chosen to cover the lifetime of the longest lived meter (15 years) following installation in 2015.

Meters installed prior to 2029 will continue to provide benefits beyond 2029. To allow a fair comparison of the costs and benefits of meters with different lifetimes and installation profiles, the capital costs of meters have been amortised. Amortisation treats the capital costs as if they have been financed over the expected lifetime of the asset, with annual repayments of capital in each year of operation. By amortising capital costs, only the share of the capital costs associated with the benefits counted before the end of the appraisal period have been included in the cost benefit analysis. Capital costs have been amortised using the HM Treasury social discount rate of 3.5%.

As set out in detail in the sections below, the regulations are expected to require the installation of a number of individual and building level meters between now and 2029. The expected profile of installations of building level meters, and individual meters and HCAs is set out in Table 6 below.

The regulations are expected to require installation of building level meters in 2015, and individual meters where cost-effective and technically feasible in 2016. These individual meters will require replacement in 2026 as they come to the end of their assumed technical life. While the case for individual meters will be re-assessed every four years, for simplicity, the analysis in this impact assessment assumes that costs of meters will not change over time, therefore no new dwellings in the analysis are found as installing meters resulting from assessments in 2016, 2020, 2024 and 2028.

Meters will also be installed each year when buildings undergo major renovations. From 2026 the number of meter installations will double as in addition to new meters being installed in renovations, existing meters will require replacement after 10 years.

Table 6: Summary of expected profile of meter and HCA investment

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	
Appraisal year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**Total**
HNOs required to assess cost-effectiveness of individual meters			X				X				X				X		
Building level meters (15 year life)		7,345															**7,345**
Individual meters and HCAs where cost-effective (10 year life)			5,675										5,675				**11,350**
Individual meters - major-renovations (10 year life)			2,335	2,335	2,335	2,335	2,335	2,335	2,335	2,335	2,335	2,335	2,335 2,335	2,335 2,335	2,335 2,335	2,335 2,335	**42,030**

Key: **-** Initial capital investment - Meter replacement costs

6.4 Costs

6.4.1 Costs to business

The implementation of the regulations will create a number of costs to heat networks operators, and government.

The direct costs include:

1) Assessment costs: the costs of assessing the case for individual meters and heat cost allocators (HCAs), including any site visits to properties to assess the technical feasibility of meters.
2) Administrative burdens: the cost to heat networks operators of complying with the regulations, including the time taken by staff to understand the requirements, gather information on the network, to report and notify the scheme administrator as necessary.
3) Capital costs and operating costs of individual unit metering: where meters or HCAs for individual customers are assessed to be cost effective and technically feasible, the costs installing meters or HCAs and the on-going costs of reading and maintaining the meter.
4) Capital Costs and operating costs of building level meters: the cost of installing meters in multi-occupancy/multi-purpose buildings.
5) Government Scheme administration costs: the cost to Government to record information on compliance and monitor compliance through audits and site visits.

Heat network operators and their customers may also face additional 'hassle' costs caused by the requirements of the regulations. These could include the costs of managing the installation of the meters or HCAs, and hassle to customers from being at home during installation. These costs are discussed further in Section 7.

The requirement to assess the case for individual meters every four years will create both assessment costs (such as the cost of collecting information on buildings connected to the heat network, and administrative burdens (such as the costs of registering with the scheme administrator).

The options presented in this impact assessment assume that heat network operators would self-assess the case for individual meters based on guidance provided by the scheme administrator. Assessments will be required every four years from 2016 onwards to ensure the UK complies with the Directive. For the purposes of this Impact Assessment the administration costs to 2029 have been included, covering assessment cycles in 2016, 2020, 2024 and 2028.

<u>Variation in costs/burden by option</u>

The assessment and administration costs are assumed to vary by the option chosen. Under Option 2 HNOs would be required to collect information on all buildings on a network, while under Option 1 the heat network operator would not have to provide as much data on units where it would be unlikely that a meter would be cost-effective. Based on the assumptions in this impact assessment, flats are unlikely to prove cost-effective for metering or HCAs[17]. Therefore, in determining the assessment and administration costs schemes have been divided into those which only contain blocks of flats ('flat-only schemes') and those which contain a mix of property types ('non-flat only' schemes).

The different stages of the assessment will require HNOs to collect data at different levels. Some costs will depend on the number of operators (e.g. registering for the scheme), while others will depend upon the number of schemes that the HNO operates, or the number of buildings or dwellings on each scheme.

[17] However, it will only be possible to determine this for certain once the guidance for HNOs has been developed.

Some costs may be one-off transition costs (such as familiarisation with the guidance), while others will be incurred each time an assessment conducted every four years. For the purposes of this impact assessment, it is assumed that given the four year gap between assessments that the full cost is incurred each time an assessment is required. For example, some costs such as familiarisation with the guidance might be required each time if the guidance has been updated or if a new HNO employee takes charge of the assessment. There is potentially some scope for costs the second time to be lower, such as by re-using the data previously collected on the properties connected to the network.

Table 7 below sets out populations for HNOs, schemes, buildings and dwellings, broken down by whether the scheme is 'flat-only' or not. The majority of schemes are 'flat-only' as this is the most common form of property connected to heat networks, and for this purpose includes communally heated blocks.

Table 7: Heat network population figures

	Flat-only Schemes		Non-flat Schemes		Total
	Population	Source	Population	Source	
Dwellings	384,300	Databuild entries: 160,400 National household surveys: 203,000)	21,200	Databuild count of non-flat dwellings and flat dwellings on a mixed building scheme.	**405,500**
Buildings[18]	19,200	Databuild entries: 8,000 National household surveys: 11,200)	9,400	Databuild count of non-flats and flat on a mixed building scheme[19]	**28,600**
Schemes	12,800	Databuild information on schemes per flat National household survey data[20]	100	Databuild count of schemes	**12,900**
Operators	1,400	Databuild count of flat-only operators. National household survey data, based on the assumption of 8 schemes per operator, sourced from current Databuild information	30	Databuild count of operators	**1,430**

Source: DECC analysis of Databuild and national household surveys

[18] Number of buildings have been estimated using an assumption of 20 flat dwellings per block (Sourced from Entranze data gathering collection: http://www.entranze.enerdata.eu/average-number-of-dwellings-per-building.html), where flats are present.
[19] Using an assumption of 20 flat dwellings per building.
[20] Based on dwelling information, where each block is 20 dwellings and each individual block counts as one scheme.

Assessment costs

For the purposes of this impact assessment it has been assumed that the assessment would consist of the following stages:

1) HNOs would collect data on each building on connected to their network, and their characteristics (e.g. location, building type etc.)
2) HNOs would self-assess the case for heat meters and HCAs based on inputting data related to the buildings connected to their scheme into a spreadsheet or tool provided by the scheme administrator.
3) Where meters and HCAs appear to be cost-effective, a site visit by an engineer would be required to confirm that a meter or HCA would be technically feasible and suitable. This may involve, amongst other things, checking that there is sufficient space and access to pipework to install the meter[21]. The site visit may also allow the HNO to collect information which may adjust the cost-effectiveness calculation; for instance confirming that there are heating controls installed.
4) HNOs would adjust the assessment of the properties that are cost-effective and technically feasible following the engineer's report and submit these to the scheme administrator.
5) HNOs would record information on any meters installed (such as location, serial numbers) for auditing purposes.

The requirement for assessment covers 28,600 buildings, as outlined in Table 7, based on an assumed population of 405,500 residential dwellings, with a separate count of non-flats and flat dwellings being sorted into buildings with the assumption of 20 dwellings per block[22]. The high-level filter of properties to minimise data collection used in Option 1 assumes that it is possible to exclude schemes and blocks consisting only of flats.[23]

Table 8 below shows the assumptions for each stage of the assessment.

Table 8: Assumed assessment requirements by option

Requirement	**Population by scheme type**	**Person required**	**Cost per hour (£)**	**Time required by option and scheme**	
Collect data on each building on the system and each of the units (e.g. location, building type etc.)[24]	9,400 *non-flat scheme* buildings	Middle Manager	26	**Option 1** 0.5 hours per non-flat scheme building 0.25 hours per flat-only scheme building	**Option 2** 0.5 hours per non-flat scheme building 0.5 hours per flat-only scheme building
	19,200 *flat-only scheme* buildings				

[21] It is assumed that all properties which are cost-effective then require a visit by an engineer to assess technical feasibility. However where there are a number of dwellings with the same construction/age (e.g. in a block) it may not be necessary for the engineer to visit every property to assess the technical feasibility.
[22] Sourced from Entranze data gathering collection: http://www.entranze.enerdata.eu/average-number-of-dwellings-per-building.html.
[23] This is based on the DECC cost-benefit analysis of individual meters used in this impact assessment. Operators would only have to provide minimal data on these filtered out buildings/systems. How far it is possible to minimise the data collected by HNOs will be determined once the guidance for assessment has been developed.
[24] Time requirements are based on the assumption that the cost-effectiveness assessment would be judged on a limited number of characteristics such as property type and age, which appear to be the key determinants of whether a meter or HCA is cost-effective. However if further characteristics which were more difficult to assess (such as insulation levels) were required, the assumed time to collect information may have to increase.

Calculate if properties are cost effective using online calculator or spread-sheet	9,400 *non-flat scheme* buildings 19,200 *flat-only scheme* buildings	Middle Manager	26	**Option 1** 0.5 hour per non-flat scheme building 0.125 hour per flat-only scheme building	**Option 2** 0.5 hours per non-flat scheme building 0.5 hours per flat-only scheme building
Site visits by Engineer to assess technical feasibility	5,675 cost effective dwellings[25]	Engineer	50	**Option 1** 1 hour per dwelling [26]	**Option 2** 1 hour per dwelling
Re-assessment if meters are required following technical feasibility visit	5,675 cost effective dwellings	Middle Manager	26	**Option 1** 0.5 hours per dwelling	**Option 2** 0.5 hours per dwelling
Record information on meters installed for auditing purposes.	5,675 cost effective dwellings	Middle Manager	26	**Option 1** 0.25 hours per dwelling	**Option 2** 0.25 hours per dwelling

Using the assumptions above, Table 9 below shows the assessment costs for both options considered. The costs for both options are highly uncertain and are sensitive to the assumed time requirements and cost per hour for each activity.

Table 9: Assessment costs (£'000s)[27]

	Flats-Only Schemes		**Schemes With Non-Flats**	
	Option 1	*Option 2*	*Option1*	*Option 2*
Collect data on each building on the system and each of the unit (e.g. location, building type etc.)	125[28]	250	122	122
Calculate if properties are cost effective using online calculator or spread-sheet	62	250	122	122
Site visits by Engineer to assess technical feasibility	0	0	284	284
Re-assessment if meters are required following technical feasibility visit	0	0	74	74
Record information on meters installed for auditing purposes.	0	0	37	37

[25] 5,675 technically feasible assessments based on the DECC cost-benefit analysis of cost-effective individual metering in this impact assessment, outlined in section 6.4.4. This takes into account that 25% of properties are already metered.

[26] Technical feasibility may require less time; this estimation takes into account the potential time taken for the engineer to travel between dwellings.

[27] Figures/calculations may not add up to totals due to rounding.

[28] Calculated using assumptions presented in Table 8, in this example (Flat-only scheme buildings) x (Cost per hour) x (Option 1 hours for flat-only scheme buildings) is represented by 19216 x 26 x 0.25 = 124904.

Total per assessment cycle (FV)	187	500	638	638
Total cost PV (2014 – 2029)	**Option 1**	2,539		
	Option 2	3,498		

Administrative burdens

The Standard Cost Model[29] approach has been used to estimate the administrative burden placed on heat network operators from complying with the regulations. This approach estimates the administrative cost by making assumptions about the time it will take each organisation to complete each activity, the person required, and the frequency of the task. Table 10 below sets out the components of the administration required as part of the assessment.

As with the estimation of assessment costs, schemes and operators with flats-only under their management have been identified and separated from the remaining data. These 'flat-only scheme' HNOs will be able to minimise costs through less time being spent understanding the more advanced requirements and the smaller amount of information to report to the central body administering the scheme, than for those schemes expecting cost effective meter installation[30].

Table 10: Assumed administration requirements by option per assessment cycle

Requirement	**Population by scheme type**	**Person required**	**Cost per hour (£)**	**Time required by option and scheme**	
Read and understand requirements of the regulation and necessary steps for compliance	30 *non-flat scheme* operators 1,400 *flat-only scheme* operators	Senior Manager	45	**Option 1** 6 hours for non-flat operators 3 hours for flat-only operators	**Option 2** 6 hours for non-flat operators 6 hours for flat-only operators
Registration with central body	30 *non-flat scheme* operators 1,400 *flat-only scheme* operators	Senior Manager	45	**Option 1** 1 hour for non-flat operators 1 hour for flat-only operators	**Option 2** 1 hours for non-flat operators 1 hours for flat-only operators
Report and notify central body (for both individual and building level meters)	100 non-flat schemes 12,800 flat-only schemes	Senior Manager	45	**Option 1** 1 hour for non-flat schemes 0.5 hour for flat-only schemes	**Option 2** 1 hour for non-flat schemes 1 hour for flat-only schemes

[29] Measuring administrative costs: UK standard cost model manual (www.berr.gov.uk/files/file44503.pdf)
[30] For example, the meter serial number.

Audit by central body - checks assessment undertaken correctly , meters installed and working etc.	5% of total schemes over 4 year assessment cycle: 648 schemes	Senior Manager	45	**Option 1** 8 hours for non-flat schemes 8 hours for flat-only schemes	**Option 2** 8 hours for non-flat schemes 8 hours for flat-only schemes

Where comparable this Impact Assessment has assumed similar time commitments to other policies or programmes such as the Carbon Reduction Commitment or the Good Quality CHP quality assurance scheme. Table 11 below shows the administrative burden by option. The Government has consulted on the assumptions used to assess the costs of administering these requirements, with no responses specifically challenging the assumptions used previously.

Table 11: Administrative costs per assessment cycle (£'000s) [31]

	Flats-Only Schemes		**Schemes With Non-Flats**	
	Option 1	*Option 2*	*Option1*	*Option 2*
Read and understand requirements of the regulation and necessary steps for compliance	187	373	8	8
Registering with central body	62	62	1	1
Report and notify central body (for both individual and building level meters)	289	578	5	5
Audit by central body - checks assessment undertaken correctly , meters installed and working etc.	231	231	2	2
Total per assessment cycle (FV)	769	1245	16	16
Total cost PV (2014 – 2029	**Option 1**	2,309		
	Option 2	3,772		

6.4.2 Costs to Government: scheme administration

For the purposes of this impact assessment, the costs of administering the scheme are based on the costs of administering similar monitoring schemes for electricity and gas meters.

The cost of the scheme administration framework may have a fixed component related to overall scheme administration, and a variable part that will depend upon the number of site audits required to ensure compliance and collect sufficient data to report to the European Commission. In addition there will be an initial one-off cost of developing the cost-effectiveness and technical feasibility guidance before the first round of assessments in 2016. This has been estimated to cost £30,000.

[31] Figures/calculations may not add up to totals due to rounding.

From initial discussions with potential suppliers, they estimate that core administration costs would cost £450,000 annually. Under both Options, the notification requirement would mean a smaller sample of schemes for auditing would be required to ensure compliance and collect sufficient data to report to the European Commission. Therefore the costs for these options assume 160 audits a year, with total scheme administration costs of £571,500. A summary of the costs is presented in Table 12, below.

Table 12: assumed breakdown of scheme administration costs by option:

Fixed scheme costs	**Option 1 & 2**
One-off cost: Develop cost effectiveness and technical feasibility guidance	£30,000
Annual core costs of running scheme	£450,000
Annual audit costs	
Number of visits	160
Cost per visit	£750
Site audits	£121,500
Total (FV per year)[32]	**£571,500**
Total (PV 2013-2029)	**£6,058,000**

6.4.3 Capital Costs and operating costs: individual meters and HCAs

The options under consideration call for HNOs to test whether an individual meter is cost-effective and technically feasible. To perform this assessment, HNOs will be given detailed guidance on determining which properties on their systems are deemed cost-effective and guidance on possible exemptions on the grounds of technical feasibility. The guidance will be prescribed by the scheme administrator.

To illustrate the possible scale of the costs, the analysis in this Impact Assessment follows the method for assessing the costs and benefits set out in the 2012 Databuild/BRE report. The method in the BRE report compares the capital and operating costs of a meter (including the cost of meter readings) against the expected energy savings for the final customer.

This impact assessment assumes that the assessment of cost-effectiveness is in respect to the costs and benefits faced by the final customer, but assumes that the capital cost and cost of the billing will be passed through to customers by the HNOs. Therefore, in order for a meter to be assessed as cost-effective, the energy savings from consumers changing their behaviour must exceed the cost of the meter and the additional costs of billing.

Installing a meter incurs a capital cost in the first year, which is offset by a net bill saving over the lifetime of the meter (assumed to be 10 years). This Impact Assessment assumes consumers discount these future benefits using a private discount rate of 9%[33] (real discount rate). Therefore a meter is only cost-effective to the consumer if the discounted net-benefits are greater than the initial capital and installation costs as well as the operating costs.

[32] Excluding first year costs relating to the development of the cost-effectiveness guidance.
[33] This private discount rate is taken from a previous BRE cost benefit analysis: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48389/5462-district-heating--heat-metering-cost-benefit-anal.pdf

Meter capital and operating costs

Responses to the consultation generally agreed that retrofitting heat meters was more costly than installing them when the building is constructed. However there was a large range of costs for retrofitting meters presented, which accorded with the figures presented in the consultation stage impact assessment. Respondents generally agreed with the assumed installation costs and the costs for meter reading. Therefore original capital and annual operating costs have been retained, taken from the BRE report; these are presented in Table 13 below. This assumes the capital cost of the meter, data gathering system and installation is £447. Annual operating costs are assumed to be £81/year. Responses to the consultation also highlighted that meter lifetimes can be shorter than the 15 years previously assumed. Therefore the assumed lifetime of the meter has moved from 15 years to 10 in this impact assessment. Further gathering of evidence on costs of individual meters, through the production of guidance to assist HNOs, will occur. A selection of assumptions presented below is explored through sensitivity testing in section 8. The costs and lifetime of meters and HCAs may be refined through further evidence-gathering as part of the creation of the cost effectiveness guidance being produced by DECC.

Table 13: assumed capital and on-going cost for individual heat meters

One-off costs (per dwelling)	
Meter	£212
Installation costs	£80
Data gathering system	£62
installation of data gathering system	£93
Total	**£447**
On-going cost (per dwelling/year)	£81
Life of meter	10 years

Source: Databuild/BRE and Consultation responses

Consultation responses identified the potential of requiring two meters in heat networks where space heating and hot water are delivered through separate piping systems. Guidance produced to aid the cost effectiveness tests will take into account these systems and the costs of additional meters. However due to a lack of knowledge on the number of such systems in the UK, it is assumed that all heat network dwellings would require one meter for both space heating and hot water, in this impact assessment.

Some responses to the consultation highlighted the possibility that the costs of meters would fall over time as new technologies reduced costs and as the market for heat metering matured in the UK. Lower costs of individual meters would lead to potentially more being installed, and therefore greater aggregate bill savings for customers and greater energy and carbon emissions savings. However there is little evidence on how costs may fall, so this Impact Assessment assumes costs stay constant over time. This assumption may therefore lead to undervaluing of the benefits of metering if costs of meters do reduce over time.

Heat cost allocator capital and operating costs

Whilst most respondents to the consultation had little knowledge of HCAs, or were not in favour of HCAs, there is potential for newer developments with this technology for significant energy savings in heat networks. More modern electronic HCAs are fitted with anti-tampering technology and have greater accuracy than older evaporative models. Many respondents to the consultation expressed doubts about the effectiveness and suitability of HCAs, however it is a requirement of the Directive that where properties are assessed as not cost-effective for metering, an assessment of whether HCAs could be cost effective must be made.

HCAs are not currently widely used in the UK and it has therefore been difficult to gather evidence on their capital an on-going costs. However, responses indicate that an electronic HCA is likely to cost £40-50, including AMR (automatic meter reading, where access to properties for readings is not required) gateway installation; operating costs are likely to be in the order of £35 a year, with billing costs being similar to existing credit billing. As HCAs take readings of space heating only, a hot water meter would be required, as a requirement of the Directive. As an allocator is required for every radiator, the capital costs will depend upon the number of rooms and the number of radiators in each property. HCA lifetime is set at 10 years, in line with individual meters. For the purposes of this impact assessment, the following assumptions have been made, using responses from the consultation period, to assess overall costs.

Table 14: Assumed capital and on-going cost and lifetimes for HCAs and hot-water meters

Capital cost (including data gathering)		£45 per radiator
Ongoing cost (per dwelling)		£35 per year
Average number of radiators	*Flats*	6[34]
	Terrace	7
	Semi-detached	7
	Detached	8
Water meter capital cost (including installation)		£150
Lifetime of HCA		10 years

Cost of Controls

There is mixed evidence on the level of controls necessary for the installation of a meter to trigger a reduction in energy consumption. Without adequate control over their heating systems, consumers would be unable to respond to the feedback on consumption provided by metering. Therefore it is important that customers have a means of control. As there is little evidence on the presence of controls in dwellings on heat networks, it is assumed that all dwellings already have some form of control, including at the simplest level the ability to switch their heating on and off as required. Absence of heating controls based on evidence from non-heat network dwellings is explored in the sensitivity analysis in section 8[35]. Responses from the consultation stage indicate the cost of buying and installing thermostatic radiator valves to be £50 per radiator, with a lifetime of at least 15 years and this is used to estimate the costs of installing controls in conjunction with meters and HCAs.

6.4.4 Number of individual meters installed where cost-effective

The assumptions set out above enabled a cost-benefit analysis of the wider Databuild/national household survey data. Changes to the assumed heat demands from the consultation stage assumptions and assessment of the cost-effectiveness of all property types has shown that some properties may be cost effective to retrofit meters or HCAs, where they are not currently installed. Table 15 below shows where the savings from meters and HCAs would be greater than the costs of installing the meter and continued maintenance. This shows that meters are expected to be cost-effective in all detached and older semi-detached properties where not currently metered, and in terraced properties with larger heat demands and some semi-detached. HCAs are also likely to be cost-effective for some terrace properties, and for flats

[34] Based on number of bedrooms 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.

[35] The Energy Follow-Up Survey (2011) finds that approximately 10% of homes sampled do not have a controlling timer.

with very high heat demands, however it appears from the database that there are no properties with these characteristics currently connected to heat networks.

Table 15: Result of private cost-effectiveness calculation for individual meters and HCAs

	Flats	**Terrace**	**Semi**	**Detached**
Pre 1917	HCA	Meter	Meter	Meter
1918 – 1938	HCA	Meter	Meter	Meter
1939 – 1959	None	HCA	Meter	Meter
1960 – 1975	None	HCA	Meter	Meter
1976 – 1982	None	HCA	Meter	Meter
1983 – 1989	None	HCA	Meter	Meter
1990 – 1999	None	None	HCA	Meter
Post 2000	None	None	HCA	Meter

Table 16 shows the private NPV of meters and HCAs for the different property types assessed using a private discount rate of 9%, and over an assessment of 10 years. For some properties, the private NPV of installing HCAs is greater than the NPV for meters. However, the Directive requires that in such cases, a meter should be installed wherever it is cost-effective.

Table 16: Private NPV of a meter assessed over 10 years PV £2013 using a 9% rate of return)

	Flats		**Terrace**		**Semi-detached**		**Detached**	
	Meters	HCAs	Meters	HCAs	Meters	HCAs	Meters	HCAs
Pre 1917	-232	108	156	453	472	768	1,034	1,287
1918 – 1938	-291	49	57	353	342	639	854	1,107
1939 – 1959	-345	-5	-47	249	202	499	661	914
1960 – 1975	-369	-29	-81	216	158	455	599	852
1976 – 1982	-409	-68	-150	147	64	361	469	722
1983 – 1989	-392	-52	-132	165	87	384	501	754
1990 – 1999	-499	-159	-311	-14	-151	146	172	425
Post 2000	-543	-202	-389	-93	-252	45	31	284

These NPVs combined with the population of the Databuild/national household survey data suggest that 5,675 properties are estimated to be cost-effective for retrofitting meters or HCAs.

It is possible that upon inspection some of these properties may not be required to install a meter because of technical considerations (e.g. space to install the meter, access to pipework etc.). However, for the estimated costs in the Impact Assessment, it is assumed that all properties install meters where they are cost-effective. Installing meters on some but not all properties on a system may result in additional costs (such as requiring two billing systems – one based on meters and one on floor space). The Directive allows for meters not to be installed in these situations where installing meters would increase the overall cost to the system and therefore not result in a bill saving to customers.

6.4.5 Major Renovations

The requirement to install meters as part of major renovations to buildings on district heating schemes (i.e. not communally heated buildings) would also trigger some installations. From discussions with HNOs, it appears that routine renovations taking place on heat network properties would not reach the threshold for installing meters, which is where the value of the total renovation exceeds 25% of the value of the building, excluding the value of the land, and where the technical services are being altered (here heating and cooling services). Therefore it is envisaged that only a small fraction of heat network dwellings (not where the building is

communally heated, but where multiple buildings are serviced by one heat source, or centralised heat sources) will be affected by the major renovation requirement.

To estimate the impact from this aspect of the Directive requirements, we have assumed the level of renovations will be at 2% of the eligible housing stock each year of this appraisal. This percentage is sourced from a UK Energy Research Centre study into homeowners' renovation decisions[36] and is only a proxy for the number of major renovations that will meet the requirements set out above, as it is based on private homeowners and dwellings/decision-makers that are not likely to be on heat networks.

As set out earlier in Figure 2, there are around 156,000 dwellings connected to non-communally heated heat network systems; using the assumption of 25% of dwellings being metered already, approximately 117,000 dwellings that are connected to such systems in the UK are currently unmetered. Using the above assumptions on the rate of major renovations, it is estimated that 2,335 flats will be in buildings which both are eligible for installations of meters (i.e. not having meters installed already) and undergo major renovation. Totalling these annually-triggered installations suggests that around 32,700 dwellings will be required to install meters by 2029 (at a rate of 2,335 for 14 years, as these meters begin to be installed in 2016). Where meters come to the end of their assumed technical lifetime they are required to be replaced (from 2026 onwards there are 4 years of replacements).

In total therefore, there are expected to be around42,000 meter installations triggered by renovations up to 2029, including replacements.

6.4.6 Summary costs of individual meters.

The following table of capital and operating costs combines both cost effective meter/HCA installation and major renovation-triggered meter installation, resulting from the assumptions and investment profile set out above. As explained in section 6.3, capital costs have been amortised so that the valuation of the costs and benefits can be compared on a like-for-like basis. With benefits stretching out over the 10 year lifetime of the meter, spreading out capital costs over the ten year period[37] allows a representative spread of values over the total appraisal time frame of 16 years.

Table 17: Cost profile of individual meters PV £m (2013)[38]

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	**Total**
Amortised capital costs- meters	-	-	0.2	0.3	0.4	0.4	0.5	0.6	0.7	0.7	0.8	0.9	0.9	1.0	1.0	1.0	**9.3**
Amortised capital costs-HCAs	-	-	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	**1.9**
Operating costs-Meters	-	-	0.2	0.4	0.6	0.7	0.8	0.9	1.1	1.2	1.3	1.3	1.4	1.5	1.6	1.6	**14.6**
Operating costs-HCAs	-	-	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	**1.8**
Total	-	-	0.7	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.3	2.4	2.6	2.7	2.8	2.9	**27.6**

[36] Understanding Homeowners' Renovation Decisions: Findings of the VERD Project: http://tyndall.ac.uk/sites/default/files/verd_summary_report_oct13.pdf

[37] With an effective interest rate of 3.5%, in line with standard discount rates used in social analysis of costs and benefits – implicitly not including finance costs.

[38] Costs presented are in present values, discounted back to 2014 at a 3.5% discount rate. Figures may not add up to totals due to rounding.

Using these assumed capital costs and annual operating costs, the expected cost of all individual meters installed (where cost-effective and when buildings undergo major renovations) to 2029 is £27.6m (in £2013). This figure is for individual consumption meters only and excludes the estimation of building level meter capital costs, which are presented below.

6.4.7 Capital and operating costs of building level meters:

The requirement to install building level meters for multi-occupancy/multi-purpose buildings is common to both options. Unlike the provisions for individual meters, the installation of building level meters is not subject to caveats on the cost effectiveness and technical feasibility. Therefore the requirement for building level meters does not allow Member States much discretion in how this is implemented.

There are no reliable sources of evidence on the number of buildings connected to networks that currently have building-level meters installed. Discussions with heat network operators suggest it is unlikely that many systems will already have meters installed at the locations required by the Directive. Therefore for the purpose of this impact assessment, it is assumed that all applicable buildings will need to install a meter.

To estimate the costs, it is assumed that the regulations would require the installation of meters in all blocks of flats connected to a heat network. Blocks of flats with a communal heating system installed in the building are expected to be exempt from the requirement to install meters at the heat exchanger. The requirements also apply to non-domestic buildings. However, it is not possible to determine whether these are charged as single units, or are part of a multi-occupancy/multi-purpose building. Non-standard configurations of piping for a row of terraces (where the heat enters one dwelling and piped through the terrace to the other buildings) would also require a building level meter at the point of entry and exit of the heat. However, it has not been possible to determine how frequently this occurs.

As set out in section 6.1, the Databuild database and the assumption of Databuild schemes with flats only and 50 or fewer dwellings being defined as communal heating, suggests that there are 147,000 non-communally heated dwellings (with more than one building attached to the network) which could be required to install building level meters (multi-apartment buildings). In order to estimate the costs it is assumed that a block of flats consists of 20 properties in the central case[39].

The assumptions above suggest therefore that 7,345 buildings would be required to install meters as a result of the regulations relating to building-level meters.

Responses from the consultation stage has suggested that the previous estimate of £1,000 as the capital cost for a building level meter is too low and that the cost of the meter is widely varied, depending on the size of the pipework present. Therefore the building-level cost estimate has been revised upwards to an approximate average of costs submitted: £2,000 with installation costs of £500. The meters are assumed to have a lifetime of 15 years and assumed to be installed by 2015. The benefits of these meters are considered over their expected lifetime up to 2045. The total cost in 2015 of the 7,345 meters at £2,500 including installation is £18.4m, which discounted back to 2014 at 3.5% gives a total present value cost of £17.7m (2013 prices).

[39] Based on the average presented here: http://www.entranze.enerdata.eu/average-number-of-dwellings-per-building.html

6.5 Benefits:

Installation of building level meters and/or individual meters or HCAs is expected to provide incentives to HNOs and their customers to use energy more efficiently. In addition as the majority of heat networks use gas as a fuel, which is the assumed fuel used throughout this analysis, there is an accompanying reduction in carbon emissions[40].

The energy and carbon savings have been valued in accordance with the Government's guidance of valuation of energy use and greenhouse gas emission for appraisal[41]. The central prices for energy and carbon prices are presented here. The impact of using high and low prices are presented as sensitivities in Section 8.

6.5.1 Individual meters

Size of energy savings

Whether a meter is cost effective is highly sensitive to the assumed reduction in energy demand resulting from customer's changing their heating behaviour. The interpretative note to the Directive suggests this could be up to 30%, but other sources suggest lower responses in the range of 10-20% are more common (see Box 1 below). The size of the behaviour change will also potentially depend on the type of meter installed, with pre-payment meters or those with real time displays expected to promote greater savings. The functionality of heating controls available to the user may also determine the size of the energy savings.

Box 1: Evidence on the Energy Savings from Individual Heat Metering and Heat Cost Allocation

Evidence on likely energy savings from meters

BRE's previous work on heat networks metering highlights a 15-17% realistic minimum energy saving, with up to 30% potential savings. This comes from a Danish study and is the most reliable figure in the paper. The study also saw rented housing energy reductions of 28-42%, however these reductions occurred alongside an extensive information campaign as well as government grants to install controls and other efficiency measures. Another prevalent finding from this study is the noted lag in behavioural change after the transition to individual meters – energy savings lags were observed as being 1-2 years in length, therefore for the purposes of this impact assessment, benefits of individual heat metering do not occur until the second year of the lifetime of the meter, 2017[42]. A Swedish paper on incentives for metering and charging also identifies studies that find savings between 10 – 40%[43]

There was also anecdotal evidence from a previous consultation; where of two identical blocks of flats – one with a meter, one without – revealed a 25-33% reduction in energy in the presence of a meter. However this does not take into account baseline trends. A literature review for Defra[44] found that there was a 5-15% saving to be made from direct feedback (i.e.

[40] Some networks may use other fuels, including biomass, and could use combined heat and power (CHP) to generate electricity at the same time as heat, which may mean the estimated carbon savings could be higher or lower than those presented here..

[41] 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

[42] The Directive requires meters to be installed by 31 December 2016, in multi-apartment and multi-purpose buildings, but it is likely that HNOs will install earlier during the summer to avoid disruption to systems during the heating system. Therefore the assumption of no benefits in the first year assumes that customers will not change their behaviour during the first six months of the meter being installed.

[43] 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

[44] Darby, S. *The effectiveness of feedback on energy consumption – A review for Defra of the literature on metering, billing and direct displays.* Environmental Change Institute (Oxford), April 2006.

live monitors) and a 0-10% saving from indirect feedback (i.e. through informative billing), but only one of these studies focussed on heat networks which was from Sweden and failed to include a comparable control group.

After retrofitting heat meters in 4 blocks of 1960s flats, Kiln Place, Camden observed reductions in heat consumption of 30%. These were however installations of pre-payment meters which bring a different form of feedback to consumers and these costs/benefits are not yet identified in this assessment.

The varying results of behavioural estimation as well as the uncertainty around smart meter costs has been taken into account by including a 20% energy saving as opposed to a 30% reduction (as cited by a number of other sources) in the baseline scenario. To capture a realistic range of behavioural change levels, sensitivity testing is undertaken with 10% and 30% energy reductions in Section 8.

Evidence on likely energy savings from HCAs

There have been a number of studies into the effect of HCAs on consumer behaviour, mostly in other European countries. One study[45] in particular by TU Dresden in Germany has examined 3.3 million dwellings and undertook quantitative analysis, accounting for factors such as differing insulation levels and weather. This study found that consumers reduced their heat consumption by 20% after installing HCAs. Further studies conducted by other European countries also find the effect of HCAs to be a reduction in consumption of between 20%-40%[46].

The analysis in this impact assessment assumes a 20% reduction to illustrate whether meters and HCAs are cost-effective. This assumption is tested as a sensitivity in section 8. The evidence also suggests that there is a lag between installing meters and changes in consumers' behaviour, as it takes time for consumers to adjust their use of heat and for them to receive their first bill based on actual use. The analysis in this impact assessment assumes therefore that there are no benefits in the year of installation of the meter (assumed to be 2016), but that the 20% reduction in heat demand occurs from the next year onwards (assumed to be 2017). It should also be noted that the 20% reduction in heat demand triggered by metering will not necessarily lead to a 20% reduction in bill costs, as fixed portions of the bill charge may be left unaffected by consumption levels e.g. to account for fixed running costs of the whole system. Savings estimated in this analysis are based on all fixed portions of billing remaining constant – only the variable segment of the heating charge is included.

Installation of individual meters is expected both where it is cost-effective for the consumer, and where communally heated buildings undergo major renovation. Meters that are privately cost effective are estimated to result in around 18GWh/year of energy savings, which is assumed in this impact assessment to be a reduction in gas consumption. Additionally, the requirement to install meters when properties undergo major renovation would lead to around 5GWh of additional savings each year as renovations trigger the installation of meters out to 2029[47]. Applying the central fossil fuel prices to these individual meter reductions in gas demand provides a benefit of £12.4m over the appraisal period, with additional benefits from carbon savings of £5.7m and air quality improvements of £0.2m. The total of these savings, attributed

[45] 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

[46] Experiences of housing association RSM URSUS, Warsaw: http://iet.jrc.ec.europa.eu/energyefficiency/sites/energyefficiency/files/files/documents/events/11_gorzycki_11.03.2014.pdf

[47] This analysis assumes a 3% rate of renovation a year, where renovation value exceeds 25% of technical service value, and includes benefits of meters installed in last year of the policy lifetime.

to individual meters only (not including savings from building level meters), are the same under both options considered and amount to a present value of approximately £18.3m[48].

6.5.2 Benefits from building level meters

Installing meters at the building level may allow heat network operators to gain a better understanding of the losses in distribution of heat on the system, and from improved management of the system.

The Commission[49] estimate that there could be savings of 2-3% for network operators from better management of their systems following installation of meters. For illustration and to avoid over-estimation of benefits, the analysis in this impact assessment assumes that installation of building-level meters generates a 1% saving in energy demand from improved management of the system.

The total heat supplied to dwellings is estimated at 1.4TWh based on the number of non-communally heated dwellings in the Databuild database and their estimated heat loads. The majority of heat networks use gas. Therefore 1% saving therefore equates to 14.4GWh of gas saved. Most networks are too small to be captured by the EU ETS, so this impact assessment assumes 90% of this saving will be in the non-traded sector.

Using the IAG guidance, and DECC's central fossil fuel prices, the value of building-level meter induced gas savings is £4m (PV, £2013). Carbon emissions savings are valued at £1.8m, with an additional £0.1m in benefits from improved air quality, totalling approximately £5.9m in benefits from building level meters out to 2029.

6.5.3 Summary of energy savings from individual and building level meters

Total energy savings over the appraisal period amounts to 860GWh, which amounts to a total of £24.2m (PV, £2013) in benefits[50], comprising of £16.4m from energy savings, £7.5m in emissions reduction and £0.3m in air quality improvement.

Table 18: Energy savings from building level and individual meters/HCAs per year (GWh)

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	**Total**
Individual meters/HCAs: traded energy savings	-	-	-	2.2	2.7	3.2	3.6	4.1	4.6	5.1	5.5	6.0	6.5	7.0	7.4	7.9	**66**
Individual meters/HCAs: non-traded energy savings	-	-	-	20.1	24.3	28.6	32.8	37.1	41.3	45.6	49.8	54.1	58.3	62.6	66.8	71.1	**592**
Building meters : traded energy savings	-	-	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	**20**
Building meters: non-traded energy savings	-	-	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	**182**
Total (GWh)	-	-	14.4	36.7	41.4	46.1	50.9	55.6	60.3	65.0	69.7	74.5	79.2	83.9	88.6	93.3	**860**

[48] In 2013 prices.
[49] Annexes to the impact assessment accompanying the document Directive of the European Parliament and of the Council on energy efficiency and amending and subsequently repealing Directives 2004/8/EC and 2006/32/EC (page 58) http://ec.europa.eu/energy/efficiency/eed/doc/2011_directive/sec_2011_0779_ia_annexes.pdf
[50] Calculated using DECC's carbon valuation calculator.

6.6 Summary of costs and benefits[51]

Using the assumptions set out above, net present values (NPVs) were calculated, using guidance set out in The Green Book[52] and the Impact Assessment Calculator[53]. A breakdown of these costs is presented below in Table 19. Costs and benefits presented throughout this section may not add up to totals due to rounding. Final values have been taken from the BIS Impact Assessment Calculator.

Table 19: Breakdown of total costs and benefits, presented PV £m (2013)

	Option 1	**Option 2**
Costs		
Assessment costs	-2.5	-3.5
Administrative burden	-2.3	-3.8
Scheme administration	-6.1	-6.1
Individual meter capex and opex	-27.6	-27.6
Building level meter capex	-17.7	-17.7
Benefits		
Value of energy savings	16.4	16.4
Value of carbon emissions savings	7.5	7.5
Value of air quality impact	0.3	0.3
Final NPV (£m)	-32.08	-34.51

6.6.1 Business costs and benefits

The direct cost to business are summarised in Table 20. The majority of the costs of the policy will fall on business, the exception being the scheme administration costs that are funded through taxes. The hassle costs of implementing recommendation are not included. Table 20 also presents the Equivalent Annual Net Cost to Business (EANCB).

Table 20: Breakdown of costs and benefits to business, presented in PV £m (2013)

	Option 1	**Option 2**
Costs		
Assessment costs	-2.5	-3.5
Administrative burden	-2.3	-3.8
Capital and operating costs	-45.3	-45.3

[51] Figures within this section may not add up to totals presented due to rounding.
[52] HM Treasury's Green Book: https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-governent
[53] BIS: Impact Assessment Calculator: https://www.gov.uk/government/publications/impact-assessment-calculator--3

Benefits		
Traded carbon savings	0.4	0.4
Business NPV (£m) compared against 'no directive' baseline)	**-49.83**	**-52.26**
EANCB (on 2009 prices)	**3.21**	**3.37**

The Better Regulation Framework guidance on One In, Two Out (OITO) sets out that in the case of EU legislation, the cost to business in scope of the OITO policy is the additional cost to business over and above the EANCB of implementing the minimum requirements.

The Government is consulting on the best way to implement the minimum requirements, so for the purposes of the Impact Assessment the cost in scope of OITO is measured against the least cost option (option 1).

6.6.2 Small and micro-businesses assessment

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

7. Non quantified costs and benefits

The requirements of these regulations are expected to give rise to a number of benefits and costs where estimation of the monetary value has not been possible. This section briefly describes the main non-quantified impacts.

Fuel Poverty

Providing meters to individual customers is intended to incentivise more efficient use of heat as reductions in energy use are translated into bill savings. However, bills based on metering may incentivise people to under-heat their properties (relative to need) in order to reduce their bills. This may be particularly important for customers on heat networks, many of whom are in social or local authority housing.

The additional costs passed through to individual consumers by HNOs, taking into account data collection, billing, capital costs etc., should be offset by the benefits that they will receive, either from reduction in consumption or by being charged less for their actual consumption. The move from a flat rate charge to a system based on actual consumption is likely to benefit those under-heating (relative to need) their homes or heating their homes less than others on the network.

Currently a flat rate charge allows for these consumers to subsidise people heating their homes more, as charging is not based on individual consumption. Therefore the move to metering should decrease bills in this way. There is currently very little evidence on the number of fuel poor residents currently living in properties served by heat networks and of under-heating their homes in properties without meters, therefore the effect of metering on those in fuel poverty is uncertain.

Transfers between customers

Installation of meters may also create transfers between customers on a network. The current basis for billing (typically based on floor area) does not take account of actual use. Charges for customers therefore do not reflect factors such as occupancy and heating behaviours. As the

total cost of the system is recovered by the system operator when setting the charges each year, this creates implicit subsidies between users as all users face the same charge regardless of actual use.

Installing building level meters will allow HNOs to accurately determine the amount of heat used by each building. This may allow HNOs to allocate the cost of the heat more accurately between users in different buildings, reducing the size of potential transfers between users on the same system.

Establishing a billing system based on actual use will create a more efficient system of charges. Therefore it is possible that some users on a system may face much higher bills as a result of meters being installed, even after taking account of the behaviour change. Other customers who are low users may face much lower bills as they will now be charged only on the basis of the heat they consume.

Pre-payment meters

Responses from the consultation period indicated the potential for pre-payment meters to be installed in dwellings with vulnerable consumers. These pre-payment meters may give more control to consumers in fuel poverty, provide a mechanism by which HNOs can control debt risks, and the feedback provided from direct top-ups is likely to induce higher reductions of heat consumption than standard metering. These meters are also likely to have significantly higher capital costs and are not a requirement of the directive, but may provide a method by which to help both the management of debt and those in fuel poverty.

Changes in back-office costs of billing systems

The analysis of individual meters does not take account of any fixed costs of switching from a flat rate charge for heat, to billing based on actual use. These fixed costs may include the costs of changes to computer software required to bill customers based on use, or other changes to systems. In instances where meters are installed for some customers but not others, there may be additional costs of running two billing systems in parallel.

Hassle costs

HNOs will face hassle costs from managing the installation of building level meters onto their system and from disruption to their operations. HNOs would have to consult with their customers to about the change to the way they are billed. Customers will also face hassle costs where building level meters are installed. These might include having the heating and hot-water to the building turned off for a period during installation and testing.

Customers may also incur hassle costs where a technical assessment of the feasibility of metering is required. This may involve customers having to stay home for the assessment and potentially clearing access to pipework which could be in cupboards for instance. However not all customers for whom metering is deemed cost-effective would face disruption as HNOs may be able to infer from inspecting one property if meters are technically feasible in all properties of that kind. If the meters are still deemed cost-effective after the technical feasibility test, the customers would incur these costs again during installation. There may be further costs for customers learning to control their heating system.

Growth and maturity of heat metering in UK

Installation of meters required by the regulations may increase the installer skill base and supply chain for heat meters in the UK. This could potentially benefit other policies such as the Renewable Heat Incentive, which is using metering to monitor heating system performance in both the domestic and non-domestic sectors. Given the relatively low level of meter installations

currently, the regulations may increase the number of technicians with experience of installing meters and therefore may reduce the costs of additional meters and or the number of installers in the UK.

Direct and indirect rebound effect

One of the knock-on effects from a consumer reducing energy consumption via a meter is that some of the financial savings may be spent on 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 energy consumption). In the example of meters, it is most likely to be an indirect rebound effect where bill savings are used to purchase other energy using goods and services.

Wider benefits of information collected

There are potentially wider benefits to society that could be gained for effective use of the information collected through HNO assessments. Some of this information is a non-rival public good, meaning once it has been produced by the HNO it can be put to multiple uses for relativity low cost to society.

The assessment findings could be used to reduce the cost to HNOs of identifying potential options for energy efficiency improvements in the buildings covered. For example, HNOs could reduce the cost of assessing the benefits and energy savings by reusing data already collected for the metering assessment.

The data collected could also be used to strengthen the evidence base underpinning policies to support development of heat networks. Provided all commercially confidential information was redacted, the aggregated results could also be made public, which would support wider analysis and debate around the role of heat networks in meeting the overall objectives of increasing economic growth, reducing carbon emissions and securing reliable energy supplies. Robust information on the current performance and level of heat network development would also provide information to potential investors in heat networks.

Finally, effective central reporting on the information gathered by the HNO assessments would enable a more robust evaluation of the policy, and enable any adjustments to be made to make the policy more effective. The results could also be fed into the wider European Commission evaluation of the Directive. Central reporting would enable DECC to monitor the development of heat networks over time and to evaluate the effectiveness of DECC policy interventions in this areas such as the development of the Heat Network Delivery Unit.

Combined heat and power systems

Feedback from the consultation phase of implementation of the Directive identified potential further costs arising where heat is supplied to networks by combined heat and power (CHP) systems. Where CHP-sourced systems see a reduction in heat load, potential revenues from electricity generation may fall, however due to the heterogeneous nature of CHP schemes (where capacity, heat-to-power ratios, storage facilities and form of revenue will vary from scheme to scheme), it is difficult to estimate the impact of metering. The Government is looking to address this issue and gather further evidence through the production of the scheme guidance.

8. Sensitivity analysis

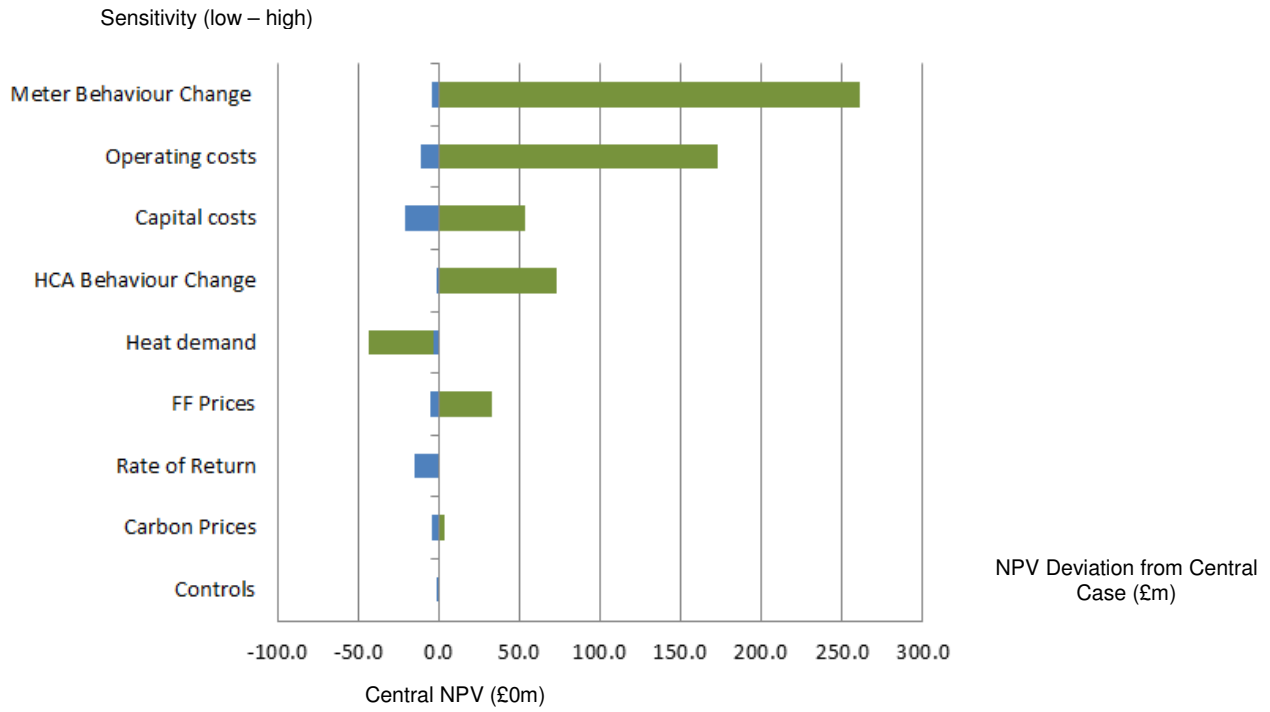
The costs and benefits presented in section 6 require a number of assumptions to be made to address the lack of evidence and uncertainty. These assumptions can significantly alter the costs and benefits of the options. Therefore, this section presents a sensitivity analysis to illustrate the effects of assumptions made within the central case, on the net present value (NPV) of the policy as a whole. The input assumptions and their levels are shown in Table 21 below, where total NPV and the change from the central scenarios (set out throughout this document) is presented.

Table 21: Details of sensitivity analysis of option 1

Sensitivity	NPV (£m, 2013)	Difference from central NPV (£m, 2013)
Option 1 (no-directive)	*-32.1*	
Low FF prices	-37.5	-5.46
High FF prices	*0.8*	*32.86*
Low Carbon prices	-35.9	-3.80
High Carbon Prices	-28.3	3.80
Meter Behaviour change 10%	-36.0	-3.92
Meter Behaviour change 30%	229.1	261.16
HCA Behaviour change 10%	-32.8	-0.76
HCA Behaviour change 30%	41.2	73.27
Capex +75%	-52.6	-20.52
Capex -75%	21.6	53.67
Opex +75%	-43.2	-11.11
Opex -75%	141.4	173.48
Heat demand -50%	-35.48	-3.40
Heat demand +50%	-72.01	-39.93
Rate of return 14.5%	-31.93	0.15
Rate of return 3.5%	-47.12	-15.04
Installation of Controls 10%	-32.77	-0.69

The NPVs shown above and outlined below in Figure 3 highlight the potential benefit that installation of meters can bring, particularly where reductions in heat consumption from a meter installation reach 30%. The NPV is also highly sensitive to operating costs, thus eventual revision of costs set in the guidance for implementation may be crucial in deciphering real cost effectiveness, as the markets for meters and HCAs mature. The difference in size of benefits in the case of HCA and meter behaviour change, show the interaction between HCA and meter uptake, due to the requirement to assess HCA cost effectiveness after meter effectiveness. In the scenario where 10% of dwellings require heating controls, the NPV does not greatly alter. A 50% increase in heat demand lowers the total benefit of the scheme, as costs associated with overall higher heat demand, assessment requirements, as well as total capital costs increase, outweighing the benefits to saving a greater amount of energy.

Figure 3: Sensitivity analysis of the NPV £m (2013)



9. Evaluation plan

The government has committed itself to reviewing the heat metering and billing requirements within 5 years of the regulations coming into force. This review is likely to include an evaluation of the impacts of implementing the Directive on both a quantitative and qualitative basis. The details of how the evaluation will be conducted are being developed but it is envisaged that the approach will be a phased one, with the obligations that do not apply conditions of technical feasibility or cost-effectiveness, being the first to be assessed.

The key metrics used to assess the impact are likely to include the energy and carbon savings delivered against the number and cost of meters installed. A further phase of the evaluation will consider those requirements that are subject to tests of technical feasibility or cost-effectiveness. The process evaluation would focus on how effective the technical and cost guidance is at ensuring that appropriate assessments are made, and how heat network operators are using the information provided and the interaction with the wider policy landscape. The evaluation will draw on a combination of administrative and survey data.

Annex A: Summary of changes to assumptions and evidence following consultation

In light of new evidence collected through the consultation and from workshops with a range of stakeholders, a number of assumptions have been updated. Table A1 below shows the major changes in assumptions and the sources of evidence used.

Table A1: Major changes in assumptions since consultation

Assumption	Consultation IA	Final IA	Notes/source of new evidence
Lifetime of individual meters	15 years	10 years	Consultation responses suggested a 10 year life for an individual meter is more realistic. While meters can last longer, recalibration is often required which often results in the whole meter being replaced.
Capital cost of building level meters	£1,000	£2,000	Consultation responses showed a large variation in estimated costs, with costs of meters expected to relate to the diameter of the pipe they are fitted to; £2,000 is a representative figure from these responses.
Heat Cost Allocator cost and performance	Insufficient data to include	Capital cost of £45/HCA, lifetime of 10 years, 20% energy savings. Number of HCAs required dependant on property type	Consultation responses outlined realistic costs of HCAs to be £45 per device, which need to be installed on each radiator within each dwelling; assumptions on the number of radiators per dwelling were sourced from the English Housing Survey report (2011) and the Dwelling Size Survey (2010). Energy savings from HCAs are outlined in a large and concise study by C. Felsmann, TU Dresden.
Heating controls	Not considered	Presented as sensitivity – where 10% of homes need to install controls	The consultation stage impact assessment did not make an assumption about the level of control that customers would have, which would determine their ability to reduce their demand. The central estimate assumes all properties have some control (including simple on/off), but need to install controls included in a sensitivity scenario. The level of heating controls needed in the sensitivity is sourced from the Energy Follow Up Survey (2011) and is used in conjunction with consultation responses on the value of thermostatic radiator valve (TRV) installation: £50 per TRV. Numbers of radiators were estimated, as outlined above.

Average number of properties in a multi-dwelling building	10	20	Revised estimate comes from an EU-funded study which estimated an average of 20 residential units in UK multi-occupant domestic buildings in 2008.
Number of residential dwellings connected to networks	371,800 dwellings	405,500 dwellings	Identification of potential overlap between the Databuild database and national housing surveys has helped to define the estimation of number of dwellings. Inclusion of Scottish, Northern Irish and Welsh dwellings has also changed this figure from the consultation stage.
Impact of major renovations requirement	Not considered	Estimate of 2% renovations per annum for non-communally heated heat network buildings	A small number of dwellings are likely to install meters after undergoing major renovation. Using research on homeowners' renovation decisions undertaken in aid of the Green Deal, 2% of the eligible housing stock has been assumed as an appropriate level of renovations for this impact assessment.
Cost effectiveness testing for non-flat/maisonette properties	Not considered	Included in analysis	The consultation stage excluded non-flats from the analysis as meter installation focussed on multi-occupancy properties. This has since been revised; in order to be compliant with the Directive, all dwellings must go through cost effectiveness testing.
Impact on detached properties	Not considered	Included in analysis	The previous impact assessment did not consider detached properties as no information on heat demands was included in the Databuild/BRE report. However a small number of detached properties are likely to need meters. The heat demand has been estimated based on comparison with NEED data – scaling estimates up from current semi-detached figures.
Heat demands	As for centrally heated properties	Adjusted for pre-metering heat demands	Heat demands in the consultation stage impact assessment were modelled based on properties with gas-central heating, which would be metered. The heat demands have been adjusted to reflect the higher expected heat use in properties where metering does not currently occur.
Assessment and administration	Assume only 25% of buildings would require	Estimated based on number of	Consultation stage assessment costs assumed that HNOs would only need to collect information on 25% of buildings

costs	assessment for cost-effectiveness	systems and buildings with non-flats	where meters were most likely to need to be installed. Revision of the properties which are connected to heat networks shows it is unlikely that flat-only blocks would need to install individual meters, therefore the admin and assessment costs have been calculated separating the costs for those with flats only (where costs are expected to be lower) from those with other property types.
Appraisal period	32 years	16 years	Adjusted to cover the 15 year lifetime of a building-level meter (from 2015 onwards), as this technology has a longer lifetime in comparison with individual meters. The appraisal also now includes amortisation of capital costs, as outlined in section 6.3, to ensure benefits and costs are compared on a like-for-like basis.

Annex B: Full text of Articles 9, 11 (and No 13 as applicable to heat metering)

Article 9

Metering

1. Member States shall ensure that, in so far as it is technically possible, financially reasonable and proportionate in relation to the potential energy savings, final customers for electricity, natural gas, district heating, district cooling and domestic hot water are provided with competitively priced individual meters that accurately reflect the final customer's actual energy consumption and that provide information on actual time of use.

Such a competitively priced individual meter shall always be provided when:

(a) an existing meter is replaced, unless this is technically impossible or not cost-effective in relation to the estimated potential savings in the long term;

(b) a new connection is made in a new building or a building undergoes major renovations, as set out in Directive 2010/31/EU.

9.3. Where heating and cooling or hot water are supplied to a building from a district heating network or from a central source servicing multiple buildings, a heat or hot water meter shall be installed at the heating exchanger or point of delivery.

In multi-apartment and multi-purpose buildings with a central heating/cooling source or supplied from a district heating network or from a central source serving multiple buildings, individual consumption meters shall also be installed by 31 December 2016 to measure the consumption of heat or cooling or hot water for each unit where technically feasible and cost-efficient. Where the use of individual meters is not technically feasible or not cost-efficient, to measure heating, individual heat cost allocators shall be used for measuring heat consumption at each radiator, unless it is shown by the Member State in question that the installation of such heat cost allocators would not be cost-efficient. In those cases, alternative cost-efficient methods of heat consumption measurement may be considered. EN L 315/18 Official Journal of the European Union 14.11.2012

Where multi-apartment buildings are supplied from district heating or cooling, or where own common heating or cooling systems for such buildings are prevalent, Member States may introduce transparent rules on the allocation of the cost of thermal or hot water consumption in such buildings to ensure transparency and accuracy of accounting for individual consumption. Where appropriate, such rules shall include guidelines on the way to allocate costs for heat and/or hot water that is used as follows:

(a) hot water for domestic needs;

(b) heat radiated from the building installation and for the purpose of heating the common areas (where staircases and corridors are equipped with radiators);

(c) for the purpose of heating apartments.

Article 10

Billing information

1. Where final customers do not have smart meters as referred to in Directives 2009/72/EC and 2009/73/EC, Member States shall ensure, by 31 December 2014, that billing information is accurate and based on actual consumption, in accordance with point 1.1 of Annex VII, for all the sectors covered by this Directive, including energy distributors, distribution system operators and retail energy sales companies, where this is technically possible and economically justified.

This obligation may be fulfilled by a system of regular self- reading by the final customers whereby they communicate readings from their meter to the energy supplier. Only when the final customer has not provided a meter reading for a given billing interval shall billing be based on estimated consumption or a flat rate.

3. Independently of whether smart meters have been installed or not, Member States:
(a) shall require that, to the extent that information on the energy billing and historical consumption of final customers is available, it be made available, at the request of the final customer, to an energy service provider designated by the final customer;
(b) shall ensure that final customers are offered the option of electronic billing information and bills and that they receive, on request, a clear and understandable explanation of how their bill was derived, especially where bills are not based on actual consumption;
(c) shall ensure that appropriate information is made available with the bill to provide final customers with a comprehensive account of current energy costs, in accordance with Annex VII;
(d) may lay down that, at the request of the final customer, the information contained in these bills shall not be considered to constitute a request for payment. In such cases, Member States shall ensure that suppliers of energy sources offer flexible arrangements for actual payments;
(e) shall require that information and estimates for energy costs are provided to consumers on demand in a timely manner and in an easily understandable format enabling consumers to compare deals on a like-for-like basis.

Article 11

Cost of access to metering and billing information

1. Member States shall ensure that final customers receive all their bills and billing information for energy consumption free of charge and that final customers also have access to their consumption data in an appropriate way and free of charge.

2. Notwithstanding paragraph 1, the distribution of costs of billing information for the individual consumption of heating and cooling in multi-apartment and multi-purpose buildings pursuant to Article 9(3) shall be carried out on a non-profit basis. Costs resulting from the assignment of this task to a third party, such as a service provider or the local energy supplier, covering the measuring, allocation and accounting for actual individual consumption in such buildings, may be passed onto the final customers to the extent that such costs are reasonable

Article 13

Penalties

Member States shall lay down the rules on penalties applicable in case of non-compliance with the national provisions adopted pursuant to Articles 7 to 11 and Article 18(3) and shall take the necessary measures to ensure that they are implemented. The penalties provided for shall be effective, proportionate and dissuasive. Member States shall notify those provisions to the Commission by 5 June 2014 and shall notify it without delay of any subsequent amendment affecting them.